THIRD EDITION

ADVANCED FINANCIAL MANAGEMENT

QUESTION BANK

KEY HIGHLIGHTS:

- Fully Amended as per New Syllabus
- Covers all ICAI Study Material Questions
- Covers all RTP, MTP & Past Papers
- All important questions have been marked

BY CA PRATIK JAGATI

MAY 24 ATTEMPT & ONWARDS

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KEY HIGHLIGHTS:

1. All ICAI Study Material Examples
2. Mostly concepts covered through self made charts

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Pratik sir is the only faculty who teaches Entire FR & SFM in full practical manner without rattafication of any formulas which in turn help students to clear CA Exams and to apply such knowledge in practical life too.

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Chapter 1

FOREX

Space for your notings of Formulae or important points

Question 1 (Study Material TYK Q. 1)

The price of a bond just before a year of maturity is $ 5,000. Its redemption value is $ 5,250 at the end of the said period. Interest is $ 350 p.a. The Dollar appreciates by 2% during the said period. Calculate the rate of return.

Solution

Here we can assume two cases (i) If investor is US investor then there will be no impact of appreciation in $. (ii) If investor is from any other nation other than US say Indian then there will be impact of $ appreciation on his returns.

First we shall compute return on bond which will be common for both investors.

$$\text{Return} = \frac{(\text{Price at end} - \text{Price at begining}) + \text{Interest}}{\text{Price at begining}}$$

$$= \frac{(5250 - 5000) + 350}{5000}$$

$$= \frac{250 + 350}{5000} = 0.12 \text{ say } 12\%$$

(i) For US investor the return shall be 12% and there will be no impact of appreciation in $.

(ii) If $ appreciate by 2% then return for non-US investor shall be:
(1+0.12) (1+0.02) -1 = 1.12 x 1.02 - 1 = 0.1424 i.e., 14.24%

Question 2 (Study Material TYK Q. 7)

You sold Hong Kong Dollar 1,00,00,000 value spot to your customer at ₹ 5.70 & covered yourself in London market on the same day, when the exchange rates were

US $ 1 = H.K. $ 7.5880 7.5920

Local interbank market rates for US $ were

Spot US $ 1 = ₹ 42.70 42.85

Calculate cover rate and ascertain the profit or loss in the transaction. Ignore brokerage.

Solution

The bank (Dealer) covers itself by buying from the market at market selling rate.

Rupee – Dollar selling rate = ₹ 42.85

Dollar – Hong Kong Dollar = HK $ 7.5880

Rupee – Hong Kong cross rate = ₹ 42.85 / 7.5880

= ₹ 5.6471

Profit / Loss to the Bank

Amount received from customer (1 crore x 5.70)	₹ 5,70,00,000
Amount paid on cover deal (1 crore x 5.6471)	₹ 5,64,71,000
Profit to Bank	**₹ 5,29,000**

Question 3 (Study Material TYK Q. 8)

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. on Copenhagen for Danish Kroner 10,00,000 at the rate of Danish Kroner 1 = ₹ 6.5150. You are required to cover the transaction either in London or New York market. The rates on that date are as under:

Mumbai-London	₹ 74.3000	₹ 74.3200
Mumbai-New York	₹ 49.2500	₹ 49.2625
London-Copenhagen	DKK 11.4200	DKK 11.4350
New York-Copenhagen	DKK 07.5670	DKK 07.5840

In which market will you cover the transaction, London or New York, and what will be the exchange profit or loss on the transaction? Ignore brokerages.

Solution

Amount realized on selling Danish Kroner 10,00,000 at ₹ 6.5150 per Kroner = ₹ 65,15,000.

Cover at London:

Bank buys Danish Kroner at London at the market selling rate.

Pound sterling required for the purchase (DKK 10,00,000 ÷ DKK 11.4200) = GBP 87,565.67

Bank buys locally GBP 87,565.67 for the above purchase at the market selling rate of ₹ 74.3200.

The rupee cost will be = ₹ 65,07,88

Profit (₹ 65,15,000 - ₹ 65,07,881) = ₹ 7,119

Cover at New York:

Bank buys Kroners at New York at the market selling rate.

Dollars required for the purchase of Danish Kroner (DKK10,00,000 ÷ 7.5670) = USD 1,32,152.77

Bank buys locally USD 1,32,152.77 for the above purchase at the market selling rate of ₹ 49.2625.

The rupee cost will be = ₹ 65,10,176.

Profit (₹ 65,15,000 - ₹ 65,10,176) = ₹ 4,824

The transaction would be covered through London which gets the maximum profit of ₹ 7,119 or lower cover cost at London Market by (₹ 65,10,176 - ₹ 65,07,881) = ₹ 2,295

Question 4(Study Material TYK Q. 9)/RTP Nov'18

On January 28, 2013 an importer customer requested a Bank to remit Singapore Dollar (SGD) 2,500,000 under an irrevocable Letter of Credit (LC). However, due to unavoidable factors, the Bank could effect the remittances only on February 4, 2013. The inter-bank market rates were as follows:

	January 28, 2013	February 4, 2013
US $ 1=	₹ 45.85/45.90	₹ 45.91/45.97
GBP £ 1 =	US $ 1.7840/1.7850	US $ 1.7765/1.7775
GBP £ 1 =	SGD 3.1575/3.1590	SGD 3. 1380/3.1390

The Bank wishes to retain an exchange margin of 0.125%

Required:

How much does the customer stand to gain or lose due to the delay?
(Note: Calculate the rate in multiples of 0.0001)

Solution

On January 28, 2013 the importer customer requested to remit SGD 25 lakhs. To consider sell rate for the bank:

US $ = ₹ 45.90

Pound 1 = US $ 1.7850

Pound 1 = SGD 3.1575

Therefore, SGD 1 = $\frac{₹\ 45.90 \times 1.7850}{SGD\ 3.1575}$

SGD 1	₹ 25.9482
Add: Exchange margin (0.125%)	₹ 0.0324
	₹ 25.9806

On February 4, 2013 the rates are

US $	₹ 45.97
Pound 1	US$ 1.7775
Pound 1	SGD 3.1380

Therefore, SGD 1 = $\frac{₹\ 45.97 \times 1.7775}{SGD\ 3.1380}$

SGD 1	₹ 26.0394
Add: Exchange margin (0.125%)	₹ 0.0325
	₹ 26.0719

Hence, Loss to Importer = SGD 25,00,000(₹ 26.0719 - ₹ 25.9806) = ₹ 2,28,250

Question 5 (Removed)

Question 6(Study Material TYK Q. 11)

The following 2 - way quotes appear in the foreign exchange market:

	Spot	2-months Forward
RS / US $	₹ 46.00 / ₹ 46.25	₹ 47.00 / ₹ 47.50

Required:

(i) How many US dollars should a firm sell to get ₹ 25 lakhs after 2 months?

(ii) How many Rupees is the firm required to pay to obtain US $ 2,00,000 in the spot market?

(iii) Assume the firm has US $ 69,000 in current account earning no interest. ROI on Rupee investment is 10% p.a. Should the firm encash the US $ now or 2 months later?

Solution

(i) US $ required to get ₹ 25 lakhs after 2 months at the Rate of ₹ 47 / $

$\frac{₹\ 25,00,000}{₹\ 47}$ = US $ 53191.489

(ii) ₹ required to get US $ 2,00,000 now at the rate of ₹ 46.25 / $
Therefore, US $ 200,000 × ₹ 46.25 = ₹ 92,50,000

(iii) Encashing US $ 69000 Now Vs 2 month later

Proceed if we can encash in open mkt $ 69000 × ₹ 46	₹ 31,74,000
Opportunity Gain $31,74,000 \times \frac{10}{100} \times \frac{2}{12}$	₹ 52,900
Likely sum at end of 2 months	32,26,900
Proceeds if we can encash by forward rate : $ 69000 × ₹ 47.00	= 32,43,000

It is better to encash the proceeds after 2 months and get opportunity gain.

Question 7(Study Material TYK Q. 6)

JKL Ltd., an Indian company has an export exposure of JPY 10,000,000 receivable August 31, 2014. Japanese Yen (JPY) is not directly quoted against Indian Rupee.

The current spot rates are:

INR / US $	₹ 62.22
JPY / US $	JPY 102.34

It is estimated that Japanese Yen will depreciate to 124 level and Indian Rupee to depreciate against US $ to ₹ 65.

Forward rates for August 2014 are

INR/US $	₹ 66.50
JPY/US$	JPY 110.35

Required:

(i) Calculate the expected loss, if the hedging is not done. How the position will change, if the firm takes forward cover?

(ii) If the spot rates on August 31, 2014 are:

INR / US $	₹ 66.25
JPY / US $	JPY 110.85

Is the decision to take forward cover justified?

.

Solution

Since the direct quote for ¥ and ₹ is not available it will be calculated by cross exchange rate as follows:
₹ / $ x $ / ¥ = ₹ / ¥

62.22 / 102.34 = 0.6080

Spot rate on date of export 1 ¥ = ₹ 0.6080

Expected Rate of ¥ for August 2014 = ₹ 0.5242 (₹ 65 / ¥ 124)

Forward Rate of ¥ for August 2014 = ₹ 0.6026 (₹ 66.50 / ¥ 110.35)

(i) Calculation of expected loss without hedging

Value of export at the time of export (₹ 0.6080 x ¥ 10,000,000)	₹ 60,80,000
Estimated payment to be received on Aug. 2014 (₹ 0.5242 x ¥ 10,000,000)	₹ 52,42,000
Loss	₹ 8,38,000

Hedging of loss under Forward Cover

₹ Value of export at the time of export (₹ 0.6080 x ¥ 10,000,000)	₹ 60,80,000
Payment to be received under Forward Cover (₹ 0.6026 x ¥ 10,000,000)	₹ 60,26,000
Loss	₹ 54,000

By taking forward cover loss is reduced to ₹ 54,000.

(ii) Actual Rate of ¥ on August 2014 = ₹ 0.5977 (₹ 66.25 / ¥ 110.85)

Value of export at the time of export (₹ 0.6080 x ¥ 10,000,000)	₹ 60,80,000
Estimated payment to be received on Aug. 2014 (₹ 0.5977 x ¥ 10,000,000)	₹ 59,77,000
Loss	₹ 1,03,000

The decision to take forward cover is still justified

Question 8(Study Material TYK Q. 17)/PP Dec'21

A company operating in Japan has today effected sales to an Indian company, the payment being due 3 months from the date of invoice. The invoice amount is 108 lakhs yen. At today's spot rate, it is equivalent to ₹ 30 lakhs. It is anticipated that the exchange rate will decline by 10% over the 3 months period and in order to protect the yen payments, the importer proposes to take appropriate action in the foreign exchange market. The 3 months forward rate is presently quoted as 3.3 yen per rupee. You are required to calculate the expected loss and to show how it can be hedged by a forward contract.

Solution

Spot rate of ₹ 1 against yen = 108 lakhs yen / ₹ 30 lakhs = 3.6 yen

3 months forward rate of Re. 1 against yen = 3.3 yen

Anticipated decline in Exchange rate = 10%.

Expected spot rate after 3 months = 3.6 yen – 10% of 3.6 = 3.6 yen – 0.36 yen = 3.24 yen per rupee

	₹ (in lakhs)
Present cost of 108 lakhs yen	30.00
Cost after 3 months: 108 lakhs yen / 3.24 yen	33.33
Expected exchange loss	3.33
If the expected exchange rate risk is hedged by a Forward contract:	
Present cost	30.00
Cost after 3 months if forward contract is taken 108 lakhs yen / 3.3 yen	32.73
Expected loss	2.73

Suggestion: If the exchange rate risk is not covered with forward contract, the expected exchange loss is ₹ 3.33 lakhs. This could be reduced to ₹ 2.73 lakhs if it is covered with Forward contract. Hence, taking forward contract is suggested.

Question 9(Study Material TYK Q. 12)/MTP Sep'22)

Z Ltd. importing goods worth USD 2 million, requires 90 days to make the payment. The overseas supplier has offered a 60 days interest free credit period and for additional credit for 30 days an interest of 8% per annum.

The bankers of Z Ltd offer a 30 days loan at 10% per annum and their quote for foreign exchange is as follows:

	₹
Spot 1 USD	56.50
60 days forward for 1 USD	57.10
90 days forward for 1 USD	57.50

You are required to evaluate the following options:

(i) Pay the supplier in 60 days, or

(ii) Avail the supplier's offer of 90 days credit.

Solution

(i) Pay the supplier in 60 days

If the payment is made to supplier in 60 days the applicable forward rate for 1 USD	₹ 57.10
Payment Due	USD 2,000,000
Outflow in Rupees (USD 2000000 × ₹ 57.10)	₹ 114,200,000
Add: Interest on loan for 30 days @ 10% p.a.	₹ 9,51,667
Total Outflow in ₹	₹ 11,51,51,667

(ii) Availing supplier's offer of 90 days credit

Amount Payable	USD 2,000,000
Add: Interest on credit period for 30 days @ 8% p.a.	USD 13,333
Total Outflow in USD	USD 2,013,333

Applicable forward rate for 1 USD	₹ 57.50
Total Outflow in ₹ (USD 2,013,333 × ₹ 57.50)	₹115,766,648

Alternative 1 is better as it entails lower cash outflow.

Question 10(Study Material TYK Q. 21)/RTP Nov'19

An Indian importer has to settle an import bill for $ 1,30,000. The exporter has given the Indian exporter two options:

(i) Pay immediately without any interest charges.

(ii) Pay after three months with interest at 5 percent per annum.

The importer's bank charges 15 percent per annum on overdrafts. The exchange rates in the market are as follows:

Spot rate (₹ / $)	48.35 / 48.36
3 - Months forward rate (₹ / $)	48.81 / 48.83

The importer seeks your advice. Give your advice.

Solution

If importer pays now, he will have to buy US $ in Spot Market by availing overdraft facility. Accordingly, the outflow under this option will be

	₹
Amount required to purchase $130000 [$130000 x ₹ 48.36]	6286800
Add: Overdraft Interest for 3 months @15% p.a.	235755
	6522555

If importer makes payment after 3 months then, he will have to pay interest for 3 months @ 5% p.a. for 3 month along with the sum of import bill. Accordingly, he will have to buy $ in forward market. The outflow under this option will be as follows:

	$
Amount of Bill	130000
Add: Interest for 3 months @5% p.a.	1625
	131625

Amount to be paid in Indian Rupee after 3 month under the forward purchase contract ₹ 6427249 (US$ 131625 x ₹ 48.83)

Since outflow of cash is least in (ii) option, it should be opted for.

Question 11(Study Material TYK Q. 22)/MTP April'22/MTP Sep'22

DEF Ltd. has imported goods to the extent of US $ 1 crore. The payment terms are 60 days interest - free credit. For additional credit of 30 days, interest at the rate of 7.75% p.a. will be charged.

The banker of DEF Ltd. has offered a 30 days loan at the rate of 9.5% p.a. Their quote for the foreign exchange is as follows:

Spot rate INR / US $	62.50
60 days forward rate INR / US $	63.15
90 days forward rate INR / US $	63.45

Which one of the following options would be better?

(i) Pay the supplier on 60th day and avail bank loan for 30 days.

(ii) Avail the supplier's offer of 90 days credit.

Solution

(i) Pay the supplier in 60 days

If the payment is made to supplier in 60 days the applicable forward rate for 1 USD	₹ 63.15
Payment Due	USD 1 crore
Outflow in Rupees (USD 1 crore × ₹ 63.15)	₹ 63.15 crore
Add: Interest on loan for 30 days @ 9.5% p.a.	₹ 0.50 crore
Total Outflow in ₹	₹ 63.65 crore

(ii) Availing supplier's offer of 90 days credit

Amount Payable	USD 1.00000 crore
Add: Interest on credit period for 30 days @ 7.75% p.a.	USD 0.00646 crore
Total Outflow in USD	USD 1.00646 crore
Applicable forward rate for 1 USD	₹ 63.45
Total Outflow in ₹ (USD 1.00646 crore × ₹ 63.45)	₹ 63.86 crore

Alternative 1 is better as it entails lower cash outflow.

Question 12(Study Material TYK Q. 23)/Similar Q asked in PP Dec'21

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st July, 2016 for which it has to make a payment of US $ 60,000 on December 31, 2016. The present exchange rate is 1 US $ = ₹ 65. It can purchase forward 1 $ at ₹ 64. The company will have to make an upfront premium @ 2% of the forward amount purchased. The cost of funds to the company is 12% per annum.

In the following situations, compute the profit / loss the company will make if it hedges its foreign exchange risk with the exchange rate on 31st December, 2016 as:

i) ₹ 68 per US $.

ii) ₹ 62 per US $.

iii) ₹ 70 per US $.

iv) ₹ 65 per US $.

Solution

	(₹)
Present Exchange Rate ₹ 65 = 1 US$	
If company purchases US$ 60,000 forward premium is	
60000 × 64 × 2%	76,800
Interest on ₹ 76,800 for 6 months at 12%	4,608
Total hedging cost	**81,408**
If exchange rate is ₹ 68	
Then gain (₹ 68 – ₹ 64) for US $ 60,000	2,40,000
Less: Hedging cost	81,408
Net gain	**1,58,592**
If US$ = ₹ 62	
Then loss (₹ 64 – ₹ 62) for US $ 60,000	1,20,000
Add: Hedging Cost	81,408
Total Loss	**2,01,408**
If US$ = ₹ 70	
Then Gain (₹ 70 – ₹ 64) for US $ 60,000	3,60,000
Less: Hedging Cost	81,408
Total Gain	**2,78,592**
If US$ = ₹ 65	
Then Gain (₹ 65 – ₹ 64) for US $ 60,000	60,000
Less: Hedging Cost	81,408
Net Loss	**21,408**

Question 13(Study Material TYK Q. 42)/PP May'22

Sun Ltd. is planning to import equipment from Japan at a cost of 3,400 lakh yen. The company may avail loans at 18 percent per annum with quarterly rests with which it can import the equipment. The company has also an offer from Osaka branch of an India based bank extending credit of 180 days at 2 percent per annum against opening of an irrecoverable letter of credit.

Additional information:

Present exchange rate	₹ 100 = 340 yen
180 day's forward rate	₹ 100 = 345 yen

Commission charges for letter of credit at 2 per cent per 12 months.

Advice the company whether the offer from the foreign branch should be accepted.

Solution

Option I (To finance the purchases by availing loan at 18% per annum):

Cost of equipment	₹ in lakhs
3400 lakh yen at ₹ 100 = 340 yen	1,000.00
Add: Interest at 4.5% I Quarter	45.00

Add: Interest at 4.5% II Quarter (on ₹ 1045 lakhs)	47.03
Total outflow in Rupees	1,092.03
Alternatively, interest may also be calculated on compounded basis, i.e., ₹ 1000 × $[1.045]^2$	₹ 1,092.03

Option II (To accept the offer from foreign branch):

Cost of letter of credit	
At 1 % on 3400 lakhs yen at ₹ 100 = 340 yen	₹ 10.00 lakhs
Add: Interest for 2 Quarters	₹ 0.90 lakhs
(A)	₹ 10.90 lakhs
Payment at the end of 180 days:	
Cost	3400.00 lakhs yen
Interest at 2% p.a. [3400 × 2/100 × 180/365]	33.53 lakhs yen
	3433.53 lakhs yen
Conversion at ₹ 100 = 345 yen [3433.53 / 345 ×100] (B)	₹ 995.23 lakhs
Total Cost: (A) + (B)	₹ 1006.13 lakhs

Advise: Option 2 is cheaper by (1092.03 – 1006.13) lakh or ₹ 85.90 lakh. Hence, the offer may be accepted.

Question 14(Study Material TYK Q. 13)/RTP May'20

Followings are the spot exchange rates quoted at three different forex markets:

USD / INR	48.30 in Mumbai
GBP / INR	77.52 in London
GBP / USD	1.6231 in New York

The arbitrageur has USD 1,00,00,000. Assuming that there are no transaction costs, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.

Solution

The arbitrageur can proceed as stated below to realize arbitrage gains.

(i) Buy ₹ from USD 10,000,000 At Mumbai 48.30 × 10,000,000 ₹ 483,000,000

(ii) Convert these ₹ to GBP at London $\left(\frac{₹\ 483,000,000}{₹\ 77.52}\right)$ GBP 6,230,650.155

(iii) Convert GBP to USD at New York GBP 6,230,650.155 × 1.6231 USD 10,112,968.26

There is net gain of USD 10,112968.26 less USD 10,000,000 i.e. USD 112,968.26

Question 15(Study Material TYK Q. 47)/MTP March'19

You have following quotes from Bank A and Bank B:

	Bank A	Bank B
SPOT	USD/CHF 1.4650/55	USD/CHF 1.4653/60
3 months	5/10	

6 months	10/15	
SPOT	GBP/USD 1.7645/60	GBP/USD 1.7640/50
3 months	25/20	
6 months	35/25	

Calculate:

(i) How much minimum CHF amount you have to pay for 1 Million GBP spot?

(ii) Considering the quotes from Bank A only, for GBP / CHF what are the Implied Swap points for Spot over 3 months?

Solution

(i) To Buy 1 Million GBP Spot against CHF
1) First to Buy USD against CHF at the cheaper rate i.e. from Bank A. 1 USD = CHF 1.4655
2) Then to Buy GBP against USD at a cheaper rate i.e. from Bank B 1 GBP = USD 1.7650

By applying chain rule Buying rate would be
1 GBP = 1.7650 * 1.4655 CHF
1 GBP = CHF 2.5866

Amount payable CHF 2.5866 Million or CHF 25,86,600

(ii) Spot rate Bid rate GBP 1 = CHF 1.4650 * 1.7645 = CHF 2.5850
Offer rate GBP 1 = CHF 1.4655 * 1.7660 = CHF 2.5881

GBP / USD 3 months swap points are at discount
Outright 3 Months forward rate GBP 1 = USD 1.7620 / 1.7640 USD / CHF 3 months swap points are at premium
Outright 3 Months forward rate USD 1 = CHF 1.4655 / 1.4665

Hence,
Outright 3 Months forward rate GBP 1 = CHF 2.5822 / 2.5869
Spot rate GBP 1 = CHF 2.5850 / 2.5881
Therefore 3-month swap points are at discount of 28 / 12.

Question 16(Study Material TYK Q. 19)/RTP Nov'19

Excel Exporters are holding an Export bill in United States Dollar (USD) 1,00,000 due 60 days hence. They are worried about the falling USD value which is currently at ₹ 45.60 per USD. The concerned Export Consignment has been priced on an Exchange rate of ₹ 45.50 per USD. The Firm's Bankers have quoted a 60-day forward rate of ₹ 45.20.

Calculate:

(i) Rate of discount quoted by the Bank

(ii) The probable loss of operating profit if the forward sale is agreed to.

Solution

(i) Rate of discount quoted by the bank

$$= \frac{(45.20 - 45.60) \times 365 \times 100}{45.60 \times 60} = 5.33\%$$

(ii) Probable loss of operating profit:
(45.20 – 45.50) ₹ 1,00,000 = ₹ 30,000

Question 17(Study Material TYK Q. 28)/MTP Oct'18

An Indian exporting firm, Rohit and Bros., would be covering itself against a likely depreciation of pound sterling. The following data is given:

Receivables of Rohit and Bros	£ 500,000
Spot rate	₹ 56.00/£
Payment date	3-months
3 months interest rate	India: 12 per cent per annum
	UK: 5 per cent per annum

What should the exporter do?

Solution

The only thing lefts Rohit and Bros to cover the risk in the money market. The following steps are required to be taken:

(i) Borrow pound sterling for 3 - months. The borrowing has to be such that at the end of three months, the amount becomes £ 500,000. Say, the amount borrowed is £ x. Therefore
$x\left(1 + 0.05 \times \frac{3}{12}\right) = 500{,}000$ or x = £ 493,827

(ii) Convert the borrowed sum into rupees at the spot rate. This gives: £493,827 × ₹ 56 = ₹ 27,654,312

(iii) The sum thus obtained is placed in the money market at 12 per cent to obtain at the end of 3-months:
$S = ₹\ 27{,}654{,}312 \times \left(1 + 0.12 \times \frac{3}{12}\right) = ₹\ 28{,}483{,}941$

(iv) The sum of £500,000 received from the client at the end of 3 – months is used to refund the loan taken earlier.
From the calculations. It is clear that the money market operation has resulted into a net gain of ₹ 483,941 (₹ 28,483,941 – ₹ 500,000 × 56).

If pound sterling has depreciated in the meantime. The gain would be even bigger.

Question 18(Study Material TYK Q. 29)/RTP May'19

An exporter is a UK based company. Invoice amount is $ 3,50,000. Credit period is three months.

Exchange rates in London are:

Spot Rate	($ / £) 1.5865 – 1.5905
3-month Forward Rate	($ / £) 1.6100 – 1.6140

Rates of interest in Money Market:

	Deposit	Loan
$	7%	9%
£	5%	8%

Compute and show how a money market hedge can be put in place. Compare and contrast the outcome with a forward contract.

Solution

Identify: Foreign currency is an asset. Amount $ 3,50,000.

Create: $ Liability.

Borrow: In $. The borrowing rate is 9% per annum or 2.25% per quarter.

Amount to be borrowed: 3,50,000 / 1.0225 = $ 3,42,298.29

Convert: Sell $ and buy £. The relevant rate is the Ask rate, namely, 1.5905 per £,

(Note: This is an indirect quote). Amount of £s received on conversion is 2,15,214.27 (3,42,298.29 / 1.5905).

Invest: £ 2,15,214.27 will be invested at 5% for 3 months and get £ 2,17,904.45

Settle: The liability of $3,42,298.29 at interest of 2.25 per cent quarter matures to $3,50,000 receivable from customer.

Using forward rate, amount receivable is = 3,50,000 / 1.6140 = £2,16,852.54

Amount received through money market hedge = £2,17,904.45

Gain = 2,17,904.45 – 2,16,852.54 = £1,051.91

So, money market hedge is beneficial for the exporter.

Question 19(Study Material TYK Q. 38)

Columbus Surgicals Inc. is based in US, has recently imported surgical raw materials from the UK and has been invoiced for £ 480,000, payable in 3 months. It has also exported surgical goods to India and France.

The Indian customer has been invoiced for £ 138,000, payable in 3 months, and the French customer has been invoiced for € 590,000, payable in 4 months.

Current spot and forward rates are as follows:

£ / US $	
Spot	0.9830 – 0.9850
Three months forward	0.9520 – 0.9545
US $ / €	
Spot	1.8890 – 1.8920
Four months forward	1.9510 – 1.9540
Current money market rates are as follows:	
UK	10.0% – 12.0% p.a.
France	14.0% – 16.0% p.a.
USA	11.5% – 13.0% p.a.

You as Treasury Manager are required to show how the company can hedge its foreign exchange exposure using Forward markets and Money markets hedge and suggest which the best hedging technique is.

Solution

£ Exposure

Since Columbus has a £ receipt (£ 138,000) and payment of (£ 480,000) maturing at the same time i.e. 3 months, it can match them against each other leaving a net liability of £ 342,000 to be hedged

(i) Forward market hedge
Buy 3 months' forward contract accordingly, amount payable after 3 months will be = £ 342,000 / 0.9520 = US $ 359,244

(ii) Money market hedge
To pay £ after 3 months' Columbus shall requires to borrow in US$ and translate to £ and then deposit in £.

For payment of £ 342,000 in 3 months (@2.5% interest) amount required to be deposited now (£ 342,000 ÷ 1.025) = £ 333,658

With spot rate of 0.9830 the US$ loan needed will be = US$ 339,429

Loan repayable after 3 months (@3.25% interest) will be = US$ 350,460

In this case the money market hedge is a cheaper option.

€ Receipt

Amount to be hedged = € 590,000

(i) Forward market hedge
Sell 4 months' forward contract accordingly, amount

receivable after 4 months will be (€ 590,000 x1.9510) = US$ 1,151,090

(ii) Money market hedge
For money market hedge Columbus shall borrow in € and then translate to US$ and deposit in US$

For receipt of € 590,000 in 4 months (@ 5.33% interest)

amount required to be borrowed now (€590,000 ÷ 1.0533) = € 560,144

With spot rate of 1.8890 the US$ deposit will be = US$ 1,058,113

Deposit amount will increase over 4 months (@3.83% interest) will be = US$ 1,098,639

In this case, more will be received in US$ under the forward hedge.

Question 20(Study Material TYK Q. 24)/MTP Aug'18/PP Nov'19

Following information relates to AKC Ltd. which manufactures some parts of an electronics device which are exported to USA, Japan and Europe on 90 days credit terms.

Cost and Sales information:

	Japan	USA	Europe
Variable cost per unit	₹ 225	₹ 395	₹ 510
Export sale price per unit	Yen 650	US$10.23	Euro 11.99
Receipts from sale due in 90 days	Yen 78,00,000	US$1,02,300	Euro 95,920

Foreign exchange rate information:

	Yen / ₹	US$ / ₹	Euro / ₹
Spot market	2.417-2.437	0.0214-0.0217	0.0177-0.0180
3 months forward	2.397-2.427	0.0213-0.0216	0.0176-0.0178
3 months spot	2.423-2.459	0.02144-0.02156	0.0177-0.0179

Advise AKC Ltd. by calculating average contribution to sales ratio whether it should hedge its foreign currency risk or not.

Solution

If foreign exchange risk is hedged

				Total (₹)
Sum due	Yen 78,00,000	US$1,02,300	Euro 95,920	
Unit input price	Yen 650	US$10.23	Euro 11.99	
Unit sold	12000	10000	8000	
Variable cost per unit	₹ 225/-	₹ 395/-	₹ 510/-	
Variable cost	₹ 27,00,000	₹ 39,50,000	₹ 40,80,000	1,07,30,000
3- months forward rate for selling	2.427	0.0216	0.0178	
Rupee value of receipts	₹ 32,13,844	₹ 47,36,111	₹ 53,88,764	1,33,38,719
Contribution	₹ 5,13,844	₹ 7,86,111	₹ 13,08,764	26,08,719
Average contribution to sale ratio				19.56%
If risk is not hedged				
Rupee value of receipt	₹ 31,72,021	₹ 47,44,898	₹ 53,58,659	1,32,75,578
Total contribution				25,45,578
Average contribution to sale ratio				19.17%

AKC Ltd. Is advised to hedge its foreign currency exchange risk.

Question 21(Old PM)

Airlines Company entered into an agreement with Airbus for buying latest plans for a total value of F. F. (French Francs) 1,000 Million payable after 6 months. The current spot exchange rate is INR (Indian Rupees) 6.60 / FF. The Airlines Company cannot predict the exchange rate in the future. Can the Airlines Company hedge its Foreign Exchange risk? Explain by examples.

Solution

Airlines Company can hedge its foreign exchange risk by the following ways:

(i) **Hedging through Forward Contract**: The Company can take full forward cover against foreign exchange exposure and entirely hedge its risk. It can contract with a bank to buy French franc forward at an agreed exchange rate e.g. suppose the 6 months forward rate is INR 6.77 / FF. The liability is fixed and the airlines can concentrate on operation. Cost of forward contract $\frac{6.60 - 6.77}{6.60} \times \frac{360}{\text{days}}$

(ii) **Foreign Currency Option**: Foreign currency option is the right (not an obligation) to buy or sell a currency at an agreed exchange rate (exercise price) on or before an agreed maturity period. The right to buy is called a call option and right to sell is put option. Suppose, the airlines want to purchase a 6 months put option. The call option exercise rate (say) is INR 6.70. The Airlines will be required to pay a premium for purchasing the option say 5% of the value of call option INR 6700 ₹ 0.05 = INR 335

Maximum final cost = 6700 + 335 = INR 7035

Suppose at the end of 6 months the exchange rate stay at INR 6.8 / FF Airlines will exercise its put option hence it will buy FF at INR 6.7

Suppose exchange rate at the end of 6 months is INR 6.35, Airlines should not exercise its option. In the open market it need to pay only INR 6.35 (instead of INR 6.70) to buy one FF. However, it has already paid the option premium.

(iii) **Money Market Operations:**
Airlines can borrow in Indian Rupee an amount and get it converted in FFs at Spot Rate. This amount can be invested in France for 6 months so that this amount along with interest due on it becomes equal to FFs 1000 million and is used for making the payment. The loan in Indian Rupee can be repaid back after 6 months along with the interest due thereon. If interest rate parity holds, the difference in the forward rate and the spot rate is the reflection of the difference in the interest rates in two countries.

Thus, Airlines will be able to hedge against the changes in the exchange rate. The problem with money market is that all markets are not open and all countries are not fully convertible.

Question 22(Study Material TYK Q. 14)/Similar Q asked in MTP April'19
The US dollar is selling in India at ₹ 55.50. If the interest rate for 6 months borrowing in India is 10% per annum and the corresponding rate in USA is 4%.

(i) Do you expect that US dollar will be at a premium or at discount in the Indian Forex Market?

(ii) What will be the expected 6 – months forward rate for US dollar in India? And

(iii) What will be the rate of forward premium or discount?

Solution

(i) Under the given circumstances, the USD is expected to quote at a premium in India as the interest rate is higher in India.

(ii) Calculation of the forward rate:

$$\frac{1+R_h}{1+R_f} - \frac{F_1}{E_0}$$

Where: Rh is home currency interest rate, Rf is foreign currency interest rate, F1 is end of the period forward rate, and Eo is the spot rate.

Therefore $\frac{1+(0.10/2)}{1+(0.04/2)} = \frac{F_1}{55.50}$

$$\frac{1+0.05}{1+0.02} - \frac{F_1}{55.50}$$

or $\frac{1.05}{1.02} \times 55.50$ = F1

or $\frac{58.275}{1.02}$ = F1

or F1 = ₹ 57.13

(iii) Rate of premium:

$\frac{57.13-55.50}{55.50} \times \frac{12}{6} \times 100$ = 5.87%

Question 23(Study Material TYK Q. 20)

(i) On 1st April, 3 months interest rate in the US and Germany are 6.5 per cent and 4.5 per cent per annum respectively. The $ / DM spot rate is 0.6560. What would be the forward rate for DM for delivery on 30th June?

(ii) In International Monetary Market an international forward bid for December, 15 on pound sterling is $ 1.2816 at the same time that the price of IMM sterling future for delivery on December, 15 is $ 1.2806. The contract size of pound sterling is £ 62,500. How could the dealer use arbitrage in profit from this situation and how much profit is earned?

Solution

(i)

	USD	DM
Spot	0.6560	1.000
Interest rate p.a.	6.5%	4.5%
Interest for 91 days	0.0106	0.0112
Amount after 91 days	0.6666	1.0112
Hence forward rate	0.6666	0.6592
	1.0112	

OR

Forward Rate $= \frac{0.6560 \times \left\{1+\left(0.065 \times \frac{91}{365}\right)\right\}}{\left\{1+\left(0.045 \times \frac{91}{365}\right)\right\}}$

= 0.6592

(ii) Buy £ 62500 × 1.2806 = $ 80037.50
Sell £ 62500 × 1.2816 = $ 80100.00
Profit = $ 62.50

Alternatively, if the market comes back together before December 15, the dealer could unwind his position (by simultaneously buying £ 62,500 forward and selling a futures contract. Both for delivery on December 15) and earn the same profit of $ 62.5.

Question 24(Study Material TYK Q. 30)
The rate of inflation in India is 8% per annum and in the U.S.A., it is 4%. The current spot rate for USD in India is ₹ 46. What will be the expected rate after 1 year and after 4 years applying the Purchasing Power Parity Theory.

Solution

End of Year	₹	₹ / USD
1	₹ 46.00 x(1+ 0.08)/(1+ 0.04)	47.77
2	₹ 47.77 x(1+ 0.08)/(1+ 0.04)	49.61
3	₹ 49.61 x(1+ 0.08)/(1+ 0.04)	51.52
4	₹ 51.52 x(1+ 0.08)/(1+ 0.04)	53.50

Question 25(Study Material TYK Q. 31)

(i) The rate of inflation in USA is likely to be 3% per annum and in India it is likely to be 6.5%. The current spot rate of US $ in India is ₹ 43.40. Find the expected rate of US $ in India after one year and 3 years from now using purchasing power parity theory.

(ii) On April 1, 3 months interest rate in the UK £ and US $ are 7.5% and 3.5% per annum respectively. The UK £ / US $ spot rate is 0.7570. What would be the forward rate for US $ for delivery on 30th June?

Solution

(i) According to Purchasing Power Parity forward rate is

Spot Rate $\left[\frac{1+^{r}H}{1+^{r}F}\right]^{t}$

So spot rate after one year

= ₹ 43.40 $\left[\frac{1+0.065}{1+0.03}\right]^{t}$

= ₹ 43.4 (1.03399)

= ₹ 44.8751

After 3 years

₹ 43.40 $\left[\frac{1+0.065}{1+0.03}\right]^3$

= ₹ 43.40 (1.03398)3

= ₹ 43.40 (1.10544) = ₹ 47.9761

(ii) As per interest rate parity

$$S_1 = S_0 \left[\frac{1 + \text{in A}}{1 + \text{in B}}\right]$$

$$S_1 = £\,0.7570 \left[\frac{1 + (0.075) \times \frac{3}{12}}{1 + (0.035) \times \frac{3}{12}}\right]$$

$$= £\,0.7570 \left[\frac{1.01875}{1.00875}\right]$$

= £ 0.7570 x 1.0099 = £ 0.7645

= UK £ 0.7645 / US $

Question 26(Old PM)

Shoe Company sells to a wholesaler in Germany. The purchase price of a shipment is 50,000 deutsche marks with term of 90 days. Upon payment, Shoe Company will convert the DM to dollars. The present spot rate for DM per dollar is 1.71, whereas the 90 - day forward rate is 1.70.

You are required to calculate and explain:

(i) If Shoe Company were to hedge its foreign - exchange risk, what would it do? What transactions are necessary?

(ii) Is the deutsche mark at a forward premium or at a forward discount?

(iii) What is the implied differential in interest rates between the two countries? (Use interest - rate parity assumption).

Solution

(i) If Shoe Company were to hedge its foreign exchange risk, it would enter into forward contract of selling deutsche marks 90 days forward. It would sell 50,000 deutsche marks 90 days forward. Upon delivery of 50,000 DM 90 days hence, it would receive US $ 29,412 i.e. 50,000 DM / 1.70. If it were to receive US $ payment today it would receive US $ 29,240 i.e. 50,000 DM / 1.71. Hence, Shoe Company will be better off by $ 172 if it hedges its foreign exchange risk.

(ii) The deutsche mark is at a forward premium. This is because the 90 days forward rate of deutsche marks per dollar is less than the current spot rate of deutsche marks per dollar. This implies that deutsche mark is expected to be strengthen i.e. Fewer deutsche mark will be required to buy dollars.

(iii) The interest rate parity assumption is that high interest rates on a currency are offset by forward discount and low interest rate on a currency is offset by forward premiums.

Further, the spot and forward exchange rates move in tandem, with the link between them based on interest differential. The movement between two currencies to take advantage of interest rates differential is a major determinant of the spread between forward and spot rates. The forward discount or premium is approximately equal to interest differential between the currencies i.e.

$$\frac{F_{(DM/US\$)} - S_{(DM/US\$)}}{S_{(DM/US\$)}} \times \frac{365}{90} = r_{DM} - r_{US\$}$$

or $\frac{1.70-1.71}{1.71} \times \frac{365}{90} = r_{DM} - r_{US\$}$

or – 0.0237 = $r_{DM} - r_{US\$}$

Therefore, the differential in interest rate is –2.37%, which means if interest rate parity holds, interest rate in the US should be 2.37% higher than in Germany.

Question 27(Study Material TYK Q. 2)
ABN - Amro Bank, Amsterdam, wants to purchase ₹ 15 million against US $ for funding their Nostro account with Canara Bank, New Delhi. Assuming the inter – bank, rates of US $ is ₹ 51.3625 / 3700, what would be the rate Canara Bank would quote to ABN - Amro Bank? Further, if the deal is struck, what would be the equivalent US $ amount.

Solution
Here Canara Bank shall buy US $ and credit ₹ to Vostro account of ABN - Amro Bank. Canara Bank's buying rate will be based on the Inter - bank Buying Rate (as this is the rate at which Canara Bank can sell US $ in the Interbank market)

Accordingly, the Interbank Buying Rate of US $ will be ₹ 51.3625 (lower of two) i.e. (1 / 51.3625) = $ 0.01947 / ₹

Equivalent of US $ for ₹ 15 million at this rate will be

$$= \frac{15,000,000}{51.3625} = US\$\ 2,92,041.86$$

or = 15,000,000 x $ 0.01947 = US$ 2,92,050

Question 28(Study Material TYK Q. 3)
XYZ Bank, Amsterdam, wants to purchase ₹ 25 million against £ for funding their Nostro account and they have credited LORO account with Bank of London, London. Calculate the amount of £'s credited. Ongoing inter-bank rates are per $, ₹ 61.3625/3700 & per £, $ 1.5260/70.

Solution
To purchase Rupee, XYZ Bank shall first sell £ and purchase $ and then sell $ to purchase Rupee. Accordingly, following rate shall be used:

The available rates are as follows: (£ / ₹)ask

($ / £)bid	$1.5260
($ / £)ask	$1.5270

(₹ / $)bid	₹ 61.3625
(₹ / $)ask	₹ 61.3700

From above available rates we can compute required rate as follows:

(£ / ₹)ask =(£ / $)ask x ($ / ₹)ask
= (1 / 1.5260) x (1 / 61.3625)
= £ 0.01068 or £ 0.0107

Thus, amount of £ to be credited = ₹ 25,000,000 x £ 0.0107
= £ 267,500

Question 29(Study Material TYK Q. 51)(MTP Oct'20/PP Nov'18/MTP March'22)

You as a dealer in foreign exchange have the following position in Swiss Francs on 31st October, 2009:

	Swiss Francs
Balance in the Nostro A/c Credit	1,00,000
Opening Position Overbought	50,000
Purchased a bill on Zurich	80,000
Sold forward TT	60,000
Forward purchase contract cancelled	30,000
Remitted by TT	75,000
Draft on Zurich cancelled	30,000

What steps would you take, if you are required to maintain a credit Balance of Swiss Francs 30,000 in the Nostro A/c and keep as overbought position on Swiss Francs 10,000?

Solution

Exchange Position:

Particulars	Purchase Sw. Fcs.	Sale Sw. Fcs.
Opening Balance Overbought	50,000	
Bill on Zurich	80,000	
Forward Sales – TT		60,000
Cancellation of Forward Contract		30,000
TT Sales		75,000
Draft on Zurich cancelled	30,000	-
	1,60,000	1,65,000
Closing Balance Oversold	5000	-
	1,65,000	1,65,000

Cash Position (Nostro A/c)

	Credit	Debit
Opening balance credit	1,00,000	—
TT sales	—	75,000

	1,00,000	75,000
Closing balance (credit)	—	25,000
	1,00,000	1,00,000

The Bank has to buy spot TT Sw. Fcs. 5,000 to increase the balance in Nostro account to Sw. Fcs. 30,000.

This would bring down the oversold position on Sw. Fcs. as Nil.

Since the bank requires an overbought position of Sw. Fcs. 10,000, it has to buy forward Sw. Fcs. 10,000.

Question 30(Old PM)

The following table shows interest rates for the United States Dollar and French Franc. The spot exchange rate is 7.05 Franc per Dollar. Complete the missing entries:

	3 Months	6 Months	1 Year
Dollar interest rate			
(annually compounded)	$11\frac{1}{2}\%$	$12\frac{1}{4}\%$	?
Franc interest rate			
(annually compounded)	$19\frac{1}{2}\%$	?	20%
Forward Franc per Dollar	?	?	7.5200
Forward discount per Franc			
percent per year	?	6.3%	

Solution

Computation of Missing Entries in the Table: For computing the missing entries in the table we will use Interest Rates Parity (IRP) theorem. This theorem states that the exchange rate of two countries will be affected by their interest rate differential. In other words, the currency of one country with a lower interest rate should be at a forward premium in terms of currency of country with higher interest rates and vice versa. This implies that the exchange rate (forward and spot) differential will be equal to the interest rate differential between the two countries i.e.

Interest rate differential = Exchange rate differential

or $\frac{(1+ r_f)}{(1+ r_d)} - \frac{S_{f/d}}{F_{f/d}}$

Where rf is the rate of interest of country F (say the foreign country), rd is rate of interest of country D (say domestic country), Sf/d is the spot rate between the two countries F and D and Ff/d is the forward rate between the two countries F and D.

3 months

Dollar interest rate = $11\frac{1}{2}$ % (annually compounded)

Franc interest rate = $19\frac{1}{2}$ % (annually compounded)

Then Forward Franc per Dollar rate would be

$$= 7.05\left(\frac{1+\frac{0.195}{4}}{1+\frac{0.115}{4}}\right) = 7.05\left(\frac{1+0.04875}{1+0.02875}\right)$$

= Franc 7.19 per US Dollar

Further Forward discount per Franc per cent per year = Interest Differential i.e.

$$= 19\frac{1}{2}\,\% - 11\frac{1}{2}\,\% = 8\%$$

Alternatively, more precisely it can also be computed as follows:

Spot Per Franc Rate = 1 / 7.05 = US Dollar 0.142 per Franc

One Year Forward Rate = $0.142\left(\frac{1+0.115}{1+0.195}\right)$ = US Dollar 0.132 per Franc

Accordingly, the discount per annum will be = $\frac{0.142-0.132}{0.142} \times 100 = 7.04\%$

6 months

Forward discount on Franc % per year = - 6.3% or – 3.15% for 6 months

Hence 6 months Forward rate = 7.05 / (100% - 3.15%)

Forward Francs per Dollar = 7.28 Francs

Let r be the Franc interest rate (annually compounded) then as per IRP Theory:

$$7.05\left(\frac{1+\frac{r}{2}}{1+\frac{0.1225}{2}}\right) = \text{Franc } 7.28 \text{ per Dollar}$$

On solving the equation we get the value of r =19.17% i.e. Franc interest rate (annually compounded)

1 Year

Franc interest rate = 20% (annually compounded)

Forward Franc per Dollar = 7.5200

As per Interest Rate Parity the relationship between the two countries rate and spot rate is

$$\frac{1+\text{ Dollar interest rate}}{1+0.20} = \frac{7.05}{7.52}$$

Accordingly, the Dollar interest rate = 1.20 x 0.9374 – 1 = 1.125 – 1 = 0.125 or 12.5%

The completed Table will be as follows:

	3 Months	6 Months	1 Year
Dollar interest rate (annually compounded)	$11\frac{1}{2}\%$	$12\frac{1}{4}\%$	12.50%
Franc interest rate (annually compounded)	$19\frac{1}{2}\%$	19.17%	20%
Forward Franc per Dollar	7.19	7.28	7.5200
Forward discount per Franc percent per year	8% or 7.04%	6.3%	

Question 31(Study Material TYK Q 26)

Spot rate 1 US $ = ₹ 48.0123

180 days Forward rate for 1 US $ = ₹ 48.8190

Annualised interest rate for 6 months – Rupee = 12%

Annualised interest rate for 6 months – US $ = 8%

Is there any arbitrage possibility? If yes how an arbitrageur can take advantage of the situation, if he is willing to borrow ₹ 40,00,000 or US $ 83,312.

Solution

Spot Rate = ₹ 40,00,000 / US $ 83,312 = 48.0123

Forward Premium on US$ = [(48.8190 – 48.0123) / 48.0123] x 12 / 6 x 100 = 3.36%

Interest rate differential = 12% - 8% = 4%

Since the negative Interest rate differential is greater than forward premium there is a possibility of arbitrage inflow into India.

The advantage of this situation can be taken in the following manner:

1	Borrow US $ 83,312 for 6 months	
	Amount to be repaid after 6 months	= US $ 83,312 (1+0.08 x 6 / 12)
		= US $ 86,644.48
2	Convert US$ 83,312 into Rupee and get the principal i.e.	₹ 40,00,000
	Interest on Investments for 6 months	₹ 40,00,000 / - x 0.06
		= ₹ 2,40,000/-
	Total amount at the end of 6 months = ₹ 42,40,000/-	= ₹ (40,00,000 + 2,40,000)
	Converting the same at the forward rate	= ₹ 42,40,000/ ₹ 48.8190
		= US $ 86,851.43

Hence the gain is US $ (86,851.43 – 86,644.48) = US $ 206.95

OR

₹ 10,103 i.e., ($ 206.95 x ₹ 48.8190)

Question 32(Study Material TYK Q 27)/PP May'18

Given the following information:
Exchange rate – Canadian dollar 0.665 per DM (spot)
Canadian dollar 0.670 per DM (3 months)
Interest rates – DM 7% p.a.
Canadian Dollar – 9% p.a.

What operations would be carried out to take the possible arbitrage gains?

Solution

In this case, DM is at a premium against the Can $.

Premium = [(0.67 – 0.665) / 0.665] x (12 / 3) x 100 = 3.01 per cent

Interest rate differential = 9% - 7% = 2 per cent.

Since the interest rate differential is smaller than the premium, it will be profitable to place money in Deutsch marks the currency whose 3 - months interest is lower.

The following operations are carried out:

Borrow Can$ 1000 at 9 per cent for 3- months;

Change this sum into DM at the spot rate to obtain DM = (1000 / 0.665) = 1503.76

Place DM 1503.76 in the money market for 3 months to obtain a sum of DM

Principal:	1503.76
Add: Interest @ 7% for 3 months	26.32
Total	1530.08

Sell DM at 3 – months forward to obtain Can $ = (1530.08 x 0.67) = 1025.15

Refund the debt taken in Can $ with the interest due on it, i.e.,

	Can $
Principal:	1000.00
Add: Interest @ 9% for 3 months =	22.50
Total	1022.50

Net arbitrage gain = 1025.15 – 1022.50 = Can $ 2.65

Question 33(Study Material TYK Q 49)/RTP May'18/RTP Nov'21

Your bank's London office has surplus funds to the extent of USD 5,00,000/- for a period of 3 months. The cost of the funds to the bank is 4% p.a. It proposes to invest these funds in London, New York or Frankfurt and obtain the best yield, without any exchange risk to the bank. The following rates of interest are available at the three centres for investment of domestic funds there at for a period of 3 months.

London	5 % p.a.
New York	8% p.a.
Frankfurt	3% p.a.

The market rates in London for US dollars and Euro are as under:

London on New York

Spot	1.5350/90
1 month	15/18
2 months	30/35
3 months	80/85

London on Frankfurt

Spot	1.8260/90
1 month	60/55
2 months	95/90
3 months	145/140

At which centre, will be investment be made & what will be the net gain (to the nearest pound) to the bank on the invested funds?

Solution

(i) **If investment is made at London**

Convert US $ 5,00,000 at Spot Rate (5,00,000 / 1.5390)		£ 3,24,886
Add: £ Interest for 3 months on £ 324,886 @ 5%		£ 4,061
		£ 3,28,947
Less: Amount Invested	$ 5,00,000	
Interest accrued thereon	$ 5,000	
	$ 5,05,000	
Equivalent amount of £ required to pay the above sum ($ 5,05,000/1.5430*)		£ 3,27,285
Arbitrage Profit		£ 1,662

(ii) **If investment is made at New York**

Gain $ 5,00,000 (8% - 4%) x 3/12	$ 5,000
Equivalent amount in £ 3 months ($ 5,000/ 1.5475)	£ 3,231

(iii) **If investment is made at Frankfurt**

Convert US $ 500,000 at Spot Rate (Cross Rate) 1.8260/1.5390	€ 1.1865
Euro equivalent US $ 500,000	€ 5,93,250
Add: Interest for 3 months @ 3%	€ 4,449
	€ 5,97,699
3 month Forward Rate of selling € (1 / 1.8150)	**£ 0.5510**
Sell € in Forward Market € 5,97,699 x £ 0.5510	£ 3,29,332
Less: Amounted invested and interest thereon	£ 3,27,285
Arbitrage Profit	**£ 2,047**

Since out of three options the maximum profit is in case investment is made in New York. Hence it should be opted.

* Due to conservative outlook.

Question 34(Old PM)

AMK Ltd. an Indian based company has subsidiaries in U.S. and U.K.

Forecasts of surplus funds for the next 30 days from two subsidiaries are as below:

U.S.	$ 12.5 million
U.K.	£ 6 million

Following exchange rate information is obtained:

	$ / ₹	£ / ₹
Spot	0.0215	0.0149
30 days forward	0.0217	0.0150

Annual borrowing / deposit rates (Simple) are available.

₹	6.4% / 6.2%
$	1.6% / 1.5%
£	3.9% / 3.7%

The Indian operation is forecasting a cash deficit of ₹ 500 million. It is assumed that interest rates are based on a year of 360 days.

(i) Calculate the cash balance at the end of 30 days period in ₹ for each company under each of the following scenarios ignoring transaction costs and taxes:
   a) Each company invests / finances its own cash balances / deficits in local currency independently.
   b) Cash balances are pooled immediately in India and the net balances are invested / borrowed for the 30 days period.

(ii) Which method do you think is preferable from the parent company's point of view?

Solution

Cash Balances: ('000)

Acting independently

	Capital	Interest	₹ in 30 days
India	-5,00,000	-2,666.67	-5,02,667
U.S.	12,500	15.63	5,76,757
U.K.	6,000	18.50	4,01,233
			4,75,323

Cash Balances:-

Immediate Cash pooling ₹

India	-	- 5,00,000
U.S. =	$\frac{12,500}{0.0215}$	5,81,395

U.K.	$\frac{6,000}{0.0149}$	**4,02,685**
		4,84,080

Immediate cash pooling is preferable as it maximizes interest earnings

Note: If the company decides to invest pooled amount of ₹ 4,84,080/- @ 6.2% p.a. for 30 days an interest of ₹ 2,501/- will accrue.

Question 35(Illustration 9)/RTP May'18/Similar Q asked in MTP Oct'21

An importer booked a forward contract with his bank on 10th April for USD 2,00,000 due on 10th June @ ₹ 64.4000. The bank covered its position in the market at ₹ 64.2800.

The exchange rates for dollar in the interbank market on 10th June and 13th June were:

	10th June	13th June
Spot USD 1=	₹ 63.8000 / 8200	₹ 63.6800 / 7200
Spot/June	₹ 63.9200 / 9500	₹ 63.8000 / 8500
July	₹ 64.0500 / 0900	₹ 63.9300 / 9900
August	₹ 64.3000 / 3500	₹ 64.1800 / 2500
September	₹ 64.6000 / 6600	₹ 64.4800 / 5600

Exchange Margin 0.10% and interest on outlay of funds @ 12%. The importer requested on 14th June for extension of contract with due date on 10th August.

Rates to be rounded off to 4 decimals in multiples of 0.0025.

On 10th June, Bank Swaps by selling spot and buying one month forward.

Calculate:

(i) Cancellation rate

(ii) Amount payable on $ 2,00,000

(iii) Swap loss

(iv) Interest on outlay of funds, if any

(v) New contract rate

(vi) Total Cost

Solution

(i) **Cancellation Rate:**

The forward sale contract shall be cancelled at Spot TT Purchase for $ prevailing on the date of cancellation as follows:

$ / ₹ Market Buying Rate	₹ 63.6800
Less: Exchange Margin @ 0.10%	₹ 0.0636
	₹ 63.6163

Rounded off to ₹ 63.6175

(ii) Amount payable on $ 2,00,000

Bank sells $2,00,000 @ ₹ 64.4000	₹ 1,28,80,000
Bank buys $2,00,000 @ ₹ 63.6175	₹ 1,27,23,500
Amount payable by customer	₹ 1,56,500

(iii) **Swap Loss**

On 10th June the bank does a swap sale of $ at market buying rate of ₹ 63.8000 and forward purchase for June at market selling rate of ₹ 63.9500.

Bank buys at	₹ 63.9500
Bank sells at	₹ 63.8000
Amount payable by customer	₹ 0.1500

Swap Loss for $ 2,00,000 is ₹ = ₹ 30,000

(iv) **Interest on Outlay of Funds**

On 10th June, the bank receives delivery under cover contract at ₹ 64.2800 and sell spot at ₹ 63.8000.

Bank buys at	₹ 64.2800
Bank sells at	₹ 63.8000
Amount payable by customer	₹ 0.4800

Outlay for $ 2,00,000 is	₹ 96,000
Interest on ₹ 96,000 @ 12% for 3 days	₹ 96

New Contract Rate

(v) **The contract will be extended at current rate**

$/ ₹ Market forward selling Rate for August	₹ 64.2500
Add: Exchange Margin @ 0.10%	₹ 0.0643
	₹ 64.3143

Rounded off to ₹ 64.3150

(vi) **Total Cost**

Cancellation Charges	₹ 1,56,500.00
Swap Loss	₹ 30,000.00
Interest	₹ 96.00
	₹ 1,86,596.00

Question 36(Study Material TYK Q 45)

A bank enters into a forward purchase TT covering an export bill for Swiss Francs 1,00,000 at ₹ 32.4000 due 25th April and covered itself for same delivery in the local interbank market at ₹ 32.4200. However, on 25th March, exporter sought for cancellation of the contract as the tenor of the bill is changed.

In Singapore market, Swiss Francs were quoted against dollars as under:

Spot	USD 1 = Sw. Fcs.	1.5076 / 1.5120
One month forward		1.5150 / 1.5160
Two months forward		1.5250 / 1.5270
Three months forward		1.5415 / 1.5445

and in the interbank market US dollars were quoted as under:

Spot	USD 1 = ₹	49.4302 /.4455
Spot / April		4100 /.4200
Spot/May		.4300 /.4400
Spot/June		.4500 /.4600

Calculate the cancellation charges, payable by the customer if exchange margin required by the bank is 0.10% on buying and selling.

Solution

First the contract will be cancelled at TT Selling Rate

USD/ Rupee Spot Selling Rate	₹ 49.4455
Add: Premium for April	₹ 0.4200
	₹ 49.8655
Add: Exchange Margin @ 0.10%	₹ 0.04987
	₹ 49.91537 Or 49.9154
USD/ Sw. Fcs One Month Buying Rate	Sw. Fcs. 1.5150
Sw. Fcs Spot Selling Rate (₹ 49.91537 / 1.5150)	₹ 32.9474
Rounded Off	₹ 32.9475
Bank buys Sw. Fcs Under original contract	₹ 32.4000
Bank Sells under cancellation	₹ 32.9475
Difference Payable by customer	**₹ 00.5475**
Exchange difference of Sw. Fcs 1,00,000 payable by customer (Sw. Fcs 1,00,000 x ₹ 0.5475)	₹ 54,750

Question 37(Old PM)

Suppose you are a treasurer of XYZ plc in the UK. XYZ have two overseas subsidiaries, one based in Amsterdam and one in Switzerland. The Dutch subsidiary has surplus Euros in the amount of 725,000 which it does not need for the next three months but which will be needed at the end of that period (91 days). The Swiss subsidiary has a surplus of Swiss Francs in the amount of 998,077 that, again, it will need on day 91. The XYZ plc in UK has a net balance of £ 75,000 that is not needed for the foreseeable future.

Given the rates below, what is the advantage of swapping Euros and Swiss Francs into Sterling?

Spot Rate (€)	£0.6858- 0.6869
91 day Pts	0.0037 0.0040
Spot Rate(£)	CHF 2.3295- 2.3326
91 day Pts	0.0242 0.0228

Interest rates for the Deposits

Amount of Currency	91 day Interest Rate % pa		
	£	€	CHF
0 – 100,000	1	¼	0
100,001 – 500,000	2	1 ½	¼
500,001 – 1,000,000	4	2	½
Over 1,000,000	5.375	3	1

Solution

Individual Basis

	Interest	Amt. after 91 days	Conversion in £
Holland € 725,000 x 0.02 x 91/360 =	€ 3,665.28	€ 728,665.28	£502,414.71 (728,665.28 x 0.6895)
Switzerland CHF 998,077 x 0.005 x 91/360 =	CHF 1,261.46	CHF 999,338.46	£432,651.51 (999,338.46 ÷ 2.3098)
UK £ 75,000 x 0.01 x 91/360 =	£ 189.58	£ 75,189.58	£ 75,189.58
Total GBP at 91 days			£ 1,010,255.80

Swap to Sterling

Sell € 7,25,000 (Spot at 0.6858) buy £	£ 4,97,205.00
Sell CHF 9,98,077(Spot at 2.3326) buy £	£ 4,27,881.76
Independent GBP amount	£ 75,000.00
	£ 1,000,086.76
Interest (£ 1,000,086.76 x 0.05375 x 91/360)	£ 13,587.98
Total GBP at 91 days	**£ 1,013,674.74**
Less: Total GBP at 91 days as per individual basis	£ 1,010,255.80
Net Gain	**£ 3,418.94**

Question 38(Study Material TYK Q 43)/MTP Oct'19

NP and Co. has imported goods for US $ 7,00,000. The amount is payable after three months. The company has also exported goods for US $ 4,50,000 and this amount is receivable in two months. For receivable amount a forward contract is already taken at ₹ 48.90.

The market rates for Rupee and Dollar are as under:

Spot	₹ 48.50/70
Two months	25 / 30 points
Three months	40 / 45 points

The company wants to cover the risk and it has two options as under:

A) To cover payables in the forward market and

B) To lag the receivables by one month and cover the risk only for the net amount. No interest for delaying the receivables is earned. Evaluate both the options if the cost of Rupee Funds is 12%. Which option is preferable?

Solution

A) To cover payable and receivable in forward Market

Amount payable after 3 months	$7,00,000
Forward Rate	₹ 48.45
Thus Payable Amount (₹) (A)	₹ 3,39,15,000
Amount receivable after 2 months	$ 4,50,000
Forward Rate	₹ 48.90
Thus Receivable Amount (₹) (B)	₹ 2,20,05,000
Interest @ 12% p.a. for 1 month (C)	₹ 2,20,050
Net Amount Payable in (₹) (A) – (B) – (C)	₹ 1,16,89,950

B) Assuming that since the forward contract for receivable was already booked it shall be cancelled if we lag the receivables. Accordingly, any profit / loss on cancellation of contract shall also be calculated and shall be adjusted as follows:

Amount Payable ($)	$7,00,000
Amount receivable after 3 months	$ 4,50,000
Net Amount payable	$2,50,000
Applicable Rate	₹ 48.45
Amount payable in (₹) (A)	₹ 1,21,12,500
Profit on cancellation of Forward cost (48.90 – 48.30) × 4,50,000 (B)	₹ 2,70,000
Thus, net amount payable in (₹) (A) + (B)	₹ 1,18,42,500

Since net payable amount is least in case of first option, hence the company should cover payable and receivables in forward market.

Note: In the question it has not been clearly mentioned that whether quotes given for 2 and 3 months (in points terms) are premium points or direct quotes. Although above solution is based on the assumption that these are direct quotes, but students can also consider them as premium points and solve the question accordingly.

Question 39(Study Material TYK Q 44)

A customer with whom the Bank had entered into 3 months' forward purchase contract for Swiss Francs 10,000 at the rate of ₹ 27.25 comes to the bank after 2 months and requests cancellation of the contract. On this date, the rates, prevailing, are:

Spot	CHF 1 =	₹ 27.30	27.35
One month forward		₹ 27.45	27.52

What is the loss / gain to the customer on cancellation?

Solution

The contract would be cancelled at the one-month forward sale rate of ₹ 27.52.

	₹
Francs bought from customer under original forward contract at:	27.25
It is sold to him on cancellation at:	27.52
Net amount payable by customer per Franc	0.27

At ₹ 0.27 per Franc, exchange difference for CHF 10,000 is ₹ 2,700.

Loss to the Customer:

Exchange difference (Loss) ₹ 2,700

Note: The exchange commission and other service charges are ignored.

Question 40(Study Material TYK Q 32)

An importer requests his bank to extend the forward contract for US $ 20,000 which is due for maturity on 30th October, 2010, for a further period of 3 months. He agrees to pay the required margin money for such extension of the contract.

Contracted Rate US $ 1= ₹ 42.32

The US Dollar quoted on 30 - 10 - 2010:

Spot	41.5000 / 41.5200
3 months' Premium	0.87% / 0.93%

Margin money for buying and selling rate is 0.075% and 0.20% respectively.

Compute:

(i) The cost to the importer in respect of the extension of the forward contract, and

(ii) The rate of new forward contract.

Solution

(i)

The contract is to be cancelled on 30-10-2010 at the spot buying rate of US $ 1	₹ 41.5000
Less: Margin Money 0.075%	₹ 0.0311
	₹ 41.4689 or ₹ 41.47
US $ 20,000 @ ₹ 41.47	₹ 8,29,400
US $ 20,000 @ ₹ 42.32	₹ 8,46,400
The difference in favour of the Bank / Cost to the importer	₹ 17,000

(ii) The Rate of New Forward Contract

Spot Selling Rate US$ 1	₹ 41.5200
Add: Premium @ 0.93%	₹ 0.3861
	₹ 41.9061
Add: Margin Money 0.20%	₹ 0.0838
	₹ 41.9899 or ₹ 41.99

Question 41(Study Material Illustration 1)

Suppose you are a dealer of ABC Bank and on 20.10.2014 you found that balance in your Nostro account with XYZ Bank in London is £ 65,000 and you had overbought £ 35,000. During the day following transaction have taken place:

	£
DD purchased	12,500
Purchased a Bill on London	40,000
Sold forward TT	30,000
Forward purchase contract cancelled	15,000
Remitted by TT	37,500
Draft on London cancelled	15,000

What steps would you take, if you are required to maintain a credit Balance of £ 7,500 in the Nostro A/c and keep as overbought position on £ 7,500?

Solution

Exchange Position:

Particulars	Purchase £	Sale £
Opening Balance Overbought	35,000	—
DD Purchased	12,500	—
Purchased a Bill on London	40,000	—
Sold forward TT	—	30,000
Forward purchase contract cancelled	—	15,000
TT Remittance		37,500
Draft on London cancelled	15,000	—
	1,02,500	**82,500**
Closing Balance Overbougt	—	20,000
	1,02,500	**1,02,500**

Cash Position (Nostro A/c)

	Credit £	Debit £
Opening balance credit	65,000	—
TT Remittance	—	37,500
	65,000	37,500
Closing balance (credit)	—	27,500
	65,000	65,000

To maintain Cash Balance in Nostro Account at £ 7,500 you have to sell £ 20,000 in Spot which will bring Overbought exchange position to Nil. Since bank require Overbought position of £ 7,500 it has to buy the same in forward market.

Question 42(Study Material Illustration 3)
On 1st June 2015 the bank enters into a forward contract for 2 months for selling US $ 1,00,000 at ₹ 65.5000. On 31st July 2015 the spot rate was ₹ 65.7500 / 65.2500. Calculate the amount to be debited in the customer's account.

Solution
The bank will apply rate originally agreed upon i.e. ₹ 65.5000 and will debit the account of the customer with ₹ 65,50,000.

Question 43(Study Material Illustration 4)/MTP Oct'18/Similar Q asked in MTP April'21/PP May'19
On 1 October 2015 Mr. X an exporter enters into a forward contract with a BNP Bank to sell US $ 1,00,000 on 31 December 2015 at ₹ 65.40 / $. However, due to the request of the importer, Mr. X received amount on 28 November 2015. Mr. X requested the bank the take delivery of the remittance on 30 November 2015 i.e. before due date. The inter - banking rates on 28 November 2015 was as follows:

Spot	₹ 65.22 / 65.27
One Month Premium	10 / 15

If bank agrees to take early delivery then what will be net inflow to Mr. X assuming that the prevailing prime lending rate is 18%.

Solution
Bank will buy from customer at the agreed rate of ₹ 65.40. In addition to the same if bank will charge / pay swap difference and interest on outlay funds.

a) Swap Difference

Bank Sells at Spot Rate on 28 November 2015	₹ 65.22
Bank Buys at Forward Rate of 31 December 2015 (65.27 + 0.15)	₹ 65.42
Swap Loss per US$	**₹ 00.20**
Swap loss for US$ 1,00,000	₹ 20,000

b) Interest on Outlay Funds

On 28th November Bank sells at	₹ 65.22
It buys from customer at	₹ 65.40
Outlay of Funds per US $	₹ 00.18
Interest on Outlay fund for US$ 1,00,000 for 31 days (US $ 100000 x 00.18 x 31/365 x 18%)	**₹ 275.00**

c) Charges for early delivery

Swap loss	₹ 20,000.00
Interest on Outlay fund for US$ 1,00,000 for 31 days	₹ 275.00
	₹ 20,275.00

d) Net Inflow to Mr X

Amount received on sale (₹ 65.40 x 1,00,000)	₹ 65,40,000
Less: Charges for early delivery payable to bank	(₹ 20,275)
	₹ 65,19,725

Question 44(Study Material Illustration 5)

On 15th January 2015 you as a banker booked a forward contract for US $ 250000 for your import customer deliverable on 15th March 2015 at ₹ 65.3450. On due date customer request you to cancel the contract. On this date quotation for US $ in the inter-bank market is as follows:

Spot	₹ 65.2900 / 2975 per US $
Spot / April	3000 / 3100
Spot / May	6000 / 6100

Assuming that the flat charges for the cancellation is ₹ 100 and exchange margin is 0.10%, then determine the cancellation charges payable by the customer.

Solution

Bank will buy from customer at the agreed rate of ₹ 65.3450.

Since this is sale contract the contract shall be cancelled at ready buying rate on the date of cancellation as follows:

Spot Buying Rate on 15 March 2015	₹ 65.2900
Less: Exchange Margin	₹ 0.0653
	₹ 65.2247
Rounded to	₹ 65.2250
Dollar sold to customer at	₹ 65.3450
Dollar bought from customer	₹ 65.2250
Net amount payable by the customer per US $	**₹ 0.1200**

Amount payable by customer

Flat Charges	₹ 100.00
Cancellation Charges (₹ 0.12 x 250000)	₹ 30,000.00
	₹ 30,100.00

Question 45(Study Material Illustration 6)

You as a banker has entered into a 3 month's forward contract with your customer to purchase AUD 1,00,000 at the rate of ₹ 47.2500. However after 2 months your customer comes to you and requests cancellation of the contract. On this date quotation for AUD in the market is as follows:

Spot	₹ 47.3000 / 3500 per AUD
1 month forward	₹ 47.4500 / 5200 per AUD

Determine the cancellation charges payable by the customer.

Solution

The contract shall be cancelled at the 1 month forward sale rate of ₹ 47.5200 as follows:

AUD bought from customer under original forward contract at	₹ 47.2500
On cancellation it is sold to him at	₹ 47.5200
Net amount payable by customer per AUD	**₹ 00.2700**

Thus, total cancellation charges payable by the customer ₹ 27,000

Question 46(Study Material Illustration 7)

Suppose you are a banker and one of your export customer has booked a US $ 1,00,000 forward sale contract for 2 months with you at the rate of ₹ 62.5200 and simultaneously you covered yourself in the interbank market at ₹ 62.5900. However, on due date, after 2 months your customer comes to you and requests for cancellation of the contract and also requests for extension of the contract by one month. On this date quotation for US $ in the market was as follows:

Spot	₹ 62.7200/62.6800
1 month forward	₹ 62.6400/62.7400

Determine the extension charges payable by the customer assuming exchange margin of 0.10% on buying as well as selling.

Solution

Cancellation

First the original contract shall be cancelled at Spot Selling Rate as follows:

US $ / ₹ Spot Selling Rate	₹ 62.7200
Add: Margin @ 0.10%	₹ 0.06272
	₹ 62.78272
Rounded of	₹ 62.7825
Bank buys US$ under original contract at	₹ 62.5200
Bank Sells at Spot Rate	₹ 62.7825
	₹ 0.2625

Thus, total cancellation charges payable by the customer for US$ 1,00,000 is 26,250.

Rebooking

Forward US $ / ₹ Buying Rate	₹ 62.6400
Less: Margin @ 0.10%	₹ 0.06264
Net amount payable by customer per US $	**₹ 62.57736**
Rounded of	₹ 62.5775

Question 47(Study Material Illustration 8)

Suppose you as a banker entered into a forward purchase contract for US $ 50,000 on 5th March with an export customer for 3 months at the rate of ₹ 59.6000. On the same day you also covered yourself in the market at ₹ 60.6025. However on 5th May your customer comes to you and requests extension of the contract to 5th July. On this date (5th May) quotation for US $ in the market is

as follows:

Spot	₹ 59.1300 / 1400 per US $
Spot/ 5th June	₹ 59.2300 / 2425 per US $
Spot/ 5th July	₹ 59.6300 / 6425 per US $

Assuming a margin 0.10% on buying and selling, determine the extension charges payable by the customer and the new rate quoted to the customer.

Note: Rates to be rounded off to 4 decimals in multiples of 0.0025.

Solution

(i) **Cancellation of Original Contract**

The forward purchase contract shall be cancelled at the for the forward sale rate for delivery June.

Interbank forward selling rate	₹ 59.2425
Add: Exchange Margin	₹ 0.0592
Net amount payable by customer per US $	₹ 59.3017
Rounded off, the rate applicable is ₹ 59.3025 Buying US $ under original contract at original rate	₹ 59.6000
Selling rate to cancel the contract	₹ 59.3025
Difference per US $	₹ 00.2975

Exchange difference for US $ 50,000 payable to the customer is ₹ 14,875.

(ii) **Rate for booking new contract**

The forward contract shall be rebooked with the delivery 15th July as follows:

Forward buying rate (5th July)	₹ 59.6300
Less: Exchange Margin	₹ 0.0596
	₹ 59.5704
Rounded off to	₹ 59.5700

Question 48(Study Material TYK Q 4)

ABC Ltd. of UK has exported goods worth Can $ 5,00,000 receivable in 6 months. The exporter wants to hedge the receipt in the forward market. The following information is available:

Spot Exchange Rate	Can $ 2.5/£
Interest Rate in UK	12%
Interest Rate In Canada	15%

The forward rates truly reflect the interest rates differential. Find out the gain / loss to UK exporter if Can $ spot rates

(i) declines 2%,

(ii) gains 4% or

(iii) remains unchanged over next 6 months.

Solution

Forward Rate = $\frac{2.50\ (1+0.075)}{(1+0.060)}$ = Can $ 2.535 / £

(i) If spot rate decline by 2%

Spot Rate = Can $ 2.50 x 1.02 = Can $ 2.55 / £

	£
£ receipt as per Forward Rate (Can $ 5,00,000 / Can $ 2.535)	1,97,239
£ receipt as per Spot Rate (Can $ 5,00,000/ Can $ 2.55)	1,96,078
Gain due to forward contract	1,161

(ii) If spot rate gains by 4%

Spot Rate = Can $ 2.50 x 0.96 = Can $ 2.40 / £

	£
£ receipt as per Forward Rate (Can $ 5,00,000 / Can $ 2.535)	1,97,239
£ receipt as per Spot Rate (Can $ 5,00,000 / Can $ 2.40)	2,08,333
Loss due to forward contract	11,094

(iii) If spot rate remains unchanged

	£
£ receipt as per Forward Rate (Can $ 5,00,000/ Can$ 2.535)	1,97,239
£ receipt as per Spot Rate (Can $ 5,00,000/ Can$ 2.50)	2,00,000
Loss due to forward contract	2,761

Question 49(Study Material TYK Q 34)

ABC Technologic is expecting to receive a sum of US $ 4,00,000 after 3 months. The company decided to go for future contract to hedge against the risk. The standard size of future contract available in the market is $ 1000. As on date spot and futures $ contract are quoting at ₹ 44.00 & ₹ 45.00 respectively. Suppose after 3 months the company closes out its position futures are quoting at ₹ 44.50 and spot rate is also quoting at ₹ 44.50. You are required to calculate effective realization for the company while selling the receivable. Also calculate how company has been benefitted by using the future option.

Solution

The company can hedge position by selling future contracts as it will receive amount from outside.

Number of Contracts = $\frac{\$\ 4,00,000}{\$\ 1,000}$ = 400 contracts

Gain by trading in futures = (₹ 45 – ₹ 44.50) 4,00,000= ₹ 2,00,000

Net Inflow after 3 months = ₹ 44.50 x ₹ 4,00,000 + 2,00,000 = ₹ 1,80,00,000

Effective Price realization = $\frac{₹\ 1,80,00,000}{\$\ 4,00,000}$ = ₹ 45 Per US $

Question 50(Study Material TYK Q 15)

In March, 2009, the Multinational Industries make the following assessment of dollar rates per British pound to prevail as on 1.9.2009:

$ / Pound	Probability
1.60	0.15
1.70	0.20
1.80	0.25
1.90	0.20
2.00	0.20

(i) What is the expected spot rate for 1.9.2009?

(ii) If, as of March, 2009, the 6 - month forward rate is $ 1.80, should the firm sell forward its pound receivables due in September, 2009?

Solution

(i) Calculation of expected spot rate for September, 2009:

$ for £	Probability	Expected $ / £
(1)	(2)	(1) × (2) = (3)
1.60	0.15	0.24
1.70	0.20	0.34
1.80	0.25	0.45
1.90	0.20	0.38
2.00	0.20	0.40
	1.00	EV = 1.81

Therefore, the expected spot value of $ for £ for September, 2009 would be $ 1.81.

(ii) If the six – month forward rate is $ 1.80, the expected profits of the firm can be maximised by retaining its pounds receivable.

Question 51(Study Material TYK Q 5)/MTP March'19/RTP Nov'22

On April 3, 2016, a Bank quotes the following:

Spot exchange Rate (US $ 1)	INR 66.2525	INR 67.5945
2 months' swap points	70	90
3 months' swap points	160	186

In a spot transaction, delivery is made after two days.

Assume spot date as April 5, 2016.

Assume 1 swap point = 0.0001,

You are required to:

(i) ascertain swap points for 2 months and 15 days. (For June 20, 2016),

(ii) determine foreign exchange rate for June 20, 2016, and

(iii) compute the annual rate of premium / discount of US $ on INR, on an average rate.

Solution

(i) Swap Points for 2 months and 15 days

	Bid	Ask
Swap Points for 2 months (a)	70	90
Swap Points for 3 months (b)	160	186
Swap Points for 30 days (c) = (b) – (a)	90	96
Swap Points for 15 days (d) = (c)/2	45	48
Swap Points for 2 months & 15 days (e) = (a) + (d)	115	138

(ii) Foreign Exchange Rates for 20th June 2016

	Bid	Ask
Spot Rate (a)	66.2525	67.5945
Swap Points for 2 months & 15 days (b)	0.0115	0.0138
	66.2640	67.6083

(iii) Annual Rate of Premium

	Bid	Ask
Spot Rate (a)	66.2525	67.5945
Foreign Exchange Rates for 20th June 2016 (b)	66.2640	67.6083
Premium (c)	0.0115	0.0138
Total (d) = (a) + (b)	132.5165	135.2028
Average (d) / 2	66.2583	67.6014
Premium	$\frac{0.0115}{66.2583} \times \frac{12}{2.5} \times 100$ = 0.0833%	$\frac{0.0138}{67.6014} \times \frac{12}{2.5} \times 100$ = 0.0980%

Question 52(Old PM)

On 10th July, an importer entered into a forward contract with bank for US $ 50,000 due on 10th September at an exchange rate of ₹ 66.8400. The bank covered its position in the interbank market at ₹ 66.6800.

How the bank would react if the customer requests on 20th September:

(i) to cancel the contract?

(ii) to execute the contract?

(iii) to extend the contract with due date to fall on 10th November?

The exchange rates for US $ in the interbank market were as below:

	10th September	20th September
Spot US$1 =	66.1500 / 1700	65.9600 / 9900
Spot / September	66.2800 / 3200	66.1200 / 1800

Spot / October	66.4100 / 4300	66.2500 / 3300
Spot / November	66.5600 / 6100	66.4000 / 4900

Exchange margin was 0.1% on buying and selling.

Interest on outlay of funds was 12% p.a.

You are required to show the calculations to:

(i) cancel the Contract,

(ii) execute the Contract, and

(iii) extend the Contract as above.

Solution

In each of the case first the FEADI Rule of Automatic Cancellation shall be applied and customer shall pay the charges consisted of following:

a) Exchange Difference

b) Swap Loss

c) Interest on Outlay Funds

a) Exchange Difference

(i) Cancellation Rate:

The forward sale contract shall be cancelled at Spot TT Purchase for $ prevailing on the date of cancellation as follows:

$ / ₹ Market Buying Rate	₹ 65.9600
Less: Exchange Margin @ 0.10%	₹ 0.0660
	₹ 65.8940
Rounded off to	₹ 65.8950

(ii) Amount payable on $ 50,000

Bank sells $ 50,000 @ ₹ 66.8400	₹ 33,42,000
Bank buys $ 50,000 @ ₹ 65.8950	₹ 32,94,750
Amount payable by customer	₹ 47,250

b) **Swap Loss**

On 10th September the bank does a swap sale of $ at market buying rate of ₹ 66.1500 and forward purchase for September at market selling rate of ₹ 66.3200.

Bank buys at	₹ 66.3200
Bank sells at	₹ 66.1500
Amount payable by customer	₹ 0.1700

Swap Loss for $ 50,000 in ₹ = ₹ 8,500

c) **Interest on Outlay of Funds**

On 10th September, the bank receives delivery under cover contract at ₹ 66.6800 and sell spot at ₹ 66.1500.

Bank buys at	₹ 66.6800
Bank sells at	₹ 66.1500
Amount payable by customer	₹ 0.5300

Outlay for $ 50,000 in ₹ 26,500

Interest on ₹ 26,500 @ 12% for 10 days ₹ 87

d) Total Cost

Cancellation Charges	₹ 47,250.00
Swap Loss	₹ 8,500.00
Interest	₹ 87.00
	₹ 55,837.00

e) New Contract Rate

The contract will be extended at current rate

$ / ₹ Market forward selling Rate for November	₹ 66.4900
Add: Exchange Margin @ 0.10%	₹ 0.0665
	₹ 66.5565
Rounded off to	₹ 66.5575

(i) Charges for Cancellation of Contract = ₹ 55,838.00 or ₹ 55,837.00

(ii) Charges for Execution of Contract

Charges for Cancellation of Contract	₹ 55,837.00
Spot Selling US $ 50,000 on 20th September at ₹ 65.9900 + 0.0660 (Exchange Margin) = ₹ 66.0560 rounded to ₹ 66.0550	₹ 33,02,750.00
	₹ 33,58,587.00

(iii) Charges for Extension of Contract

Charges for Cancellation of Contract	55837
New Forward Rate	₹ 66.5575

Question 53(Study Material TYK Q 16)

An importer customer of your bank wishes to book a forward contract with your bank on 3rd September for sale to him of SGD 5,00,000 to be delivered on 30th October.

The spot rates on 3rd September are USD 49.3700 / 3800 and USD / SGD 1.7058 / 68. The swap points are:

USD / ₹		USD / SGD	
Spot / September	0300 / 0400	1st month forward	48 / 49
Spot / October	1100 / 1300	2nd month forward	96 / 97
Spot / November	1900 / 2200	3rd month forward	138 / 140

Spot / December	2700 / 3100		
Spot / January	3500 / 4000		

Calculate the rate to be quoted to the importer by assuming an exchange margin of 5 paisa.

Solution

USD / ₹ on 3rd September	49.3800
Swap Point for October	0.1300
	49.5100
Add: Exchange Margin	0.0500
	49.5600
USD / SGD on 3rd September	1.7058
Swap Point for 2nd month Forward	0.0096
	1.7154

Cross Rate for SGD / ₹ of 30th October

USD / ₹ selling rate = ₹ 49.5600

SGD / ₹ buying rate = SGD 1.7154

SGD / ₹ cross rate = ₹ 49.5600 / 1.7154 = ₹ 28.8912

Question 54(Study Material TYK Q 50)

Drill dip Inc. a US based company has a won a contract in India for drilling oil field. The project will require an initial investment of ₹ 500 crore. The oil field along with equipments will be sold to Indian Government for ₹ 740 crore in one year time. Since the Indian Government will pay for the amount in Indian Rupee (₹) the company is worried about exposure due exchange rate volatility.

You are required to:

a) Construct a swap that will help the Drill dip to reduce the exchange rate risk.

b) Assuming that Indian Government offers a swap at spot rate which is 1US $ = ₹ 50 in one year, then should the company should opt for this option or should it just do nothing. The spot rate after one year is expected to be 1 US $ = ₹ 54. Further you may also assume that the Drilldip can also take a US $ loan at 8% p.a.

Solution

a) The following swap arrangement can be entered by Drill dip.

(i) Swap a US $ loan today at an agreed rate with any party to obtain Indian Rupees (₹) to make initial investment.

(ii) After one year swap back the Indian Rupees with US $ at the agreed rate. In such case the company is exposed only on the profit earned from the project.

b) With the swap

	Year 0 (Million US $)	Year 1 (Million US $)
Buy ₹ 500 crore at spot rate of 1 US $ = ₹ 50	(100.00)	----
Swap ₹ 500 crore back at agreed rate of ₹ 50	----	100.00
Sell ₹ 240 crore at 1 US $ = ₹ 54	----	44.44

Interest on US $ loan @ 8% for one year	----	(8.00)
	(100.00)	**136.44**

Net result is a net receipt of US$ 36.44 million.

Without the swap

	Year 0 (Million US $)	Year 1 (Million US $)
Buy ₹ 500 crore at spot rate of 1 US $ = ₹50	(100.00)	----
Sell ₹ 740 crore at 1 US $ = ₹ 54	----	137.04
Interest on US $ loan @ 8% for one year	----	(8.00)
	(100.00)	**129.04**

Net result is a net receipt of US$ 29.04 million.

Decision: Since the net receipt is higher in swap option the company should opt for the same.

Question 55(Study Material TYK Q 46)/MTP Oct'19

Your forex dealer had entered into a cross currency deal and had sold US $ 10,00,000 against EURO at US $ 1 = EURO 1.4400 for spot delivery.

However, later during the day, the market became volatile and the dealer in compliance with his management's guidelines had to square - up the position when the quotations were:

Spot US $ 1	INR 31.4300 / 4500
1 month margin	25 / 20
2 months margin	45 / 35
Spot US $ 1	EURO 1.4400 / 4450
1 month forward	1.4425 / 4490
2 months forward	1.4460 / 4530

What will be the gain or loss in the transaction?

Solution

The amount of EURO bought by selling US$

US$ 10,00,000 * EURO 1.4400	EURO 14,40,000
The amount of EURO sold for buying USD 10,00,000 * 1.4450	EURO 14,45,000
Net Loss in the Transaction	**EURO 5,000**

To acquire EURO 5,000 from the market @

a) USD 1 = EURO 1.4400 &

b) USD1 = INR 31.4500

Cross Currency buying rate of EUR / INR is ₹ 31.4500 / 1.440 i.e. ₹ 21.8403

Loss in the Transaction ₹ 21.8403 * 5000 = 1,09,201.50

Alternatively, if delivery to be affected then computation of loss shall be as follows:

EURO to be surrendered to acquire $ 10,00,000	EURO 14,45,000
EURO to be received after selling $ 10,00,000	EURO 14,40,000
Loss	**EURO 5,000**

To acquire EURO 5,000 from market @

US $ 1 = EURO 1.4400

US $ 1 = INR 31.45

Cross Currency = $\frac{31.45}{1.440}$ = ₹ 21.8403

Loss in Transaction (21.8403 x EURO 5,000) = ₹ 1,09,201.50

Question 56(Study Material TYK Q 35)/MTP May'20

Gibralater Limited has imported 5000 bottles of shampoo at landed cost in Mumbai, of US $ 20 each. The company has the choice for paying for the goods immediately or in 3 months' time. It has a clean overdraft limited where 14% p.a. rate of interest is charged.

Calculate which of the following method would be cheaper to Gibralter Limited.

(i) Pay in 3 months' time with interest @ 10% p.a. and cover risk forward for 3 months.

(ii) Settle now at a current spot rate and pay interest of the overdraft for 3 months.

The rates are as follows:

Mumbai ₹ / $ spot	60.25 - 60.55
3 months swap points	35 / 25

Solution

Option - I

$ 20 x 5000 = $ 1,00,000

Repayment in 3 months' time = $ 1,00,000 x (1 + 0.10 / 4) = $ 1,02,500

3-months outright forward rate = ₹ 59.90 / ₹ 60.30

Repayment obligation in ₹ ($1,02,500 X ₹ 60.30) = ₹ 61,80,750

Option – II

Overdraft ($1,00,000 x ₹ 60.55)	₹ 60,55,000
Interest on Overdraft (₹ 60,55,000 x 0.14/4)	₹ 2,11,925
	₹ 62,66,925

Option I should be preferred as it has lower outflow.

Question 57(Study Material TYK Q 18)

ABC Co. have taken a 6 month loan from their foreign collaborators for US Dollars 2 millions. Interest payable on maturity is at LIBOR plus 1.0%. Current 6 - month LIBOR is 2%.

Enquiries regarding exchange rates with their bank elicits the following information:

Spot USD 1	₹ 48.5275
6 months forward	₹ 48.4575

(i) What would be their total commitment in Rupees, if they enter into a forward contract?

(ii) Will you advise them to do so? Explain giving reasons.

Solution

Firstly, the interest is calculated at 3% p.a. for 6 months. That is:

USD 20,00,000 × 3/100 × 6/12 = USD 30,000

From the forward points quoted, it is seen that the second figure is less than the first, this means that the currency is quoted at a discount.

The value of the total commitment in Indian rupees is calculated as below:

Principal Amount of loan	USD 20,00,000
Add: Interest	USD 30,000
Amount due	USD 20,30,000
Spot rate	₹ 48.5275
Forward Points (6 months)	(–) 0.0700
Forward Rate	₹ 48.4575
Value of Commitment	₹ 9,83,68,725

It is seen from the forward rates that the market expectation is that the dollar will depreciate. If the firm's own expectation is that the dollar will depreciate more than what the bank has quoted, it may be worthwhile not to cover forward and keep the exposure open.

If the firm has no specific view regarding future dollar price movements, it would be better to cover the exposure. This would freeze the total commitment and insulate the firm from undue market fluctuations. In other words, it will be advisable to cut the losses at this point of time.

Given the interest rate differentials and inflation rates between India and USA, it would be unwise to expect continuous depreciation of the dollar. The US Dollar is a stronger currency than the Indian Rupee based on past trends and it would be advisable to cover the exposure.

Question 58(Illustration 2)

If the Indian rupee is the home currency and the foreign currency is the US Dollar then what is the exchange rate between the rupee and the US dollar?

Solution

(i) One can buy 0.0217 US dollars for one Indian rupee.

(ii) ₹ 46.08 Indian rupees are needed to buy one US dollar.

RTP, MTP& PREVIOUS YEAR QUESTIONS

Question 1(RTP Nov'18)

Place the following strategies by different persons in the Exposure Management Strategies Matrix.

Strategy 1: Kuljeet a wholesaler of imported items imports toys from China to sell them in the domestic market to retailers. Being a sole trader, he is always so much involved in the promotion of his trade in domestic market and negotiation with foreign supplier that he never pays attention to hedge his payable in foreign currency and leaves his position unhedged.

Strategy 2: Moni, is in the business of exporting and importing brasswares to USA and European countries. In order to capture the market he invoices the customers in their home currency. Lavi enters into forward contracts to sell the foreign exchange only if he expects some profit out of it other-wise he leaves his position open.

Strategy 3: TSC Ltd. is in the business of software development. The company has both receivables and payables in foreign currency. The Treasury Manager of TSC Ltd. not only enters into forward contracts to hedge the exposure but carries out cancellation and extension of forward contracts on regular basis to earn profit out of the same. As a result management has started looking Treasury Department as Profit Centre.

Strategy 4: DNB Publishers Ltd. in addition to publishing books are also in the business of importing and exporting of books. As a matter of policy the movement company invoices the customer or receives invoice from the supplier immediately covers its position in the Forward or Future markets and hence never leave the exposure open even for a single day.

Solution

Strategy 1: This strategy is covered by High Risk: Low Reward category and worst as it leaves all exposures unhedged. Although this strategy does not involve any time and effort, it carries high risk.

Strategy 2: This strategy covers Low Risk: Reasonable reward category as the exposure is covered wherever there is anticipated profit otherwise it is left.

Strategy 3: This strategy is covered by High Risk: High Reward category as to earn profit, cancellations and extensions are carried out. Although this strategy leads to high gains but it is also accompanied by high risk.

Strategy 4: This strategy is covered by Low Risk: Low Reward category as company plays a very safe game.

Diagrammatically all these strategies can be depicted as follows:

<table>
<tr><td colspan="4">High Risk</td></tr>
<tr><td rowspan="2">Low
Reward</td><td>Strategy 1</td><td>Strategy 3</td><td rowspan="2">High
Reward</td></tr>
<tr><td>Strategy 4</td><td>Strategy 2</td></tr>
<tr><td colspan="4">Low Risk</td></tr>
</table>

Question 2(RTP Nov'20)

Citi Bank quotes JPY/ USD 105.00 -106.50 and Honk Kong Bank quotes USD / JPY 0.0090- 0.0093.

a) Are these quotes identical if not then how they are different?

b) Is there a possibility of arbitrage?

c) If there is an arbitrage opportunity, then show how would you make profit from the given quotation in both cases if you are having JPY 1,00,000 or US$ 1,000.

Solution

a) No, while Citi Bank's quote is a Direct Quote for JPY (i.e. for Japan) the Hong Kong Bank quote is a Direct Quote for USD (i.e. for USA).

b) Since Citi Bank quote imply USD/ JPY 0.0094 - 0.0095 and both rates exceed those offered by Hong Kong Bank, there is an arbitrage opportunity.
Alternatively, it can also be said that Hong Kong Bank quote imply JPY / USD 107.53 – 111.11 and both rates exceed quote by Citi Bank, there is an arbitrage opportunity.

c) Let us how arbitrage profit can be made.

(i)	Covert US $ 1,000 into JPY by buying from Hong Kong Bank Sell these JPY to Citi Bank at JPY / USD 106.50	JPY 1,07,530
	and convert in US $	US $ 1009.67
	Thus, arbitrage gain (US $ 1009.67 – US $ 1000.00)	US $ 9.67
(ii)	Covert JPY 1,00,000 into USD by buying from Citi Bank at JPY/ USD 106.50	JPY 1,07,530
	Sell these US $ to Hong Kong Bank at	US $ 938.97
	JPY/ USD 107.53 and convert in US $	JPY 100967.44
	Thus, arbitrage gain (JPY 1,00,967.44 - JPY 1,00,000)	JPY 967.44

Question 3(RTP Nov'20)

a) Given:
US $ 1 = ¥ 107.31
£ 1 = US$ 1.26
A $ 1 = US$ 0.70

(i) Calculate the cross rate for Pound in Yen terms

(ii) Calculate the cross rate for Australian Dollar in Yen terms

(iii) Calculate the cross rate for Pounds in Australian Dollar terms

b) The current spot exchange rate is $ 1.35 / £ and the three-month forward rate is $ 1.30/£. According to your analysis of the exchange rate, you are quite confident that the spot exchange rate will be $1.32 / £ after 3 months.
(i) Suppose you want to speculate in the forward market then what course of action would be required and what is the expected dollar Profit (Loss) from this speculation?
(ii) What would be your Profit (Loss) in Dollar terms on the position taken as per your speculation if the spot exchange rate turns out to be $ 1.26 / £.

Assume that you would like to buy or sell £1,000,000.

Solution

a)

(i) Calculate the cross rate for Pounds in Yen terms

1£ = ? ¥

US $ 1 = ¥ 107.31

£1 = US $ 1.26

$$\frac{¥}{\$} \times \frac{\$}{£} = \frac{¥}{£}$$

$$\frac{¥}{£} = 107.31 \times 1.26$$

£1 = ¥ 135.21

(ii) Calculate the cross rate for Australian Dollar in Yen terms

A $ 1 = ¥ ?

US $ 1 = ¥ 107.31

A $ 1 = US $ 0.70

$$\frac{¥}{\$} \times \frac{\$}{A\$} = \frac{¥}{A\$}$$

$\frac{¥}{A\$}$ = 107.31 x 0.70

A$ 1 = ¥ 75.12

(iii) Calculate the cross rate for Pounds in Australian Dollar terms

£ 1 = A$?

A$ 1 = US$ 0.70

US $ 1 = A$ 1.4286

£1 = US $ 1.26

$$\frac{A\$}{\$} \times \frac{\$}{£} = \frac{A\$}{£}$$

$$\frac{A\$}{£} = 1.4286 \times 1.26 = 1.80$$

£ 1 = A$ 1.80

b)

(i) If you believe the spot exchange rate will be $ 1.32 / £ in three months, you should buy £ 1,000,000 forward for $1.30 / £ and sell at $ 1.32 / £ 3 months hence.

Your expected profit will be: £ 1,000,000 x ($ 1.32 - $ 1.30) = $ 20,000

(ii) If the spot exchange rate turns out to be $ 1.26/£ in three months, your loss from the long

position in Forward Market will be: -

£ 1,000,000 x ($ 1.26 - $ 1.30) = $ 40,000

Question 4(MTP Oct'19)Similar to Study Material Q 27)

Mercy is a Forex Dealer with XYZ Bank. She notices following information relating to Canadian Dollar (CAD) and German Deutschmark (DEM):

Exchange Rate	CAD 0.775 per DEM (Spot)
	CAD 0.780 per DEM (3 months)
Interest Rates	DEM 7% p.a.
	CAD 9% p.a.

(i) Assuming that there is no transaction cost determine does the Interest Rate Parity holds in above quotations.

(ii) If yes, then explain the steps that would be required to make an arbitrage profit if Mercy is authorized to work with CAD 1 Million for the same purpose. Also determine the profit that would be made in CAD.

Note: Ignore the decimal points in the amounts. (8 Marks)

Solution

(i) For 3 months, rCAD = 2.25% and rDEM = 1.75%. Since the exchange rate is in CAD / DEM term the appropriate equation for Interest Rate Parity is as follows:

$$\frac{F}{S} = \frac{(1 + r_{CAD})}{(1 + r_{DEM})}$$

$$\frac{0.780}{0.775} = \frac{(1 + 0.0225)}{(1 + 0.0175)}$$

1.00645 ≠ 1.00491

Since both sides are not equal, Interest Rate Parity does not hold.

(ii) Since IRP does not hold there is an arbitrage opportunity.

Interest Differential = 2.25% - 1.75% = 0.50%

Premium = $\frac{0.780-0.775}{0.775} \times 100$ = 0.645%

Since the interest rate differential is smaller than the premium, it will be profitable to place money in Deutschmarks the currency whose 3-months interest is lower.

The following operations are carried out:

(i) Borrow CAD 1 Million at 9 per cent for 3 - months;

(ii) Change this sum into DEM at the spot rate = (1,000,000 / 0.775) = 1,290,323

(iii) Place DM 1,290,323 in the money market for 3 months to obtain a sum of DM

Principal	1,290,323
Add: Interest @ 7 % for 3 months	22,581

Total	**1,312,904**

(iv) Sell DEM at 3-months forward to obtain CAD = (1,312,904 x 0.780) = CAD 1,024,065

(v) Refund the debt taken in CAD with the interest due on it, i.e.,

	CAD
Principal	1,000,000
Add: Interest @ 9 % for 3 months	22,500
Total	**1,022,500**

Net arbitrage gain = CAD 1,024,065 – CAD 1,022,500 = CAD 1,565

Question 5(MTP April'21)

On 1st February 2020, XYZ Ltd. a laptop manufacturer imported a particular type of Memory Chips from SKH Semiconductor of South Korea. The payment is due in one month from the date of Invoice, amounting to 1190 Million South Korean Won (SKW). Following Spot Exchange Rates (1st February) are quoted in two different markets:

USD/ INR	75.00/ 75.50	in Mumbai
USD/ SKW	1190.00/ 1190.75	in New York

Since hedging of Foreign Exchange Risk was part of company's strategic policy and no contract for hedging in SKW was available at any in - shore market, it approached an off – shore Non – Deliverable Forward (NDF) Market for hedging the same risk.

In NDF Market a dealer quoted one – month USD/ SKW at 1190.00/1190.50 for notional amount of USD 100,000 to be settled at reference rate declared by Bank of Korea.

After 1 month (1st March 2020) the dealer agreed for SKW 1185 / USD as rate for settlement and on the same day the Spot Rates in the above markets were as follows:

USD/ INR	75.50/ 75.75	in Mumbai
USD/ SKW	1188.00/ 1188.50	in New York

Analyze the position of company under each of the following cases, comparing with Spot Position of 1st February

(i) Do Nothing.

(ii) Opting for NDF Contract.

Note: Both Rs. / SKW Rate and final payment (to be computed in Rs. Lakh) to be rounded off upto 4 decimal points. (10 Marks)

Solution

(i) **Do Nothing**

We shall compute the cross rates in Spot Market on both days and shall compare the amount payable in INR on these two days.

On 1st February 2020

Rupee – Dollar selling rate = Rs. 75.50
Dollar – SKW = SKW 1190.00
Rupee – SKW cross rate = Rs. 75.50 / 1190.00
= Rs. 0.0634
Amount payable to Importer as per above rate (1190 Million x Rs. 0.0634) Rs. 754.4600 Lakh

On 1st March 2020
Rupee – Dollar selling rate = Rs. 75.75
Dollar – SKW = SKW 1188.00
Rupee – SKW cross rate = Rs. 75.75 / 1188.00
= Rs. 0.0638
Amount payable to Importer as per above rate (1190 Million x Rs. 0.0638) Rs. 759.2200 Lakh

Thus, Exchange Rate Loss = (Rs. 759.2200 Lakh - Rs. 754.4600 Lakh) Rs. 4.7600 Lakh

(ii) **Hedging in NDF**

Since company needs SKW after one month it will take long position in SKW at quoted rate of SKW 1190 / USD and after one-month it will reverse its position at fixing rate of SKW 1187 / USD. The profit / loss position will be as follows:

Buy SKW 1190 Million and sell USD (1190 Million / 1190)	USD 1,000,000
Sell SKW 1190 Million and buy USD at Fixing Rate (1190 Million /1185)	USD 1,004,219
Profit	USD 4,219

Final Position

Amount Payable in Spot Market (as computed earlier)	Rs. 759.2200 Lakh
Less: Profit form NDF Market USD 4219 x 75.50	Rs. 3.1853 Lakh
1185)	Rs. 756.0347 Lakh

Thus, Exchange Rate Loss = (Rs. 756.0347 Lakh - Rs. 754.4600 Lakh) Rs. 1.5747 Lakh

Decision: Since Exchange Loss is less in case of NDF same can be opted for.

Question 6(MTP Oct'21)

Shanti exported 200 pieces of a designer jewellery to USA at $ 200 each. To manufacture and design this jewellery she imported raw material from Japan of the cost of JP ¥ 6000 for each piece.

The labour cost and variable overhead incurred in producing each piece of jewellery are ₹ 1,300 and ₹ 650 respectively.

Suppose Spot Rates are:

₹ / US $	₹ 65.00 – ₹ 66.00
JP ¥ / US $	JP ¥ 115 – JP ¥ 120

Shanti is expecting that by the time the export remittance is received and payment of import is made the expected Spot Rates are likely to be as follows:

₹ / US $	₹ 68.90 – ₹ 69.25
JP ¥ / US $	JP ¥ 105 – JP ¥ 112

You are required to calculate the resultant transaction exposure. (6 Marks)

Solution

Profit as per Spot Rates

Sales Revenue (US $ 200 x 200 x ₹ 65)	26,00,000
Less: Cost of Imported Raw Material (200 x 6000/115 x ₹ 66)	6,88,696
Labour Cost (200 x ₹ 1,300)	2,60,000
Variable Overheads (200 x ₹ 650)	1,30,000
Profit	**15,21,304**

Profit as per expected Spot Rates

	₹
Sales Revenue (US$ 200 x 200 x ₹ 68.90)	27,56,000
Less: Cost of Imported Raw Material (200 x 6000 x ₹ 69.25) 105	7,91,429
Labour Cost (200 x ₹ 1,300)	2,60,000
Variable Overheads (200 x ₹ 650)	1,30,000
Profit	**15,74,571**

Increase / (Decrease) in Profit due to Transaction Exposure ₹ 53,267
(₹ 15,74,571 – ₹ 15,21,304)

Question 7(PP Nov'18/MTP March'21) (8 Marks)

An Indian company obtains the following quotes (₹ / $)

Spot:	35.90 / 36.10
3 - Months forward rate:	36.00 / 36.25
6 - Months forward rate:	36.10 / 36.40

The company needs $ funds for six months. Determine whether the company should borrow in $ or ₹ Interest rates are:

3 - Months interest rate	₹ : 12%, $: 6%
6 - Months interest rate	₹ : 11.50%, $: 5.5%

Also determine what should be the rate of interest after 3-months to make the company in different between 3 – months borrowing and 6 – months borrowing in the case of:

(i) Rupee borrowing

(ii) Dollar borrowing

Note: For the purpose of calculation you can take the units of dollar and rupee as 100 each.

Solution

(i) If company borrows in $ then outflow would be as follows:

Let company borrows $ 100	$ 100.00
Add: Interest for 6 months @ 5.5%	$ 2.75
Amount Repayable after 6 months	$ 102.75
Applicable 6 month forward rate	36.40
Amount of Cash outflow in Indian Rupees	₹ 3,740.10

If company borrows equivalent amount in Indian Rupee, then outflow would be as follows:

Equivalent ₹ amount ₹ 36.10 x 100	₹ 3,610.00
Add: Interest @11.50%	₹ 207.58
	₹ 3817.58

Since cash outflow is more in ₹ borrowing then borrowing should be made in $.

(ii)

a) Let 'ir' be the interest rate of ₹ borrowing make in different between 3 months borrowings and 6 months borrowing then
(1 + 0.03) (1 + ir) = (1 + 0.0575)

i_r = 2.67% or 10.68% (on annualized basis)

b) Let 'id' be the interest rate of $ borrowing after 3 months to make in difference between 3 months borrowings and 6 months borrowings. Then,
(1 + 0.015) (1 + id) = (1 + 0.0275)

i_d = 1.232% or 4.93% (on annualized basis)

Question 8(PP Nov'20)

ZX Ltd. has made purchases worth USD 80,000 on 1st May 2020 for which it has to make a payment on 1st November 2020. The present exchange rate is INR / USD 75. The company can purchase forward dollars at INR / USD 74. The company will have to make an upfront premium @ 1 per cent of the forward amount purchased. The cost of funds to ZX Ltd. is 10 per cent per annum.

The company can hedge its position with the following expected rate of USD in foreign exchange market on 1st May 2020:

	Exchange Rate	Probability
(i)	INR/USD 77	0.15
(ii)	INR/USD 71	0.25
(iii)	INR/USD 79	0.20
(iv)	INR/USD 74	0.40

You are required to advise the company for a suitable cover for risk. (8 Marks)

Solution

(i) If ZX Ltd. does not take forward (Unhedged Position):
Expected Rate = ₹ 77 x 0.15 + ₹ 71 x 0.25 + ₹ 79 x 0.20 + ₹ 74 x 0.40

= ₹ 11.55 + ₹ 17.75 + ₹ 15.80 + ₹ 29.60 = ₹ 74.70

Expected Amount Payable = USD 80,000 x ₹ 74.70 = ₹ 59,76,000

(ii) If the ZX Ltd. hedge its position in the forward market:

Particulars	Amount (₹)
If company purchases US $ 80,000 forward premium is (80000 × 74 × 1%)	59,200
Interest on ₹ 59,200 for 6 months at 10%	2,960
Total hedging cost (a)	62,160
Amount to be paid for US $ 80,000 @ ₹ 74.00 (b)	59,20,000
Total Cost (a) + (b)	59,82,160

Advise: Since cashflow is less in case of unhedged position company should opt for the same.

Question 9(PP Nov'20)

ZX Ltd. has made purchases worth USD 80,000 on 1st May 2020 for which it has to make a payment USD 10,000 is lying idle in your Bank Account. You are able to get the following quotes from the dealers:

	Dealer	Quote
A	EUR / USD	1.1539
B	EUR / GBP	0.9094
C	GBP / USD	1.2752

Is there an opportunity of gain from these quotes? (4 Marks)

Solution

The arbitrageur can proceed as stated below to realize arbitrage gains.

(i) Buy € from US $ 10,000 from Dealer A (10,000 / 1.1539) € 8,666.26

(ii) Convert these € to £ by selling to Dealer B (€ 8,666.26 × 0.9094) £ 7,881.09

(iii) Convert £ to US$ by selling to Dealer C (£ 7,881.09 × 1.2752) US$ 10,049.97

There is net gain of US $ 10,049.97 less US $ 10,000 i.e. US $ 49.97 or US $ 50.00.

Question 10(PP Jan'21)

M/s. Sky products Ltd., of Mumbai, an exporter of sea foods has submitted a 60 days bill for EUR 5,00,000 drawn under an irrevocable Letter of Credit for negotiation. The company has desired to keep 50% of the bill amount under the Exchange Earners Foreign Currency Account (EEFC). The rates for ₹ / USD and USD/EUR in inter-bank market are quoted as follows:

	₹ / USD	USD / EUR
Spot	67.8000 - 67.8100	1.0775 - 1.8000
1 month forward	10 / 11 Paise	0.20 / 0.25 Cents
2 months forward	21 / 22 Paise	0.40 / 0.45 Cents
3 months forward	32 / 33 Paise	0.70 / 0.75 Cents

Transit Period is 20 days. Interest on post shipment credit is 8 % p.a. Exchange Margin is 0.1%. Assume 365 days in a year.

You are required to calculate:

(i) Exchange rate quoted to the company

(ii) Cash inflow to the company

(iii) Interest amount to be paid to bank by the company. (8 Marks)

Solution

(i) Transit and usance period is 80 days. It will be rounded off to the lower of months and @ months forward bid rate is to be taken

₹ / USD	₹ 67.8000
Add: Premium for 2 months	₹ 0.2100
	₹ 68.0100
Less: Exchange margin @ 0.1%	₹ 0.0680
Bid rate for USD	₹ 67.9420
USD / EUR	USD 1.0775
Add: Premium	USD 0.0040
	USD 1.0815
₹ / EUR Rate (67.942 x 1.0815)	₹ 73.4793
Amount of Export Bill	EUR 5,00,000
Less: EEFC	EUR 2,50,000
	EUR 2,50,000
Exchange Rate	₹ 73.4793

(ii) Cash Inflow ₹ 1,83,69,825

(iii) Interest for 80 days @ 8% ₹ 3,22,101

Question 11(PP Jan'21)

XYZ has taken a six-month loan from its foreign collaborator for USD 2 millions. Interest is payable on maturity @ LIBOR plus 1%. The following information is available:

Spot Rate	INR / USD	68.5275
6 months Forward rate	INR / USD	68.4575
6 months LIBOR for USD	2%	
6 months LIBOR for INR	6%	

You are required to

(i) Calculate Rupee requirements if forward cover is taken.

(ii) Advise the company on the forward cover.

What will be your opinion if spot rate of INR / USD is 68.4275? (8 Marks)

Solution

(i) Rupee requirement if forward cover is taken:

6 Month Forward rate	68.4575
Interest amount (20,00,000 x 3%* x 6 / 12)	US $30,000
Principal amount	US$ 20,00,000
	US$ 20,30,000

Rupee Requirement = INR 68.4575 x US $ 20,30,000 = INR 13,89,68,725

* LIBOR + 1%

(ii) Forward Rate as per Interest Rate Parity after 6 months is expected to be:

$= 68.5275 \times \frac{(1.03)}{(1.01)}$ = 69.8845 / US $

The company should take forward cover because as per Interest Rate Parity, the rate after 6 months is expected to be higher than forward rate.

However, if spot rate is 68.4275, the expected rate as per Interest Rate Parity shall be:

$= 68.4275 \times \frac{(1.03)}{(1.01)}$ = 69.7825 / US $

Thus, still the company should take forward cover.

Question 12(PP July'21)

XP Pharma Ltd., has acquired an export order for ₹ 10 million for formulations to a European company. The Company has also planned to import bulk drugs worth ₹ 5 million from a company in UK. The proceeds of exports will be realized in 3 months from now and the payments for imports will be due after 6 months from now. The invoicing of these exports and imports can be done in any currency i.e. Dollar, Euro or Pounds sterling at company's choice. The following market quotes are available.

	Spot Rate	Annualised Premium
₹ / $	67.10 / 67.20	$ - 7%
₹ / Euro	63.15 / 63.20	Euro - 6%
₹ / Pound	88.65 / 88.75	Pound - 5%

Advice XP Pharma Ltd. about invoicing in which currency.

(Calculation should be upto three decimal places). (8 Marks)

Solution

Proceeds of Exports in INR = ₹ 10 Million

Position of Inflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 3 - months	Conversion in INR after 3-months
$	₹ 100,00,000 / ₹ 67.10 = $ 149031.297	₹ 67.10 (1 + 0.07/4) = ₹ 68.27	₹ 68.27 x $ 149031.297 = ₹ 1,01,74,367
€	₹ 100,00,000 / ₹ 63.15	₹ 63.15 (1 + 0.06 / 4)	₹ 64.10 x € 1,58,353.127

	= € 1,58,353.127	= ₹ 64.10	= ₹ 1,01,50,435
£	₹ 100,00,000 / ₹ 88.65 = £ 1,12,803.158	₹ 88.65 (1 + 0.05 / 4) = ₹ 89.76	₹ 89.76 x £ 1,12,803.158 = ₹ 1,01,25,211

Payment of Import in INR = ₹ 5 Million

Position of outflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 6 - months	Conversion in INR after 6 - months
$	₹ 50,00,000 / ₹ 67.20 = $ 74404.762	₹ 67.20 (1 + 0.07 / 2) = ₹ 69.55	₹ 69.55 x $ 74404.762 = ₹ 51,74,851
€	€ 50,00,000/ ₹ 63.20 = € 79,113.924	₹ 63.20 (1 + 0.06 / 2) = ₹ 65.10	₹ 65.10 x € 79,113.924 = ₹ 51,50,316
£	£ 50,00,000/ ₹ 88.75 = £ 56,338.028	₹ 88.75 (1 + 0.05 / 2) = ₹ 90.97	₹ 90.97 x £ 56,338.028 = ₹ 51,25,070

Advice: Since cash inflow is highest (1,01,74,367) in case of $ hence invoicing for Export should be in $. However, cash outflow is least (51,25,070) in case of £ the invoicing for imports should be in £.

Question 13(RTP May'22)

A US investor chose to invest in Sensex for a period of one year. The relevant information is given below.

Size of Investment($)	20,00,000
Spot rate 1 year ago (₹/$)	42.50/60
Spot rate now (₹/$)	43.85/90
Sensex 1 year ago	3,256
Sensex now	3,765
Inflation in US	5%
Inflation in India	9%

(i) Compute the nominal rate of return to the US investor.

(ii) Compute the real depreciation /appreciation of Rupee.

(iii) What should be the exchange rate if relevant purchasing power parity holds good?

(iv) What will be the real return to an Indian investor in Sensex?

Solution

(i) Nominal rate of return to the US investor

Size of investment ($) 20,00,000

Size of investment (₹) ($ 20,00,000 x 42.50)	8,50,00,000
Sensex at To	3,256
No. of units of Sensex that can be purchased at To (₹ 8,50,00,000/3,256)	26,105
Sensex at T1	3,765
Sale of Sensex (26,105 x 3,765)	9,82,85,325
US$ at T1 `	43.90
Equivalent Amount in US$	22,38,846
Gain in US$ [22,38,846 – 20,00,000]	2,38,846
Nominal rate to US investor	11.94%

(ii) Real Appreciation/Depreciation of Rupee

$$\text{Real exchange rate (Buying)} = \frac{43.85\,(1 + 0.05)}{(1 + 0.09)} = 42.24$$

$$\text{Real appreciation of ₹} = \frac{42.5 - 42.24 \times 100}{42.5} = 0.61\%$$

(iii) Exchange rate if relevant purchasing power parity holds

$$\text{Buying rate} = \frac{42.50\,(1 + 0.09)}{(1 + 0.05)} = 44.12$$

$$\text{Selling rate} = \frac{42.60\,(1 + 0.09)}{(1 + 0.05)} = 44.22$$

Exchange rate = 44.12/ 44.22

(iv) Real return to Indian investor in Sensex:

$$\text{Nominal return} = \frac{3,765 - 3,256 \times 100}{3,256} = 15.63\%$$

$$\text{Real return} = \frac{(1.1563) - 1}{(1.09)} = 0.0608 \text{ or } 6.08\%$$

Question 14(RTP May'22/ MTP Oct'22)

Mr. Mammen, an Indian investor invests in a listed bond in USA. If the price of the bond at the beginning of the year is USD 100 and it is USD 103 at the end of the year. The coupon rate is 3% payable annually. CALCULATE the return on investment in terms of home country currency if:

(i) USD is Flat.
(ii) USD appreciates during the year by 3%.
(iii) USD depreciates during the year by 3%.
(iv) Indian Rupee appreciates during the year by 5%.
(v) Will your answer differ if Mr. Mammen invests in the bond just before the interest payable?

Solution

(i) If USD is flat

Return = $\frac{\text{(Price at end - Price at begining)+Interest}}{\text{Price at begining}}$

= $\frac{(103 - 100) + 3}{100}$

= (3 + 3)/100 = 0.06 say 6%

(ii) If USD appreciates by 3%

(1+0.06)(1+0.03) -1 = 1.06 X1.03 - 1 = 0.0918 i.e. 9.18%

(iii) If USD depreciates by 3%

(1+0.06)(1-0.03) -1 = 1.06 X 0.97 - 1 = 0.0282 i.e. 2.82%

(iv) If Indian Rupee is appreciated by 5%

(1+0.06)(1-0.05) -1 = 1.06 X 0.95 - 1 = 0.007 i.e. 0.7%.

(v) No, our answer will not differ even if Mr. Mammen invests in bond just before the interest is payable.

Question 15(RTP Nov'20)

Suppose you are a treasurer of XYZ plc in the UK. XYZ have two overseas subsidiaries, one is based in Amsterdam and another in Switzerland. The surplus position of funds in hand is as follows which it does not need for the next three months but will be needed at the end of that period (91 days).

Holding Company	£ 150,000
Swiss Subsidiary	CHF 1,996,154
Dutch Subsidiary	€ 1,450,000

Exchange Rate as on date are as follows:

Spot Rate (€)	£0.6858 - 0.6869
91 day Pts	0.0037 0.0040
Spot Rate (£)	CHF 2.3295 - 2.3326
91 day Pts	0.0242 0.0228

91-Day Interest rates on p.a. basis on the Deposits in Money Market are as follows:

Amount of Currency	£	€	CHF
0 – 200,000	1.00	0.25	Nil
200,001 – 1,000,000	2.00	1.50	0.25
1,000,001 – 2,000,000	4.00	2.00	0.50
Over 2,000,000	5.38	3.00	1.00

You have been approached by your banker where in the above – mentioned surplus was lying, requesting you to swap the surplus lying with other two subsidiaries and place them in deposit with them.

Determine the minimum interest rate per annum (upto 3 decimal points) that should be offered by the bank to your organization so that your organization is ready to undertake such swap arrangement.

Note: Consider 360 days a year.

Solution

XYZ plc shall be ready to undertake this swap arrangement only if it receives the interest on the surplus funds if invested on individual basis as follows:

	Interest	Amt. after 91 days	Conversion in £
Holland € 1,450,000 x 0.02 x 91/360 =	€ 7,330.56	€ 1,457,330.56	£1,004,829.42 (1,457,330.56 x 0.6895)
Switzerland CHF 1,996,154 x 0.005 x 91/360 =	CHF 2,522.92	CHF 1,998,676.92	£865,303.02 (1,998,676.92÷2.3098)
UK £ 150,000 x 0.01 x 91/360 =	£ 379.17	£ 150,379.17	£ 150,379.17
Total GBP at 91 days			£ 2,020,511.61

Swap to Sterling

Sell € 1,450,000 (Spot at 0.6858) buy £	£ 994,410.00
Sell CHF 1,996,154 (Spot at 2.3326) buy £	£ 855,763.53
Independent GBP amount	£ 150,000.00
	£ 2,000,173.53
Amount accrued on Individual Basis (Principal + Interest)	£ 2,020,511.61
Interest Required	£ 20,338.08
Required Interest Rate on Per Annuam Basis 20,338.08 × 360 ×100 2,000,173.53 91	4.023%

Thus, the minimum rate that should be offered is 4.023%.

Question 16(PP May'22)

M/s. Daksh Ltd is planning to import multipurpose machine from USA at a cost of $15000. The company can avail loans at 19% Interest per annum with quarterly rests with which it can import the machine.

However, there is an offer from New York branch of an Indian based bank extending credit of 180 days at 2% per annum against opening of an irrevocable letter of credit.

Other Information:

Spot rate US$ 1 = ₹ 75

180 days forward rate US $ 1 = ₹ 77

Commission charges for letter of credit at 2% per 12 months.

(i) Justify why the offer from the foreign branch should be accepted?
(ii) Based on the present market condition company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expenses of ₹ 30,000, if so, what is your advise to the company?

Assume 360 days in the year. (8 Marks)

Solution

(i) **Option I (To finance the purchases by availing loan at 18% per annum):**

	₹
Cost of equipment($ 15,000 at US $ 1 = ₹ 75)	11,25,000
Add: Interest at 4.75% I Quarter	53,438
Add: Interest at 4.75% II Quarter (on ₹ 11,78,438)	55,976
Total outflow in Rupees	12,34,414
Alternatively, interest may also be calculated on compounded basis, i.e., ₹ 1,12,5000× $[1.0475]^2$	12,34,413

Option II (To accept the offer from foreign branch):

	₹
Cost of letter of credit at 1 % on US $ 15,000 at US $ 1 = ₹ 75	11,250
Add: Interest for 180 Days (₹ 11,250 x 19% x 180/360)	1,069
(A)	**12,319**
Payment at the end of 180 days:	
Cost	US $ 15,000
Interest at 2% p.a. [15,000 × 2/100 × 180/360]	US $ 150
	US $ 15,150
Conversion at US $ 1 = 77 [15,150 x 77] (B)	₹ 11,66,550
Total Cost: (A) + (B)	₹ 11,78,869

Advise: Option 2 is cheaper by (12,34,413 – 11,78,869) lakh or ₹ 55,544. Hence, the offer may be accepted.

(ii) If company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expense of ₹ 30,000 then it can do so because even taking forward position is resulting in increased cash outflow by the same amount.

Chapter 2

DERIVATIVES

Space for your notings of Formulae or important points

FUTURES

Question 1 (Study Material TYK Q. 7)/MTP March'19

A Mutual Fund is holding the following assets in ₹ Crores:

Investments in diversified equity shares	90.00
Cash and Bank Balances	10.00
	100.00

The Beta of the equity shares portfolio is 1.1. The index future is selling at 4300 level. The Fund Manager apprehends that the index will fall at the most by 10%. How many index futures he should short for perfect hedging? One index future consists of 50 units.

Substantiate your answer assuming the Fund Manager's apprehension will materialize.

Solution

Number of index future to be sold by the Fund Manager is:

$$\frac{1.1 \times 90,00,00,000}{4,300 \times 50} = 4,605$$

Justification of the answer:

Loss in the value of the portfolio if the index falls by 10% is $\frac{₹\ 11}{100} \times 90 \text{ crore} = ₹\ 9.90 \text{ crore}$

Gain by short covering of index future is: $\frac{0.1 \times 4,300 \times 50 \times 4,605}{1,00,00,000} = 9.90 \text{ crore}$

This justifies the answer. Further, cash is not a part of the portfolio.

Question 2 (Study Material TYK Q 8)

A trader is having in its portfolio shares worth ₹ 85 lakhs at current price and cash ₹ 15 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%.

Determine:

(i) Current portfolio beta

(ii) Portfolio beta after 3 months if the trader on current date goes for long position on ₹ 100 lakhs Nifty futures.

Solution

(i) Current Portfolio Beta

Current Beta for share portfolio	= 1.6
Beta for cash	= 0
Current portfolio beta	= 0.85 x 1.6 + 0 x 0.15 = 1.36

(ii) Portfolio beta after 3 months:

Beta for portfolio of shares = $\frac{\text{Change in value of portfolio of share}}{\text{Change in value of market portfolio (Index)}}$

$$1.6 = \frac{0.032}{\text{Change in value of market portfolio (Index)}}$$

Change in value of market portfolio (Index) = (0.032 / 1.6) x 100 = 2%

Position taken on 100 lakh Nifty futures: Long

Value of index after 3 months = ₹ 100 lakh x (1.00 - 0.02) = ₹ 98 lakh

Mark-to-market paid= ₹ 2 lakh

Cash balance after payment of mark-to-market = ₹ 13 lakh

Value of portfolio after 3 months = ₹ 85 lakh x (1 - 0.032) + ₹13 lakh = ₹ 95.28 lakh

Change in value of portfolio = $\frac{₹\ 100\ \text{lakh} - ₹\ 95.28\ \text{lakh}}{₹\ 100\ \text{lakh}} = 4.72\%$

Portfolio beta= 0.0472 / 0.02 = 2.36

Question 3(Study Material TYK Q 5)/PP July'21

BSE	5000
Value of portfolio	₹ 10,10,000
Risk free interest rate	9% p.a.
Dividend yield on Index	6% p.a.
Beta of portfolio	1.5

We assume that a future contract on the BSE index with four months maturity is used to hedge the value of portfolio over next three months. One future contract is for delivery of 50 times the index.

Based on the above information calculate:

(i) Price of future contract.

(ii) The gain on short futures position if index turns out to be 4,500 in three months.

Solution

(i) Current future price of the index = $5000 + 5000\,(0.09 - 0.06)\,\frac{4}{12} = 5000 + 50 = 5{,}050$

Therefore, Price of the future contract = ₹ 50 x 5,050 = ₹ 2,52,500

(ii) Hedge ratio = $\frac{1010000}{252500} \times 1.5 = 6$ contracts

Index after there months turns out to be 4500

Future price will be = $4500 + 4500\,(0.09 - 0.06) \times \frac{1}{2} = 4{,}511.25$

Therefore, Gain from the short futures position is = 6 x (5050 – 4511.25) x 50 = ₹ 1,61,625

Note: Alternatively, we can also use daily compounding (exponential) formula.

Question 4(Study Material TYK Q 4)

Calculate the price of 3 months PQR futures, if PQR (FV ₹ 10) quotes ₹ 220 on NSE and the three months future price quotes at ₹ 230 and the one month borrowing rate is given as 15 percent per annum and the expected annual dividend is 25 percent, payable before expiry. Also examine arbitrage opportunities.

Solution

Future's Price = Spot + cost of carry – Dividend
F = 220 + 220 × 0.15 × 0.25 – 0.25** × 10 = 225.75
** Entire 25% dividend is payable before expiry, which is ₹ 2.50.
Thus, we see that futures price by calculation is ₹ 225.75 which is quoted at ₹ 230 in the exchange.

(i) Analysis:
Fair value of Futures less than Actual futures Price:
Futures Overvalued Hence it is advised to sell. Also do Arbitraging by buying stock in the cash market.

Step I
He will buy PQR Stock at ₹ 220 by borrowing at 15% for 3 months. Therefore, his outflows are:

Cost of Stock	220.00
Add: Interest @ 15 % for 3 months i.e. 0.25 years (220 × 0.15 × 0.25)	8.25
Total Outflows (A)	228.25

Step II
He will sell March 2000 futures at ₹ 230. Meanwhile he would receive dividend for his stock.

Hence his inflows are	230.00
Sale proceeds of March 2000 futures	2.50
Total inflows (B)	232.50

Inflow – Outflow = Profit earned by Arbitrageur
= 232.50 – 228.25 = 4.25

Question 5 (Study Material TYK Q 14)/RTP Nov'19
Sensex futures are traded at a multiple of 50. Consider the following quotations of Sensex futures in the 10 trading days during February, 2009:

Day	High	Low	Closing
4-2-09	3306.4	3290.00	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

Abhishek bought one sensex futures contract on February, 04. The average daily absolute change in the value of contract is ₹ 10,000 and standard deviation of these changes is ₹ 2,000. The maintenance margin is 75% of initial margin.

You are required to determine the daily balances in the margin account and payment on margin calls, if any.

Solution

Initial Margin = $\mu + 3\sigma$

Where μ = Daily Absolute Change

σ = Standard Deviation

Accordingly,

Initial Margin = ₹ 10,000 + ₹ 6,000 = ₹ 16,000

Maintenance margin = ₹ 16,000 x 0.75 = ₹ 12,000

Day	Changes in future Values (₹)	Margin A/c (₹)	Call Money (₹)
4/2/09	-	16000	-
5/2/09	50 x (3294.40 - 3296.50) = -105	15895	-
6/2/09	50 x (3230.40 - 3294.40) = -3200	12695	-
7/2/09	50 x (3212.30 - 3230.40) = -905	16000	4210
10/2/09	50 x (3267.50 - 3212.30) = 2760	18760	-
11/2/09	50 x (3263.80 - 3267.50) = -185	18575	-
12/2/09	50 x (3292 - 3263.80) =1410	19985	-
14/2/09	50 x (3309.30 - 3292) = 865	20850	-
17/2/09	50 x (3257.80 - 3309.30) = -2575	18275	-
18/2/09	50 x (3102.60 - 3257.80) = -7760	16000	5485

Question 6 (Study Material TYK Q 3)

On 31-8-2011, the value of stock index was ₹ 2,200. The risk free rate of return has been 8% per annum. The dividend yield on this Stock Index is as under:

Month	Dividend Paid p.a.
January	3%
February	4%
March	3%
April	3%
May	4%
June	3%
July	3%
August	4%
September	3%
October	3%
November	4%
December	3%

Assuming that interest is continuously compounded daily, find out the future price of contract deliverable on 31-12-2011. Given: e 0.01583= 1.01593

Solution

The duration of future contract is 4 months. The average yield during this period will be:

$$\frac{3\% + 3\% + 4\% + 3\%}{4} = 3.25\%$$

As per Cost to Carry model the future price will be

F = Se (rf – D)t

Where S = Spot Price

rf = Risk Free interest
D = Dividend Yield
T = Time Period

Accordingly, future price will be

= ₹ 2,200 $e^{(0.08 - 0.0325) \times 4/12}$ = ₹ 2,200 x $e^{0.01583}$

= ₹ 2,200 x 1.01593 = ₹ 2235.05

Question 7 (Study Material TYK Q 10)/RTP Nov'18/MTP April'19/MTP Oct'20 /RTP Nov'22

Ram buys 10,000 shares of X Ltd. at a price of ₹ 22 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. at a price of ₹ 40 per share having a beta value of 2. He obtains a complete hedge by Nifty futures at ₹ 1,000 each. He closes out his position at the closing price of the next day when the share of X Ltd. dropped by 2%, share of A Ltd. appreciated by 3% and Nifty futures dropped by 1.5%.

What is the overall profit / loss to Ram?

Solution

No. of the Future Contract to be obtained to get a complete hedge

$$= \frac{10{,}000 \times ₹\,22 \times 1.5 - 5000 \times ₹\,40 \times 2}{₹\,1000}$$

$$= \frac{₹\,3{,}30{,}000 - ₹\,4{,}00{,}000}{₹\,1000} = 70 \text{ contracts}$$

Thus, by purchasing 70 Nifty future contracts to be long to obtain a complete hedge.

Cash Outlay

= (10000 x ₹ 22) – (5000 x ₹ 40) + (70 x ₹ 1,000)

= ₹ 2,20,000 – ₹ 2,00,000 + ₹ 70,000 = ₹ 90,000

Cash Inflow at Close Out

= (10000 x ₹ 22 x 0.98) – (5000 x ₹ 40 x 1.03) + (70 x ₹ 1,000 x 0.985)

= ₹ 2,15,600 – ₹ 2,06,000 + ₹ 68,950 = ₹ 78,550

Gain / Loss

= ₹ 78,550 – ₹ 90,000 = - ₹ 11,450 (Loss)

Question 8 (Study Material TYK Q 11)/RTP May'20/MTP March'19

On January 1, 2013 an investor has a portfolio of 5 shares as given below:

Security	Price	No. of Shares	Beta
A	349.30	5,000	1.15
B	480.50	7,000	0.40
C	593.52	8,000	0.90
D	734.70	10,000	0.95
E	824.85	2,000	0.85

The cost of capital to the investor is 10.5% per annum.

You are required to calculate:

(i) The beta of his portfolio.

(ii) The theoretical value of the NIFTY futures for February 2013.
(iii) The number of contracts of NIFTY the investor needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures have a minimum trade lot requirement of 200 units. Assume that the futures are trading at their fair value.
(iv) The number of future contracts the investor should trade if he desires to reduce the beta of his portfolios to 0.6.

No. of days in a year be treated as 365.
Given: In (1.105) = 0.0998 and $e^{(0.015858)}$ = 1.01598

Solution

(i) Calculation of Portfolio Beta

Security	Price of the Stock	No. of shares	Value	Weightage wi	Beta Bi	Weighted Beta
A	349.30	5,000	17,46,500	0.093	1.15	0.107
B	480.50	7,000	33,63,500	0.178	0.40	0.071
C	593.52	8,000	47,48,160	0.252	0.90	0.227
D	734.70	10,000	73,47,000	0.390	0.95	0.370
E	824.85	2,000	16,49,700	0.087	0.85	0.074
			1,88,54,860			0.849

Portfolio Beta = 0.849

(ii) Calculation of Theoretical Value of Future Contract

Cost of Capital = 10.5% p.a. Accordingly, the Continuously Compounded Rate of Interest ln (1.105) = 0.0998

For February 2013 contract, t = 58 / 365= 0.1589
Further F= Sert
F = ₹ 5,900 e (0.0998) (0.1589)
F = ₹ 5,900 e 0.015858
F = ₹ 5,900 x 1.01598 = ₹ 5,994.28

Alternatively, it can also be taken as follows:
= ₹ 5900 e0.105 x 58 / 365
= ₹ 5900 e 0.01668
= ₹ 5900 x 1.01682 = ₹ 5,999.24

(iii) When total portfolio is to be hedged:

$$= \frac{\text{Value of Spot Position requiring hedging}}{\text{Value of Future Contract}} \times \text{Portfolio Beta}$$

$$= \frac{1,88,54,860}{5994.28 \times 200} \times 0.849 = 13.35 \text{ contracts say 13 or 14 contracts}$$

(iv) When total portfolio beta is to be reduced to 0.6:

$$\text{Number of Contracts to be sold} = \frac{P\,(\beta_p - \beta')}{F}$$

$$= \frac{1{,}88{,}54{,}860\ (0.849 - 0.600)}{5994.28 \times 200} = 3.92 \text{ contracts say } 4 \text{ contracts}$$

Question 9 (Study Material TYK Q 13)

On April 1, 2015, an investor has a portfolio consisting of eight securities as shown below:

Security	Market Price	No. of Shares	Value
A	29.40	400	0.59
B	318.70	800	1.32
C	660.20	150	0.87
D	5.20	300	0.35
E	281.90	400	1.16
F	275.40	750	1.24
G	514.60	300	1.05
H	170.50	900	0.76

The cost of capital for the investor is 20% p.a. continuously compounded. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for the advice to protect the interest of his portfolio.

You can make use of the following information:

1) The current NIFTY value is 8500.
2) NIFTY futures can be traded in units of 25 only.
3) Futures for May are currently quoted at 8700 and Futures for June are being quoted at 8850.

You are required to calculate:

(i) the beta of his portfolio.
(ii) the theoretical value of the futures contract for contracts expiring in May and June. Given ($e^{0.03}$ =1.03045, $e^{0.04}$ = 1.04081, $e^{0.05}$ =1.05127)
(iii) the number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:
   A. His total portfolio
   B. 50% of his portfolio
   C. 120% of his portfolio

Solution

(i) Beta of the Portfolio

Security	Market Price	No. of Shares	Value	β	Value x β
A	29.40	400	11760	0.59	6938.40
B	318.70	800	254960	1.32	336547.20
C	660.20	150	99030	0.87	86156.10
D	5.20	300	1560	0.35	546.00
E	281.90	400	112760	1.16	130801.60
F	275.40	750	206550	1.24	256122.00
G	514.60	300	154380	1.05	162099.00

H	170.50	900	153450	0.76	116622.00
			994450		1095832.30

Portfolio Beta = $\frac{10,95,832.30}{9,94,450} = 1.102$

(ii) Theoretical Value of Future Contract Expiring in May and June

F = Sert

FMay= 8500 x $e^{0.20 \times (2/12)}$ = 8500 x $e^{0.0333}$

$e^{0.0333}$ shall be computed using Interpolation Formula as follows:

$e^{0.03}$	= 1.03045
$e^{0.04}$	= 1.04081
$e^{0.01}$	= 0.01036
$e^{0.0033}$	= 0.00342
$e^{0.0067}$	= 0.00694

$e^{0.0333}$ = 1.03045 + 0.00342 = 1.03387 or 1.04081 – 0.00694 = 1.03387

<u>According the price of the May Contract</u>

8500 X 1.03387 = ₹ 8788

Price of the June Contract

F May= 8500 x $e^{0.20 \times (3/12)}$ = 8500 x $e^{0.05}$ = 8500 x 1.05127 = 8935.80

(iii) No. of NIFTY Contracts required to sell to hedge until June

$$= \frac{\text{Value of Position to be hedged}}{\text{Value of Future Contract}} \times \beta$$

(A) <u>Total portfolio</u>

$$\frac{994450}{8850 \times 25} \times 1.102 = 4.953 \text{ say } 5 \text{ contracts}$$

(B) <u>50% of Portfolio</u>

$$\frac{994450 \times 0.50}{8850 \times 25} \times 1.102 = 2.47 \text{ say } 3 \text{ contracts}$$

(C) <u>120% of Portfolio</u>

$$\frac{994450 \times 1.20}{8850 \times 25} \times 1.102 = 5.94 \text{ say } 6 \text{ contracts}$$

<u>Question 10 (Old PM) (Portfolio + Futures)</u>

A company is long on 10 MT of copper @ ₹ 474 per kg (spot) and intends to remain so for the ensuing quarter. The standard deviation of changes of its spot and future prices are 4% and 6% respectively, having correlation coefficient of 0.75.

What is its hedge ratio? What is the amount of the copper future it should short to achieve a perfect hedge?

<u>Solution</u>

The optional hedge ratio to minimize the variance of Hedger's position is given by:

$$H = p\frac{\sigma S}{\sigma F}$$

Where,

σS = Standard deviation of ΔS

σF=Standard deviation of ΔF

ρ= coefficient of correlation between ΔS and ΔF

H= Hedge Ratio

ΔS = change in Spot price.

ΔF= change in Future price.

Accordingly,

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

No. of contract to be short = 10 x 0.5 = 5

Amount = 5000 x ₹ 474 = ₹ 23,70,000

Question 11 (Study Material TYK Q 6)

The share of X Ltd. is currently selling for ₹ 300. Risk free interest rate is 0.8% per month. A three-month futures contract is selling for ₹ 312. Develop an arbitrage strategy and show what your riskless profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months.

Solution

The appropriate value of the 3 months futures contract is –

$$Fo = ₹\ 300\ (1.008)^3 = ₹\ 307.26$$

Since the futures price exceeds its appropriate value it pays to do the following: -

Action	Initial Cash Flow	Cash Flow at time T(3 months)
Borrow ₹ 300 now and repay with interest after 3 months	+ ₹ 300	- ₹ 300 $(1.008)^3$ =- ₹ 307.26
Buy a share	- ₹ 300	ST
Sell a futures contract (Fo = 312/-)	0	₹ 312 – ST
Total	**₹ 0**	**₹ 4.74**

Such an action would produce a risk less profit of ₹ 4.74.

Question 12 (Study Material TYK Q 1)

The 6 - months forward price of a security is ₹ 208.18. The borrowing rate is 8% per annum payable with monthly rests. What should be the spot price?

Solution

Calculation of spot price

The formula for calculating forward price is:

$$A = P\ (1 + \frac{r}{n})^{nt}$$

Where,

A = Forward price
P = Spot Price
r = rate of interest
n = no. of compounding
t = time

Using the above formula,

208.18 = P (1 + 0.08/12)6
Or 208.18 = P x 1.0409
P = 208.18/1.0409 = 200
Hence, the spot price should be ₹ 200.

Question 13 (Study Material TYK Q 2)/RTP May'21/MTP Sep'22
The following data relate to Anand Ltd.'s share price:
Current price per share ₹ 1,800
6 months future's price / share ₹ 1,950

Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are required:

(i) to calculate the theoretical minimum price of a 6 - months forward purchase; and
(ii) to explain arbitrate opportunity.

Solution

Anand Ltd

(i) Calculation of theoretical minimum price of a 6 months forward contract-
Theoretical minimum price = ₹ 1,800 + (₹ 1,800 x 12 / 100 x 6 / 12) = ₹ 1,908

(ii) Arbitrage Opportunity-
The arbitrageur can borrow money @ 12 % for 6 months and buy the shares at ₹ 1,800. At the same time he can sell the shares in the futures market at ₹ 1,950. On the expiry date 6 months later, he could deliver the share and collect ₹ 1,950 pay off ₹ 1,908 and record a profit of ₹ 42 (₹ 1,950 – ₹ 1,908)

Question 14 Removed(Same as Q 4)

SWAPPING

Question 15(IRRM)(Study Material TYK Q 4)(Similar Q asked in MTP March'21/PP July'21)

Suppose a dealer quotes 'All-in-cost' for a generic swap at 8% against six month LIBOR flat. If the notional principal amount of swap is ₹ 5,00,000.

(i) Calculate semi-annual fixed payment.

(ii) Find the first floating rate payment for (i) above if the six month period from the effective date of swap to the settlement date comprises 181 days and that the corresponding LIBOR was 6% on the effective date of swap.

In (ii) above, if the settlement is on 'Net' basis, how much the fixed rate payer would pay to the floating rate payer?

Generic swap is based on 30 / 360 days basis.

Solution

(i) Semi – annual fixed payment

= (N) (AIC) (Period)

Where N = Notional Principal amount = ₹ 5,00,000

AIC = All-in-cost = 8% = 0.08

$= 5{,}00{,}000 \times 0.08 \left(\frac{180}{360}\right)$

$= 5{,}00{,}000 \times 0.08\ (0.5)$

$= 5{,}00{,}000 \times 0.04 = ₹\ 20{,}000/-$

(ii) Floating Rate Payment

$= \mathrm{N(LIBOR)} \left(\frac{\mathrm{dt}}{360}\right)$

$= 5{,}00{,}000 \times 0.06 \times \frac{181}{360}$

= 5,00,000 × 0.06 (0.503) or 5,00,000 × 0.06 (0.502777)

= 5,00,000 × 0.03018 or 5,00,000 × 0.030166 = ₹ 15,090 or 15,083

(iii) Net Amount

= (i) – (ii)

= ₹20,000 – ₹ 15,090 = ₹ 4,910

or = ₹ 20,000 – ₹ 15,083 = ₹ 4,917

Question 16(IRRM)(Study Material TYK Q 6)

A Inc. and B Inc. intend to borrow $ 200,000 and $ 200,000 in ¥ respectively for a time horizon of one year. The prevalent interest rates are as follows:

Company	¥ Loan	$ Loan
A Inc	5%	9%
B Inc	8%	10%

The prevalent exchange rate is $ 1 = ¥ 120.

They entered in a currency swap under which it is agreed that B Inc will pay A Inc @ 1% over the ¥ Loan interest rate which the later will have to pay as a result of the agreed currency swap whereas

A Inc will reimburse interest to B Inc only to the extent of 9%. Keeping the exchange rate invariant, quantify the opportunity gain or loss component of the ultimate outcome, resulting from the designed currency swap.

Solution

Opportunity Gain of A Inc under currency swap	Receipt	Payment	Net
Interest to be remitted to B Inc in $ 2,00,000 x 9% = $ 18,000			
Converted into ($ 18,000 x ¥ 120)		¥ 21,60,000	
Interest to be received from B. Inc in $ converted into Y (6%x $ 2,00,000 x ¥ 120)	¥ 14,40,000		
Interest payable on Y loan		¥ 12,00,000	
	¥ 14,40,000	**¥ 33,60,000**	
Net Payment	¥ 19,20,000	-	
	¥ 33,60,000	**¥ 33,60,000**	
$ equivalent paid ¥ 19,20,000 x (1 / ¥120)			$ 16000
Interest payable without swap in $			$ 18000
Opportunity gain in $			$ 2000

Opportunity gain of B inc under currency swap	Receipt	Payment	Net
Interest to be remitted to A. Inc in ($ 2,00,000 x 6%)		$ 12,000	
Interest to be received from A. Inc in Y converted into $ = ¥ 21,60,000 / ¥ 120	$18,000		
Interest payable on $ loan@10%	-	$ 20,000	
	$18,000	**$ 32,000**	
Net Payment	$14,000	-	
	$ 32,000	**$ 32,000**	
Y equivalent paid $14,000 X ¥ 120			¥16,80,000
Interest payable without swap in ¥ ($ 2,00,000 X ¥ 120 X 8%)			¥19,20,000
Opportunity gain in Y			¥ 2,40,000

Alternative Solution,

Cash Flows of A Inc

(i) At the time of exchange of principal amount

Transactions		Cash Flows
Borrowings	$ 2,00,000 x ¥ 120	+ ¥ 240,00,000
Swap		- ¥ 240,00,000
Swap		+ $ 2,00,000
Net Amount		+ $ 2,00,000

(ii) At the time of exchange of interest amount

Transactions		Cash Flows

Interest to the lender	¥ 240,00,000 x 5%	¥ 12,00,000
Interest Receipt from B Inc.	¥ 2,00,000 x 120 x 6%	¥ 14,40,000
Net Saving (in $)	¥ 2,40,000 / ¥1 20	$ 2,000
Interest to B Inc.	$ 2,00,000 x 9%	- $ 18,000
Net Interest Cost		-$ 16,000

A Inc. used $ 2,00,000 at the net cost of borrowing of $ 16,000 i.e. 8%. If it had not opted for swap agreement the borrowing cost would have been 9%. Thus there is saving of 1%.

Cash Flows of B Inc

(i) At the time of exchange of principal amount

Transactions		Cash Flows
Borrowings		+ $ 2,00,000
Swap		- $ 2,00,000
Swap	$ 2,00,000 x ¥ 120	+ ¥ 240,00,000
Net Amount		+ ¥ 240,00,000

(ii) At the time of exchange of interest amount

Transactions		Cash Flows
Interest to the lender	$ 2,00,000 x 10%	- $ 20,000
Interest Receipt from A Inc.		+$ 18,000
Net Saving (in ¥)	-$ 2,000 x ¥ 120	- ¥ 2,40,000
Interest to A Inc.	$ 2,00,000 x 6% x ¥ 120	- ¥ 14,40,000
Net Interest Cost		- ¥ 16,80,000

B Inc. used ¥ 240,00,000 at the net cost of borrowing of ¥ 16,80,000 i.e. 7%. If it had not opted for swap agreement the borrowing cost would have been 8%. Thus there is saving of 1%.

Question 17(IRRM)(Study Material TYK Q 5)(MTP Oct'20)(PP May'18)/MTP Sep'22

Derivative Bank entered into a plain vanilla swap through on OIS (Overnight Index Swap) on a principal of 10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday, 2nd August, 2010 and was to commence on 3rd August, 2010 and run for a period of 7 days.

Respective MIBOR rates for Tuesday to Monday were:

7.75%,8.15%,8.12%,7.95%,7.98%,8.15%.

If Derivative Bank received 317 net on settlement, calculate Fixed rate and interest under both legs.

Notes:

(i) Sunday is Holiday.
(ii) Work in rounded rupees and avoid decimal working.

Solution

Day	Principal (₹)	MIBOR (%)	Interest (₹)
Tuesday	10,00,00,000	7.75	21,233
Wednesday	10,00,21,233	8.15	22,334
Thursday	10,00,43,567	8.12	22,256
Friday	10,00,65,823	7.95	21,795
Saturday & Sunday (*)	10,00,87,618	7.98	43,764
Monday	10,01,31,382	8.15	22,358
Total Interest @ Floating			1,53,740
Less: Net Received			317
Expected Interest @ fixed			1,53,423
Thus Fixed Rate of Interest			0.07999914
Approx.			8%

(*) i.e. interest for two days.

Note: Alternatively, answer can also be calculated on the basis of 360 days in a year.

Question 18(IRRM)(Study Material TYK Q 1)(MTP March'18)/MTP Oct'22)

M/s. Parker & Co. is contemplating to borrow an amount of ₹ 60 crores for a Period of 3 months in the coming 6 months' time from now. The current rate of interest is 9% p.a., but it may go up in 6 months' time. The company wants to hedge itself against the likely increase in interest rate.

The Company's Bankers quoted an FRA (Forward Rate Agreement) at 9.30% p.a.

What will be the Final settlement amount, if the actual rate of interest after 6 months happens to be (i) 9.60% p.a. and (ii) 8.80% p.a.?

Solution

Final settlement amount shall be computed by using formula:

$$= \frac{(N)(RR - FR)(\frac{dtm}{DY})}{[1 + RR\left(\frac{dtm}{DY}\right)]}$$

Where,

N = the notional principal amount of the agreement;

RR = Reference Rate for the maturity specified by the contract prevailing on the contract settlement date;

FR = Agreed-upon Forward Rate; and

dtm = maturity of the forward rate, specified in days (FRA Days)

DY = Day count basis applicable to money market transactions which could be 360 or 365 days.

Accordingly,

If actual rate of interest after 6 months happens to be 9.60%

$$= \frac{(₹\ 60\ \text{crore})(0.096 - 0.093)(\frac{3}{12})}{[1 + 0.096\left(\frac{3}{12}\right)]}$$

$$= \frac{(₹\ 60\ \text{crore})(0.00075)}{1.024} = ₹\ 4,39,453$$

Thus, banker will pay Parker & Co. a sum of ₹ 4,39,453

If actual rate of interest after 6 months happens to be 8.80%

$$= \frac{(₹\ 60\ \text{crore})(0.088 - 0.093)(\frac{3}{12})}{[1 + 0.088\left(\frac{3}{12}\right)]}$$

$$= \frac{(₹\ 60\ \text{crore})(-0.00125)}{1.022} = -₹\ 7{,}33{,}855$$

Thus Parker & Co. will pay banker a sum of ₹ 7,33,855

Note: It might be possible that students may solve the question on basis of days instead of months (as considered in above calculations). Further there may be also possibility that the FRA days and Day Count convention may be taken in various plausible combinations such as 90 days / 360 days, 90 days / 365 days, 91 days /360 days or 91 days / 365days.

Question 19(Old PM)(RTP May'18)

The following market data is available:

Spot USD/JPY 116.00

Deposit rates p.a.	USD	JPY
3 months	4.50%	0.25%
6 months	5.00%	0.25%

Forward Rate Agreement (FRA) for Yen is Nil.

1) What should be 3 months FRA rate at 3 months forward?
2) The 6 & 12 months LIBORS are 5% & 6.5% respectively. A bank is quoting 6 / 12 USD FRA at 6.50 – 6.75%. Is any arbitrage opportunity available?

Calculate profit in such case.

Solution

1) 3 Months Interest rate is 4.50% & 6-Months Interest rate is 5% p.a.
   Future Value 6 Months from now is a product of Future Value 3 Months now & 3 Months Future Value from after 3 Months.
   (1+0.05*6/12) = (1+0.045*3/12) x (1+i3,6 *3/12)
   i3,6 = [(1+0.05* 6/12) /(1+0.045 *3/12) – 1] *12/3
   i.e. 5.44% p.a.

2) 6 Months Interest rate is 5% p.a & 12 Month interest rate is 6.5% p.a.
   Future value 12 month from now is a product of Future value 6 Months from now and 6 Months Future value from after 6 Months.
   (1+0.065) = (1+0.05*6/12) x (1+i6,6 *6/12)
   i6,6 = [(1+0.065/1.025) – 1] *12/6
   6 Months forward 6 month rate is 7.80% p.a.
   The Bank is quoting 6/12 USD FRA at 6.50 – 6.75%
   Therefore, there is an arbitrage Opportunity of earning interest @ 7.80% p.a. & paying @ 6.75%

Borrow for 6 months, buy an FRA & invest for 12 months
To get $ 1.065 at the end of 12 months for $ 1 invested today
To pay $ 1.060# at the end of 12 months for every $ 1 Borrowed today
Net gain $ 0.005 i.e. risk less profit for every $ borrowed
(1+0.05/2) (1+.0675/2) = (1.05959) say 1.060

Question 20(Old PM)

From the following data for Government securities, calculate the forward rates:

Face value (₹)	Interest rate	Maturity (Year)	Current price (₹)
1,00,000	0%	1	91,500
1,00,000	10%	2	98,500
1,00,000	10.5%	3	99,000

Solution

Consider one – year Treasury bill.

$$91{,}500 = \frac{1{,}00{,}000}{(1 + r_1)}$$

$$1 + r_1 = \frac{1{,}00{,}000}{91{,}500} = 1.092896$$

r_1 = 0.0929 or 0.093

Consider two-year Government Security

$$98{,}500 = \frac{10{,}000}{1.093} + \frac{1{,}10{,}000}{1.093\,(1 + r_2)}$$

$$98{,}500 = 9149.131 + \frac{1{,}10{,}000}{1.093\,(1 + r_2)}$$

$$89{,}350.87 = \frac{100640.4}{1 + r_2}$$

1 + r_2 = 1.126351
r_2 = 0.12635
r_2 = 0.1263

Consider three – year Government Securities:

$$99{,}000 = \frac{10{,}500}{1.093} + \frac{10{,}500}{1.093 \times 1.1263} + \frac{1{,}10{,}500}{1.093 \times 1.1263\,(1 + r_3)}$$

$$99{,}000 = 9{,}606.587 + 8{,}529.65 + \frac{89{,}761.07}{1 + r_3}$$

$$80{,}863.763 = \frac{89{,}761.07}{1 + r_3}$$

1+r_3 = 1.1100284
r_3 = 0.1100284 say 11.003%

Question 21(IRRM)(Study Material TYK Q 2)(MTP March'19)

TM Fincorp has bought a 6 x 9 ₹ 100 crore Forward Rate Agreement (FRA) at 5.25%. On fixing date reference rate i.e. MIBOR turns out be as follows:

Period	Rate (%)
3 months	5.50
6 months	5.70
9 months	5.85

You are required to determine:

a) Profit/Loss to TM Fincorp. in terms of basis points.
b) The settlement amount.

(Assume 360 days in a year)

Solution

TM will make a profit of 25 basis points since a 6X9 FRA is a contract on 3 - month interest rate in 6 months, which turns out to be 5.50% (higher than FRA price).

The settlement amount shall be calculated by using the following formula:

$$\frac{N\,(RR - FR)\left(\frac{dtm}{360}\right)}{1 + RR\left(\frac{dtm}{360}\right)}$$

Where

N = Notional Principal Amount
RR = Reference Rate
FR = Agreed upon Forward Rate
Dtm= FRA period specified in days.

Accordingly:

$$\frac{100\text{ crore}(5.50\% - 5.25\%)\left(\frac{92^*}{360}\right)}{1 + 0.055\left(\frac{92^*}{360}\right)} = ₹\,6{,}30{,}032$$

Hence there is profit of ₹ 6,30,032 to TM Fincorp.

* Alternatively, it can also be taken as 90 days.

Question 22(FRA + Interest Rate Futures)(Old PM)

Electra space is consumer electronics wholesaler. The business of the firm is highly seasonal in nature. In 6 months of a year, firm has a huge cash deposit and especially near Christmas time and other 6 months firm cash crunch, leading to borrowing of money to cover up its exposures for running the business.

It is expected that firm shall borrow a sum of € 50 million for the entire period of slack season in about 3 months.

A Bank has given the following quotations:

Spot	5.50% - 5.75%
3 × 6 FRA	5.59% - 5.82%
3 × 9 FRA	5.64% - 5.94%

3 month € 50,000 future contract maturing in a period of 3 months is quoted at 94.15 (5.85%).

You are required to determine:

a) How a FRA, shall be useful if the actual interest rate after 3 months turnout to be:
(i) 4.5% (ii) 6.5%

b) How 3 months Future contract shall be useful for company if interest rate turns out as mentioned in part (a) above.

Solution

a) By entering into an FRA, firm shall effectively lock in interest rate for a specified future in the given it is 6 months. Since, the period of 6 months is starting in 3 months, the firm shall opt for 3 × 9 FRA locking borrowing rate at 5.94%. In the given scenarios, the net outcome shall be as follows:

	If the rate turns out to be 4.50%	If the rate turns out to be 6.50%
FRA Rate	5.94%	5.94%
Actual Interest Rate	4.50%	6.50%
Loss/ (Gain)	1.44%	(0.56%)
FRA Payment / (Receipts)	€ 50 m × 1.44% × $\frac{1}{2}$ = € 360,000	€ 50m × 0.56% × $\frac{1}{2}$ = (€ 140,000)
Interest after 6 months on €50 Million at actual rates	= € 50m × 4.5% × $\frac{1}{2}$ = €1,125,000	= € 50m × 6.5% × $\frac{1}{2}$ = € 1,625,000
Net Out Flow	**€ 1,485,000**	**€ 1,485,000**

Thus, by entering into FRA, the firm has committed itself to a rate of 5.94% as follows:

$$\frac{€\ 1{,}485{,}000}{€\ 50{,}000{,}000} \times 100 \times \frac{6}{12} = 5.94\%$$

b) Since firm is a borrower, it will like to off – set interest cost by profit on Future Contract. Accordingly, if interest rate rises it will gain hence it should sell interest rate futures.

$$\text{No. of Contracts} = \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Duration of Loan}}{\text{3 months}}$$

$$= \frac{€\ 50{,}000{,}000}{€\ 50{,}000} \times \frac{6}{3} = 2000 \text{ Contracts}$$

The final outcome in the given two scenarios shall be as follows:

	If the interest rate turns out to be 4.5%	If the interest rate turns out to be 6.5%
Future Course Action:		

Sell to open	94.15	94.15
Buy to close	95.50 (100 - 4.5)	93.50 (100 - 6.5)
Loss / (Gain)	1.35%	(0.65%)
Cash Payment (Receipt) for Future Settlement	€ 50,000 × 2000 × 1.35% × 3/12 = €337,500	€ 50,000 × 2000 × 0.65% × 3/12 = (€ 162,500)
Interest for 6 months on € 50 million at actual rates	€ 50 million × 4.5% × $\frac{1}{2}$ = € 11,25,000	€ 50 million × 6.5% × $\frac{1}{2}$ = € 16,25,000
	€ 1,462,500	**€ 1,462,500**

Thus, the firm locked itself in interest rate $\frac{€\ 1,462,500}{€\ 50,000,000} \times 100 \times \frac{12}{6} = 5.85\%$

Question 23(Old PM)(MTP Oct'21)

Two companies ABC Ltd. and XYZ Ltd. approach the DEF Bank for FRA (Forward Rate Agreement). They want to borrow a sum of ₹ 100 crores after 2 years for a period of 1 year. Bank has calculated Yield Curve of both companies as follows:

Year	XYZ Ltd.	ABC Ltd.*
1	3.86	4.12
2	4.20	5.48
3	4.48	5.78

*The difference in yield curve is due to the lower credit rating of ABC Ltd. compared to XYZ Ltd.

(i) You are required to calculate the rate of interest DEF Bank would quote under 2V3 FRA, using the company's yield information as quoted above.

(ii) Suppose bank offers Interest Rate Guarantee for a premium of 0.1% of the amount of loan, you are required to calculate the interest payable by XYZ Ltd. if interest rate in 2 years turns out to be:

a) 4.50%

b) 5.50%

Solution

(i) DEF Bank will fix interest rate for 2V3 FRA after 2 years as follows:

XYZ Ltd.

$(1+r)\ (1+0.0420)^2 = (1+0.0448)^3$

$(1+r)\ (1.0420)^2 = (1.0448)^3$

$r = 5.04\%$

Bank will quote 5.04% for a 2V3 FRA.

ABC Ltd.

$(1+r)\ (1+0.0548)^2 = (1+0.0578)^3$

$(1+r)\ (1.0548)^2 = (1.0578)^3$

$r = 6.38\%$

Bank will quote 6.38% for a 2V3 FRA

(ii)

		4.50% - Allow to Lapse	5.50% - Exercise
Interest	₹ 100 crores X 4.50%	₹ 4.50 crores	
	₹100 crores X 5.04%	-	₹ 5.04 crores
Premium(Cost ofOption)	₹ 100 crores X 0.1%	₹ 0.10 crores	₹ 0.10 crores
		₹ 4.50 crores	**₹ 5.14 crores**

OPTION

Question 24(Study Material TYK Q 15)(PP May'18)

Mr. A purchased a 3 month call option for 100 shares in XYZ Ltd. at a premium of ₹ 30 per share, with an exercise price of ₹ 550. He also purchased a 3 month put option for 100 shares of the same company at a premium of ₹ 5 per share with an exercise price of ₹ 450. The market price of the share on the date of Mr. A's purchase of options, is ₹ 500. Calculate the profit or loss that Mr. A would make assuming that the market price falls to ₹ 350 at the end of 3 months.

Solution

Since the market price at the end of 3 months falls to ₹ 350 which is below the exercise price under the call option, the call option will not be exercised. Only put option becomes viable.

	₹
The gain will be:	
Gain per share (₹ 450 – ₹ 350)	100
Total gain per 100 shares	10,000
Cost or premium paid (₹ 30 x 100) + (₹ 5 x 100)	3,500
Net gain	6,500

Question 25(Study Material TYK Q 21)(MTP Aug'18)

Sumana wanted to buy shares of EIL which has a range of ₹ 411 to ₹ 592 a month later. The present price per share is ₹ 421. Her broker informs her that the price of this share can sore up to ₹ 522 within a month or so, so that she should buy a one month CALL of EIL. In order to be prudent in buying the call, the share price should be more than or at least ₹ 522 the assurance of which could not be given by her broker.

Though she understands the uncertainty of the market, she wants to know the probability of attaining the share price ₹ 592 so that buying of a one month CALL of EIL at the execution price of ₹ 522 is iustified. Advice her. Take the risk free interest to be 3.60% and $e^{0.036}$ = 1.037.

Solution

$p = \frac{e^{rt}-d}{u-d}$

e^{rt} = e0.036

d = 411 / 421 = 0.976

u = 592 / 421 = 1.406

$p = \frac{e^{0.036} - 0.976}{1.406 - 0.976} = \frac{1.037 - 0.976}{0.43} = \frac{0.061}{0.43} = 0.1418$

Thus, probability of rise in price 0.1418

Question 26(Study Material TYK Q 22)/MTP March'18/MTP April'21/PP Nov'19/MTP Oct'22/RTP Nov'22

Mr. Dayal is interested in purchasing equity shares of ABC Ltd. which are currently selling at ₹ 600 each. He expects that price of share may go upto ₹ 780 or may go down to ₹ 480 in three months. The chances of occurring such variations are 60% and 40% respectively. A call option on the shares of ABC Ltd. can be exercised at the end of three months with a strike price of ₹ 630.

(i) What combination of share and option should Mr. Dayal select if he wants a perfect hedge?
(ii) What should be the value of option today (the risk free rate is 10% p.a.)?
(iii) What is the expected rate of return on the option?

Solution

(i) To compute perfect hedge we shall compute Hedge Ratio (Δ) as follows:

$\Delta = \frac{C_1 - C_2}{S_1 - S_2} = \frac{150 - 0}{780 - 480} = \frac{150}{300} = 0.50$

Mr. Dayal should purchase 0.50 share for every 1 call option.

(ii) Value of Option today

If price of share comes out to be ₹ 780 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 780)	₹ 390
Loss on account of Short Position (₹ 780 – ₹ 630)	₹ 150
	₹ 240

If price of share comes out to be ₹ 480 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 480) ₹ 240

Accordingly, Premium say P shall be computed as follows:

(₹ 300 – P) 1.025 = ₹ 240

P = ₹ 65.85

(iii) Expected Return on the Option

Expected Option Value = (₹ 780 – ₹ 630) × 0.60 + ₹ 0 × 0.40 = ₹ 90

Expected Rate of Return = $\frac{90 - 65.85}{65.85} \times 100 = 36.67\%$

Question 27(Study Material TYK Q 16)/RTP May'19

The market received rumour about ABC corporation's tie-up with a multinational company. This has induced the market price to move up. If the rumour is false, the ABC corporation stock price will probably fall dramatically. To protect from this an investor has bought the call and put options.

He purchased one 3 months call with a striking price of ₹ 42 for ₹ 2 premium, and paid Re.1 per share premium for 3 months put with a striking price of ₹ 40.

(i) Determine the Investor's position if the tie up offer bids the price of ABC Corporation's stock up to ₹ 43 in 3 months.
(ii) Determine the Investor's ending position, if the tie up programme fails and the price of the stocks falls to ₹ 36 in 3 months.

Solution

Cost of Call and Put Options

= (₹ 2 per share) x (100 share call) + (₹ 1 per share) x (100 share put)
= ₹ 2 x 100 + 1 x 100
= ₹ 300

(i) Price increases to ₹ 43. Since the market price is higher than the strike price of the call, the investor will exercise it.

Ending position = (- ₹ 300 cost of 2 option) + (₹ 1 per share gain on call) x 100
= - ₹ 300 + 100
Net Loss = - ₹ 200

(ii) The price of the stock falls to ₹ 36. Since the market price is lower than the strike price, the investor may not exercise the call option.

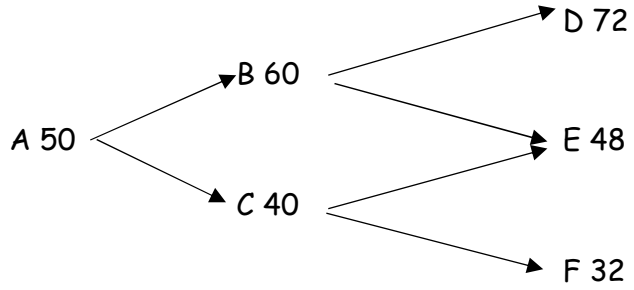
Ending Position = (- ₹ 300 cost of 2 options) + (₹ 4 per stock gain on put) x 100
= - ₹ 300 + 400
Gain = ₹ 100

Question 28(Study Material TYK Q 23)/RTP Nov'19

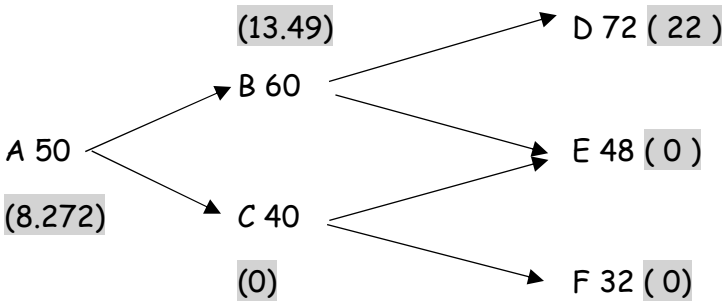
Consider a two – year call option with a strike price of ₹ 50 on a stock the current price of which is also ₹ 50. Assume that there are two – time periods of one year and in each year the stock price can move up or down by equal percentage of 20%. The risk – free interest rate is 6%. Using binominal option model, calculate the probability of price moving up and down. Also draw a two – step binomial tree showing prices and payoffs at each node.

Solution

Stock prices in the two step Binominal tree



Using the single period model, the probability of price increase is



$$P = \frac{R-d}{u-d} = \frac{1.06-0.80}{1.20-0.80} = \frac{0.26}{0.40} = 0.65$$

therefore, the p of price decrease = 1-0.65 = 0.35

The two step Binominal tree showing price and pay off

The value of an American call option at nodes D, E and F will be equal to the value of European option at these nodes and accordingly the call values at nodes D, E and F will be 22, 0 and 0 using the single period binomial model the value of call option at node B is

$$C = \frac{Cup+Cd(1-p)}{R} = \frac{22 \times 0.65+0 \times 0.35}{1.06} = 13.49$$

The value of option at node 'A' is

$$\frac{13.49 \times 0.65 + 0 \times 0.35}{1.06} = 8.272$$

Question 29(Study Material Illustration 2/TYK Q 23)/MTP Oct'18/MTP Sep'22)

The current market price of an equity share of Penchant Ltd is ₹ 420. Within a period of 3 months, the maximum and minimum price of it is expected to be ₹ 500 and ₹ 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of ₹ 450? Given $e^{0.02}$ = 1.0202

Solution

Let the probability of attaining the maximum price be

p (500 - 420) x p+(400 - 420) x (1-p) = 420 x ($e^{0.02}$-1)

or, 80p - 20(1 - p) = 420 x 0.0202

or, 80p – 20 + 20p = 8.48 or, 100p = 28.48

p= 0.2848

The value of Call Option in ₹ = $\frac{0.2848 \times (500-450)}{1.0202} = \frac{0.2848 \times 50}{1.0202} = 13.96$

Question 30(Study Material TYK Q 19)/MTP Oct'18/PP May'19/MTP Sep'22

Mr. X established the following strategy on the Delta Corporation's stock:

1) Purchased one 3 – month call option with a premium of ₹ 30 and an exercise price of ₹ 550.
2) Purchased one 3 – month put option with a premium of ₹ 5 and an exercise price of ₹ 450.

Delta Corporation's stock is currently selling at ₹ 500. Determine profit or loss, if the price of Delta Corporation's:

(i) remains at ₹ 500 after 3 months.
(ii) falls at ₹ 350 after 3 months.
(iii) rises to ₹ 600.

Assume the option size is 100 shares of Delta Corporation.

Solution

(i) Total premium paid on purchasing a call and put option
= (₹ 30 per share × 100) + (₹ 5 per share × 100).
= 3,000 + 500 = ₹ 3,500

In this case, X exercises neither the call option nor the put option as both will result in a loss for him.
Ending value = - ₹ 3,500 + zero gain = - ₹ 3,500
i.e., Net loss = ₹ 3,500

(ii) Since the price of the stock is below the exercise price of the call, the call will not be exercised. Only put is valuable and is exercised.
Total premium paid = ₹ 3,500
Ending value = – ₹ 3,500 + ₹ [(450 – 350) × 100] = – ₹ 3,500 + ₹ 10,000 = ₹ 6,500
Then, Net gain = ₹ 6,500

(iii) In this situation, the put is worthless, since the price of the stock exceeds the put's exercise price. Only call option is valuable and is exercised.
Total premium paid = ₹ 3,500
Ending value = -3,500 + [(600 – 550) × 100]
Net Gain = -3,500 + 5,000 = ₹ 1,500

Question 31(Study Material TYK Q 17)

Equity share of PQR Ltd. is presently quoted at ₹ 320. The Market Price of the share after 6 months has the following probability distribution:

Market Price	₹ 180	260	280	320	400
Probability	0.1	0.2	0.5	0.1	0.1

A put option with a strike price of ₹ 300 can be written.
You are required to find out expected value of option at maturity (i.e., 6 months)

Solution

Expected Value of Option

(300 – 180) x 0.1	12
(300 – 260) x 0.2	8
(300 – 280) x 0.5	10
(300 – 320) x 0.1	Not Exercised*
(300 – 400) x 0.1	Not Exercised*
Expected Value of Option	**30**

* If the strike price goes beyond ₹ 300, option is not exercised at all.

In case of Put option, since Share price is greater than strike price Option Value would be zero.

Question 32(Study Material TYK Q 18)/MTP April'18

You as an investor had purchased a 4-month call option on the equity shares of X Ltd. of ₹ 10, of which the current market price is ₹ 132 and the exercise price ₹ 150. You expect the price to range between ₹ 120 to ₹ 190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	.05	.20	.50	.10	.15

Compute the following:

a) Expected Share price at the end of 4 months.
b) Value of Call Option at the end of 4 months, if the exercise price prevails.
c) In case the option is held to its maturity, what will be the expected value of the call option?

Solution

a) Expected Share Price

= ₹ 120X 0.05 + ₹ 140X 0.20 + ₹ 160X 0.50 + ₹ 180X 0.10 + ₹ 190X 0.15

= ₹ 6 + ₹ 28 + ₹ 80 + ₹ 18 + ₹ 28.50 = ₹ 160.50

b) Value of Call Option

= ₹ 150 - ₹ 150 = Nil

c) If the option is held till maturity the expected Value of Call Option

Expected price (X)	Value of call (C)	Probability (P)	CP
₹ 120	0	0.05	0
₹ 140	0	0.20	0
₹ 160	₹ 10	0.50	₹ 5
₹ 180	₹ 30	0.10	₹ 3
₹ 190	₹ 40	0.15	₹ 6
Total			₹ 14

Alternatively, it can also be calculated as follows:

Expected Value of Option

(120 – 150) X 0.1	Not Exercised*
(140 – 150) X 0.2	Not Exercised*
(160 – 150) X 0.5	5
(180 – 150) X 0.1	3
(190 – 150) X 0.15	6
Expected Value of Option	**14**

* If the strike price goes below ₹ 150, option is not exercised at all.

Question 33(Study Material TYK Q 20)/MTP Oct'19/PP Nov'18

The equity share of VCC Ltd. is quoted at ₹ 210. A 3 – month call option is available at a premium of ₹ 6 per share and a 3 – month put option is available at a premium of ₹ 5 per share. Ascertain the net payoffs to the option holder of a call option and a put option separately.

(i) the strike price in both cases in ₹ 220; and

(ii) the share price on the exercise day is ₹ 200, 210, 220, 230, 240.

Also indicate the price range at which the call and the put options may be gainfully exercised.

Solution

Net payoff for the holder of the call option (₹)

Share price on exercise day	200	210	220	230	240
Option exercise	No	No	No	Yes	Yes
Outflow (Strike price)	Nil	Nil	Nil	220	220
Out flow (premium)	6	6	6	6	6
Total Outflow	**6**	**6**	**6**	**226**	**226**
Less:					
Inflow (Sales proceeds)	-	-	-	230	240
Net payoff	**-6**	**-6**	**-6**	**4**	**14**

Net payoff for the holder of the put option (₹)

Share price on exercise day	200	210	220	230	240
Option exercise	Yes	Yes	No	No	No
Inflow (strike price)	**220**	**220**	**Nil**	**Nil**	**Nil**
Less					
Outflow(Purchase Price)	200	210	-	-	-
Outflow (Premium)	5	5	5	5	5
Net Payoff	**15**	**5**	**-5**	**-5**	**-5**

The call option can be exercised gainfully for any price above ₹ 226 (₹ 220 + ₹ 6) and put option for any price below ₹ 215 (₹ 220 - ₹ 5).

Question 34(Old PM)

A call and put exist on the same stock each of which is exercisable at ₹ 60. They now trade for:

Market price of Stock or stock index	₹ 55
Market price of call	₹ 9
Market price of put	₹ 1

Calculate the expiration date cash flow, investment value, and net profit from:

(i) Buy 1.0 call

(ii) Write 1.0 call

(iii) Buy 1.0 put

(iv) Write 1.0 put

for expiration date stock prices of ₹ 50, ₹ 55, ₹ 60, ₹ 65, ₹ 70.

Solution

Expiration date cash flows

Stock Prices	**₹ 50**	**₹ 55**	**₹ 60**	**₹ 65**	**₹ 70**
Buy 1.0 call	0	0	0	-60	-60
Write 1.0 call	0	0	0	60	60
Buy 1.0 put	60	60	0	0	0
Write 1.0 put	-60	-60	0	0	0

Expiration date investment value

Stock Prices	**₹ 50**	**₹ 55**	**₹ 60**	**₹ 65**	**₹ 70**
Buy 1.0 call	0	0	0	5	10
Write 1.0 call	0	0	0	-5	-10
Buy 1.0 put	10	5	0	0	0
Write 1.0 put	-10	-5	0	0	0

Expiration date net profits

Stock Prices	**₹ 50**	**₹ 55**	**₹ 60**	**₹ 65**	**₹ 70**
Buy 1.0 call	-9	-9	-9	-4	1
Write 1.0 call	9	9	9	4	-1
Buy 1.0 put	9	4	-1	-1	-1
Write 1.0 put	-9	-4	1	1	1

CAP AND FLOOR OPTION STRATEGY

Question 35(IRRM)(Study Material TYK Q 3)/MTP April'18/MTP Aug'18/MTP Oct'19/MTP May'20/ RTP Nov'22

XYZ Limited borrows £ 15 Million of six months LIBOR + 10.00% for a period of 24 months. The company anticipates a rise in LIBOR, hence it proposes to buy a Cap Option from its Bankers at the strike rate of 8.00%. The lump sum premium is 1.00% for the entire reset periods and the fixed rate of interest is 7.00% per annum. The actual position of LIBOR during the forth coming reset period is as under:

Reset Period	LIBOR
1	9.00%
2	9.50%
3	10.00%

You are required to show how far interest rate risk is hedged through Cap Option.

For calculation, work out figures at each stage up to three decimal points and amount nearest to £. It should be part of working notes.

Solution

First of all we shall calculate premium payable to bank as follows:

$$P = \frac{rp}{\left[(1+i) - \frac{1}{i \times (1+i)^t}\right]} \times A \text{ or } \frac{rp}{PVAF\ (3.5\%,4)} \times A$$

Where,

P = Premium

A = Principal Amount

rp = Rate of Premium

i = Fixed Rate of Interest

t = Time

$$= \frac{0.01}{\left[\left(\frac{1}{0.035}\right) - \frac{1}{0.035 \times 1.035^4}\right]} \times £\,15{,}000{,}000 \text{ or } \frac{0.01}{(0.966 + 0.933 + 0.901 + 0.871)} \times £\,15{,}000{,}000$$

$$= \frac{0.01}{[\,(28.5714) - \frac{1}{0.04016}} \times £\,15{,}000{,}000 \text{ or } \frac{£\,150{,}000}{3.671} = £\,40{,}861$$

Now we see the net payment received from bank

Reset Period	Additional interest due to rise in interest rate	Amount received from bank	Premium paid to bank*	Net Amt. received from bank
1	£ 75,000	£ 75,000	£ 40,861	£34,139
2	£ 112,500	£ 112,500	£ 40,861	£71,639
3	£ 150,000	£ 150,000	£ 40,861	£109,139
TOTAL	£ 337,500	£ 337,500	£122,583	£ 214,917

Thus, from above it can be seen that interest rate risk amount of £ 337,500 reduced by £ 214,917 by using of Cap option.

* Alternatively, if premium paid is considered as £ 40,595, then above figure of £ 214,917 shall be changed to £ 215,715.

Question 36(Old PM)/MTP Oct'18

XYZ Inc. issues a £ 10 million floating rate loan on July 1, 2013 with resetting of coupon rate every 6 months equal to LIBOR + 50 bp. XYZ is interested in a collar strategy by selling a Floor and buying a Cap. XYZ buys the 3 years Cap and sell 3 years Floor as per the following details on July 1, 2013:

Notional Principal Amount	$ 10 million
Reference Rate	6 months LIBOR
Strike Rate	4% for Floor and 7% for Cap
Premium	0*

*Since Premium paid for Cap = Premium received for Floor

Using the following data you are required to determine:

(i) Effective interest paid out at each reset date,

(ii) The average overall effective rate of interest p.a.

Reset Date	LIBOR (%)
31-12-2013	6.00

30-06-2014	7.50
31-12-2014	5.00
30-06-2015	4.00
31-12-2015	3.75
30-06-2016	4.25

Solution

a) The pay-off of each leg shall be computed as follows:

Cap Receipt

$$\text{Max}\ \frac{\{0,\ [\text{Notional principal} \times (\text{LIBOR on Reset date} - \text{Cap Strike Rate}) \times \text{Number of days in the settlement period}\}}{365}$$

Floor Pay-off

$$\text{Max}\ \frac{\{0,[\text{Notional principal} \times (\text{Floor Strike Rate} - \text{LIB}\quad \text{on Reset date}) \times \text{Number of days in the settlement period}\}}{365}$$

Statement showing effective interest on each re-set date

Reset Date	LIBOR (%)	Days	Interest Payment ($) LIBOR+0.50%	Cap Receipts ($)	Floor Pay-off ($)	Effective Interest
31-12-2013	6.00	184	3,27,671	0	0	3,27,671
30-06-2014	7.50	181	3,96,712	24,795	0	3,71,917
31-12-2014	5.00	184	2,77,260	0	0	2,77,260
30-06-2015	4.00	181	1,98,356	0	0	1,98,356
31-12-2015	3.75	184	1,89,041	0	12,603	2,01,644
30-06-2016	4.25	182	2,36,849	0	0	2,36,849
Total		**1096**				**16,26,094**

b) Average Annual Effective Interest Rate shall be computed as follows:

$$\frac{16,26,094}{1,00,00,000} \times \frac{365}{1096} \times 100 = 5.42\%$$

Question 37(IRRM)(Study Material TYK Q 7)/MTP Nov'21

A textile manufacturer has taken floating interest rate loan of ₹ 40,00,000 on 1st April, 2012. The rate of interest at the inception of loan is 8.5% p.a. interest is to be paid every year on 31st March, and the duration of loan is four years. In the month of October 2012, the Central bank of the country releases following projections about the interest rates likely to prevail in future.

(i) On 31st March, 2013, at 8.75%; on 31st March, 2014 at 10% on 31st March, 2015 at 10.5% and on 31st March, 2016 at 7.75%. Show how this borrowing can hedge the risk arising out of expected rise in the rate of interest when he wants to peg his interest cost at 8.50% p.a.

(ii) Assume that the premium negotiated by both the parties is 0.75% to be paid on 1st October, 2012 and the actual rate of interest on the respective due dates happens to be as: on 31st March, 2013 at 10.2%; on 31st March, 2014 at 11.5%; on 31st March, 2015 at 9.25%; on 31st March, 2016 at 8.25%. Show how the settlement will be executed on the perspective interest due dates.

Solution

As borrower does not want to pay more than 8.5% p.a., on this loan where the rate of interest is likely to rise beyond this, hence, he has hedge the risk by entering into an agreement to buy interest rate caps with the following parameters:

- National Principal: ₹ 40,00,000/-
- Strike rate: 8.5% p.a.
- Reference rate: the rate of interest applicable to this loan
- Calculation and settlement date: 31st March every year
- Duration of the caps: till 31st March, 2016
- Premium for caps: negotiable between both the parties

To purchase the caps this borrower is required to pay the premium up front at the time of buying caps. The payment of such premium will entitle him with right to receive the compensation from the seller of the caps as soon as the rate of interest on this loan rises above 8.5%. The compensation will be at the rate of the difference between the rate of none of the cases the cost of this loan will rise above 8.5% calculated on ₹ 40,00,000/-. This implies that in none of the cases the cost of this loan will rise above 8.5%. This hedging benefit is received at the respective interest due dates at the cost of premium to be paid only once.

The premium to be paid on 1st October 2012 is 30,000/- (₹ 40,00,000 x 0.75 / 100). The payment of this premium will entitle the buyer of the caps to receive the compensation from the seller of the caps whereas the buyer will not have obligation. The compensation received by the buyer of caps will be as follows:

On 31st March 2013

The buyer of the caps will receive the compensation at the rate of 1.70% (10.20 - 8.50) to be calculated on ₹ 40,00,000, the amount of compensation will be ₹ 68000/- (40,00,000 x 1.70 / 100).

On 31st March 2014

The buyer of the caps will receive the compensation at the rate of 3.00% (11.50 – 8.50) to be calculated on ₹ 40,00,000/-, the amount of compensation will be ₹ 120000/- (40,00,000 x 3.00 / 100).

On 31st March 2015

The buyer of the caps will receive the compensation at the rate of 0.75% (9.25 – 8.50) to be calculated on ₹ 40,00,000/-, the amount of compensation will be ₹ 30,000 (40,00,000 x 0.75/100).

On 31st March 2016

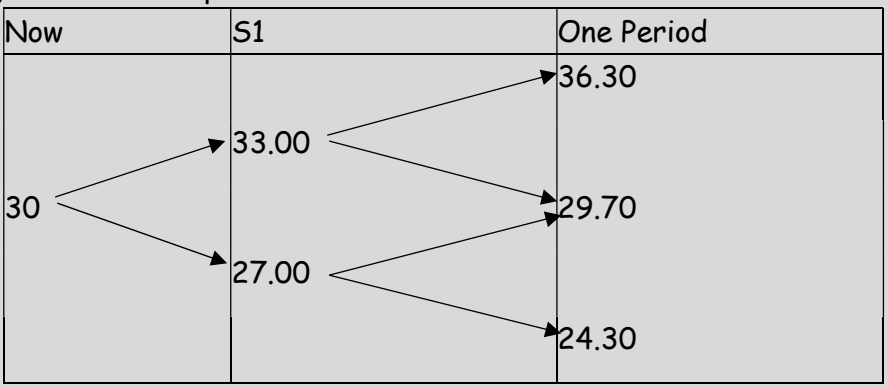
The buyer of the caps will not receive the compensation as the actual rate of interest is 8.25% whereas strike rate of caps is 8.5%. Hence, his interest liability shall not exceed 8.50%.

Thus, by paying the premium up front buyer of the caps gets the compensation on the respective interest due dates without any obligations.

BINOMIAL OPTIONS

Question 38(Study Material Illustration 1)

Following is a two sub – periods tree of 6 – months each for the share of CAB Ltd.:



Using the binomial model, calculate the current fair value of a regular call option on CAB Stock with the following characteristics: X = ₹ 28, Risk Free Rate = 5 percent p.a. You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

Solution

u = 33.00/30.00 = 36.30/33.00 = 1.10

d = 27.00/30.00 = 24.30/27.00 = 0.90

r = (1 + .05)1/2 = 1.0247

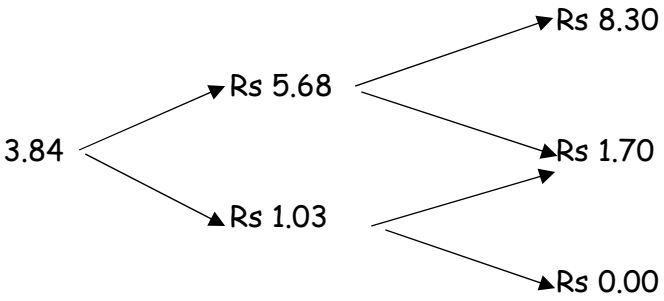
p = $\frac{r-d}{u-d} = \frac{1.0247 - .90}{1.10-0.90}$ = 0.1247/0.20 = 0.6235 (Prob. of increase in Price of Share)

Prob. of decrease in Price of Share = 1 – 0.6235 = 0.3765

Cuu = Max [0, 36.30 – 28] = 8.30

Cud = Max [0, 29.70 – 28] = 1.70

Cdd = Max [0, 24.30 – 28] = 0



$C_u = \frac{(0.6235)(8.30)+(0.3765)(1.70)}{1.025} = \frac{5.175 \quad .640}{1.025} = 5.815 / 1.025 = ₹ 5.673$

$C_d = \frac{(0.6235)(1.70) + (0.3765)(0.00)}{1.025} = \frac{1.05995}{1.025} = 1.0341$

$C_o = \frac{(0.6235)(5.673) + (0.3765)(1.0341)}{1.025} = \frac{3.537 + 0.3893}{1.025} = ₹ 3.83$

The composition of the implied risk-less hedge portfolio at valuation date is called Delta (Δ) and it is calculated as follows:

$$\frac{C_u - C_d}{S_u - S_d}$$

Where,

Cu = Pay-off from Call Option if price of Stock goes up
Cd = Pay-off from Call Option if price of Stock goes down
Su = Upward price of the Stock
Sd = Downward price of the Stock

Accordingly, the Risk – less Portfolio shall require Δ Share shall be required for writing off one Call Option. The Δ shall be computed as follows:

$$\Delta = \frac{5-0}{33-27} = \frac{5}{6}$$

Thus, $\frac{5}{6}$ shares shall be held or purchased for writing one Call Option.

Question 39(Study Material Illust 3)/Similar Q asked in MTP Oct'22 except Black Scholes)

(i) The shares of TIC Ltd. are currently priced at ₹ 415 and call option exercisable in three months' time has an exercise rate of ₹ 400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of share price is 22%. Based on the assumption that TIC Ltd. is not going to declare any dividend over the next three months, is the option worth buying for ₹ 25?

(ii) Calculate value of aforesaid call option based on Block Scholes valuation model if the current price is considered as ₹ 380.

(iii) What would be the worth of put option if current price is considered ₹ 380.

(iv) If TIC Ltd. share price at present is taken as ₹ 408 and a dividend of ₹ 10 is expected to be paid in the two months' time, then, calculate value of the call option.

Given
In (1.0375) = 0.03681
In (0.95) = -0.05129
In (0.9952) = -0.00481
$e^{0.0125}$ = 1.012578
$e^{0.008333}$ = 1.0084

Solution

(i) Given: TIC Ltd. Current Price = ₹ 415
Exercise rate = 400
Risk free interest rate is = 5% p.a.
SD (Volatility) = 22%

Based on the above bit is calculated value of an option based on Block Scholes Model:

$$d_1 = \frac{\ln\left(\frac{415}{400}\right) + \left[.05 + \frac{1}{2}(.22)^2\right]25}{.22\sqrt{.25}} = \frac{0.3681 + .01855}{.11} = .5032727$$

$$d_2 = \frac{\ln\left(\frac{415}{400}\right) + \left[0.5 - \frac{1}{2}(.22)^2\right].25}{.22\sqrt{.25}} = \frac{.03681 + .00645}{.11} = .3932727$$

N(d1) = N (.50327) = 1 - .3072 = .6928

N(d2) = N (.39327) = 1 - .3471 = .6529

Value of Option = $415\,(.6928) - \frac{400}{e^{(.05)(.25)}}\,(.6529)$

$$= 287.512 - \frac{400}{1.012578}\,(.6529) = 287.512 - 257.916 = ₹\,29.60$$

NB: N (0.39327) can also be find as under:

Step 1: From table of area under normal curve find the area of variable 0.39 i.e. 0.6517.

Step 2: From table of area under normal curve find the area of variable 0.40.

Step 3: Find out the difference between above two variables and areas under normal curve.

Step 4 : Using interpolation method find out the value of 0.00327. Which is as follows:

$$\frac{0.0037}{0.01} \times 0.00327 = 0.0012$$

Step 5: Add this value, computed above to the N (0.39). Thus N (0.39327)
= 0.6517 + 0.0012 = 0.6529

Since market price of ₹ 25 is less than ₹ 27.60 (Block Scholes Valuation model) indicate that option is under priced, hence worth buying.

(ii) If the current price is taken as 380 the computations are as follows:

$$d_1 = \frac{\ln\left(\frac{380}{400}\right) + \left[.05 + \frac{1}{2}(.22)^2\right].25}{.22\sqrt{.25}} = \frac{-.005129 + .01855}{.11} = -0.297636$$

$$d_2 = \frac{\ln\left(\frac{380}{400}\right) + \left[.05 - \frac{1}{2}(.22)^2\right].25}{.22\sqrt{.25}} = \frac{-0.05129 + .00645}{.11} = -0.407636$$

$$V_0 = V_s\,N\,(d_1) - \frac{E}{e^{rt}}\,N\,(d_2)$$

N (d1) = N (-0.297636) = .3830

N (d2) = N (-0.407636) = .3418

$$380\,(.3830) - \frac{400}{e^{(.05)(.25)}} \times (.3418)$$

$$145.54 - \frac{400}{1.012578}\,(.3418) = 145.54 - 135.02 = ₹\,10.52$$

(iii) Value of call option = ₹ 10.52

Current Market Value = ₹ 415

Present Value of Exercise Price = $\frac{400}{1.0125} = 395.06$ or $\frac{400}{1.012578} = 395.03$

Value of Put Option can be find by using Put Call Parity relationship as follows:

Vp = -Vs + Vc + PV (E)

Vp = -380 + 10.52 + 395.06 = 25.58

= ₹ 25.58 Ans

or -380 + 10.52 + 395.03 = 25.55

= ₹ 25.55

(iv) Since dividend is expected to be paid in two months' time we have to adjust the share price and then use Block Scholes model to value the option:

Present Value of Dividend (using continuous discounting) = Dividend x e-rt

= ₹ 10 x $e^{-.05 \times .16666}$

= ₹ 10 x $e^{-.008333}$

= ₹ 9.917 (Please refer Exponential Table)

Adjusted price of shares is ₹ 408 – 9.917 = ₹ 398.083

This can be used in Block Scholes model

$$d_1 = \frac{\ln\left(\frac{398.083}{400}\right) + \left[.05 + \frac{1}{2}(.22)^2\right].25}{.22\sqrt{.25}} = \frac{-.00481 + .01855}{.11} = .125$$

$$d_2 = \frac{\ln\left(\frac{398.083}{400}\right) + \left[.05 - \frac{1}{2}(.22)^2\right].25}{.22\sqrt{.25}} = \frac{-.00481 + .00645}{.11} = .015$$

N (d1) = N (.125) = .5498

N (d2) = N (.015) = .5060

Value of option = $398.03\,(.5498) - \frac{400}{e^{(.05)(.25)}} \times (.5060)$

$218.866 - \frac{400}{e^{.0125}}\,(.5060)$

$218.866 - \frac{400}{.1012578}\,(.5060) = 218.866 - 199.8858 =$ ₹ 18.98

Question 40

Ram Chemical is in production Line of Chemicals and considering a proposal of building new plant to produce pesticides. The Present Value (PV) of new proposal is Rs. 150 crores (After considering scrap value at the end of life of project). Since this is a new product market, survey indicates following variation in Present Value (PV):

Condition Favourable in First Year	PV will increase 30% from original estimate
Condition sluggish in First Year	PV will decrease by 40% from original estimate

In addition Rama Chemical has a option to abandon the project at the end of Year and dispose it at Rs. 100 crores. If risk free rate of interest is 8%, what will be present value of put option?

Solution

Decision tree showing pay-off

Year 0	Year 1	Pay Off
150	195	0
	90	100-90 = 10

First of all, we shall calculate probability of high demand(P) using risk neutral method as follows:

8% = p x 30% + (1-p) x (-40%)

0.08 = 0.30 p – 0.40 + 0.40p

$p = \frac{0.48}{0.70} = 0.6857$ say 0.686

The value of abandonment option will be as follows:

Expected Pay Off at year 1

= p x 0 + [(1-p) x 10] = 0.686 x 0 + [0.314x 10] = ₹ 3.14 crore

Since expected pay off at year 1 is 3.14 crore, present value of expected pay off will be:

$\frac{3.14}{1.08}$ = 2.907 crore

This is the value of abandonment option(Put Option)

Question 41(Old PM)

A call option on gold with exercise price ₹ 26,000 per ten gram and three months to expire is being traded at a premium of ₹ 1,010 per ten gram. It is expected that in three months' time the spot price might change to ₹ 27,300 or 24,700 per ten gram. At present this option is at – the – money and the rate of interest with simple compounding is 12% per annum. Is the current premium for the option justified? Evaluate the option and comments.

Solution

To determine whether premium is justified we shall compute the value of option by using any of the following models:

By use of Binomial Model

Decision Tree showing pay off

Year 0	3 Months	Pay Off
26,000 →	27,300	1,300
26,000 →	24,700	0

The Delta (Δ) Ratio = $\frac{1300-0}{27300-24700} = 0.50$

Replicating portfolio Buy 5 gram of gold and sell one call option.

The pay off if price goes up = 0.50 x ₹ 27300 – ₹ 1,300 = ₹ 12,350

The pay off if price goes down = 0.50 x ₹ 24,700 = ₹ 12,350

Present Value of Pay - off = $\frac{12,350}{1.03} = 11,990$

Current Investment = ₹ 26,000 x 0.50 = ₹ 13,000
Value of Option = ₹ 13,000 - ₹ 11,990 = ₹ 1,010
Thus, the price of option is justified.

Alternatively, by using Risk Neutral Model:

First of all we shall calculate probability of high demand (P) using risk neutral method as follows:
3% = p x 5% + (1 - p) x (- 5%)
0.03 = 0.05p - 0.05 + 0.05p
p = $\frac{0.08}{0.10} = 0.80$

The value of Call Option = $\frac{1300 \times 0.8 + 0 \times 0.2}{1.03} = ₹\ 1,009.71$ say ₹ 1,010

Thus, the price of option is justified.

Question 42(Old PM)

ABC Co. have taken a 6 month loan from their foreign collaborators for US Dollars 2 million. Interest payable on maturity is at LIBOR plus 1.0%. Current 6 – month LIBOR is 2%.
Enquiries regarding exchange rates with their bank elicits the following information:

Spot USD 1	₹ 48.5275
6 months forward	₹ 48.4575

(i) What would be their total commitment in Rupees, if they enter into a forward contract?
(ii) Will you advise them to do so? Explain giving reasons.

Solution

Firstly, the interest is calculated at 3% p.a. for 6 months. That is:
USD 20,00,000 × 3/100 × 6/12 = USD 30,000
From the forward points quoted, it is seen that the second figure is less than the first, this means that the currency is quoted at a discount.

(i) The value of the total commitment in Indian rupees is calculated as below:

Principal Amount of loan	USD 20,00,000

Add: Interest	USD 30,000
Amount due	USD 20,30,000
Spot rate	₹ 48.5275
Forward Points (6 months)	(-) 0.0700
Forward Rate	₹ 48.4575
Value of Commitment	₹ 9,83,68,725

(ii) It is seen from the forward rates that the market expectation is that the dollar will depreciate. If the firm's own expectation is that the dollar will depreciate more than what the bank has quoted, it may be worthwhile not to cover forward and keep the exposure open.

If the firm has no specific view regarding future dollar price movements, it would be better to cover the exposure. This would freeze the total commitment and insulate the firm from undue market fluctuations. In other words, it will be advisable to cut the losses at this point of time.

Given the interest rate differentials and inflation rates between India and USA, it would be unwise to expect continuous depreciation of the dollar. The US Dollar is a stronger currency than the Indian Rupee based on past trends and it would be advisable to cover the exposure.

Question 43: Removed

Question 44(Old PM)

ABC Technologic is expecting to receive a sum of US $ 4,00,000 after 3 months. The company decided to go for future contract to hedge against the risk. The standard size of future contract available in the market is $ 1000. As on date spot and futures $ contract are quoting at ₹ 44.00 & ₹ 45.00 respectively. Suppose after 3 months the company closes out its position futures are quoting at ₹ 44.50 and spot rate is also quoting at ₹ 44.50. You are required to calculate effective realization for the company while selling the receivable. Also calculate how company has been benefitted by using the future option.

Solution

The company can hedge position by selling future contracts as it will receive amount from outside.

Number of Contracts = $\frac{\$\ 4,00,000}{\$\ 1,000} = 400$ contracts

Gain by trading in futures = (₹ 45 – ₹ 44.50) x 4,00,000= ₹ 2,00,000

Net Inflow after 3 months = ₹ 44.50 x ₹ 4,00,000 + 2,00,000 = ₹ 1,80,00,000

Effective Price realization = $\frac{₹\ 1,80,00,000}{\$\ 4,00,000} =$ ₹ 45 Per US $

Question 45(Old PM)

On 19th April following are the spot rates

Spot	EURO / USD 1.20000	USD / INR 44.8000

Following are the quotes of European Options:

Currency Pair	Call / Put	Strike Price	Premium	Expiry date
EUR / USD	Call	1.2000	$ 0.035	July 19

EUR / USD	Put	1.2000	$ 0.04	July 19
USD / INR	Call	44.8000	₹ 0.12	Sep. 19
USD / INR	Put	44.8000	₹ 0.04	Sep. 19

(i) A trader sells an at – the – money spot straddle expiring at three months (July 19). Calculate gain or loss if three months later the spot rate is EUR / USD 1.2900.

(ii) Which strategy gives a profit to the dealer if five months later (Sep. 19) expected spot rate is USD / INR 45.00. Also calculate profit for a transaction USD 1.5 million.

Solution

(i) Straddle is a portfolio of a CALL & a PUT option with identical Strike Price. A trader will be selling a Call option & a Put option with Strike Price of USD per EURO.

He will receive premium of $ 0.035 + $ 0.040 = $ 0.075

At the expiry of three months Spot rate is 1.2900 i.e. higher than Strike Price. Hence, buyer of the Call option will exercise the option, but buyer of Put option will allow the option to lapse.

Profit or Loss to a trader is

Premium received	$ 0.075
Loss on call option exercised 1.2900 – 1.2000	$ 0.090
Net Loss of	$ 0.015 per EURO

(ii) Strategy i.e. either Call or Put

Price is expected to go up then buy call option is beneficial.

On 19th April to pay Premium US $ 15,00,000 @ ₹ 0.12 i.e.	INR 1,80,000
On 19th September exercise call option to gain US $15,00,000 @ ₹ 0.20	INR 3,00,000
Net Gain or Profit	**INR 1,20,000**

Or Sell of Put option will be beneficial.

On 19th April to receive Premium US$ 15,00,000 @ ₹ 0.04 i.e.	INR 60,000
On 19th September option buyer shall not exercise the option hence no loss	INR -
Net Gain or Profit	**INR 60,000**

Question 46(Mutual Fund-Study Material TYK Q 25)/MTP Oct'21

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund she has constructed and compare the gains and losses from the technique with those from a passive buy and hold strategy. The fund consists of equities only and the ending NAVs of the fund he constructed for the last 10 months are given below:

Month Ending	NAV (₹ / unit)	Month Ending	NAV (₹ / unit)
December 2008	40.00	May 2009	37.00
January 2009	25.00	June 2009	42.00

February 2009	36.00	July 2009	43.00
March 2009	32.00	August 2009	50.00
April 2009	38.00	September 2009	52.00

Assume Sunidhi had invested a notional amount of ₹ 2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%.

You are required to determine the value of the portfolio for each level of NAV following the Constant Ratio Plan.

Solution

Constant Ratio Plan:

Stock Portfolio NAV (₹)	Value of Conservative Portfolio (₹)	Value of aggressive Portfolio (₹)	Total value of Constant Ratio Plan (₹)	Revaluation Action	Total No. of units in aggressive portfolio
40.00	1,00,000	1,00,000	2,00,000	-	2500
25.00	1,00,000	62,500	1,62,500	-	2500
	81,250	81,250	1,62,500	Buy 750 units	3250
36.00	81,250	1,17,000	1,98,250	-	3250
	99,125	99,125	1,98,250	Sell 496.53 units	2753.47
32.00	99,125	88,111.04	1,87,236.04	-	2753.47
38.00	99,125	1,04,631.86	2,03,756.86	-	2753.47
	1,01,878.43	1,01,878.43	2,03,756.86	Sell 72.46 units	2681.01
37.00	1,01,878.50	99,197.37	2,01,075.87	-	2681.01
42.00	1,01,878.50	1,12,602.42	2,14,480.92	-	2681.01
43.00	1,01,878.50	1,15,283.43	2,17,161.93	-	2681.01
50.00	1,01,878.50	1,34,050.50	2,35,929	-	2681.01
	1,17,964.50	1,17,964.50	2,35,929	Sell 321.72 units	2359.29
52.00	1,17,964.50	1,22,683.08	2,40,647.58	-	2359.29

Hence, the ending value of the mechanical strategy is ₹ 2,40,647.58 and buy & hold strategy is ₹ 2,60,000.

Question 47(RTP May'19)

Indira has a fund of ₹ 3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. The present NIFTY is 5326. The minimum NIFTY within a month can at most be 4793.4. She wants to know as to how she should rebalance her portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:

1) Immediately to start with.
2) 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.
3) 10 days further from the above date if the NIFTY touches 5539.04.

For the sake of simplicity, assume that the value of her equity component will change in tandem with that of the NIFTY and the risk free securities in which she is going to invest will have no Beta.

Solution

Maximum decline in one month = $\frac{5326-4793.40}{5326} \times 100 = 10\%$

1) Immediately to start with

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (3,00,000 – 2,70,000) = ₹ 60,000

Indira may invest ₹ 60,000 in equity and balance in risk free securities.

2) After 10 days

Value of equity = 60,000 x 5122.96 / 5326	=	₹ 57,713
Value of risk free investment	=	₹ 2,40,000
Total value of portfolio	=	₹ 2,97,713

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (2,97,713 – 2,70,000) = ₹ 55,426

Revised Portfolio:

Equity	=	₹ 55,426
Risk free Securities (₹ 2,97,713 – ₹ 55,426)	=	2,42,287

3) After another 10 days

Value of equity = 55,426 x 5539.04 / 5122.96	=	₹ 59,928
Value of risk free investment	=	₹ 2,42,287
Total value of portfolio	=	₹ 3,02,215

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (3,02,215 – 2,70,000) = ₹ 64,430

Revised Portfolio:

Equity	=	₹ 64,430
Risk free Securities (₹ 3,02,215 – ₹ 64,430)	=	₹ 2,37,785

The investor should off – load ₹ 4502 of risk free securities and divert to Equity.

Question 48 Removed

Question 49(Study Material TYK Q 9)

Which position on the index future gives a speculator, a complete hedge against the following transactions:

(i) The share of Right Limited is going to rise. He has a long position on the cash market of ₹ 50 lakhs on the Right Limited. The beta of the Right Limited is 1.25.

(ii) The share of Wrong Limited is going to depreciate. He has a short position on the cash market of ₹ 25 lakhs on the Wrong Limited. The beta of the Wrong Limited is 0.90.

(iii) The share of Fair Limited is going to stagnant. He has a short position on the cash market of ₹ 20 lakhs of the Fair Limited. The beta of the Fair Limited is 0.75.

Solution

Sl. No.	Company Name	Trend	Amount (₹)	Beta	(₹)	Position
(1)	(2)	(3)	(4)	(5)	(6)= (4 X 5)	(7)
(i)	Right Ltd.	Rise	50 lakh	1.25	62,50,000	Short
(ii)	Wrong Ltd.	Depreciate	25 lakh	0.90	22,50,000	Long
(iii)	Fair Ltd.	Stagnant	20 lakh	0.75	15,00,000	Long
					25,00,000	**Short**

Question 50(Study Material TYK Q 12)/RTP Nov'21/MTP April'19/MTP Oct'19

Details about portfolio of shares of an investor is as below:

Shares	No. of shares (Iakh)	Price per share	Beta
A Ltd.	3.00	₹ 500	1.40
B Ltd.	4.00	₹ 750	1.20
C Ltd.	2.00	₹ 250	1.60

The investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91. He is considering two below mentioned alternative strategies:

(i) Dispose off a part of his existing portfolio to acquire risk free securities, or

(ii) Take appropriate position on Nifty Futures which are currently traded at 8125 and each Nifty points is worth ₹ 200.

You are required to determine:

1) portfolio beta,
2) the value of risk-free securities to be acquired,
3) the number of shares of each company to be disposed off,
4) the number of Nifty contracts to be bought/sold; and
5) the value of portfolio beta for 2% rise in Nifty.

Solution

Shares	No. of shares (lakhs) (1)	Market Price of Per Share (2)	× (2) (₹ lakhs)	% to total (w)	ß (x)	wx
A Ltd.	3.00	500.00	1500.00	0.30	1.40	0.42
B Ltd.	4.00	750.00	3000.00	0.60	1.20	0.72
C Ltd.	2.00	250.00	500.00	0.10	1.60	0.16
			5000.00	**1.00**		**1.30**

1) Portfolio beta 1.30
2) Required Beta 0.91

Let the proportion of risk-free securities for target beta 0.91 = p

0.91 = 0 × p + 1.30 (1 – p)

p = 0.30 i.e. 30%

Shares to be disposed off to reduce beta (5000 × 30%) ₹ 1,500 lakh and Risk-Free securities to be acquired.

3) Number of shares of each company to be disposed off

Shares	% to total (w)	Proportionate Amount (₹ lakhs)	Market Price Per Share	No. of Shares (Lakh)
A Ltd.	0.30	450.00	500.00	0.90
B Ltd.	0.60	900.00	750.00	1.20
C Ltd.	0.10	150.00	250.00	0.60

4) Number of Nifty Contract to be sold

$$\frac{(1.30 - 0.91) \times 5000 \text{ lakh}}{8{,}125 \times 200} = 120 \text{ contracts}$$

5) 2% rises in Nifty is accompanied by 2% x 1.30 i.e. 2.6% rise for portfolio of shares

	₹ Lakh
Current Value of Portfolio of Shares	5000
Value of Portfolio after rise	5130
Mark – to – Market Margin paid (8125 × 0.020 × ₹ 200 × 120)	39
Value of the portfolio after rise of Nifty	5091
% change in value of portfolio (5091 – 5000) / 5000	1.82%
% rise in the value of Nifty	2%
Beta	0.91

Question 51(Study Material TYK Q 25)/RTP May'20/MTP May'20

From the following data for certain stock, find the value of a call option:

Price of stock now	=	₹ 80
Exercise price	=	₹ 75
Standard deviation of continuously compounded annual return	=	0.40
Maturity period	=	6 months
Annual interest rate	=	12%

Given

Number of S.D. from Mean, (z)	Area of the left or right (one tail)
0.25	0.4013
0.30	0.3821
0.55	0.2912
0.60	0.2743

$e^{0.12 \times 0.5}$ = 1.062

In 1.0667 = 0.0646

Solution

Applying the Black Scholes Formula,

Value of the Call option now:

The Formula $C = SN(d1) - Ke^{(-rt)}N(d2)$

$$d_1 = \frac{\text{In}\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Where,

C = Theoretical call premium
S = Current stock price
t = time until option expiration
K = option striking price
r = risk-free interest rate
N = Cumulative standard normal distribution
e = exponential term
σ = Standard deviation of continuously compounded annual return.

In = natural logarithim

$$d_1 = \frac{\text{In}\,(1.0667) + (12\% + 0.08)0.5}{0.40\sqrt{0.5}}$$

$$= \frac{0.0646 + (0.2)0.5}{0.40 \times 0.7071}$$

$$= \frac{0.1646}{0.2828}$$

= 0.5820

d2 = 0.5820 – 0.2828 = 0.2992

N (d1) = N (0.5820)
N (d2) = N (0.2992)
Price = SN (d1) – Ke (- rt) N (d2)
= 80 x N (d1) – (75 / 1.062) x N (d2)

Value of option

$$= 80\ \text{N}\,(d_1) - \frac{75}{1.062} \times \text{N}\,(d_2)$$

N(d1) = N (0.5820) = 0.7197
N(d2) = N(0.2992) = 0.6176

Price = $80 \times 0.7197 - \frac{75}{1.062} \times 0.6176$

= 57.57 – (70.62 x 0.6176)
= 57.57 – 43.61
= ₹ 13.96

Teaching Notes:

Students may please note following important point:

Values of N(d1) and N(d2) have been computed by interpolating the values of areas under respective numbers of SD from Mean (Z) given in the question.

It may also be possible that in question paper areas under Z may be mentioned otherwise e.g. Cumulative Area or Area under Two tails. In such situation the areas of the respective Zs given in the question will be as follows:

Cumulative Area

Number of S.D. from Mean, (z)	Cumulative Area
0.25	0.5987
0.30	0.6179
0.55	0.7088
0.60	0.7257

Two tail area

Number of S.D. from Mean, (z)	Area of the left and right (two tail)
0.25	0.8026
0.30	0.7642
0.55	0.5823
0.60	0.5485

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1(RTP May'18/MTP Oct'21)

TMC Holding Ltd. has a portfolio of shares of diversified companies valued at ₹ 400 crore enters into a swap arrangement with None Bank on the terms that it will get 1.15% quarterly on notional principal of ₹ 400 crore in exchange of return on portfolio which is exactly tracking the Sensex which is presently 21600.

CALCULATE the net payment to be received / paid at the end of each quarter if Sensex turns out to be 21,860, 21,780, 22,080 and 21,960.

Solution

Qtrs.	Sensex	Sensex Return (%)	Amount Payable (₹ Crore)	Fixed Return (Receivable) (₹ Crore)	Net (₹ Crore)
(1)	(2)	(3)	(4)	(5)	(6)
0	21,600	-	-	-	-
1	21,860	1.2037	4.8148	4.6000	- 0.2148
2	21,780	-0.3660	-1.4640	4.6000	6.0640
3	22,080	1.3774	5.5096	4.6000	- 0.9096
4	21,960	-0.5435	-2.1740	4.6000	6.7740

Question 2(RTP Nov'18/MTP Nov'21/MTP May'23)

Ram holding shares of Reliance Industries Ltd. which is currently selling at ₹ 1000. He is expecting that this price will further fall due to lower than expected level of profits to be announced after one month. As on following option contract are available in Reliance Share.

Strike Price (₹)	Option	Premium (₹)
1030	Call	40
1010	Call	35
1000	Call	30
990	Put	35
970	Put	20
950	Put	8
930	Put	5

Ram is interested in selling his stock holding as he cannot afford to lose more than 5% of its value.

RECOMMEND a hedging strategy with option and show how his position will be protected.

Solution

Instead of selling the stock of Reliance Ltd., Ram must cover his Risk by buying or long position in Put Option with appropriate strike price. Since Ram's risk appetite is 5%, the most suitable strike price in Put Option shall be ₹ 950 (₹ 1000 – 5% of ₹ 1000). If Ram does so, the overall position will be as follows:

Spot Price after 1 month	Stock Value	Put Payoff	Initial Cash Flow	Total
S < 950	S	950 – S	-8	942 - S
S > 950	S	-	-8	S – 8

Thus, from the above, it can be seen that the value of holding of Ram shall never be less than ₹ 942 as Put Option will compensate for loss below spot price of ₹ 950. However, this strategy will involve a cost of ₹ 8.

Question 3(RTP Nov'20)

Mr. SG sold five 4 – Month Nifty Futures on 1st February 2020 for ₹ 9,00,000. At the time of closing of trading on the last Thursday of May 2020 (expiry), Index turned out to be 2100. The contract multiplier is 75.

Based on the above information calculate:

(i) The price of one Future Contract on 1st February 2020.
(ii) Approximate Nifty Sensex on 1st February 2020 if the Price of Future Contract on same date was theoretically correct. On the same day Risk Free Rate of Interest and Dividend Yield on Index was 9% and 6% p.a. respectively.
(iii) The maximum Contango / Backwardation.
(iv) The pay – off of the transaction.

Note: Carry out calculation on month basis.

Solution

(i) The price of one Future Contract

Let X be the Price of Future Contract. Accordingly,

$$5 = \frac{₹\ 9{,}00{,}000}{X}$$

X (Price of One Future Contract) = ₹ 1,80,000

(ii) Current Future price of the index = $\frac{₹\ 1{,}80{,}000}{75}$ = 2400

Let Y be the current Nifty Index (on 1st February 2020) then

Accordingly, $Y + Y(0.09 - 0.06)\frac{4}{12}$ = 2400

and Y = $\frac{2400}{1.01}$ = 2376.24

Hence Nifty Index on 1st February 2020 shall be approximately 2376.

(iii) To determine whether the market is in Contango / Backwardation first we shall compute basis as follows:

Basis = Spot Price – Future Price

If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation.

Since current Spot Price is 2400 and Nifty Index is 2376, the Basis is negative and hence there is Contango Market and maximum Contango shall be 24 (2400 – 2376).

(iv) Pay off on the Future transaction shall be [(2400-2100) x 375] ₹ 112500

The Future seller gains if the Spot Price is less than Futures Contract price as position shall be reversed at same Spot price. Therefore, Mr. SG has gained ₹ 1,12,500/- on the short position taken.

Question 4(RTP Nov'20)

A Rice Trader has planned to sell 22000 kg of Rice after 3 months from now. The spot price of the Rice is ₹ 60 per kg and 3 months Future on the same is trading at ₹ 59 per kg. Size of the contract is 1000 kg. The price is expected to fall as low as ₹ 56 per kg, 3 months hence.

Required:

(i) to interpret the position of trader in the Cash Market.
(ii) to advise the trader the trader should take in Future Market to mitigate its risk of reduced profit.
(iii) to demonstrate effective realized price for its sale if he decides to make use of future market and after 3 months, spot price is ₹ 57 per kg and future contract price for closing the contract is ₹ 58 per kg.

Solution

(i) Since trader has planned to sell after 3 months now it implies, he is in Long Position in Cash or Spot Market.
(ii) Since the trader is in Long Position in Cash Market, he can mitigate its risk of reduced profit by hedging his position by selling Rice Futures i.e. Short Position in Future Market.

(iii) The gain on futures contract = (₹ 59 – ₹ 58) x 22,000 kg. = ₹ 22,000

Revenue from the sale of Rice = 22,000 x ₹ 57 = ₹ 12,54,000

Total Cash Flow = ₹ 12,54,000 + ₹ 22,000 = ₹ 12,76,000

Cash Flow per kg. of Rice = $\frac{₹\ 12,76,000}{22,000}$ = ₹ 58

Question 5(RTP May'21)

The Following data relate to A Ltd.'s Portfolio:

Shares	X Ltd.	Y Ltd.	Z Ltd.
No. of Shares (lakh)	6	8	4
Price per share (₹)	1000	1500	500
Beta	1.50	1.30	1.70

The CEO is of opinion that the portfolio is carrying a very high risk as compared to the market risk and hence interested to reduce the portfolio's systematic risk to 0.95. Treasury Manager has

suggested two below mentioned alternative strategies:

(i) Dispose off a part of his existing portfolio to acquire risk free securities, or

(ii) Take appropriate position on Nifty Futures, currently trading at 8250 and each Nifty points multiplier is ₹ 210.

You are required to:

a) Interpret the opinion of CEO, whether it is correct or not.

b) Calculate the existing systematic risk of the portfolio,

c) Advise the value of risk-free securities to be acquired,

d) Advise the number of shares of each company to be disposed off,

e) Advise the position to be taken in Nifty Futures and determine the number of Nifty contracts to be bought / sold; and

f) Calculate the new systematic risk of portfolio if the company has taken position in Nifty Futures and there is 2% rise in Nifty.

Note: Make calculations in ₹ lakh and upto 2 decimal points.

Solution

a) Yes, the apprehension of CEO is correct as the current portfolio is riskier than market as the beta (Systematic Risk) of market portfolio is as computed as follows:

Shares	No. of shares (lakhs) (1)	Market Price of Per Share (2) (₹)	(1) × (2) (₹ lakhs)	% to total (w)	ß (x)	Wx
X Ltd.	6.00	1000.00	6000.00	0.30	1.50	0.45
Y Ltd.	8.00	1500.00	12000.00	0.60	1.30	0.78
Z Ltd.	4.00	500.00	2000.00	0.10	1.70	0.17
			20000.00	1.00		1.40

b) Since the Beta of existing portfolio is 1.40, the systematic risk of the current portfolio is 1.40.

c) Required Beta 0.95

Let the proportion of risk-free securities for target beta 0.95 = p

$0.95 = 0 \times p + 1.40 (1 - p)$

$p = 0.32$ i.e. 32%

Shares to be disposed off to reduce beta (20000 × 32%) ₹ 6,400 lakh and Risk-Free securities to be acquired for the same amount.

d) Number of shares of each company to be disposed off

Shares	% to total (w)	Proportionate Amount (₹ lakhs)	Market Price Per Share (₹)	No. of Shares (Lakh)
X Ltd.	0.30	1920.00	1000.00	1.92
Y Ltd.	0.60	3840.00	1500.00	2.56
Z Ltd.	0.10	640.00	500.00	1.28

e) Since, the company is in long position in cash market it shall take short position in Future Market.

Number of Nifty Contract to be sold

$$\frac{(1.40-0.95) \times 20000 \text{ lakh}}{8{,}250 \times 210} = 519 \text{ contracts}$$

f) If there is 2% rises in Nifty there will be 2.80%(2%x1.40) rise for portfolio of shares

	₹ Lakh
Current Value of Portfolio of Shares	20000
Value of Portfolio after rise	20560
Mark-to-Market Margin paid (8250 × 0.020 × ₹ 210 × 519)	179.83
Value of the portfolio after rise of Nifty	20380.17
% change in value of portfolio (20380.17 – 20000) / 20000	1.90%
% rise in the value of Nifty	2%
New Systematic Risk (Beta)	0.95

Question 6(RTP Nov'21/MTP Oct'20)

A company is long on 10 MT of copper @ ₹ 534 per kg (spot) and intends to remain so for the ensuing quarter. The variance of change in its spot and future prices are 16% and 36% respectively, having correlation coefficient of 0.75. The contract size of one contract is 1,000 kgs.

Required:

(i) Calculate the Optimal Hedge Ratio for perfect hedging in Future Market.
(ii) Advice the position to be taken in Future Market for perfect hedging.
(iii) Determine the number and the amount of the copper futures to achieve a perfect hedge.

Solution

(i) The optional hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma S}{\sigma F}$$

Where

σS = Standard deviation of ΔS (Change in Spot Prices)
σF = Standard deviation of ΔF (Change in Future Prices)
ρ = coefficient of correlation between ΔS and ΔF
H = Hedge Ratio
ΔS = change in Spot price.
ΔF = change in Future price.

Accordingly

Standard deviation of ΔS = $\sqrt{16\%}$ = 4% and
Standard deviation of ΔF = $\sqrt{36\%}$ = 6% and
H = $0.75 \times \frac{0.04}{0.06}$ = 0.5

(ii) Since the company is long position in Spot (Cash) Market it shall take Short Position in Future Market.

(iii) Since contact size of one contract is 1,000 Kg,

No. of contract to be short = $\frac{10{,}000 \text{ kgs}}{1{,}000 \text{ kgs}} \times 0.5$ = 5 contracts

Amount = ₹ 5000 x 534 = ₹ 26,70,000

Question 7(MTP March'18)

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was ₹ 9,94,450, the weighted average of beta of 9 securities was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April.

a) Calculate the beta of the 10th security.
b) Reconcile the reasons in spite of 2% fall in the market as per Sunidhi's apprehension if she would have earned some profit on her cash position. (8 Marks)

Solution

a) To compute the beta of 10th security first we shall compute overall weighted beta as follows:
Let weighted β be w, then

$5 = \frac{994450}{8767.07 \times 25} \times w$

w = 1.102 approximately

Let beta of 10th security is β then,
1.102 = 0.90 x 1.10 + 0.10 x β
β = 1.12

b) the main reason for the profit in cash position might due to reason that contrary to her expectation fall in the value of cash position there may be increase in value of cash position.

Question 8(MTP Oct'20)

Derivative Bank entered into a swap arrangement on a principal of ₹ 10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday, 19th August, 2019 and was to commence on 20th August, 2019 and run for a period of 7 days.

Respective MIBOR rates for Tuesday to Monday were:

8.15%, 7.98%, 7.95%, 8.12%, 8.15%, 7.75%.

If Fixed Rate of Interest is 8%, then evaluate

(i) the nature of this Swap arrangement.
(ii) the Net Settlement amount.

Notes:

1) Sunday is Holiday.

2) Work in rounded rupees and avoid decimal working.
3) Consider 365 days in a year. (8 Marks)

Solution

(i) The given swap arrangement is Plain Vanilla Overnight Index Swap (OIS).

(ii) To compute the Net Settlement amount we shall compute Interest as per floating rate as follows:

Day	Principal (₹)	MIBOR (%)	Interest (₹)
Tuesday	10,00,00,000	8.15	22,329
Wednesday	10,00,22,329	7.98	21,868
Thursday	10,00,44,197	7.95	21,790
Friday	10,00,65,987	8.12	22,261
Saturday & Sunday (*)	10,00,88,248	8.15	44,697
Monday	10,01,32,945	7.75	21,261
Total Interest @ Floating Rate (A)			1,54,206
Total Interest @ Fixed Rate (B) 10,00,00,000× 8.00% x 7/365			1,53,425
Net Settlement Amount Paid			781

Question 9(MTP March'21/MTP Oct'21) (8 Marks)

IM is an American firm having its subsidiary in Japan and JI is a Japanese firm having its subsidiary in USA: They face the following interest rates

	IM	JI
USD Floating rate	LIBOR+0.5%	LIBOR+2.5%
JPY Fixed rate	4%	4.25%

IM wishes to borrow USD at floating rate and JI JY at fixed rate. The amount required by both the companies is same at the current Exchange Rate. A financial institution requires 75 basis points as commission for arranging Swap. The companies agree to share the benefit/ loss equally.

Advise:

(i) How a beneficial swap can be arranged?
(ii) The effective interest cost for both IM and JI if swap arrangement is entered into.

Solution

IM has overall strong position and hence is in a comparative advantageous position in both rates. However, it has a comparative advantage in floating-rate market.

The differential between the U.S. dollar floating rates is 2.00% per annum, and the differential between the JPY fixed rates is 0.25% per annum. The difference between the differentials is 1.75% per annum. The total potential gain to all parties from the swap is therefore 1.75% per annum, or 175 basis points. If the financial intermediary requires 75 basis points, each of IM and JI can be made 50 basis points better off.

Since the Net Benefit of 100 Basis Points to be shared equally among IM and JI interest rate for them shall be as follows:

IM

Borrowing from Market	LIBOR + 0.5%
Less: Benefit from Swap	0.5%
Net Interest	LIBOR

JI

Borrowing from Market	4.25%
Less: Benefit from Swap	0.5%
Net Interest	3.75%

Question 10(MTP April'21)

In March 2020, XYZ Bank sold some 7% Interest Rate Futures underlying Notional 7.50% Coupon Bonds. The exchange provides following details of eligible securities that can be delivered:

Security	Quoted Price of Bonds	Conversion Factor
7.96 GOI 2023	1037.40	1.0370
6.55 GOI 2025	926.40	0.9060
6.80 GOI 2029	877.50	0.9195
6.85 GOI 2026	972.30	0.9643
8.44 GOI 2027	1146.30	1.1734
8.85 GOI 2028	1201.70	1.2428

Recommend the Security that should be delivered by the XYZ Bank if Future Settlement Price is 1000. (8 Marks)

Solution

The XYZ Bank shall choose those CTD (Cheapest-to-Deliver) Bonds from the basket of deliverable Bonds which gives maximum profit computed as follows:

Profit = Future Settlement Price x Conversion Factor – Quoted Spot Price of Deliverable Bond

Accordingly, the profit of each bond shall be computed as follows:

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	(4) = (2) x (3)	Quoted Price of Bonds (5)	Profit (6)
7.96 GOI 2023	1000	1.0370	1037.00	1037.40	- 0.40
6.55 GOI 2025	1000	0.9060	906.00	926.40	- 20.40
6.80 GOI 2029	1000	0.9195	919.50	877.50	42.00
6.85 GOI 2026	1000	0.9643	964.30	972.30	- 8.00
8.44 GOI 2027	1000	1.1734	1173.40	1146.30	27.10
8.85 GOI 2028	1000	1.2428	1242.80	1201.70	41.10

Since maximum profit to the Bank is in case of 6.80 GOI 2029, same should be opted for.

Question 11(PP Nov'19)/Similar Q asked in MTP March'21

A future contract is available on R Ltd. that pays an annual dividend of ₹ 4 and whose stock is currently priced at ₹ 125. Each future contract calls for delivery of 1,000 shares to stock in one year, daily marking to market. The corporate treasury bill rate is 8%.

Required:

(i) Given the above information, what should the price of one future contract be?
(ii) If the company stock price decreases by 6%, what will be the price of one futures contract?
(iii) As a result of the company stock price decrease, will an investor that has a long position in one futures contract of R Ltd. realizes a gain or loss? What will be the amount of his gain or loss?

(Ignore margin and taxation, if any) (6 Marks)

Solution

(i) Future Price = Spot + Cost of Carry – Dividend
= ₹ 125 + (₹ 125 x 0.08) – 4 = ₹ 131

Price of one future contract = 1000 share x ₹ 131 = ₹ 1,31,000

(ii) Price decrease by 6 %
Market Price = 125 x 94% = 117.50
Then, price of one future contract
= ₹ 117.50 + (₹ 117.50 x 0.08) – 4 = ₹ 122.90
= ₹ 122.90 x 1000 = ₹ 1,22,900

(iii) If the investor has taken a long position, decrease in price will result in loss for the investor.

Amount of loss will be:
₹ 1, 31,000 - ₹ 1,22,900 = ₹ 8,100

Question 12(PP Nov'19)/Similar Q asked in MTP March'21

AB Ltd.'s equity shares are presently selling at a price of ₹ 500 each. An investor is interested in purchasing AB Ltd.'s shares. The investor expects that there is a 70% chance that the price will go up to ₹ 650 or a 30% chance that it will go down to ₹ 450, three months from now. There is a call option on the shares of the firm that can be exercised only at the end of three months at an exercise price of ₹ 550.

Calculate the following:

(i) If the investor wants a perfect hedge, what combination of the share and option should he select?
(ii) Explain how the investor will be able to maintain identical position regardless of the share price.
(iii) If the risk-free rate of return is 5% for the three months period, what is the value of the option at the beginning of the period?
(iv) What is the expected return on the option? (8 Marks)

Solution

(i) To compute perfect hedge, we shall compute Hedge Ratio (Δ) as follows:

$\Delta = \frac{C_1 - C_2}{S_1 - S_2} = \frac{100 - 0}{650 - 450} = \frac{100}{200} = 0.50$

The investor should purchase 0.50 share for every 1 call option

Or, the investor should purchase 1 share for every 2 Call Option.

(ii) How the investor will be able to maintain his position if he purchase 0.50 share for 1 call option written.

a) If price of share goes upto ₹ 650 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 650)	₹ 325
Loss on account of Short Position (₹ 650 – ₹ 550)	₹ 100
	₹ 225

b) If price of share comes down to ₹ 450 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 450)	₹ 225

(iii) The Value of Option, say, P at the beginning of the period shall be computed as follows:

(₹ 250 – P) 1.05 = ₹ 225

₹ 262.50 – 1.05 P = ₹ 225

₹ 37.5 = 1.05 P

P = ₹ 35.71

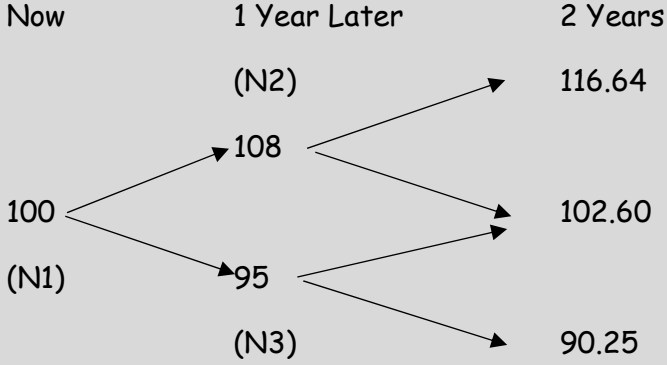
(iv) Expected Return on the Option

Expected Option Value = (₹ 650 – ₹ 550) × 0.70 + ₹ 0 × 0.30 = ₹ 70

Expected Rate of Return = $\frac{70 - 35.71}{35.71} \times 100$ = 96.02%

Question 13(PP Nov'20)

A two year tree for a share of stock in ABC Ltd., is as follows:



Consider a two years American call option on the stock of ABC Ltd., with a strike price of ₹ 98. The current price of the stock is ₹ 100. Risk free return is 5 per cent per annum with a continuous compounding and $e^{0.05}$ = 1.05127.

Assume two time periods of one year each.

Using the Binomial Model, calculate:

(i) The probability of price moving up and down;

(ii) Expected pay offs at each nodes i.e. N1, N2 and N3 (round off upto 2 decimal points).

(8 Marks)

Solution

(i) Using the single period model, the probability of price moving up is

$$P = \frac{R-d}{u-d} = \frac{1.05127-\frac{95}{100}}{\frac{108}{100}-\frac{95}{100}} = \frac{0.10127}{0.13} = 0.779 \text{ say } 0.78 \text{ i.e., } 78\%$$

Therefore, the probability of price moving down = 1 - 0.78 = 0.22 i.e., 22%

(ii) Expected pay-off at

Node N2

$$\frac{0.78 \times 18.64 + 0.22 \times 4.60}{1.05127} = \frac{15.55}{1.05127} = ₹\ 14.79$$

Node N3

$$\frac{0.78 \times 4.60 + 0.22 \times 0}{1.05127} = \frac{3.588}{1.05127} = ₹\ 3.41$$

Node N1

$$\frac{0.78 \times 14.79 + 0.22 \times 3.41}{1.05127} = \frac{12.286}{1.05127} = ₹\ 11.69$$

Question 14(PP Nov'20)

On Tuesday morning (before opening of the capital market) an investor, while going through his bank statement, has observed that an amount of ₹ 7 lakhs is lying in his bank account. This amount is available for use from Tuesday till Friday. The Bank requires a minimum balance of ₹ 1000 all the time. The investor desires to make a maximum possible investment where Value at Risk (VaR) should not exceed the balance lying in his bank account. The standard deviation of market price of the security is 1.5 per cent per day. The required confidence level is 99 per cent. Given

Standard Normal Probabilities										
z	0.00	.01	.02	.03	0.04	.05	.06	.07	.08	.09
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9998	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9923	.9925	.9929	.9931	.9932	.9934	.9936

You are required to determine the maximum possible investment. (4 Marks)

Solution

Particulars	Amount (₹)
Amount available in bank account	7,00,000
Minimum balance to be kept	1,000
Available amount which can be used for potential investment for 4 days	6,99,000

Maximum Loss for 4 days at 99% level	6,99,000
Maximum Loss for 1 day at 99 % level = Maximum Loss for 4 days /√No. of days = 699000 / √4	3,49,500
Z Score at 99% Level	2.33
Volatility in terms of Rupees (Maximum Loss / Z Score at 99% level) = 349500 / 2.33	1,50,000
Maximum Possible Investment (Volatility in Rupees/Std Deviation) = 150000 /.015	1,00,00,000

Question 15(PP Nov'20)

IB an Indian firm has its subsidiary in Japan and Zaki a Japanese firm has its subsidiary in India and face the following interest rates:

Company	IB	Zaki
INR floating rate	BPLR + 0.50%	BPLR + 2.50%
JPY (Fixed rate)	2%	2.25%

Zaki wishes to borrow Rupee Loan at a floating rate and IB wishes to borrow JPY at a fixed rate. The amount of loan required by both the firms is same at the current exchange rate. A financial institution may arrange a swap and requires 25 basis points as its commission. Gain, if any, is to be shared by the firms equally.

You are required to find out:

(i) Whether a swap can be arranged which may be beneficial to both the firms?

(ii) What rate of interest will the firms end up paying? (8 Marks)

Solution

Though Company IB has an advantage in both the markets but it has comparative more advantage in the INR floating-rate market. Company Zaki has a comparative advantage in the JPY fixed interest rate market.

However, company IB wants to borrow in the JPY fixed interest rate market and company Zaki wants to borrow in the INR floating-rate market. This gives rise to the swap opportunity.

IB raises INR floating rate at BPLR + 0.50% and Zaki raises JPY at 2.25%

Total Potential Gain = (INR interest differential) - (Yen rate differential) = (BPLR + 2.50% - BPLR + 0.50%) + (2% - 2.25%)	1.75%
Less: Banker's Commission(to be shared equally)	0.25%
Net Gain (To be shared equally: 0.75% each)	1.50%

Yes, a beneficial swap can be arranged

Effective cost of borrowing = pays to lenders + pays to other party - receives from other party + banker's commission

IB = BPLR + 0.50% +1.125%* - (BPLR + 0.50%) + 0.125% = 1.25%

(* has been arrived as 2% - 0.75% - 0.125%)

Zaki = 2.25% + BPLR + 0.50% - 1.125% + 0.125% = BPLR + 1.75%

Note: Candidates can also present the above Swap arrangement in a different manner. In such case they should be awarded due marks provided solution be ended up in correct answer.

Question 16(PP Jan'21, MTP May'23)

The price of March Nifty Futures Contract on a particular day was 9170. The minimum trading lot on Nifty Futures is 50. The initial margin is 8 and the maintenance margin is 6%. The index closed at the following levels on next five days:

Day	1	2	3	4	5
Settlement Price (₹)	9380	9520	9100	8960	9140

You are required to calculate:

(i) Mark to market cash flows and daily closing balances on account of
   a) An investor who has taken a long position at 9170
   b) An investor who has taken a short position at 9170

(ii) Net profit/ loss on each of the contracts (8 Marks)

Solution

(i)

Contract Size (₹ 9,170 x 50)	= ₹ 4,58,500
Initial Margin (8% of 4,58,500)	= ₹ 36,680
Maintenance Margin (6% of 4,58,500)	= ₹ 27,510

a) For investor taken Long position:

Day	Change in Future value (₹)	Margin A/c (₹)	Call Money (₹)
0	-----	36,680	-
1	(₹ 9,380 - ₹ 9,170) x 50 = 10,500	47,180	-
2	(₹ 9,520 - ₹ 9,380) x 50 = 7,000	54,180	-
3	(₹ 9,100 - ₹ 9,520) x 50 = - 21,000	33,180	-
4	(₹ 8,960 - ₹ 9,100) x 50 = - 7,000	36,680	10,500
5	(₹ 9,140 - ₹ 8,960) x 50 = 9,000	45,680	-

b) For investor taken Short position:

Day	Change in Future value (₹)	Margin A/c (₹)	Call Money (₹)
0	-----	36,680	-
1	(₹ 9,170 - ₹ 9,380) x 50 = -10,500	36,680	10,500
2	(₹ 9,380 - ₹ 9,520) x 50 = -7,000	29,680	-
3	(₹ 9,520 - ₹ 9,100) x 50 = 21,000	50,680	-
4	(₹ 9,100 - ₹ 8,960) x 50 = 7,000	57,680	-
5	(₹ 8,960 - ₹ 9,140) x 50 = -9,000	48,680	-

(ii) Calculation of Net Profit / Loss

a) Long Position

	(₹)
Ending margin	45,680
Less: Initial Margin	36,680
Profit	**9,000**
Less: Margin Call	10,500
Net Loss	**1,500**

OR, Loss = (9,140 – 9,170) x 50 = (₹ 1500)

b) Short Position

	(₹)
Ending margin	48,680
Less: Initial Margin	36,680
Profit	**12,000**
Less: Margin Call	10,500
Net Profit	**1,500**

OR, Profit = (9,170 – 7,040) x 50 = ₹ 1,500

Question 17(PP Dec'21)

On 31/08/2021 Mr. R has taken a Long position of Two lots of Nifty Futures at 17300. One lot of Nifty future is 50 units.

Initial Margin required is 10% of Contract Value. Maintenance Margin required is 80% of Initial Margin. The closing price of 5 days are given below-

Date	Closing Price of Nifty Future
01/09/2021	17340
02/09/2021	17180
03/09/2021	16990
06/09/2021	16900
07/09/2021	17120

You are required to-

(i) Prepare a statement showing the daily balances in the margin account & payment on margin calls, if any.

(ii) Compute the Gain or Loss of Mr. R, if contract squared off on 07/09/2021.

(iii) What would be the Gain or Loss if Mr. R, had taken the short position? (8 Marks)

Solution

(i)

Contract Size (₹ 17,300 x 50 x 2)	= ₹ 17,30,000
Initial Margin (10% of 17,30,000)	= ₹ 1,73,000
Maintenance Margin (80% of 1,73,000)	= ₹ 1,38,400

Statement showing the daily balances in Margin A/c and margin call if any,

Day	Change in Future value (₹)	Margin A/c (₹)	Call Money (₹)

31/08/21	-----	1,73,000	-----
01/09/21	(₹ 17,340 - ₹ 17,300) x 50 x 2 = 4,000	1,77,000	-----
02/09/21	(₹ 17,180 - ₹ 17,340) x 50 x 2 = -16,000	1,61,000	-----
03/09/21	(₹ 16,990 - ₹ 17,180) x 50 x 2 = - 19,000	1,42,000	-----
06/09/21	(₹ 16,900 - ₹ 16,990) x 50 x 2 = - 9,000	1,73,000	40,000
07/09/21	(₹ 17,120 - ₹ 16,900) x 50 x 2 = 22,000	1,95,000	-----

(ii) Gain or Loss of Mr. R squared off position on 07/09/21

	(₹)
Ending margin	1,95,000
Less: Initial Margin	1,73,000
Profit	**22,000**
Less: Margin Call	40,000
Net Loss	**(18,000)**

(iii) Gain / Loss if Mr. R has taken Short Position

Day	Change in Future value (₹)	Margin A/c (₹)	Call Money (₹)
31/08/21	-----	1,73,000	-----
01/09/21	(₹ 17,300 - ₹ 17,340) x 50 x 2 = - 4,000	1,69,000	-----
02/09/21	(₹ 17,340 - ₹ 17,180) x 50 x 2 = 16,000	1,85,000	-----
03/09/21	(₹ 17,180 - ₹ 16,990) x 50 x 2 = 19,000	2,04,000	-----
06/09/21	(₹ 16,990 - ₹ 16,900) x 50 x 2 = 9,000	2,13,000	-----
07/09/21	(₹ 16,900 - ₹ 17,120) x 50 x 2 = - 22,000	1,91,000	-----

Profit or Loss on Short Position

	(₹)
Ending margin	1,91,000
Less: Initial Margin	1,73,000
Profit	18,000

Question 18(PP Dec'21)

On 1st July 2021 Mr. P has made the following investment:

Name of Company	No. of Equity Share	Beta Value	Purchase Price per Equity Share
ML Ltd	1000	1.25	₹ 700

He wants to hold the investment till end of September 2021 with an expectation of huge dividends to be announced in the AGM.

On the date of investment, September Nifty Futures are quoting at 175000 and tradeable with lot size of 50 for each contract.

You are the Investment advisor to Mr. P,

(i) Please advise Mr. P how to hedge his market exposure using the available data.

(ii) Calculate the profit or loss of Mr. P during the expiry of September 2021 futures in following situation:
   a) Nifty Future rise by 10%
   b) ML Ltd. falls by 5%

(iii) Is it possible stock as well as nifty to raise or fall at the same percentage? Please state the reason. (8 Marks)

Solution

(i) To hedge his market exposure Mr. P should take short position in the Nifty Futures.

No. of Contract of Nifty Future to be Short = $\frac{1.25 \times \text{Rs } 700 \times 1,000}{17,500 \times 50}$ = 1

(ii)

a) Profit or loss of Mr. P during the expiry of September 2021 Futures:

Particulars	If Nifty rises by 10%
Loss on Nifty Futures (17,500 x 50 x 0.10)	₹ 87,500
Gain on Stock of ML Ltd. (1.25 x 0.10 x ₹ 7,00,000)	₹ 87,500
Net Gain / (Loss)	Nil

b) Profit or loss of Mr. P during the expiry of September 2021 Futures:

Particulars	If ML Ltd. falls by 5%
Gain on Nifty Futures (17,500 x 50 x 0.05)/1.25	₹ 35,000
Gain on Stock of ML Ltd. (0.05 x ₹ 7,00,000)	₹ 35,000
Net Gain / (Loss)	Nil

(iii) Normally it is not possible that Nifty to rise or fall by same percentage because of systematic risk i.e., Beta may not be the same as of market.

Question 19(MTP April'22)

The following is the data related to 9% Fully convertible (into Equity Shares) debentures issued by Delta Ltd. at ₹ 1000.

Market Price of 9% Debenture	₹ 1,000
Conversion Ratio (No. of shares)	25
Straight Value of 9% Debentures	₹ 800
Market price of equity share on the date of conversion	₹ 30
Expected Dividend per share	₹ 1

ANALYSE the value of Debenture both from cost and payback period angle for an investor who is considering to adopt the route of conversion to acquire the shares of the company.

Solution

Working Notes

(i) Conversion Value of Debenture

= Market Price of one Equity Share X Conversion Ratio

= ₹ 30 X 25 = ₹ 750

(ii) Market Conversion Price

$$= \frac{\text{Market Price of Convertible Debenture}}{\text{Conversion Ratio}}$$

$$= \frac{1000}{25} = ₹ 40$$

(iii) Conversion Premium per share

= Market Conversion Price – Market Price of Equity Share

= ₹ 40 – ₹ 30 = ₹ 10

(iv) Favourable income differential per share

$$\frac{\text{Coupon Interest from Debenture - Conversion Ratio x Dividend per Share}}{\text{Conversion Ratio}}$$

$$= \frac{(90 - 25) \times 1}{25} = ₹ 2.6$$

(v) Premium pay back period =

$$\frac{\text{Conversion Premium Per Share}}{\text{Favourable Income Differential Per Share}}$$

= 10 / 2.6 = 3.85 years

Analysis: Thus from above it can be analysed that:

- The Conversion Value of Debenture is less than the Market Value of Debenture because the Coupon Interest Rate is higher than Yield as Straight Value is somewhat near about the conversion value.
- If the investor adopts the route of Convertible Debenture for acquiring shares he/ she will have to pay premium over the market price.
- So far as the recovery of the premium paid for acquiring one share is concerned approximate it will take about 4 years.
- However, in case if the market price of the share is increased then of course the premium will be reduced and hence the payback period. Reverse will happen in case if the prices of the share goes below ₹ 30 per share.

Question 20(PP May'22)

You had purchased a 3 month call option on the Equity shares of Satya Ltd for a premium of ₹ 30 each, the current market price of the share is ₹ 560 and the exercise price is ₹ 590. You expect the price range between ₹ 540 to ₹ 640.

The expected share price of Satya Ltd and related probability is given below:

Expected Price (₹)	540	560	580	600	620	640
Probability	0.10	0.15	0.05	0.35	0.20	0.15

Compute the followings:

(i) Expected share price at the end of 3 months,
(ii) Value of call option at the end of 3 months, if the exercise price prevails,
(iii) In case the option is held to its maturity, what will be the expected value of the call option?
(iv) Find out the price of the shares quoted at the stock exchange to get the value of the call option as computed in (iii) above. (8 Marks)

Solution

(i) Expected Share Price
= ₹ 540 X 0.10 + ₹ 560 X 0.15 + ₹ 580 X 0.05 + ₹ 600 X 0.35 + ₹620 X 0.20 + ₹ 640 X 0.15
= ₹ 54 + ₹ 84 + ₹ 29 + ₹ 210 + ₹ 124 + ₹ 96 = ₹ 597

(ii) Value of Call Option:
= ₹ 590 - ₹ 590 = Nil

(iii) If the option is held till maturity the expected Value of Call Option

Expected Price ₹	Value of Call(C)	Probability(P)	Expected value of Option
540	0	0.10	0
560	0	0.15	0
580	0	0.05	0
600	₹ 10	0.35	₹ 3.50
620	₹ 30	0.20	₹ 6.00
640	₹ 50	0.15	₹ 7.50
Total			₹ 17.00

Alternatively, it can also be calculated as follows:

Expected Price (X)	Value of Call(E)	Probability(P)	Expected value of Option CP(X-E) x P
₹ 540	₹ 590	0.10	Not Exercised*
₹ 560	₹ 590	0.15	Not Exercised*
₹ 580	₹ 590	0.05	Not Exercised*
₹ 600	₹ 590	0.35	₹ 3.50
₹ 620	₹ 590	0.20	₹ 6.00
₹ 640	₹ 590	0.15	₹ 7.50
Total			₹ 17.00

*If the stock price goes below ₹ 590, option is not exercised at all.

(iv) Price to be quoted at the stock exchange to get the value of the call option
₹ 590 + ₹ 17 = ₹ 607

Question 21(PP May'22) (8 Marks)

MPD Inc. issues a ₹ 50 million floating rate loan on July 1, 2018 with resetting of coupon rate every 6 months equal to LIBOR + 50 bp. MPD is interested in an Interest Rate collar strategy by selling a Floor and buying a Cap. MPD buys the 3 years Cap and sell 3 years Floor as per the following details on July 1, 2018:

Principal Amount	₹ 50 million
Reference Rate	6 months LIBOR
Strike Rate	5% for Floor and 8% for Cap
Premium	Nil, Since Premium paid for Cap = Premium received for Floor

Using the following data you are required to determine:

(i) Effective interest paid out at each six reset dates,(Round off to the nearest rupee)

(ii) The average overall effective rate of interest p.a.(Round off to 2 decimals)

Reset Date	LIBOR (%)
31-12-2018	7.00
30-06-2019	8.00
31-12-2019	6.00
30-06-2020	4.75
31-12-2020	4.25
30-06-2021	5.25

Solution

a) The pay-off of each leg shall be computed as follows:

Cap Receipt

$$\text{Max}\ \frac{\{0,\ [\text{Notional principal} \times (\text{LIBOR on Reset date} - \text{Cap Strike Rate}) \times \text{Number of days in the settlement period}\}}{365}$$

Floor Pay-off

$$\text{Max}\ \frac{\{0,[\text{Notional principal} \times (\text{Floor Strike Rate} - \text{LI}\quad\ \text{on Reset date}) \times \text{Number of days in the settlement period}\}}{365}$$

Statement showing effective interest on each re-set date

Reset Date	LIBOR (%)	Date of Payment	Days	Interest Payment (₹) LIBOR+ 0.50%	Cap Receipts (₹)	Floor Pay-off (₹)	Effective Interest
31-12-2018	7.00	30-06-2019	181	18,59,589	0	0	18,59,589
30-06-2019	8.00	31-12-2019	184	21,42,466	0	0	21,42,466
31-12-2019	6.00	30-06-2020		16,16,120	0	0	16,16,120
30-06-2020	4.75	31-12-2020	184	13,19,672	0	62,842	13,82,514
31-12-2020	4.25	30-06-2021	181	11,77,740	0	1,85,959	13,63,699
30-06-2021	5.25	31-12-2021	184	14,49,315	0	0	14,49,315
Total			**1096**				**98,13,703**

b) Average Annual Effective Interest Rate shall be computed as follows:

$$\frac{98,13,703}{5,00,00,000} \times \frac{365}{1096} \times 100 = 6.54\%$$

Question 22(MTP Sep'22)
The share of X Ltd. is currently selling for ₹ 500. Risk free interest rate is 0.6% per month. A three-month futures contract is selling for ₹ 511. DEVELOP an arbitrage strategy and show what your riskless profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months. (4 Marks)

Solution

The appropriate value of the 3 months futures contract is –
Fo = ₹ 500 $(1.006)^3$ = ₹ 509.05.

Since the futures price exceeds its appropriate value it pays to do the following:

Action	Initial Cash Flow	Cash Flow at time T(3 months)
Borrow ₹ 500 now and repay with interest after 3 months	+ ₹ 500	- ₹ 500 $(1.006)^3$ = - ₹ 509.05
Buy a share	- ₹ 500	ST
Sell a futures contract (Fo = 511/-)	₹ 0	₹ 511 – ST
Total	**₹ 0**	**₹ 1.95**

Such an action would produce a risk less profit of ₹ 1.95.

Question 23(PP May'22)
What is Net interest position risk and Price risk?

Solution

Net Interest Position Risk: The size of non-paying liabilities is one of the significant factors contributing towards profitability of banks. Where banks have more earning assets than paying liabilities, interest rate risk arises when the market interest rates adjust downwards. Thus, banks with positive net interest positions will experience a reduction in NII as the market interest rate declines and increases when interest rate rises. Thus, large float is a natural hedge against the variations in interest rates.

Price Risk: Price risk occurs when assets are sold before their stated maturities. In the financial market, bond prices and yields are inversely related. The price risk is closely associated with the trading book, which is created for making profit out of short -term movements in interest rates.

Banks which have an active trading book should, therefore, formulate policies to limit the portfolio size, holding period, duration, defeasance period, stop loss limits, marking to market, etc.

Question 24(MTP Sep'22)
EXPLAIN necessary conditions of Commodity Derivatives.

Solution

The commodity characteristic approach defines feasible commodities for derivatives trading based on an extensive list of required commodity attributes. It focuses on the technical aspects of the underlying commodity. The following attributes are considered crucial for qualifying for the derivatives trade:

1) a commodity should be durable and it should be possible to store it;
2) units must be homogeneous;
3) the commodity must be subject to frequent price fluctuations with wide amplitude; supply and demand must be large;
4) supply must flow naturally to market and there must be breakdowns in an existing pattern of forward contracting.

Chapter 3

CURRENCY FUTURES & OPTIONS

Space for your notings of Formulae or important points

Question 1(RTP May'19)

XYZ Ltd. is an export oriented business house based in Mumbai. The Company invoices in customers' currency. Its receipt of US $ 1,00,000 is due on September 1, 2009.

Market information as at June 1, 2009 is:

Exchange Rates		Currency Futures		
US $ / ₹		US $ / ₹	Contract size	₹ 4,72,000
Spot	0.02140	June	0.02126	
1 Month Forward	0.02136	September	0.02118	
3 Months Forward	0.02127			
		Initial Margin		Interest Rates in India
June		₹ 10,000		7.50%
September		₹ 15,000		8.00%

On September 1, 2009 the spot rate US $ Re. is 0.02133 and currency future rate is 0.02134. Comment which of the following methods would be most advantageous for XYZ Ltd.

a) Using forward contract
b) Using currency futures
c) Not hedging currency risks.

It may be assumed that variation in margin would be settled on the maturity of the futures contract.

Solution

Receipts using a forward contract (1,00,000 / 0.02127)	₹ 47,01,457
Receipts using currency futures	
The number of contracts needed is (1,00,000 / 0.02118) = 10 4,72,000	
Initial margin payable is 10 x ₹ 15,000 = ₹ 1,50,000	
On September 1 Close at 0.02134	
Receipts = US $ 1,00,000 / 0.02133	46,88,233
Variation Margin = [(0.02134 – 0.02118) x 10 x 472000/-] 0.02133	
OR (0.00016 x 10 x 472000) = 755.2 .02133 .02133	35,406
	47,23,639
Less: Interest Cost 1,50,000 x 0.08 x 3 / 12	₹3,000
Net Receipts	₹ 47,20,639
Receipts under different methods of hedging	
Forward contract	₹ 47,01,457
Futures	₹ 47,20,639
No hedge	
US$ 1,00,000 / 0.02133	₹ 46,88,233
The most advantageous option would have been to hedge with futures.	

Question 2(MTP March'18, MTP Oct'18)

EFD Ltd. is an export business house. The company prepares invoice in customers'currency. Its debtors of US$. 10,000,000 is due on April 1, 2015.

Market information as at January 1, 2015 is:

Exchange rates US$/INR		Currency Futures US$/INR	
Spot	0.016667	Contract size: ₹ 24,816,975	
1-month forward	0.016529	1-month	0.016519
3-months forward	0.016129	3-month	0.016118
	Initial Margin	Interest rates in India	
1-Month	₹ 17,500	6.5%	
3-Months	₹ 22,500	7%	

On April 1, 2015 the spot rate US$/INR is 0.016136 and currency future rate is 0.016134.

Which of the following methods would be most advantageous to EFD Ltd?

a) Using forward contract
b) Using currency futures
c) Not hedging the currency risk

Solution

Receipts using a forward contract = $10,000,000/0.016129 = ₹ 620,001,240

Receipts using currency futures

The number of contracts needed is ($10,000,000/0.016118)/24,816,975 = 25

Initial margin payable is 25 contracts x ₹ 22,500	=	₹ 5,62,500
On April 1,2015 Close at 0.016134		
Receipts = US$10,000,000/0.016136		₹ 619,732,276
Variation Margin = [(0.016134 – 0.016118) x 25 x 24,816,975/-] / 0.016136 OR (0.000016x 25 x 24,816,975) / .016136 = 9926.79 / .016136	=	₹ 615,195
Less: Interest Cost – ₹ 5,62,500x 0.07 x 3/12	=	₹ 9,844
Net Receipts	=	**₹ 620,337,627**
Receipts under different methods of hedging		
Forward contract		₹ 620,001,240
Futures		₹ 620,337,627
No hedge (US$ 10,000,000/0.016136)	=	₹ 619,732,276

The most advantageous option would have been to hedge with futures.

Question 3(Study Material TYK Q 37)

Zaz plc, a UK Company is in the process of negotiating an order amounting €2.8 million witha large German retailer on 6 month's credit. If successful, this will be first time for Zaz has exported goods into the highly competitive German Market. The Zaz is considering following3 alternatives for managing the transaction risk before the order is finalized.

Mr. Peter the Marketing head has suggested that in order to remove transaction risk completely Zaz should invoice the German firm in Sterling using the current €/£average spot rate to calculate the invoice amount.

Mr. Wilson, CE is doubtful about Mr. Peter's proposal and suggested an alternative of invoicing the German firm in € and using a forward exchange contract to hedgethe transaction risk.

Ms. Karen, CFO is agreed with the proposal of Mr. Wilson to invoice the German first in €, but she is of opinion that Zaz should use sufficient 6 month sterling further contracts (to the nearest whole number) to hedge the transaction risk.

Following data is available	
Spot Rate	€ 1.1960 - €1.1970/£
6 months forward points	0.60 – 0.55 Euro Cents.
6 month further contract is currently trading at	€ 1.1943/£
6 month future contract size is	£62,500
After 6 month Spot rate and future rate	€ 1.1873/£

You are required to

(i) Calculate (to the nearest £) the £ receipt for Zaz plc, under each of 3 above proposals.

(ii) In your opinion which alternative you consider to be most appropriate.

Solution

(i) Receipt under three proposals:

(a)	Proposal of Mr. Peter	
	Invoicing in £ will produce = € 2.8 million / 1.1965	£ 2.340 million
(b)	Proposal of Mr Wilson	
	Forward Rate = € 1.1970 – 0.0055	1.1915
	Using Forward Market Hedge, Sterling Receipt would be € 2.8 million / 1.1915	£ 2.35 million
(c)	Proposal of Ms Karen	
	The equivalent sterling of the order placed based on future price(€ 1.1943) = € 2.8 million / 1.1943	£ 2,344,470(round off)

Number of Contracts = £ 2,344,470 = 37 Contracts(to the nearest whole number)
62,500

Thus, the amount hedged by future contract will be 37 x £ 62,500 = £ 23,12,500

Buy Future at	€ 1.1943
	€ 1.1873
	€ 0.0070

Total Loss on Future Contracts = 37 x £ 62,500 x € 0.0070 = € 16,188

After 6 months,

Amount Received	€ 28,00,000
Less: Loss on Future Contracts	€ 16,188
	€ 27,83,812

Sterling Receipts:
On Sale of € at spot = € 27,83,812 = £ 2.3446 million
1.1873

(ii) Proposal of option (b) is preferable because the option (a) & (c) produces least receipts. Further, in case of proposal (a) there must be a doubt as to whether this would be acceptable to German firm as it is described as a competitive market and Zaz is moving into it first time.

Question 4(RTP May'20)

Nitrogen Ltd, a UK company is in the process of negotiating an order amounting to €4 million with a large German retailer on 6 months credit. If successful, this will be the first time that Nitrogen Ltd has exported goods into the highly competitive German market. The following three alternatives are being considered for managing the transaction risk before the order is finalized.

(i) Invoice the German firm in Sterling using the current exchange rate to calculate the invoice amount.
(ii) Alternative of invoicing the German firm in € and using a forward foreign exchange contract to hedge the transaction risk.
(iii) Invoice the German first in € and use sufficient 6 months sterling future contracts (to the nearly whole number) to hedge the transaction risk.

Following data is available:

Spot Rate	€ 1.1750 - € 1.1770/£
6 months forward premium	0.55 - 0.60 Euro Cents
6 months future contract is currently trading at	€ 1.1760/£
6 months future contract size is	£ 62500
Spot rate and 6 months future rate	€ 1.1785/£

Required:

a) Calculate to the nearest £ the receipt for Nitrogen Ltd, under each of the three proposals.
b) In your opinion, which alternative would you consider to be the most appropriate and the reason there of.

Solution

(i) Receipt under three proposals:

(a)	Invoincing in Sterling	
	Invoicing in £ will produce = € 4 million / 1.1770	£ 3398471
(b)	Use of Forward Contract	
	Forward Rate = €1.1770 + 0.0060	1.1830
	Using Forward Market Hedge, Sterling Receipt would be € 4 million / 1.1830	£ 3381234
(c)	Use of Future Contract	
	The equivalent sterling of the order placed based on future price(€ 1.1760) = € 4 million / 1.1760	£ 3401360

Number of Contracts = £ 3401360 / 62,500 = 54 Contracts(to the nearest whole number)

Thus, the amount hedged by future contract will be 54 x £ 62,500 = £ 3375000

Buy Future at	€ 1.1760
	€ 1.1785
	€ 0.0025

Total Profit on Future Contracts = 54 x £ 62,500 x € 0.0025 = € 8438

After 6 months,

Amount Received	€4000000
Add: Profit on Future Contracts	€ 8438
	€ 4008438

Sterling Receipts:

On Sale of € at spot = € 4008438 / 1.1785 = € 3401305

Proposal of option (c) is preferable because the option (a) & (b) produces least receipts.

Question 5(Study Material TYK 33)(MTP Mar'19)

XYZ, an Indian firm, will need to pay JAPANESE YEN (JY) 5,00,000 on 30th June. In order to hedge the risk involved in foreign currency transaction, the firm is considering two alternative

methods i.e. forward market cover and currency option contract.

On 1st April, following quotations (JY / INR) are made available:

Spot	3 months forward
1.9516/1.9711	1.9726./1.9923

The prices for forex currency option on purchase are as follows:

Strike Price	JY 2.125
Call option (June)	JY 0.047
Put option (June)	JY 0.098

For excess or balance of JY covered, the firm would use forward rate as future spot rate.

You are required to recommend cheaper hedging alternative for XYZ.

Solution:

(i)	**Forward Cover**	
	3 month forward rate = $\frac{1}{1.9726}$	₹ 0.5070 / JY
	Accordingly, INR required for JY 5,00,000 (5,00,000 x ₹ 0.5070) ₹ 2,53,500	
(b)	**Option Cover**	
	To purchase JY 5,00,000, XYZ shall enter into a Put Option @ JY 2.125 / INR	
	Accordingly outflow in INR $\frac{(\text{JY } 5,00,000)}{2.125}$	₹ 2,35,294
	Premium($\frac{\text{INR } 2,35,294 \times 0.098)}{1.9516}$	₹ 11,815
		₹ 2,47,109

Since outflow of cash is least in case of Option same should be opted for. Further if price of INR goes above JY 2.125 / INR the outflow shall further be reduced.

Question 6(MTP Nov'21/MTP Sep'22)

An American firm is under obligation to pay interests of Can $ 10,10,000 and Can $ 7,05,000 on 31st July and 30th September respectively. Since X Inc. is risk averse and its policy is to hedge the risks involved in all foreign currency transactions. The Finance Manager of the X Inc. is thinking of hedging the risk considering two methods i.e. fixed forward or option contracts.

It is now June 30. Following quotations regarding rates of exchange, US $ per Can $, from the firm's bank were obtained:

Spot	1 Month Forward	3 Months Forward
0.9284-0.9288	0.9301	0.9356

Price for a Can $ / US $ option on a U.S. stock exchange (cents per Can $, payable on purchase of the option, contract size Can$ 50000) are as follows:

Strike Price	Calls		Puts	
(US $ / Can $)	July	Sept.	July	Sept.
0.93	1.56	2.56	0.88	1.75
0.94	1.02	NA	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of finance manager if options are to be used, one month option should be bought at a strike price of 94 cents and three-month option at a strike price of 95 cents and for the remainder uncovered by the options the firm would bear the risk itself. For this, it would use forward rate as the best estimate of spot. Transaction costs are ignored.

Recommend, which of the above two methods would be appropriate for the American firm to hedge its foreign exchange risk on the two interest payments? (8 Marks)

Solution

Forward Market Cover

Hedge the risk by buying Can$ in 1 and 3 months' time will be:

July - 1010000 X 0.9301 = US $ 939401

Sept. -705000 X 0.9356 = US $ 659598

Option Contracts

July Payment = 1010000 / 50,000 = 20.20

September Payment = 705000 / 50,000 = 14.10

Company would like to take out 20 contracts for July and 14 contracts for September respectively. Therefore costs, if the options were exercised, will be: -

	July		Sept.	
	Can $	US $	Can $	US $
Covered by Contracts	1000000	940000	700000	665000
Balance bought at spot rate	10000	9301	5000	4678
Option Costs:				
Can $ 50000 x 20 x 0.0102		10200	---	
Can $ 50000 x 14 x 0.0164	---			11480
Total cost in US $ of using Option Contract		959501		681158

Decision: As the firm is stated as risk averse and the money due to be paid is certain, a fixed forward contract, being the cheapest alternative in the both the cases, would be recommended.

Question 7(MTP April'18/Similar Q asked in PP May'19)

XYZ Ltd. a US firm will need £ 3,00,000 in 180 days. In this connection, the following information is available: Spot rate 1 £ = $ 2.00

180 days forward rate of £ as of today = $1.96 Interest rates are as follows:

	U.K.	US
180 days deposit rate	4.5%	5%
180 days borrowing rate	5%	5.5%

A call option on £ that expires in 180 days has an exercise price of $ 1.97 and a premium of $ 0.04. XYZ Ltd. has forecasted the spot rates 180 days hence as below:

Future rate	Probability
$ 1.91	25%
$ 1.95	60%
$ 2.05	15%

The company has following four choices:

(i) A forward contract;
(ii) A money market hedge;
(iii) An option contract;
(iv) No hedging.

Recommend the alternative (among the four choices mentioned above) that would be preferable by the company.

Solution

(i) **Forward contract**: Dollar needed in 180 days = £3,00,000 x $ 1.96 = $5,88,000/-

(ii) **Money market hedge:**

Borrow $, convert to £, invest £, repay $ loan in 180 days
Amount in £ to be invested = 3,00,000/1.045 = £ 2,87,081
Amount of $ needed to convert into £ = 2,87,081 x 2 = $ 5,74,162

Interest and principal on $ loan after 180 days = $5,74,162 x 1.055 = $ 6,05,74

(iii) **Call option:**

Expected Spot rate in 180 days	Prem./ unit	Exercise Option	Total price per unit	Total price for £3,00,000 xi	Prob. Pi	pixi
1.91	0.04	No	1.95	5,85,000	0.25	1,46,250
1.95	0.04	No	1.99	5,97,000	0.60	3,58,200
2.05	0.04	Yes	2.01*	6,03,000	0.15	90,450
						5,94,900
Add: Interest on Premium @ 5.5% (12,000 x 5.5%)						660
						5,95,560

*($1.97 + $0.04)

(iv) **No hedge option:**

Expected Future spot rate	Dollar needed Xi	Prob. Pi	Pi xi
1.91	5,73,000	0.25	1,43,250
1.95	5,85,000	0.60	3,51,000
2.05	6,15,000	0.15	92,250
			5,86,500

Recommendation: No hedging strategy i.e. keeping the position open appears to be most preferable because least number of $ are needed under this option to arrange £3,00,000.

Question 8(MTP March'18/ MTP April'19/RTP Nov'22)

A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. suppliers. The amount is payable in six months' time. The relevant spot and forward rates are:

Spot rate	USD 1.5617-1.5673
6 months' forward rate	USD 1.5455 –1.5609

The borrowing rates in U.K. and U.S. are 7% and 6% respectively and the deposit rates are 5.5% and 4.5% respectively.

Currency options are available under which one option contract is for GBP 12,500. The option premium for GBP at a strike price of USD 1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for 6 months period.

The company has three choices:

a) Forward cover
b) Money market cover, and
c) Currency option

Recommend the alternative (among the three choices mentioned above) that would be preferable by the company.

Solution

In the given case, the exchange rates are indirect. These can be converted into direct rates as follows:

Spot Rates:

GBP = $\frac{1}{\text{USD } 1.5617}$ to $\frac{1}{\text{USD } 1.5673}$

USD = GBP 0.64033 - GBP 0.63804

6 months forward rates:

GBP = $\frac{1}{\text{USD } 1.5455}$ to $\frac{1}{\text{USD } 1.5609}$

USD = GBP 0.64704 - GBP 0.64066

Payoff in 3 alternatives:

(a)	**Forward Cover**	
	Amount Payable	USD 3,64,897
	Forward rate	GBP 0.64704
	Payable in GBP	GBP 2,36,103
(b)	**Money market Cover**	
	Amount payable	USD 3,64,897
	PV @ 4.5% for 6 months i.e.1 = 0.9779951 / 1.0225	USD 3,56,867
	Spot rate purchase	GBP 0.64033
	Borrow GBP 3,56,867 x 0.64033	GBP 2,28,512
	Interest for 6 months @ 7 %	7,998
	Payable after 6 months	GBP 2,36,510
(c)	**Currency options**	
	Amount payable	USD 3,64,897
	Unit in Options contract	GBP 12,500
	Value in USD at strike rate of 1.70 (GBP 12,500 x 1.70)	USD 21,250
	Number of contracts USD 3,64,897/ USD 21,250	17.17
	Exposure covered USD 21,250 x 17	USD 3,61,250
	Exposure to be covered by Forward (USD 3,64,897 – USD 3,61,250)	USD 3,647
	Options premium 17 x GBP 12,500 x 0.096	USD 20,400
	Premium in GBP (USD 20,400 x 0.64033)	GBP 13,063
	Total payment in currency option	
	Payment under option (17 x 12,500)	GBP 2,12,500
	Premium payable	GBP 13,063
	Payment for forward cover (USD 3,647 x 0.64704)	GBP 2,360
		GBP 2,27,923

The company should take currency option for hedging the risk.

Note: Even interest on Option Premium can also be considered in the above solution.

Question 9(Study Material TYK Q 48)

M/s Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of Euro 500per unit. The cost of imported components is S$ 800 per unit. The fixed cost and other variables cost per unit are ₹ 1,000 and ₹ 1,500 respectively. The cash flows in Foreign currencies are due in six months. The current exchange rates are as follows:

₹/Euro	51.50/55
₹/S$	27.20/25

After six months the exchange rates turn out as follows:

₹/Euro	52.00/05
₹/S$	27.70/75

A. You are required to calculate loss/gain due to transaction exposure.
B. Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is₹ 25,000 :
   (i) the current exchange rate changes to

₹/Euro	51.75/80
₹/S$	27.10/15

   (ii) Price elasticity of demand is estimated to be 1.5
   (iii) Payments and receipts are to be settled at the end of six months.

Solution

(i) **Profit at current exchange rates**

2400 [€ 500 × ₹ 51.50 – (S$ 800 × ₹ 27.25 + ₹ 1,000 + ₹ 1,500)]
2400 [₹ 25,750 - ₹ 24,300] = ₹ 34,80,000

Profit after change in exchange rates

2400[€500× ₹ 52 – (S$ 800 × ₹ 27.75 + ₹ 1000 + ₹ 1500)]
2400[₹ 26,000 - ₹ 24,700] = ₹ 31,20,000

LOSS DUE TO TRANSACTION EXPOSURE

₹ 34,80,000 – ₹ 31,20,000 = ₹ 3,60,000

(ii) **Profit based on new exchange rates**

2400[₹ 25,000 - (800 × ₹ 27.15 + ₹ 1,000 + ₹ 1,500)]
2400[₹ 25,000 - ₹ 24,220] = ₹ 18,72,000

Profit after change in exchange rates at the end of six months

2400 [₹ 25,000 - (800 × ₹ 27.75 + ₹ 1,000 + ₹ 1,500)]
2400 [₹. 25,000 - ₹ 24,700] = ₹ 7,20,000

Decline in profit due to transaction exposure

₹ 18,72,000 - ₹ 7,20,000 = ₹ 11,52,000

Current Price of each unit in € = $\frac{₹\ 25,000}{₹\ 51.50}$ = € 485.44

Price after change in exchange rate = $\frac{₹\ 25,000}{₹\ 51.75}$ = € 483.09

Change in price due to exchange rate = € 485.44 - € 483.09 = € 2.35 or (-) 0.48%

Price elasticity of demand = 1.5

Increase in demand due to fall in price = 0.48 x 1.5 = 0.72 %

Size of increased order = 2400 x 1.0072 = 2417 units

Profit = 2417[₹ 25,000 – (800 x 27.75 + ₹ 1000 + ₹ 1500)]
= 2417[₹ 25,000 - ₹ 24,700] = ₹ 7,25,100

Therefore, decrease in profit due to operating expenses
₹ 18,72,000 - ₹ 7,25,100 = ₹ 11,46,900

Alternatively, if it is assumed that Fixed Cost shall not be changed with change in units then answer will be as follows:
Fixed Cost = 2400(₹ 1000) = ₹ 24,00,000

Profit = 2417 [₹ 25,000 – (800 × ₹ 27.75 + ₹ 1,500)] – ₹ 24,00,000
= 2417 (₹ 1,300) – ₹ 24,00,000 = ₹ 7,42,100

Therefore, decrease in profit due to operating exposure
= ₹ 18,72,000 – ₹ 7,42,100
= ₹ 11,29,900

Chapter 4

SECURITY VALUATION

Space for your notings of Formulae or important points

Question 1(Study Material TYK Q 1)

A company has a book value per share of ₹137.80. Its return on equity is 15% and it follows a policy of retaining 60% of its earnings. If the Opportunity Cost of Capital is 18%, compute is the price of the share today using both Dividend Growth Model and Walter's Model.

Solution

The company earnings and dividend per share after a year are expected to be:

EPS = ₹ 137.8 × 0.15 = ₹ 20.67

Dividend = 0.40 × 20.67 = ₹ 8.27

The growth in dividend would be: g = 0.6 x 0.15 = 0.09

As per Dividend Growth Model,

Perpetual Growth Model Formula: $P_0 = \frac{\text{Dividend}}{K_e - g}$

$$P_0 = \frac{8.27}{0.18 - 0.09}$$

$$P_0 = ₹\ 91.89$$

Walter's approach showing relationship between dividend and share price can be expressed by the following formula

$$V_c = \frac{D + \frac{R_a}{R_c}}{R_c} (E - D)$$

Where,

Vc = Market Price of the ordinary share of the company.

Ra = Return on internal retention i.e. the rate company earns on retained profits.

Rc = Capitalisation rate i.e. the rate expected by investors by way of return from particular category of shares.

E = Earnings per share.

D = Dividend per share.

Hence,

$$V_c = \frac{8.27 + \frac{.15}{.18}}{.18} (20.67 - 8.27)$$

$$= \frac{18.60}{.18}$$

= ₹ 103.35

Question 2(Study Material TYK Q 3)

MNP Ltd. has declared and paid annual dividend of ₹ 4 per share. It is expected to grow @ 20% for the next two years and 10% thereafter. The required rate of return of equity investors is 15%. Compute the current price at which equity shares should sell.

Note: Present Value Interest Factor (PVIF) @ 15%:

For year 1 = 0.8696;

For year 2 = 0.7561

Solution

$D_0 = ₹ 4$

$D_1 = ₹ 4 (1.20) = ₹ 4.80$

$D_2 = ₹ 4 (1.20)^2 = ₹ 5.76$

$D_3 = ₹ 4(1.02)^2 (1.10) = ₹ 6.336$

$$P = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \frac{TV}{(1+k_e)^2}$$

$$TV = \frac{D_3}{(k_e - g)} = \frac{6.336}{0.15-0.10} = 126.72$$

$$P = \frac{4.80}{(1+0.15)} + \frac{5.76}{(1+0.15)^2} + \frac{126.72}{(1+0.15)^2}$$

= 4.80 x 0.8696 + 5.76 x 0.7561 + 126.72 x 0.7561 = 104.34

Question 3(Study Material TYK Q 5)/MTP Oct'19

X Limited, just declared a dividend of ₹ 14.00 per share. Mr. B is planning to purchase the share of X Limited, anticipating increase in growth rate from 8% to 9%, which will continue for three years. He also expects the market price of this share to be ₹ 360.00 after three years.

You are required to determine:

(i) the maximum amount Mr. B should pay for shares, if he requires a rate of return of 13% per annum.

(ii) the maximum price Mr. B will be willing to pay for share, if he is of the opinion that the 9% growth can be maintained indefinitely and require 13% rate of return per annum.

(iii) the price of share at the end of three years, if 9% growth rate is achieved and assuming other conditions remaining same as in (ii) above

Calculate rupee amount up to two decimal points.

	Year-1	Year-2	Year-3
FVIF @ 9%	1.090	1.188	1.295
FVIF @ 13%	1.130	1.277	1.443
PVIF @ 13%	0.885	0.783	0.693

Solution

(i) Expected dividend for next 3 years.

Year 1 (D1) ₹ 14.00 (1.09) = ₹ 15.26

Year 2 (D2) ₹ 14.00 $(1.09)^2$ = ₹ 16.63

Year 3 (D3) ₹ 14.00 $(1.09)^3$ = ₹ 18.13

Required rate of return = 13% (Ke)

Market price of share after 3 years = (P3) = ₹ 360

The present value of share

$$P_0 = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \frac{D_3}{(1+k_e)^3} + \frac{P_3}{(1+k_e)^3}$$

$$P_0 = \frac{15.26}{(1+0.13)} + \frac{16.63}{(1+0.13)^2} + \frac{18.13}{(1+0.13)^3} + \frac{360}{(1+0.13)^3}$$

P0 = 15.26(0.885) + 16.63(0.783) +18.13(0.693) + 360(0.693)

P0 = 13.50 + 13.02 + 12.56 + 249.48

P0 = ₹ 288.56

(ii) If growth rate 9% is achieved for indefinite period, then maximum price of share should Mr. A willing to be pay is

$$P_0 = \frac{Dividend}{ke-g} = \frac{15.26}{0.13-0.09} = \frac{15.26}{0.04} = ₹\ 381.5$$

(iii) Assuming that conditions mentioned above remain same, the price expected after 3 years will be:

$$P_0 = \frac{D4}{ke-g} = \frac{D3(1.09)}{0.13-0.09} = \frac{19.76}{0.04} = ₹\ 494$$

Question 4(Study Material TYK Q 6)/RTP Nov'18

Piyush Loonker and Associates presently pay a dividend of Re. 1.00 per share and has a share price of ₹ 20.00.

(i) If this dividend were expected to grow at a rate of 12% per annum forever, what is the firm's expected or required return on equity using a dividend-discount model approach?

(ii) Instead of this situation in part (i), suppose that the dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter. Now what is the firm's expected, or required, return on equity?

Solution

(i) Firm's Expected or Required Return on Equity (Using a dividend discount model approach)

According to Dividend discount model approach the firm's expected or required return on equity is computed as follows:

$$K_e = \frac{D_1}{P_0} + q$$

Where,

Ke = Cost of equity share capital or (Firm's expected or required return on equity share capital)

D1 = Expected dividend at the end of year 1

P0 = Current market price of the share.

g = Expected growth rate of dividend.

Now, D1 = D0 (1 + g) or ₹ 1 (1 + 0.12) or ₹ 1.12, P0 = ₹ 20 and g = 12% per annum

Therefore, $K_e = \frac{₹1.12}{₹20} + 12\%$

Or, $K_e = ₹ 17.6\%$

(ii) Firm's Expected or Required Return on Equity (If dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter)

Since in this situation if dividends are expected to grow at a super normal growth rate gs, for n years and thereafter, at a normal, perpetual growth rate of gn beginning in the year n + 1, then the cost of equity can be determined by using the following formula:

$$P_0 = \sum_{t=1}^{n} \frac{Div_0(1+g_s)^t}{(1+K_e)^t} + \frac{Div_n + 1}{K_e - 9_n} * \frac{1}{(1+K_e)^n}$$

Where,

gs = Rate of growth in earlier years.

gn = Rate of constant growth in later years.

P0 = Discounted value of dividend stream.

Ke = Firm's expected, required return on equity (cost of equity capital).

Now,

gs = 20% for 5 years, gn = 10%

Therefore,

$$P_0 = \sum_{t=1}^{n} \frac{D_{0(1+0.20)^t}}{(1+K_e)^t} + \frac{Div_5 + 1}{K_e - 0.10} \times \frac{1}{(1+K_e)^t}$$

$$P_0 = \frac{1.20}{(1+K_e)^1} + \frac{1.44}{(1+K_e)^2} + \frac{1.73}{(1+K_e)^3} + \frac{2.07}{(1+K_e)^4} \frac{2.49}{(1+K_e)^5} + \frac{2.49(1+0.10)}{K_e - 0.10} \times \frac{1}{(1+K_e)^5}$$

or, $P_0 = ₹ 1.20\ (PVF1, Ke) + ₹ 1.44\ (PVF2, Ke) + ₹ 1.73\ (PVF3, Ke) + ₹ 2.07(PVF4, Ke) +$
$₹ 2.49\ (PVF5, Ke) + \frac{₹ 2.74(PVF_5, K_e)}{K_e - 0.10}$

By trial and error we are required to find out Ke

Now, assume Ke = 18% then we will have

$$P_0 = ₹ 1.20\ (0.8475) + ₹ 1.44\ (0.7182) + ₹ 1.73\ (0.6086) + ₹ 2.07\ (0.5158) + ₹ 2.49(0.4371) + ₹ 2.74\ (0.4371) \times \frac{1}{0.18 - 0.10}$$

= ₹ 1.017 + ₹ 1.034 + ₹ 1.053 + ₹ 1.068 + ₹ 1.09 + ₹ 14.97= ₹ 20.23

Since the present value of dividend stream is more than required it indicates that Ke is greater than 18%

Now, assume Ke = 19% we will have.

$$P_0 = ₹\,1.20\,(0.8403) + ₹\,1.44\,(0.7061) + ₹\,1.73\,(0.5934) + ₹\,2.07\,(0.4986) + ₹\,2.49(0.4190) + ₹\,2.74\,(0.4190) \times \frac{1}{0.19 - 0.10}$$

= ₹ 1.008 + ₹ 1.017 + ₹ 1.026+ ₹ 1.032 + ₹ 1.043 + ₹ 12.76

= ₹ 17.89

Since the market price of share (expected value of dividend stream) is ₹ 20. Therefore, the discount rate is closer to 18% than it is to 19%, we can get the exact rate by interpolation by using the following formula:

$$K_e = LR + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} \times \Delta r$$

Where,

LR = Lower Rate

NPV at LR = Present value of share at LR

NPV at HR = Present value of share at Higher Rate

Δ r = Difference in rates

$$K = 18\% + \frac{(₹\,20.23 - ₹20)}{₹20.23 - ₹17.89} \times 1\%$$

$$= 18\% + \frac{₹0.23}{₹2.34} \times 1\%$$

$$= 18\% + 0.10\% = 18.10\%$$

Therefore, the firm's expected, or required, return on equity is 18.10%. At this rate the present discounted value of dividend stream is equal to the market price of the share.

Question 5(Study Material TYK Q 8)

ABC Ltd. has been maintaining a growth rate of 10 percent in dividends. The company has paid dividend @ ₹ 3 per share. The rate of return on market portfolio is 12 percent and the risk-free rate of return in the market has been observed as 8 percent. The Beta co-efficient of company's share is 1.5.

You are required to calculate the expected rate of return on company's shares as per CAPM model and equilibrium price per share by dividend growth model.

Solution:

CAPM formula for calculation of Expected Rate of Return is:

$$ER = R_f + \beta\,(R_m - R_f)$$

= 8 + 1.5 (12 – 8)

= 8 + 1.5 (4)

= 8 + 6

=14% or 0.14

Applying Dividend Growth Model for the calculation of per share equilibrium price:

$$ER = \frac{D_1}{P_0} + g$$

$$0.14 = \frac{3(1.10)}{P_0} + 0.10$$

$$0.14 - 0.10 = \frac{3.30}{P_0}$$

$$0.04\, P_0 = 3.30$$

$$P_0 = \frac{3.30}{0.04} = ₹\, 82.50$$

Per share equilibrium price will be ₹ 82.50.

Question 6(Study Material TYK Q 9)

A Company pays a dividend of ₹ 2.00 per share with a growth rate of 7%. The risk free rate is 9% and the market rate of return is 13%. The Company has a beta factor of 1.50. However, due to a decision of the Finance Manager, beta is likely to increase to 1.75. Find out the present as well as the likely value of the share after the decision.

Solution

In order to find out the value of a share with constant growth model, the value of Ke should be ascertained with the help of 'CAPM' model as follows:

$$K_e = R_f + \beta\,(R_m - R_f)$$

Where,

Ke = Cost of equity
Rf = Risk free rate of return
β = Portfolio Beta i.e. market sensitivity index
Km = Expected return on market portfolio

By substituting the figures, we get

Ke = 0.09 + 1.5 (0.13 – 0.09) = 0.15 or 15%

and the value of the share as per constant growth model is

$$P_0 = \frac{D_1}{(K_e - g)}$$

Where,

P0 = Price of a share
D1 = Dividend at the end of the year 1
Ke = Cost of equity
G = growth

$$P_0 = \frac{2.00}{(K_e - g)}$$

$$P_0 = \frac{2.00}{0.15 - .007} = ₹\, 25.00$$

Alternatively, it can also be found as follows:

$$\frac{2.00(1.07)}{0.15-0.07} = ₹26.75$$

However, if the decision of finance manager is implemented, the beta (β) factor is likely to increase to 1.75 therefore,

Ke would be

$$K_e = R_f + \beta\,(R_m - R_f)$$

= 0.09 + 1.75 (0.13 – 0.09) = 0.16 or 16%

The value of share is

$$P_0 = \frac{D_1}{(K_e - g)}$$

$$P_0 = \frac{2.00}{0.16-0.07} = ₹22.22$$

Alternatively, it can also be found as follows:

$$\frac{2.00(1.07)}{0.16-0.07} = ₹\,23.78$$

Question 7(Study Material TYK Q 11)/PP Nov'18

Shares of Voyage Ltd. are being quoted at a price – earning ratio of 8 times. The company retains ₹ 5 per share which is 45% of its Earning Per Share.

You are required to compute

(i) The cost of equity to the company if the market expects a growth rate of 15% p.a.

(ii) If the anticipated growth rate is 16% per annum, calculate the indicative market price with the same cost of capital.

(iii) If the company's cost of capital is 20% p.a. & the anticipated growth rate is 19% p.a., calculate the market price per share.

Solution

(i) **Cost of Capital**

Retained earnings (45%) ₹ 5 per share

Dividend (55%) ₹ 6.11 per share

EPS (100%) ₹ 11.11 per share

P/E Ratio 8 times

Market price ₹ 11.11 x 8 = ₹ 88.88

Cost of equity capital

$$= \left(\frac{\text{Div}}{\text{Price}} \times 100\right) + \text{Growth}\% = \frac{₹6.11}{₹88.88} \times 100 + 15\% = 21.87\%$$

(ii) Market Price $= \left(\frac{\text{Dividend}}{\text{Cost of Capital}(\%) - \text{Growth Rate}(\%)}\right)$

$= \frac{₹\ 6.11}{(21.87 - 16)\%} = ₹104.08$ per share

(iii) Market Price $= \frac{₹\ 6.11}{(20-19)\%} = ₹611.00$ per share

Question 8(Old PM)

A share of Tension-free Economy Ltd. is currently quoted at, a price earnings ratio of 7.5 times. The retained earnings per share being 37.5% is ₹ 3 per share. Co

1) The company's cost of equity, if investors expect annual growth rate of 12%.
2) If anticipated growth rate is 13% p.a., calculate the indicated market price, with same cost of capital.
3) If the company's cost of capital is 18% and anticipated growth rate is 15% p.a., calculate the market price per share, assuming other conditions remain the same.

Solution

1) Calculation of cost of Capital

Retained Earnings	37.5%	₹3 per share
Dividend*	62.5%	₹5 per share
EPS	100%	₹8 per share
P/E ratio	7.5 times	

Market price is ₹ 7.5 x 8 = ₹ 60 per share

Cost of equity capital = (Dividend/ price x 100) + growth %

=(5/60x100) + 12% = 20.33%

*$\left(\frac{₹3}{37.5} \times 625 = ₹\ 5\right)$

2) Market Price = Dividend / (Cost of equity Capital % - growth rate%) = 5 / (20.33% - 13%) = 5 / 7.33% = ₹ 68.21 per share.
3) Market price = Dividend / (Cost of equity Capital % - growth rate%) = 5 / (18% - 15%) = 5 / 3% = ₹ 166.66 per share

Question 9(Study Material TYK Q 13)

M/s X Ltd. has paid a dividend of ₹ 2.5 per share on a face value of ₹ 10 in the financial year ending on 31st March, 2009. The details are as follows:

Current market price of share	₹ 60
Growth rate of earnings and dividends	10%
Beta of share	0.75
Average market return	15%
Risk free rate of return	9%

Calculate the intrinsic value of the share.

Solution

Intrinsic Value $P_0 = \frac{D_1}{k-g}$

Using CAPM

$k = R_f + \beta(R_m - R_f)$

Rf = Risk Free Rate

β = Beta of Security

Rm = Market Return

$= 9\% + 0.75\ (15\% - 9\ \%) = 13.5\%$

$P = \frac{2.5 \times 1.1}{0.135 - 0.10} = \frac{2.75}{0.035} = ₹\ 78.57$

Question 10(Old PM)/RTP May'19

Seawell Corporation, a manufacturer of do-it-yourself hardware and housewares, reported earnings per share of € 2.10 in 2003, on which it paid dividends per share of € 0.69. Earnings are expected to grow 15% a year from 2004 to 2008, during this period the dividend payout ratio is expected to remain unchanged. After 2008, the earnings growth rate is expected to drop to a stable rate of 6%, and the pay-out ratio is expected to increase to 65% of earnings. The firm has a beta of 1.40 currently, and is expected to have a beta of 1.10 after 2008. The market risk premium is 5.5%. The Treasury bond rate is 6.25%.

(i) What is the expected price of the stock at the end of 2008?

(ii) What is the value of the stock, using the two-stage dividend discount model?

Solution

The expected rate of return on equity after 2008 = 0.0625 + 1.10(0.055) = 12.3%

The dividends from 2003 onwards can be estimated as:

Year	2003	2004	2005	2006	2007	2008	2009
Earnings Per Share (€)	2.1	2.415	2.78	3.19	3.67	4.22	4.48
Dividends Per Share (€)	0.69	0.794	0.913	1.048	1.206	1.387	2.91

(i) The price as of 2008 = € 2.91/(0.123- 0.06) = € 46.19

(ii) The required rate of return up to 2008 = 0.0625 + 1.4(0.055) = 13.95%. The dividends up to 2008 are discounted using this rate as follow:

Year	PV of Dividend
2004	0.794 / 1.1395 = 0.70
2005	0.913 / $(1.1395)^2$ = 0.70
2006	1.048 / $(1.1395)^3$ =0.70
2007	1.206 / $(1.1395)^4$ = 0.72
2008	1.387 / $(1.1395)^5$ = 0.72
Total	3.54

The current price = € 3.54 + € 46.19 / $(1.1395)^5$ = € 27.58.

* Values have been rounded off.

Question 11(Study Material TYK Q 15)/MTP March'19/Similar PP May'18

The risk-free rate of return Rf is 9 percent. The expected rate of return on the market portfolio Rm is 13 percent. The expected rate of growth for the dividend of Platinum Ltd. is 7 percent. The last dividend paid on the equity stock of firm A was ₹ 2.00. The beta of Platinum Ltd. equity stock is 1.2.

(i) What is the equilibrium price of the equity stock of Platinum Ltd.?
(ii) How would the equilibrium price change when
   a) The inflation premium increases by 2 percent?
   b) The expected growth rate increases by 3 percent?
   c) The beta of Platinum Ltd. equity rises to 1.3?

Solution

(i) Equilibrium price of Equity using CAPM

= 9% + 1.2(13% - 9%)

= 9% + 4.8% = 13.8%

$$P = \frac{D_1}{K_e - g} = \frac{2.00(1.07)}{0.138 - 0.07} = \frac{2.14}{0.068} = ₹\,31.47$$

(ii) New Equilibrium price of Equity using CAPM

= 9.18% + 1.3(13% - 9.18%)

= 9.18% + 4.966% = 14.146%

$$P = \frac{D_1}{K_e - g} = \frac{2.00(1.10)}{0.14146 - 0.10} = \frac{2.20}{0.04146} = ₹\,53.06$$

Alternatively, it can also be computed as follows:

= 11% + 1.3(15% - 8%)

= 11% + 5.2% = 16.20%

$$P = \frac{D_1}{K_e - g} = \frac{2.00(1.10)}{0.162 - 0.10} = ₹35.48$$

Alternatively, if all the factors are taken separately then solution will be as follows:

a) Inflation Premium increase by 3%. This raises Rx to 15.80%. Hence, new equilibrium price will be:

$$= \frac{2.00(1.07)}{0.158 - 0.07} = ₹\,24.32$$

b) Expected Growth rate decreases by 3%. Hence, revised growth rate stands at 10%:

$$= \frac{2.00(1.10)}{0.138 - 0.10} = ₹57.89$$

c) Beta decreases to 1.3. Hence, revised cost of equity shall be:

= 9% + 1.3(13% - 9%)

= 9% + 5.2% = 14.2%

As a result, New Equilibrium price shall be:

$$P = \frac{D_1}{K_e - g} = \frac{2.00(1.07)}{0.142 - 0.07} = ₹\ 29.72$$

Question 12(Study Material TYK Q 16)/RTP May'18/MTP March'18/MTP Oct'20

SAM Ltd. has just paid a dividend of ₹ 2 per share and it is expected to grow @ 6% p.a. After paying dividend, the Board declared to take up a project by retaining the next three annual dividends. It is expected that this project is of same risk as the existing projects. The results of this project will start coming from the 4th year onward from now. The dividends will then be ₹ 2.50 per share and will grow @ 7% p.a.

An investor has 1,000 shares in SAM Ltd. and wants a receipt of at least ₹ 2,000 p.a. from this investment.

Show that the market value of the share is affected by the decision of the Board. Also show as to how the investor can maintain his target receipt from the investment for first 3 years and improved income thereafter, given that the cost of capital of the firm is 8%.

Solution

Value of Share at present $= \frac{D_1}{K_e - g}$

$$= \frac{2(1.06)}{0.08 - 0.06} = ₹\ 106$$

However, if the Board implement its decision, no dividend would be payable for 3 years and the dividend for year 4 would be ₹ 2.50 and growing at 7% p.a. The price of the share, in this case, now would be:

$$P_0 = \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^3} = ₹\ 198.46$$

So, the price of the share is expected to increase from ₹ 106 to ₹ 198.45 after the announcement of the project. The investor can take up this situation as follows:

Expected market price after 3 years $= \frac{2.50}{(0.08 - 0.07)} = ₹\ 250.00$

Expected market price after 2 years $= \frac{2.50}{(0.08 - 0.07)} \times \frac{1}{(1 + 0.08)} = ₹\ 231.48$

Expected market price after 1 years $= \frac{2.50}{(0.08 - .07)} \times \frac{1}{(1 + 0.08)^2} = ₹\ 214.33$

In order to maintain his receipt at ₹ 2,000 for first 3 year, he would sell

10 shares in first year @ ₹ 214.33 for	₹ 2,143.30
9 shares in second year @ ₹ 231.48 for	₹ 2,083.32
8 shares in third year @ ₹ 250 for	₹ 2,000.00

At the end of 3rd year, he would be having 973 shares valued @ ₹ 250 each i.e. ₹ 2,43,250. On these 973 shares, his dividend income for year 4 would be @ ₹ 2.50 i.e. ₹ 2,432.50.

So, if the project is taken up by the company, the investor would be able to maintain his receipt of at least ₹ 2,000 for first three years and would be getting increased income thereafter.

Question 13((Study Material TYK Q 14)/RTP Nov'19/MTP April'19

Mr. A is thinking of buying shares at ₹ 500 each having face value of ₹ 100. He is expecting a bonus at the ratio of 1: 5 during the fourth year. Annual expected dividend is 20% and the same rate is expected to be maintained on the expanded capital base. He intends to sell the shares at the end of seventh year at an expected price of ₹ 900 each. Incidental expenses for purchase and sale of shares are estimated to be 5% of the market price. He expects a minimum return of 12% per annum.

Should Mr. A buy the share? If so, what maximum price should he pay for each share? Assume no tax on dividend income and capital gain.

Solution

P.V. of dividend stream and sales proceeds

Year	Divd. /Sale	PVF (12%)	PV (₹)
1	₹ 20/-	0.893	17.86
2	₹ 20/-	0.797	15.94
3	₹ 20/-	0.712	14.24
4	₹ 24/-	0.636	15.26
5	₹ 24/	0.567	13.61
6	₹ 24/	0.507	12.17
7	₹ 24/	0.452	10.85
7	₹ 1026/- (₹ 900 x 1.2 x 0.95)	0.452	463.75
			₹ 563.68
	Less: - Cost of Share (₹ 500 x 1.05)		₹ 525.00
	Net Gain		**₹ 38.68**

Since Mr. A is gaining ₹ 38.68 per share, he should buy the share.

Maximum price Mr. A should be ready to pay is ₹ 563.68 which will include incidental expenses. So the maximum price should be ₹ 563.68 x 100/105 = ₹ 536.84

Question 14(Study Material TYK Q 12)

Following Financial data are available for PQR Ltd. for the year 2008:

	(₹ in lakh)
8% debentures	125
10% bonds (2007)	50
Equity shares (₹ 10 each)	100
Reserves and Surplus	300
Total Assets	600
Assets Turnovers ratio	1.1

Effective interest rate	8%
Effective tax rate	40%
Operating margin	10%
Dividend payout ratio	16.67%
Current market Price of Share	₹ 14
Required rate of return of investors	15%

You are required to:

(i) Draw income statement for the year

(ii) Calculate its sustainable growth rate of earnings

(iii) Calculate the fair price of the Company's share using dividend discount model, and

(iv) What is your opinion on investment in the company's share at current price?

Solution

Workings:

Asset turnover ratio = 1.1

Total Assets = ₹ 600

Turnover ₹ 600 lakhs × 1.1 = ₹ 660 lakhs

Effective interest rate $= \frac{\text{Interest}}{\text{Liabilities}} = 8\%$

Liabilities = ₹ 125 lakhs + 50 lakhs = 175 lakh

Interest = ₹ 175 lakhs × 0.08 = ₹ 14 lakh

Operating Margin = 10%

Hence operating cost = (1 - 0.10) ₹ 660 lakhs = ₹ 594 lakh

Dividend Payout = 16.67%

Tax rate = 40%

(i) **Income statement**

	(₹ Lakhs)
Sale	660
Operating Exp	594
EBIT	66
Interest	14
EBT	52
Tax @ 40%	20.80
EAT	31.20
Dividend @ 16.67%	5.20
Retained Earnings	26.00

(ii) SGR = ROE (1-b)

ROE = $\frac{PAT}{NW}$ and NW = ₹100 lakh + ₹ 300 lakh = 400 lakh

ROE = $\frac{₹\ 31.2\ lakhs}{₹\ 400\ lakhs} \times 100 = 7.8\%$

SGR = 0.078(1 – 0.1667) = 6.5% or $\frac{0.078 \times 0.8333}{1 - 0.078 \times 0.8333} = 6.95\%$

(iii) Calculation of fair price of share using dividend discount model

$P_{0=} \frac{D_0(1+g)}{K_e - g}$

Dividends $= \frac{₹\ 5.2\ lakhs}{₹\ 10\ lakhs} = ₹\ 0.52$

Growth Rate = 6.5% or 6.95%

Hence $P_0 = \frac{₹\ 0.52\ (1+0.065)}{0.15-0.065} = \frac{₹\ 0.5538}{0.085} = ₹\ 6.51$ or $\frac{0.52(1+0.0695)}{0.15-0.0695}$

$= \frac{0.5561}{0.0805} = ₹\ 6.91$

(iv) Since the current market price of share is ₹ 14, the share is overvalued. Hence the investor should not invest in the company.

Question 15(Old PM)

XYZ company has current earnings of ₹ 3 per share with 5,00,000 shares outstanding. The company plans to issue 40,000, 7% convertible preference shares of ₹ 50 each at par. The preference shares are convertible into 2 shares for each preference shares held. The equity share has a current market price of ₹ 21 per share.

a) What is preference share's conversion value?
b) What is conversion premium?
c) Assuming that total earnings remain the same, calculate the effect of the issue on the basic earning per share (a) before conversion (b) after conversion.
d) If profits after tax increases by ₹ 1 million what will be the basic EPS (a) before conversion and (b) on a fully diluted basis?

Solution

a. Conversion value of preference share

Conversion Ratio x Market Price

2 x ₹ 21 = ₹ 42

b. Conversion Premium

(₹50 / ₹ 42) – 1 = 19.05%

c. Effect of the issue on basic EPS

	₹
Before Conversion	
Total (after tax) earnings ₹ 3 × 5,00,000	15,00,000
Dividend on Preference shares	1,40,000

Earnings available to equity holders	**13,60,000**
No. of shares	5,00,000
EPS	2.72
On Diluted Basis	
Earnings	15,00,000
No of shares (5,00,000 + 80,000)	5,80,000
EPS	2.59

d. EPS with increase in Profit

	₹
Before Conversion	
Earnings	25,00,000
Dividend on Pref. shares	1,40,000
Earning for equity shareholders	**23,60,000**
No. of equity shares	5,00,000
EPS	4.72
On Diluted Basis	
Earnings	25,00,000
No. of shows	5,80,000
EPS	4.31

Question 16(Old PM)/RTP Nov'18

ABC Limited's shares are currently selling at ₹ 13 per share. There are 10,00,000 shares outstanding. The firm is planning to raise ₹ 20 lakhs to Finance a new project.

Required:

What are the ex-right price of shares and the value of a right, if

(i) The firm offers one right share for every two shares held.
(ii) The firm offers one right share for every four shares held.
(iii) How does the shareholders' wealth change from (i) to (ii)? How does right issue increases shareholders' wealth?

Solution

(i) Number of shares to be issued: 5,00,000

Subscription price ₹ 20,00,000 / 5,00,000 = ₹ 4

Ex-right Price $= \frac{₹1,30,00,000 + ₹\ 20,00,000}{15,00,000} = ₹\ 10$

Or Value of Right = ₹ 10 - ₹ 4 = ₹ 6

$= \frac{₹\ 10 - ₹\ 4}{2} = 3$

(ii) Subscription price ₹ 20,00,000 / 2,50,000 = ₹ 8

Ex-right Price $= \frac{₹\ 1,30,00,000 + ₹\ 20,00,000}{12,50,000} = ₹\ 12$

Value of Right = ₹ 12 - ₹ 8 = ₹ 4 or $\frac{₹\,12-₹\,8}{4} = 1$

(iii) Calculation of effect of right issue on wealth of Shareholder's wealth who is holding, say 100 shares.

a) When firm offers one share for two shares held.

Value of Shares after right issue (150 x ₹ 10)	₹ 1,500
Less: Amount paid to acquire right shares (50 x ₹ 4)	₹ 200
	₹ 1,300

b) When firm offers one share for every four shares held.

Value of Shares after right issue (125 x ₹ 12)	₹ 1,500
Less: Amount paid to acquire right shares (25 x ₹ 8)	₹ 200
	₹ 1,300

c) Wealth of Shareholders before Right Issue ₹1,300

Thus, there will be no change in the wealth of shareholders from (i) and (ii).

Question 17(Old PM)

Pragya Limited has issued 75,000 equity shares of ₹ 10 each. The current market price per share is ₹ 24. The company has a plan to make a rights issue of one new equity share at a price of ₹ 16 for every four share held.

You are required to:

(i) Calculate the theoretical post - rights price per share;
(ii) Calculate the theoretical value of the right alone;
(iii) Show the effect of the rights issue on the wealth of a shareholder, who has 1,000 shares assuming he sells the entire rights; and
(iv) Show the effect, if the same shareholder does not take any action and ignores the issue.

Solution

(i) Calculation of theoretical post – rights (ex-right) price per share:

Ex – right value = $\left[\frac{MN+SR}{N+R}\right]$

Where,

M = Market price,
N = Number of old shares for a right share
S = Subscription price
R = Right share offer

$= \left[\frac{(₹\,24 \times 4) + (₹\,16 \times 1)}{4+1}\right] = ₹\,22.40$

(ii) Calculation of theoretical value of the rights alone:

= Ex-right price – Cost of rights share

= ₹ 22.40 – ₹ 16 = ₹ 6.40

Or $= \frac{₹\ 22.40 - ₹\ 16}{4} = ₹\ 1.60$

(iii) Calculation of effect of the rights issue on the wealth of a shareholder who has 1,000 shares assuming he sells the entire rights:

		₹
(a)	Value of shares before right issue (1,000 shares × ₹ 24)	24,000
(b)	Value of shares after right issue (1,000 shares × ₹ 22.40)	22,400
	Add: Sale proceeds of rights renunciation (250 shares × ₹ 6.40)	1,600
		24,000

There is no change in the wealth of the shareholder even if he sells his right.

(iv) Calculation of effect if the shareholder does not take any action and ignores the issue:

	₹
Value of shares before right issue (1,000 shares ×₹ 24)	24,000
Less: Value of shares after right issue (1,000 shares × ₹ 22.40)	22,400
Loss of wealth to shareholders, if rights ignored	**1,600**

Question 18

The stock of the Soni plc is selling for £ 50 per common stock. The company then issues rights to subscribe to one new share at £ 40 for each five rights held.

a) What is the theoretical value of a right when the stock is selling rights – on?
b) What is the theoretical value of one share of stock when it goes ex-rights?
c) What is the theoretical value of a right when the stock sells ex-rights at £ 50
d) John Speculator has £ 1,000 at the time Soni plc goes ex-rights at £ 50 per common stock. He feels that the price of the stock will rise to £ 60 by the time the rights expire. Compute his return on his £ 1,000 if he (1) buys Soni plc stock at £ 50, or (2) buys the rights as the price computed in part c, assuming his price expectations are valid.

Solution

$a)\quad R_0 = \frac{P_0 - S}{N + 1} = \frac{£\ 50 - £\ 40}{5 + 1} = £\ 1.67$

$b)\quad P_x = \frac{(P_0 \times N) + S}{N+1} = \frac{(£50 \times 5) + £40}{6} = £\ 48.33$

c) $\quad R_x = \frac{P_x - S}{N} = \frac{£50 - £40}{5} = £2.00$

d)

1) £ 1,000 / £ 50= 20 shares × £ 60 = £ 1,200
£ 1,200 - £ 1,000 = £ 200

2) £ 1,000 / £2 = 500 rights x £ 4* = £ 2,000
£ 2,000 - £ 1,000 = £ 1,000
*Rx = (£ 60 - £ 40) / 5 = £ 4

Question 19(Study Material TYK Q 4)

On the basis of the following information:

Current dividend (Do)	=	₹ 2.50
Discount rate (k)	=	10.5%
Growth rate (g)	=	2%

(i) Calculate the present value of stock of ABC Ltd.

(ii) Is its stock overvalued if stock price is ₹ 35, ROE = 9% and EPS = ₹ 2.25? Show detailed calculation. Using PE Multiple Approach and Earning Growth Model.

Solution

(i) Present Value of the stock of ABC Ltd. is: -

$$V_0 = \frac{2.50(1.02)}{0.105 - 0.02} = ₹30$$

(ii)

A. Value of stock under the PE Multiple Approach

Particulars	
Actual Stock Price	₹ 35.00
Return on equity	9%
EPS	₹ 2.25
PE Multiple (1 / Return on Equity) = 1 / 9%	11.11
Market Price per Share	₹ 25.00

Since, Actual Stock Price is higher, hence it is overvalued.

B. Value of the Stock under the Earnings Growth Model

Particulars	
Actual Stock Price	₹ 35.00
Return on equity	9%
EPS	₹ 2.25
Growth Rate	2%
Market Price per Share [EPS × (1 + g)] / (Ke – g)	₹ 32.79
= ₹ 2.25 × 1.02 / 0.07	

Since, Actual Stock Price is higher, hence it is overvalued.

Question 20

Given the following information:

Current Dividend	₹ 5.00
Discount Rate	10%
Growth rate	2%

(i) Calculate the present value of the stock.

(ii) Is the stock over valued if the price is ₹ 40, ROE = 8% and EPS = ₹ 3.00. Show your calculations under the PE Multiple approach and Earnings Growth model.

Solution

(i) Present Value of the stock :-

$$V_0 = \frac{5.00(1.02)}{0.10 - 0.02} = ₹\,63.75/-$$

(ii) Value of stock under the PE Multiple Approach

Particulars	
Actual Stock Price	₹ 40.00
Return on equity	8%
EPS	₹ 3.00
PE Multiple (1 / Return on Equity) = 1 / 8%	12.50
Market Price per Share	₹ 37.50

Since, Actual Stock Price is higher, hence it is overvalued.

(iii) Value of the Stock under the Earnings Growth Model

Particulars	
Actual Stock Price	₹ 40.00
Return on equity	8%
EPS	₹ 3.00
Growth Rate	2%
Market Price per Share [EPS × (1 + g)] / (Ke – g)	₹ 51.00
= ₹ 3.00 × 1.02 / 0.06	

Since, Actual Stock Price is lower, hence it is undervalued.

Question 21(Study Material TYK Q 7)

Capital structure of Sun Ltd., as at 31.3.2003 was as under:

	(₹ in lakhs)
Equity share capital	80
8% Preference share capital	40
12% Debentures	64
Reserves	32

Sun Ltd., earns a profit of ₹ 32 lakhs annually on an average before deduction of income- tax, which works out to 35%, and interest on debentures.

Normal return on equity shares of companies similarly placed is 9.6% provided:

a) Profit after tax covers fixed interest and fixed dividends at least 3 times.
b) Capital gearing ratio is 0.75.
c) Yield on share is calculated at 50% of profits distributed and at 5% on undistributed profits.

Sun Ltd., has been regularly paying equity dividend of 8%.

Compute the value per equity share of the company assuming:

(i) 1% for every one time of difference for Interest and Fixed Dividend Coverage.
(ii) 2% for every one time of difference for Capital Gearing Ratio.

Solution

a. Calculation of Profit after tax (PAT)

		₹
Profit before interest and tax (PBIT)		32,00,000
Less: Debenture interest (₹ 64,00,000 × 12 / 100)		7,68,000
Profit before tax (PBT)		24,32,000
Less: Tax @ 35%		8,51,200
Profit after tax (PAT)		15,80,800
Less: Preference Dividend		
(₹ 40,00,000 × 8 / 100)	3,20,000	
Equity Dividend (₹ 80,00,000 × 8 / 100)	6,40,000	**9,60,000**
Retained earnings (Undistributed profit)		6,20,800

Calculation of Interest and Fixed Dividend Coverage

$$= \frac{\text{PAT} + \text{Debenture interest}}{\text{Debenture interest} + \text{Preference dividend}} \text{ or } \frac{\text{PAT} + \text{Debenture Interest Net of tax}}{\text{Debenture interest} + \text{Preference dividend}}$$

$$= \frac{15,80,800+7,68,000}{7,68,000+3,20,000} \text{ or } \frac{15,80,800+4,99,200}{7,68,000+3,20,000}$$

$$= \frac{23,48,800}{10,88,000} \text{ or } \frac{20,80,000}{10,88,000} = 2.16 \text{ times or } 1.91 \text{ times}$$

b. **Calculation of Capital Gearing Ratio**

$$\text{Capital Gearing Ratio} = \frac{\text{Fixed interest bearing funds}}{\text{Equity shareholder 'funds}}$$

$$= \frac{\text{Preference Share Capital} + \text{Debentures}}{\text{Equity Share Capital} + \text{Reserves}} = \frac{40,00,000 + 64,00,000}{80,00,000 + 32,00,000} = \frac{1,04,00,000}{1,12,00,000} = 0.93$$

c. **Calculation of Yield on Equity Shares:**

Yield on equity shares is calculated at 50% of profits distributed and 5% on undistributed profits:

	₹
50% on distributed profits (₹ 6,40,000 × 50/100)	3,20,000
5% on undistributed profits (₹ 6,20,800 × 5/100)	31,040
Yield on equity shares	**3,51,040**

$$\text{Yield on equity shares \%} = \frac{\text{Yield on shares}}{\text{Equity share capital}} \times 100$$

$$= \frac{3,51,040}{80,00,000} \times 100 = 4.39\% \text{ or } 4.388\%$$

Calculation of Expected Yield on Equity shares

(i) Interest and fixed dividend coverage of Sun Ltd. is 2.16 times but the industry average is 3 times. Therefore, risk premium is added to Sun Ltd. Shares @ 1% for every 1 time of difference. Hence,

Risk Premium = 3.00 – 2.16 (1%) = 0.84 (1%) = 0.84%

(ii) Capital Gearing ratio of Sun Ltd. is 0.93 but the industry average is 0.75 times. Therefore, risk premium is added to Sun Ltd. shares @ 2% for every 1 time of difference.

Risk Premium = (0.75 – 0.93) (2%) = 0.18 (2%) = 0.36%

	(%)
Normal return expected	9.60
Add: Risk premium for low interest and fixed dividend coverage	0.84
Add: Risk premium for high interest gearing ratio	0.36
	10.80

Value of Equity Share

$$= \frac{\text{Actual yield}}{\text{Expected yield}} \times \text{Paid} - \text{up value of share} = \frac{4.39}{10.80} \times 100 = ₹\ 40.65$$

Question 22(Study Material TYK Q 10)/RTP May'20/MTP Aug'18-Corporate Valuation

Calculate the value of share from the following information:

Profit after tax of the company	₹ 290 crores
Equity capital of company	₹ 1,300 crores
Par value of share	₹ 40 each
Debt ratio of company (Debt / Debt + Equity)	27%
Long run growth rate of the company	8%
Beta 0.1; risk free interest rate	8.7%
Market returns	10.3%
Capital expenditure per share	₹ 47
Depreciation per share	₹ 39
Change in Working capital	₹ 3.45 per share

Solution

No. of Shares= $\frac{₹\ 1300\ \text{crores}}{₹\ 40} = 32.5\ \text{crores}$

EPS = $\frac{\text{PAT}}{\text{No of shares}}$

EPS = $\frac{₹\ 290\ \text{crores}}{32.5\ \text{crores}} = ₹\ 8.923$

FCFE = Net income - [(1-b) (capex-deb) + (1-b) (ΔWC)]

FCFE= 8.923 - [(1-0.27) (47-39) + (1-0.27) (3.45)]

= 8.923 - [5.84+2.5185] = 0.5645

Cost of Equity = Rf + ß (Rm – Rf)

= 8.7 + 0.1 (10.3 – 8.7) = 8.86%

$$P_0 = \frac{FCFE(1+g)}{K_e - g} = \frac{0.5645(1.08)}{0.0886 - .08} = \frac{0.60966}{0.0086} = ₹\ 70.89$$

Question 23(Study Material-Corporate Valuation TYK Q 3)/RTP May'20/Similar Q asked in MTP Nov'21

ABC Co. is considering a new sales strategy that will be valid for the next 4 years. They want to know the value of the new strategy. Following information relating to the year which has just ended, is available:

Income Statement	₹
Sales	20,000
Gross margin (20%)	4,000
Administration, Selling & distribution expense (10%)	2,000
PBT	2,000
Tax (30%)	600
PAT	1,400
Balance Sheet Information	
Fixed Assets	8,000
Current Assets	4,000
Equity	12,000

If it adopts the new strategy, sales will grow at the rate of 20% per year for three years. The gross margin ratio, Assets turnover ratio, the Capital structure and the income tax rate will remain unchanged. Depreciation would be at 10% of net fixed assets at the beginning of the year. The Company's target rate of return is 15%.

Determine the incremental value due to adoption of the strategy.

Solution

Projected Balance Sheet

	Year 1	**Year 2**	**Year 3**	**Year 4**
Fixed Assets (40% of Sales)	9,600	11,520	13,824	13,824
Current Assets (20% of Sales)	4,800	5,760	6,912	6,912
Total Assets	**14,400**	**17,280**	**20,736**	**20,736**
Equity	14,400	17,280	20,736	20,736

Projected Cash Flows: -

	Year 1	**Year 2**	**Year 3**	**Year 4**
Sales	24,000	28,800	34,560	34,560
PBT (10% of sale)	2,400	2,880	3,456	3,456
PAT (70%)	1,680	2,016	2,419.20	2,419.20
Depreciation	800	960	1,152	1,382
Addition to Fixed Assets	2,400	2,880	3,456	1,382
Increase in Current Assets	800	960	1,152	-
Operating cash flow (FCFF)	(720)	(864)	(1,036.80)	2,419.20

Projected Cash Flows: -

Present value of Projected Cash Flows:-

Cash Flows	PVF at 15%	PV
-720	0.870	-626.40
-864	0.756	-653.18
-1,036.80	0.658	-682.21
		-1,961.79

Residual Value = 2419.20 / 0.15 = 16,128

Present value of Residual value = $16128 / (1.15)^3$

= 16128 / 1.521 = 10603.55

Total shareholders' value = 10,603.55 – 1,961.79 = 8,641.76

Pre strategy value = 1,400 / 0.15 = 9,333.33

Therefore, Value of strategy = 8,641.76 – 9,333.33 = – 691.57

Conclusion: The strategy is not financially viable

Question 24(Study Material-Corporate Valuation TYK Q 7)/PP May'22

Following information are available in respect of XYZ Ltd. which is expected to grow at a higher rate for 4 years after which growth rate will stabilize at a lower level:

Base year information:

Revenue - ₹ 2,000 crores
EBIT - ₹ 300 crores
Capital expenditure - ₹ 280 crores
Depreciation - ₹ 200 crores

Information for high growth and stable growth period are as follows:

	High Growth	**Stable Growth**
Growth in Revenue & EBIT	20%	10%
Growth in capital expenditure and depreciation	20%	Capital expenditure are offset by depreciation
Risk free rate	10%	9%
Equity beta	1.15	1
Market risk premium	6%	5%
Pre tax cost of debt	13%	12.86%
Debt equity ratio	1:1	2:3

For all time, working capital is 25% of revenue and corporate tax rate is 30%. What is the value of the firm?

Solution

High growth phase:

ke = 0.10 + 1.15 x 0.06 = 0.169 or 16.9%.

kd = 0.13 x (1-0.3) = 0.091 or 9.1%.

Cost of capital = 0.5 x 0.169 + 0.5 x 0.091 = 0.13 or 13%.

Stable growth phase:

ke = 0.09 + 1.0 x 0.05 = 0.14 or 14%.

kd = 0.1286 x (1 - 0.3) = 0.09 or 9%.

Cost of capital = 0.6 x 0.14 + 0.4 x 0.09 = 0.12 or 12%.

Determination of forecasted Free Cash Flow of the Firm (FCFF) (₹ in crores)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Capital Expenditure	96	115.20	138.24	165.89	-
Less: Depreciation					
Δ Working Capital	100.00	120.00	144.00	172.80	103.68
Free Cash Flow (FCF)	56.00	67.20	80.64	96.77	375.32

Alternatively, it can also be computed as follows: (₹ in crores)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Add: Depreciation	240	288	345.60	414.72	456.19
	492	**590.40**	**708.48**	**850.18**	**935.19**
Less: Capital Exp.	336	403.20	483.84	580.61	456.19
Δ WC	100.00	120.00	144.00	172.80	103.68
	56.00	**67.20**	**80.64**	**96.77**	**375.32**

Present Value (PV) of FCFF during the explicit forecast period is:

FCFF (₹ in crores)	PVF @ 13%	PV (₹ in crores)
56.00	0.885	49.56
67.20	0.783	52.62
80.64	0.693	55.88
96.77	0.613	59.32
		₹ 217.38

Terminal Value of Cash Flow

$$= \frac{375.32}{0.12 - 0.10} = ₹\ 18{,}766.00\ \text{Crores}$$

PV of the terminal, value is:

$$₹\ 18{,}766.00\ \text{Crores} \times \frac{1}{(1.13)^4} = ₹\ 18{,}766.00\ \text{Crores} \times 0.613 = ₹\ 11{,}503.56\ \text{Crores}$$

The value of the firm is:

₹ 217.38 Crores + ₹ 11,503.56 Crores = ₹ 11,720.94 Crores

Question 25(Study Material-Corporate Valuation TYK Q 8)/RTP Nov'20

Following information is given in respect of WXY Ltd., which is expected to grow at a rate of 20% p.a. for the next three years, after which the growth rate will stabilize at 8% p.a. normal level, in perpetuity.

	For the year ended March 31, 2014
Revenues	₹ 7,500 Crores
Cost of Goods Sold (COGS)	₹ 3,000 Crores
Operating Expenses	₹ 2,250 Crores
Capital Expenditure	₹ 750 Crores
Depreciation (included in Operating Expenses)	₹ 600 Crores

During high growth period, revenues & Earnings before Interest & Tax (EBIT) will grow at 20% p.a. and capital expenditure net of depreciation will grow at 15% p.a. From year 4 onwards, i.e. normal growth period revenues and EBIT will grow at 8% p.a. and incremental capital expenditure will be offset by the depreciation. During both high growth & normal growth period, net working capital requirement will be 25% of revenues.

The Weighted Average Cost of Capital (WACC) of WXY Ltd. is 15%.

Corporate Income Tax rate will be 30%.

Required:

Estimate the value of WXY Ltd. using Free Cash Flows to Firm (FCFF) & WACC methodology.

The PVIF @ 15 % for the three years are as below:

Year	t1	t2	t3
PVIF	0.8696	0.7561	0.6575

Solution

Determination of forecasted Free Cash Flow of the Firm (FCFF) (₹ in crores)

	Yr. 1	**Yr. 2**	**Yr. 3**	**Terminal Year**
Revenue	9000.00	10800.00	12960.00	13996.80
COGS	3600.00	4320.00	5184.00	5598.72
Operating Expenses	1980.00*	2376.00	2851.20	3079.30
Depreciation	720.00	864.00	1036.80	1119.74
EBIT	2700.00	3240.00	3888.00	4199.04
Tax @30%	810.00	972.00	1166.40	1259.71
EAT	1890.00	2268.00	2721.60	2939.33
Capital Exp. – Dep.	172.50	198.38	228.13	-
Δ Working Capital	375.00	450.00	540.00	259.20
Free Cash Flow (FCF)	1342.50	1619.62	1953.47	2680.13

* Excluding Depreciation.

Present Value (PV) of FCFF during the explicit forecast period is:

FCFF (₹ in crores)	PVF @ 15%	PV (₹ in crores)
1342.50	0.8696	1167.44
1619.62	0.7561	1224.59
1953.47	0.6575	1284.41
		3676.44

PV of the terminal, value is:

$$\frac{2680.13}{0.15-0.08} \times \frac{1}{(1.15)^3} = ₹38287.57 \text{ Crore} \times 0.6575 = ₹ 25174.08 \text{ Crore}$$

The value of the firm is:

₹ 3676.44 Crores + ₹ 25174.08 Crores = ₹ 28,850.52 Crores

Question 26

BRS Inc deals in computer and IT hardwares and peripherals. The expected revenue for the next 8 years is as follows:

Years	Sales Revenue ($ Million)
1	8
2	10
3	15
4	22
5	30
6	26
7	23
8	20

Summarized financial position as on 31st March 2012 as follows: $ Million

Liabilities	Amount ($ Million)	Assets	Amount ($ Million)
Equity Stocks	12	Fixed Assets (Net)	17
12% Bonds	8	Current Assets	3
	20		20

Additional Information:

Its variable expenses is 40% of sales revenue and fixed operating expenses (cash) are estimated to be as follows:

Period	Amount ($ Million)
1 – 4 years	1.6
5 – 8 years	2

An additional advertisement and sales promotion campaign shall be launched requiring expenditure as per following details:

Period	Amount ($ Million)
1 year	0.50
2 – 3 years	1.50
4 – 6 years	3.00
7– 8 years	1.00

Fixed assets are subject to depreciation at 15% as per WDV method.

The company has planned additional capital expenditures (in the beginning of each year) for the coming 8 years as follows:

Period	Amount ($ Million)
1	0.50
2	0.80
3	2.00
4	2.50
5	3.50
6	2.50
7	1.50
8	1.00

a) Investment in Working Capital is estimated to be 20% of Revenue.
b) Applicable tax rate for the company is 30%
c) Cost of Equity is estimated to be 16%
d) The Free Cash Flow of the firm is expected to grow at 5% per annum after 8 years. With above information you are require to determine the:
   (i) Value of Firm &
   (ii) Value of Equity

Solution

Working Notes

'a) **Determination of Weighted Average Cost of Capital**

Sources of funds	Cost (%)	Proportions	Weights	Weighted Cost
Equity Stock	16	12/20	0.60	9.60
12% Bonds	12% (1-0.30) = 8.40	8/20	0.40	3.36
				12.96 say 13

'b) **Schedule of Depreciation** $ Million

Year	Opening Balance of Fixed Assets	Additional during the year	Total	Depreciation @ 15%
1	17.00	0.50	17.50	2.63
2	14.87	0.80	15.67	2.35
3	13.32	2.00	15.32	2.30
4	13.02	2.50	15.52	2.33
5	13.19	3.50	16.69	2.50
6	14.19	2.50	16.69	2.50

7	14.19	1.50	15.69	2.35
8	13.34	1.00	14.34	2.15

'c) **Determination of Investment** $ Million

Year	Investment Required			Existing Investment in CA	Additional Investment required
	For Capital Expenditure	CA (20% of Revenue)	Total		
1	0.50	1.60	2.10	3.00	0.00
2	0.80	2.00	2.80	2.50*	0.30
3	2.00	3.00	5.00	2.00**	3.00
4	2.50	4.40	6.90	3.00	3.90
5	3.50	6.00	9.50	4.40	5.10
6	2.50	5.20	7.70	6.00	1.70
7	1.50	4.60	6.10	5.20	0.90
8	1.00	4.00	5.00	4.60	0.40

*Balance of CA in Year 1 ($ 3 Million) – Capital Expenditure in Year 1 ($ 0.50 Million)

** Similarly balance of CA in Year 2 ($2.80) – Capital Expenditure in Year 2 ($ 0.80 Million)

'd) **Determination of Present Value of Cash Inflows** $ Million

Particulars	Years							
	1	2	3	4	5	6	7	8
Revenue(A)	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
Less:								
Expenses								
-Variable Cost	3.20	4.00	6.00	8.80	12.00	10.40	9.20	8.00
-Fixed Cash Operating Cost	1.60	1.60	1.60	1.60	2.00	2.00	2.00	2.00
Advertisement Cost	0.50	1.50	1.50	3.00	3.00	3.00	1.00	1.00
Depreciation	2.63	2.35	2.30	2.33	2.50	2.50	2.35	2.15
Total Expenses(B)	**7.93**	**9.45**	**11.40**	**15.73**	**19.50**	**17.90**	**14.55**	**13.15**
EBIT C = A-B	**0.07**	**0.55**	**3.60**	**6.27**	**10.50**	**8.10**	**8.45**	**6.85**
Less: Taxes @ 30% (D)	0.02	0.16	1.08	1.88	3.15	2.43	2.53	2.06
NOPAT (E) = (C) – (D)	**0.05**	**0.39**	**2.52**	**4.39**	**7.35**	**5.67**	**5.92**	**4.79**
Gross Cash Flow (F) = (E) + Dep	2.68	2.74	4.82	6.72	9.85	8.17	8.27	6.97
Free Cash Flow (H) = (F) -(G)	**2.68**	**2.44**	**1.82**	**2.82**	**4.75**	**6.47**	**7.37**	**6.54**
PVF @ 13% (I)	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376
PV (H)(I)	2.371	1.911	1.261	1.729	2.579	3.106	3.132	2.46

Total present value = $ 18.549 million

'e) **Determination of Present Value of Continuing Value (CV)**

$$CV = \frac{FCF_9}{k-g} = \frac{\$\ 6.54 \text{ million } (1.05)}{0.13-0.05} = \frac{\$\ 6.867 \text{ million}}{0.08} = \$\ 85.8375 \text{ million}$$

Present Value of Continuing Value (CV) = $ 85.8376 million x PVF13%,8 = $ 85.96875 million x 0.376 = $ 32.2749

(i) Value of Firm

	$ Million
Present Value of cash flow during explicit period	18.5490
Present value of Continuing Value	32.2749
Total Value	**50.8239**

(ii) Value Of Equity

	$ Million
Total value of Firm	50.8239
Less: Value of Debt	8.0000
Value of Equity	**42.8239**

Question 27(Corporate Valuation)

ABC (India) Ltd., a market leader in printing industry, is planning to diversify into defense equipment businesses that have recently been partially opened up by the GOI for private sector. In the meanwhile, the CEO of the company wants to get his company valued by a leading consultant, as he is not satisfied with the current market price of his scrip.

He approached consultant with a request to take up valuation of his company with the following data for the year ended 2009:

Share Price	₹ 66 per share
Outstanding debt	1934 lakh
Number of outstanding shares	75 lakh
Net income (PAT)	17.2 lakh
EBIT	245 lakh
Interest expenses	218.125 lakh
Capital expenditure	234.4 lakh
Depreciation	234.4 lakh
Working capital	44 lakh
Growth rate 8% (from 2010 to 2014)	
Growth rate 6% (beyond 2014)	
Free cash flow	240.336 lakh (year 2014 onwards)

The capital expenditure is expected to be equally offset by depreciation in future and the debt is expected to decline by 30% in 2014.

Required:

Estimate the value of the company and ascertain whether the ruling market price is undervalued as felt by the CEO based on the foregoing data. Assume that the cost of equity is 16%, and 30% of debt repayment is made in the year 2014.

Solution

As per Firm Cash Flow Approach

(i) **Computation of Tax rate**

EBIT = ₹ 245 lakh

Interest = ₹ 218.125 lakh

PBT = ₹ 26.875 lakh

PAT = ₹ 17.2 lakh

Tax Paid = ₹ 9.675 lakh

Tax Rate = ₹ 9.675/26.875 = 0.36 = 36%

(ii) **Computation for increase in working capital**

Working capital (2009) = ₹ 44 lakh

Increase in 2010 = ₹ 44 x 0.08 = ₹ 3.52 lakh

It will continue to increase @ 8% per annum.

(iii) **Weighted average Cost of capital**

Present debt = ₹ 1934 lakh

Interest cost = ₹ 218.125 lakh/ ₹ 1934 = 11.28%

$$K_c = \frac{4950}{1934+4950} \times 16\% + \frac{1934}{1934+4950} \times 11.28(1-0.36) = 11.51 + 2.028 = 13.54$$

(iv) As capital expenditure and depreciation are equal, they will not influence the free cash flows of the company.

(v) Computation of free cash flows upto 2012

Year	2010	2011	2012	2013	2014
	₹	₹	₹	₹	₹
EBIT (1- t)	169.344 lakh	182.89 lakh	197.52 lakh	213.32 lakh	230.39 lakh
Increase in working capital	3.52 lakh	3.80 lakh	4.10 lakh	4.43 lakh	4.78 lakh
Debt repayment	-	-	-	-	1934 x 0.30 = 580.2 lakh
Free cash flows	165.824 lakh	179.09 lakh	193.41 lakh	208.89 lakh	-354.59 lakh
PVF @ 13.54%	0.8807	0.7757	0.6832	0.6017	0.53
PV of free cash flow @ 13.54%	146.04 lakh	138.92 lakh	132.14 lakh	125.69 lakh	-187.93 lakh

Present value of free cash flows upto 2014 = ₹ 354.86 lakh

(vi) **Cost of capital (2014 Onwards)**

Debt =0.7 × ₹ 1934= ₹ 1353.80 lakh

Equity = ₹ 4950 lakh

$$K_c = \frac{4950}{4950 + 1353.80} \times 16\% + \frac{1353.80}{4950 + 1353.80} \times 11.28\,(1 - 0.36)$$

= 12.56 + 1.55 % = 14.11%

(vii) **Continuing value**

$$\frac{240.336}{0.1411 - 0.06} \times (1/1.1354)^5$$

= ₹ 1570.556 lakh

a) Value of Firm = PV of free cash flows upto 2014 + continuing value

= ₹ 354.86 lakh + ₹ 1570.556 lakh

= ₹ 1925.416 lakh

b) Value per share = (Value of Firm – Value of Debt) / Number of Shares

= (₹ 1925.416 lakh - ₹ 1353.80 lakh) / 75 lakh

= ₹ 7.622 < ₹ 66 (present market price)

Alternatively, following value can also be considered

= (Value of Firm - Value of Debt) / No. of Shares

= (₹ 1925.416 lakh - ₹ 1934) / 75 lakh

= - ₹ 0.1145 or ₹ 0

Thus, share has zero value, and hence overvalued.

Answer as per Equity Cash Approach

(i) **Computation of tax rate**

EBIT	=	₹ 245 lakh
Interest	=	₹ 218.125 lakh
PBT	=	₹ 26.875 lakh
PAT	=	₹ 17.2 lakh
Tax Paid	=	₹ 9.675 lakh
Tax Rate	=	₹ 9.675 / 26.875 = 0.36 = 36%

(ii) **Computation for increase in working capital**

Working capital (2009)	=	₹ 44 lakh
Increase in 2010	=	₹ 44 x 0.08 = ₹ 3.52 lakh

(iii) As capital expenditure and depreciation are equal, they will not influence the free cash flows of the company.

(iv) Computation of free cash flows upto 2014

Year	2010	2011	2012	2013	2014
	₹	₹	₹	₹	₹
EBIT	245.000	264.600	285.768	308.629	333.319
Less : Interest	218.125	218.125	218.125	218.125	218.125
EBT	26.875	46.475	67.643	90.504	180.531
Less: Tax	9.675	16.266	24.351	32.581	65.027
EAT	17.200	30.209	43.292	57.923	115.604
Increase in working capital	3.52	3.80	4.10	4.43	4.78
Debt Repayment	-	-	-	-	1934 x 0.30 = 580.20
Free cash flows	13.68	26.409	39.192	53.493	-469.376
PVF @ 16%	0.8621	0.7632	0.6407	0.5523	0.4761
PV of free cash flow	11.794	19.627	25.110	29.544	-233.470

Present value of free cash flows upto 2014 = - ₹ 137.395 lakh

(v) **Continuing value**

$$\frac{117.473^{*}}{0.16-0.06} \times \frac{1}{1.16)^{5}} = \text{₹ } 559.304 \text{ lakh}$$

*(115.604 – 4.78) (1.06)

(i) Value of Firm = PV of free cash flows upto 2014 + continuing value

= - ₹ 137.395 lakh + ₹ 559.304 lakh

= ₹ 421.909 lakh

(ii) Value per share = Value of Equity / Number of Shares

= ₹ 421.909 lakh / 75 lakh

= ₹ 5.62 < ₹ 66 (present market value)

Question 28 (Old PM- Corporate Valuation)

Personal Computer Division of Distress Ltd., a computer hardware manufacturing company has started facing financial difficulties for the last 2 to 3 years. The management of the division headed by Mr. Smith is interested in a buy - out on 1 April 2013. However, to make this buy - out successful there is an urgent need to attract substantial funds from venture capitalists. Ven Cap, a European venture capitalist firm has shown its interest to finance the proposed buy-out. Distress Ltd. is interested to sell the division for ₹ 180 crore and Mr. Smith is of opinion that an additional amount of ₹ 85 crore shall be required to make this division viable. The expected financing pattern shall be as follows:

Source	Mode	Amount (₹ Crore)

Management	Equity Shares of ₹ 10 each	60.00
Ven Cap VC	Equity Shares of ₹ 10 each	22.50
	9% Debentures with attached warrant of ₹ 100 each	22.50
	8% Loan	160.00
Total		**265.00**

The warrants can be exercised any time after 4 years from now for 10 equity shares @ ₹ 120 per share.

The loan is repayable in one go at the end of 8th year. The debentures are repayable in equal annual installment consisting of both principal and interest amount over a period of 6 years.

Mr. Smith is of view that the proposed dividend shall not be kept more than 12.5% of distributable profit for the first 4 years. The forecasted EBIT after the proposed buyout is as follows:

Year	2013-14	2014-15	2015-16	2016-17
EBIT (₹ crore)	48	57	68	82

Applicable tax rate is 35% and it is expected that it shall remain unchanged at least for 5 - 6 years. In order to attract Ven Cap, Mr. Smith stated that book value of equity shall increase by 20% during above 4 years. Although, Ven Cap has shown their interest in investment but are doubtful about the projections of growth in the value as per projections of Mr. Smith. Further Ven Cap also demanded that warrants should be convertible in 18 shares instead of 10 as proposed by Mr. Smith.

You are required to determine whether or not the book value of equity is expected to grow by 20% per year. Further if you have been appointed by Mr. Smith as advisor then whether you would suggest to accept the demand of Ven Cap of 18 shares instead of 10 or not.

Solution

Working Notes

Calculation of Interest Payment on 9% Debentures

PVAF (9%,6) = 4.486

Annual Installment = $\frac{₹\ 22{,}50\ \text{crore}}{4.486}$ = ₹ 5.0156 crore

Year	Balance Outstanding (₹ Crore)	Interest (₹ Crore)	Installment (₹ Crore)	Principal Repayment (₹ Crore)	Balance (₹ Crore)
1	22.5000	2.025	5.0156	2.9906	19.5094
2	19.5094	1.756	5.0156	3.2596	16.2498
3	16.2498	1.462	5.0156	3.5536	12.6962
4	12.6962	1.143	5.0156	3.8726	8.8236

Statement showing Value of Equity

Particulars	2013-14 (₹ Crore)	2014-15 (₹ Crore)	2015-16 (₹ Crore)	2016-17 (₹ Crore)
EBIT	48.0000	57.0000	68.0000	82.0000
Interest on 9% Debentures	2.0250	1.7560	1.4620	1.1430
Interest on 8% Loan	12.8000	12.8000	12.8000	12.8000
EBT	33.1750	42.4440	53.7380	68.0570
Tax* @35%	11.6110	14.8550	18.8080	23.8200
EAT	21.5640	27.5890	34.9300	44.2370
Dividend @12.5% of EAT*	2.6955	3.4490	4.3660	5.5300
	18.8685	24.1400	30.5640	38.7070
Balance b/f	Nil	18.8685	43.0085	73.5725
Balance c/f	18.8685	43.0085	73.5725	112.2795
Share Capital	82.5000	82.5000	82.5000	82.5000
	101.3685	125.5085	156.0725	194.7795

*Figures have been rounded off.

In the beginning of 2013 - 14 equity was ₹ 82.5000 crore which has been grown to ₹ 194.7795 over a period of 4 years. In such case the compounded growth rate shall be as follows:

$(194.7795 / 82.5000)^{\frac{1}{4}} - 1 = 23.96\%$

This growth rate is slightly higher than 20% as projected by Mr. Smith.

If the condition of Ven Cap for 18 shares is accepted the expected shareholding after 4 years shall be as follows:

No. of shares held by Management	6.00 crore
No. of shares held by Ven Cap at the starting stage	2.25 crore
No. of shares held by Ven Cap after 4 years	4.05 crore
Total holding	6.30 crore

Thus, it is likely that Mr. Smith may not accept this condition of Ven Cap as this may result in losing their majority ownership and control to Ven Cap. Mr. Smith may accept their condition if management has further opportunity to increase their ownership through other forms.

Question 29 (Old PM-Corporate Valuation)

A valuation done of an established company by a well - known analyst has estimated a value of ₹ 500 lakhs, based on the expected free cash flow for next year of ₹ 20 lakhs and an expected growth rate of 5%.

While going through the valuation procedure, you found that the analyst has made the mistake of using the book values of debt and equity in his calculation. While you do not know the book value weights he used, you have been provided with the following information:

(i) Company has a cost of equity of 12%,

(ii) After tax cost of debt is 6%,

(iii) The market value of equity is three times the book value of equity, while the market value of debt is equal to the book value of debt.

You are required to estimate the correct value of the company.

Solution

Cost of capital by applying Free Cash Flow to Firm (FCFF) Model is as follows:-

Value of Firm = V0 = $\frac{FCFF_1}{K_c - g_n}$

Where –

FCFF1 = Expected FCFF in the year

1 Kc = Cost of capital

gn = Growth rate forever

Thus, ₹ 500 lakhs = ₹ 20 lakhs / (Kc - g)

Since g = 5%, then Kc = 9%

Now, let X be the weight of debt and given cost of equity = 12% and cost of debt = 6%, then 12% (1 – X) + 6% X = 9%

Hence, X = 0.50, so book value weight for debt was 50%

Therefore, Correct weight should be 150% of equity and 50% of debt.

Therefore, Cost of capital = Kc = 12% (0.75) + 6% (0.25) = 10.50%

and correct firm's value = ₹ 20 lakhs / (0.105 – 0.05) = ₹ 363.64 lakhs.

Question 30 (Study Material- Corporate Valuation TYK Q 6)/RTP May'19

The valuation of Hansel Limited has been done by an investment analyst. Based on an expected free cash flow of ₹ 54 lakhs for the following year and an expected growth rate of 9 percent, the analyst has estimated the value of Hansel Limited to be ₹ 1800 lakhs. However, he committed a mistake of using the book values of debt and equity.

The book value weights employed by the analyst are not known, but you know that Hansel Limited has a cost of equity of 20 percent and post - tax cost of debt of 10 percent. The value of equity is thrice its book value, whereas the market value of its debt is nine - tenths of its book value. What is the correct value of Hansel Ltd?

Solution

Cost of capital by applying Free Cash Flow to Firm (FCFF) Model is as follows:

Value of Firm = $V_0 = \frac{FCFF_1}{K_c - g_n}$

Where ,

FCFF1 = Expected FCFF in the year 1

Kc = Cost of capital

gn = Growth rate forever

Thus, ₹ 1800 lakhs = ₹ 54 lakhs / (Kc - g)

Since g = 9%, then Kc = 12%

Now, let X be the weight of debt and given cost of equity = 20% and cost of debt = 10%, then 20% (1 – X) + 10% X = 12%

Hence, X = 0.80, so book value weight for debt was 80%

Therefore, Correct weight should be 60 of equity and 72 of debt.

Therefore, Cost of capital = Kc = 20% (60/132) + 10% (72/132) = 14.5455% and

correct firm's value = ₹ 54 lakhs / (0.1454 – 0.09) = ₹ 974.73 lakhs.

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1 (RTP May'22)

Mr. A is holding 1000 shares of face value of ₹ 100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s XYZ Ltd. has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

(i) Shares to be borrowed for 3 months from 01-01-2020 to 31-03-2020,

(ii) Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and

(iii) Bank Guarantee will be provided as collateral for the value as on 01-01-2020.

Other Information:

a) Cost of Bank Guarantee is 8% per annum,

b) On 29-02-2020 M/s ABC Ltd.'s share quoted in Stock Exchange on various dates are as follows:

Date	Share Price in Scenario-1 Bullish	Share Price in Scenario-1 Bullish
01-01-2020	1000	1000
31-01-2020	1020	980
29-02-2020	1040	960
31-03-2020	1050	940

You are required to find out:

(i) Earning of Mr. A through Stock Lending Scheme in both the scenarios,

(ii) Total Earnings of Mr. A during 01-01-2020 to 31-03-2020 in both the scenarios,

(iii) What is the Profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios?

Solution

Earnings of Mr. A through stock lending scheme

		Scenario 1	Scenario 2
(i)	Lending fee		
	31-01-20 1020 x 1% and 980 x 1%	10.20	9.80
	29-02-20 1040 x 1% and 960 x 1%	10.40	9.60
	31-03-20 1050 x 1% and 940 x 1%	10.50	9.40
	Earnings from lending per Share (A)	**31.10**	**28.80**
	Total No. of Shares	1000	1000
	Total Earning from Lending	**31,100**	**28,800**
(ii)	Dividend income per Share (B)	25.00	25.00
	Total earnings per share (A) + (B)	56.10	53.80

	Total No. of Shares	1000	1000
	Total Earning	**56,100**	**53,800**
(iii)	Gain on shortening the shares		
	(1,050 - 1,000) and (1,000 - 940)	(50.00)	60.00
	Lending fees paid	(31.10)	(28.80)
	Bank guarantee charges @ 8%	(20.00)	(20.00)
	Gain Per Share	**(101.10)**	**11.20**
	Total No. of Shares	1000	1000
	Total Gain on shortening the shares	(1,01,100)	11,200

Question 2 (RTP May'22)

Following is the information for the options free bond:

Face value of the bond	₹ 1,000
Coupon rate	7%
Terms of Maturity	7 years
Yield to Maturity	8%

You are required to calculate:

(i) Market price of the bound and duration.

(ii) If there is an increase in yield by 35 basis points, what would be the price of bond?

Present Value	t1	t2	t3	t4	t5	t6	t7
PVIF0.07,t	0.935	0.874	0.817	0.764	0.714	0.667	0.623
PVIF0.08,t	0.926	0.857	0.794	0.735	0.681	0.631	0.584

Solution

(i)

1) Market price and duration of Bond

= 70 (PVIAF 8%,7) + 1,000 (PVIF 8%,7)

= 70 (5.208) + 1,000 (0.584) = 364.56 + 584.00 = 948.56

2) Duration of Bond

Period (A)	Cash flow (₹) (B)	PVF@ 8% (C)	PV (₹) (D) = (B) x (C)	(E) = (A) x (D)
1	70	0.926	64.82	64.82
2	70	0.857	59.99	119.98
3	70	0.794	55.58	166.74
4	70	0.735	51.45	205.80
5	70	0.681	47.67	238.35
6	70	0.631	44.17	265.02
7	1,070	0.584	624.88	4374.16
			948.56	**5434.87**

Duration of the Bond is $\frac{5434.87}{948.56}$ = 5.73 years

(ii) Price of Bond if increase in yield by 35 basis points

Period	Cash flow (₹)	PVF@8.35%	PV (₹)
1	70	0.923	64.61
2	70	0.852	59.64
3	70	0.786	55.02
4	70	0.726	50.82
5	70	0.670	46.90
6	70	0.618	43.26
7	1,070	0.570	609.90
			930.15

Alternatively, if the same increase in yield is linked with duration as computed in sub part (i), then answer will be computed as follows:

Volatility of Bond = $\frac{Duration}{1+YTM}$ = $\frac{5.73}{1+0.08}$ = 5.306

The expected market price if increase in yield is by 35 basis points.

= ₹ 948.56 x 0.35 (5.306/100) = ₹ 17.62

Hence expected market price is ₹ 948.56 – ₹ 17.62 = ₹ 930.94

Hence, the market price will decrease with increase in the yield.

Question 31(Study Material TYK Q 19)
Nominal value of 10% bonds issued by a company is ₹ 100. The bonds are redeemable at ₹ 110 at the end of year 5. Determine the value of the bond if required yield is (i) 5%, (ii) 5.1%, (iii) 10% and (iv) 10.1%.

Solution
Case (i) Required yield rate = 5%

Year	Cash Flow ₹	DF (5%)	Present Value ₹
1-5	10	4.3295	43.295
5	110	0.7835	86.185
Value of bond			129.48

Case (ii) Required yield rate = 5.1%

Year	Cash Flow ₹	DF (5.1%)	Present Value ₹
1-5	10	4.3175	43.175
5	110	0.7798	85.778
Value of bond			128.953

Case (iii) Required yield rate = 10%

Year	Cash Flow ₹	DF (10%)	Present Value ₹
1-5	10	3.7908	37.908
5	110	0.6209	68.299
Value of bond			106.207

Case (iv) Required yield rate = 10.1%

Year	Cash Flow ₹	DF (10.1%)	Present Value ₹
1-5	10	3.7811	37.811
5	110	0.6181	67.991
Value of bond			105.802

Question 32(Study Material TYK Q 23)/PP May'18
Saranam Ltd. has issued convertible debentures with coupon rate 12%. Each debenture has an option to convert to 20 equity shares at any time until the date of maturity. Debentures will be redeemed at ₹ 100 on maturity of 5 years. An investor generally requires a rate of return of 8% p.a. on a 5-year security. As an investor when will you exercise conversion for given market prices of the equity share of (i) ₹ 4, (ii) ₹ 5 and (iii) ₹ 6

Cumulative PV factor for 8% for 5 years	3.993
PV factor for 8% for year 5	0.681

Solution
If Debentures are not converted its value is as under:

	PVF @ 8 %	₹
Interest - ₹ 12 for 5 years	3.993	47.916
Redemption - ₹ 100 in 5th year	0.681	68.100
		116.016

Value of equity shares:

Market Price	No.	Total
₹ 4	20	₹ 80
₹ 5	20	₹ 100
₹ 6	20	₹ 120

Hence, unless the market price is ₹ 6 conversion should not be exercised.

Question 33(Study Material TYK Q 20)

An investor is considering the purchase of the following Bond:

Face value	₹ 100
Coupon rate	11%
Maturity	3 years

(i) If he wants a yield of 13% what is the maximum price, he should be ready to pay for?

(ii) If the Bond is selling for ₹ 97.60, what would be his yield?

Solution

(i) **Calculation of Maximum price**

B0 = ₹ 11 × PVIFA (13%,3) + ₹ 100 × PVIF (13%,3)

= ₹ 11 × 2.361 + ₹ 100 × 0.693 = ₹ 25.97 + ₹ 69.30 = ₹ 95.27

(ii) **Calculation of yield**

At 12% the value = ₹ 11 × PVIFA (12%,3) + 100 × PVIF (12%,3)

= ₹ 11×2.402 + ₹ 100×0.712 = ₹ 26.42 + ₹ 71.20 = ₹ 97.62

It the bond is selling at ₹ 97.60 which is more than the fair value, the YTM of the bond would be less than 13%. This value is almost equal to the amount price of ₹ 97.60. Therefore, the YTM of the bond would be 12%.

Alternatively

$$\text{YTM} = \frac{₹\,11 + \frac{(₹\ 100 - ₹\,97.60)}{3}}{\frac{(₹\,100 + ₹\,97.60)}{2}} = 0.1194 \text{ or } 11.94\% \text{ say } 12\%$$

Question 34(Study Material TYK Q 21)

Calculate Market Price of:

(i) 10% Government of India security currently quoted at ₹ 110, but yield is expected to go up by 1%.

(ii) A bond with 7.5% coupon interest, Face Value ₹ 10,000 & term to maturity of 2 years, presently yielding 6%. Interest payable half yearly.

Solution

(i) Current yield = (Coupon Interest / Market Price) X 100 = (10/110) X 100 = 9.09%

If current yield go up by 1% i.e. 10.09 the market price would be

10.09 = 10 / Market Price X 100

Market Price = ₹ 99.11

(ii) Market Price of Bond = P.V. of Interest + P.V. of Principal

= ₹ 1,394 + ₹ 8,885 = ₹ 10,279

Question 35(Old PM)/RTP May'2020

M/s Agfa Industries is planning to issue a debenture series on the following terms:

Face Value	₹ 100
Term of maturity	10 years
Years	Yearly Coupon rate
1 - 4	9%
5 – 8	10%
9 - 10	14%

The current market rate on similar debentures is 15 percent per annum. The Company proposes to price the issue in such a manner that it can yield 16 percent compounded rate of return to the investors. The Company also proposes to redeem the debentures at 5 percent premium on maturity. Determine the issue price of the debentures.

Solution

Years	Cash out flow (₹)	PVIF @ 16%	PV
1	9	.862	7.758
2	9	.743	6.687
3	9	.641	5.769
4	9	.552	4.968
5	10	.476	4.76
6	10	.410	4.10
7	10	.354	3.54
8	10	.305	3.05
9	14	.263	3.682
10	14 + 105 = 119	.227	3.178 + 23.835
			71.327

The issue price of the debentures will be the sum of present value of interest payments during 10 years of its maturity and present value of redemption value of debenture.

Thus the debentures should be priced at ₹ 71.327

Question 36(Old PM)/RTP May'19

Based on the credit rating of bonds, Mr. Z has decided to apply the following discount rates for valuing bonds:

Credit Rating	Discount Rate
AAA	364 day T bill rate + 3% spread
AA	AAA + 2% spread
A	AAA + 3% spread

He is considering to invest in AA rated, ₹ 1,000 face value bond currently selling at ₹ 1,025.86. The bond has five years to maturity and the coupon rate on the bond is 15% p.a. payable annually. The next interest payment is due one year from today and the bond is redeemable at par. (Assume the 364 day T-bill rate to be 9%).

You are required to calculate the intrinsic value of the bond for Mr. Z. Should he invest in the bond? Also calculate the current yield and the Yield to Maturity (YTM) of the bond.

Solution

The appropriate discount rate for valuing the bond for Mr. Z is: R = 9% + 3% + 2% = 14%

Time	CF	PVIF 14% PV (CF)	PV (CF)
1	150	0.877	131.55
2	150	0.769	115.35
3	150	0.675	101.25
4	150	0.592	88.80
5	1150	0.519	596.85
		∑ PV (CF) i.e. $P_0 =$	1033.80

Since, the current market value is less than the intrinsic value; Mr. Z should buy the bond.

Current yield = Annual Interest / Price = 150 / 1025.86 = 14.62%

The YTM of the bond is calculated as follows:

@ 15%

P = 150 × PVIFA (15%, 4) + 1150 × PVIF (15%, 5)

= 150 × 2.855 + 1150 × 0.497 = 428.25 + 571.55 = 999.80

@ 14 %

As found in sub part (a) P0 = 1033.80

By interpolation we get,

$$= 14\% + \frac{7.94}{7.94 - (-26.06)} \times (15\% - 14\%) = 14\% + \frac{7.94}{34}\%$$

YTM = 14.23%

Question 37(Old PM)/MTP April'18/MTP May'20

ABC Ltd. issued 9%, 5 year bonds of ₹ 1,000/- each having a maturity of 3 years. The present rate of interest is 12% for one year tenure. It is expected that Forward rate of interest for one year tenure is going to fall by 75 basis points and further by 50 basis points for every next year in

further for the same tenure. This bond has a beta value of 1.02 and is more popular in the market due to less credit risk.

Calculate

(i) Intrinsic value of bond

(ii) Expected price of bond in the market.

Solution

(i) **Intrinsic value of Bond**

PV of Interest + PV of Maturity Value of Bond

Forward rate of interests

1st Year	12%
2nd Year	11.25%
3rd Year	10.75%

$$\text{PV of Interest} = \frac{₹\,90}{(1+0.12)} + \frac{₹\,90}{(1+0.12)(1+0.1125)} + \frac{₹\,90}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹\,217.81$$

$$\text{PV of Maturity Value of Bond} = \frac{₹\,1000}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹\,724.67$$

Intrinsic Value of Bond$= ₹\,217.81 + ₹\,724.67 = ₹\,942.48$

(ii) Expected Price = Intrinsic Value x Beta Value

= ₹ 948.48 x 1.02 = ₹ 961.33

Question 38(Old PM)

Name of Security	Face Value ₹	Maturity Date	Coupon Rate	Coupon Date(s)
Zero coupon	10,000	31st March, 2023	N.A.	N..A.
T-Bill	1,00,000	20th June, 2013	N.A.	N.A.
10.71% GOI 2023	100	31st March, 2023	10.71	31st March
10 % GOI 2018	100	31st March, 2018	10.00	31st March & 30th September

On 31st March, 2013, the following information about Bonds is available:

Calculate:

(i) If 10 years yield is 7.5% p.a. what price the Zero Coupon Bond would fetch on 31st March, 2013?

(ii) What will be the annualized yield if the T-Bill is traded @ 98500?

(iii) If 10.71% GOI 2023 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

(iv) If 10% GOI 2018 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

Solution

(i) Rate used for discounting shall be yield. Accordingly, ZCB shall fetch:

$$= \frac{10000}{(1 + 0.075)^{10}} = ₹ 4{,}852$$

(ii) The day count basis is actual number days / 365. Accordingly annualized yield shall be:

$$\text{Yield} = \frac{\text{FV} - \text{Price}}{\text{Price}} \times \frac{365}{\text{No. of Days}} = \frac{100000 - 98500}{98500} \times \frac{365}{81} = 6.86\%$$

Note: Alternatively, it can also computed on 360 days a year.

(iii) Price GOI 2023 would fetch:

= ₹ 10.71 PVAF (8%, 10) + ₹ 100 PVF (8%, 10)

= ₹ 10.71 x 6.71 + ₹ 100 x 0.4632

= ₹ 71.86 + ₹ 46.32 = ₹ 118.18

(iv) Price GOI 2018 Bond would fetch:

= ₹ 5 PVAF (4%, 10) + ₹ 100 PVF (4%, 10)

= ₹ 5 x 8.11 + ₹ 100 x 0.6756

= 40.55 + 67.56 = 108.11

Question 39(Old PM)

a) Consider two bonds, one with 5 years to maturity and the other with 20 years to maturity. Both the bonds have a face value of ₹ 1,000 and coupon rate of 8% (with annual interest payments) and both are selling at par. Assume that the yields of both the bonds fall to 6%, whether the price of bond will increase or decrease? What percentage of this increase / decrease comes from a change in the present value of bond's principal amount and what percentage of this increase / decrease comes from a change in the present value of bond's interest payments?
b) Consider a bond selling at its par value of ₹ 1,000, with 6 years to maturity and a 7% coupon rate (with annual interest payment), what is bond's duration?
c) If the YTM of the bond in (b) above increases to 10%, how it affects the bond's duration? And why?

Solution

a) If the yield of the bond falls the price will always increase. This can be shown by following calculation.

If yield falls to 6%

Price of 5yr. bond

₹ 80 (PVIFA 6%, 5yrs.) + ₹ 1000 (PVIF 6%, 5yrs.)

₹ 80 (4.212)+ ₹ 1000 (0.747)

₹ 336.96 + ₹ 747.00 = ₹ 1,083.96

Increase in 5 year's bond price = ₹ 83.96

Current price of 20 year bond

₹ 80 (PVIFA 6%, 20) + ₹ 1,000 (PVIF 6%, 20)

₹ 80 (11.47) + ₹ 1,000 (0.312)

₹ 917.60 + ₹ 312.00 = ₹ 1229.60

So increase in bond price is ₹ 229.60

PRICE INCREASE DUE TO CHANGE IN PV OF PRINCIPAL

5 yrs. Bond

₹ 1,000 (PVIF 6%, 5) – ₹ 1,000 (PVIF 8%, 5)

₹ 1,000 (0.747) – ₹ 1,000 (0.681)

₹ 747.00 – ₹ 681.00 = ₹ 66.00

& change in price due to change in PV of Principal (₹ 66 / ₹ 83.96) x 100 = 78.6%

20 yrs. Bond

₹ 1,000 (PVIF 6%, 20) – ₹ 1,000 (PVIF 8%, 20)

₹ 1,000 (0.312) – ₹ 1,000 (0.214)

₹ 312.00 – ₹ 214.00 = ₹ 98.00

& change in price due to change in PV of Principal (₹ 98 / ₹ 229.60) x 100 = 42.68%

PRICE CHANGE DUE TO CHANGE IN PV OF INTEREST

5 yrs. Bond

₹ 80 (PVIFA 6%, 5) – ₹ 80 (PVIFA 8%, 5)

₹ 80 (4.212) – ₹ 80 (3.993)

₹ 336.96 – ₹ 319.44 = ₹ 17.52

% change in price = $\frac{₹\ 17.52}{₹\ 83.96} \times 100 = 20.86\%$

20 yrs. Bond

₹ 80 (PVIFA 6%, 20) – ₹ 80 (PVIFA 8%,20)

₹ 80 (11.47) – ₹ 80 (9.82)

₹ 917.60 – ₹ 785.60 = ₹ 132

& change in price = $\frac{₹\ 132}{₹\ 229.60} \times 100 = 57.49\%$

b) Duration in the average time taken to recollect back the investment

Years (A)	Coupon Payments (₹)	Redemption (₹)	Total (₹)	PVIF @ 7% (₹)	(A)x(B)x (C) (₹)

			(B)	(C)	
1	70	-	70	0.935	65.45
2	70	-	70	0.873	122.22
3	70	-	70	0.816	171.36
4	70	-	70	0.763	213.64
5	70	-	70	0.713	249.55
6	70	1000	1070	0.666	4,275.72
				Σ ABC	**5,097.94**

Duration = $\frac{\sum ABC}{\text{Purchase Price}} = \frac{₹\ 5097.94}{₹\ 1000}$ = 5.098 years

c) If YTM goes up to 10%, current price of the bond will decrease to

₹ 70 x PVIFA (10%,6) + ₹ 1000 PVIF (10%,6)

₹ 304.85 + ₹ 564.00 = ₹ 868.85

Year (A)	Inflow (₹) (B)	PVIF @ 10% (C)	(A)x(B)x (C) (₹)
1	70	0.909	63.63
2	70	0.826	115.64
3	70	0.751	157.71
4	70	0.683	191.24
5	70	0.621	217.35
6	1070	0.564	3,620.88
		Σ ABC	**4,366.45**

New Duration ₹ 4,366.45/ ₹ 868.85 = 5.025 years

The duration of bond decreases, reason being the receipt of slightly higher portion of one's investment on the same intervals.

Question 40(Old PM)

John inherited the following securities on his uncle's death:

Types of Security	Nos.	Annual Coupon %	Maturity Years	Yield %
Bond A (₹ 1,000)	10	9	3	12
Bond B (₹ 1,000)	10	10	5	12
Preference shares C (₹ 100)	100	11	*	13*
Preference shares D (₹ 100)	100	12	*	13*

*likelihood of being called at a premium over par.

Compute the current value of his uncle's portfolio.

Solution

Computation of current value of John's portfolio

(i) 10 Nos. Bond A, ₹ 1,000 par value, 9% Bonds maturity 3 years:

Current value of interest on bond A		
1-3 years: ₹ 900 x Cumulative P.V. @ 12% (1-3 years)		
= ₹ 900 x 2.402	2,162	
Add: Current value of amount received on maturity of Bond A		
End of 3rd year: ₹ 1,000 x 10 x P.V. @ 12% (3rd year)		
= ₹ 10,000 x 0.712	7,120	**9,282**

(ii) 10 Nos. Bond B, ₹ 1,000 par value, 10% Bonds maturity 5 years:

Current value of interest on bond B		
1-5 years: ₹ 1,000 x Cumulative P.V. @ 12% (1-5 years)		
= ₹ 1,000 x 3.605	3,605	
Add: Add: Current value of amount received on maturity of Bond B		
End of 5th year: ₹ 1,000 x 10 x P.V. @ 12% (5th year)		
= ₹ 10,000 x 0.567	5,670	**9,275**

(iii) 100 Preference shares C, ₹ 100 par value, 11% coupon

11% x 100 Nos. x ₹ 100 = 1,100 / 13% 0.13	8,462	

(iv) 100 Preference shares D, ₹ 100 par value, 12% coupon

12% x 100 Nos. x ₹ 100 = 1,200 / 13% 0.13	9,231	**17,693**

Total current value of his portfolio [(i) + (ii) + (iii) + (iv)] **36,250**

Question 41(Old PM)

Pet feed plc has outstanding, a high yield Bond with following features:

Face Value	£ 10,000
Coupon	10%
Maturity Period	6 Years
Special Feature	Company can extend the life of Bond to 12 years.

Presently the interest rate on equivalent Bond is 8%.

a) If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.
b) Now suppose, on the basis of that expectation, he invests in the Bond, but interest rate turns out to be 12%, six years from now, then what will be his potential loss / gain if the company extents the life of Bond for another 6 years.

Solution

a) If the current interest rate is 8%, the company will not extent the duration of Bond and the maximum amount the investor would ready to pay will be:

= £1,000 PVIAF (8%, 6) + £10,000 PVIF (8%, 6)

= £1,000 x 4.623 + £10,000 x 0.630

= £4,623 + £ 6,300

= £ 10,923

b) If the current interest rate is 12%, the company will extent the duration of Bond. After six years the value of Bond will be:

= £1,000 PVIAF (12%, 6) + £10,000 PVIF (12%, 6)

= £1,000 x 4.111 + £10,000 x 0.507

= £4,111 + £5,070

= £9,181

Thus, potential loss will be £9,181 - £10,923= £ 1,742

Question 42(Old PM)
If the market price of the bond is ₹ 95; years to maturity = 6 yrs: coupon rate = 13% p.a (paid annually) and issue price is ₹ 100. What is the yield to maturity?

Solution

$\text{YTM} = \frac{C+\frac{(F-P)}{n}}{\frac{F+P}{2}}$ C = Coupon Rate; F = Face Value (Issue Price); P = Market Price of Bond

$$\text{YTM} = \frac{13+\frac{(100-95)}{6}}{\frac{100+95}{2}} = 0.1418 \text{ or } 14.18\%$$

Question 43(Old PM)
There is a 9% 5-year bond issue in the market. The issue price is ₹ 90 and the redemption price ₹ 105. For an investor with marginal income tax rate of 30% and capital gains tax rate of 10% (assuming no indexation), what is the post-tax yield to maturity?

Solution
Calculation of yield to Maturity (YTM)

$\text{YTM} = \frac{\text{Coupon+Pro-rated discount}}{(\text{Redemption Price+Purchase Price})/2}$

After tax coupon = 9 x (1 – .30) = 6.3%

After tax redemption price = 105 – (15 x .10) or ₹ 103.5

After tax capital gain = 103.50 – 90 = ₹ 13.50

YTM = $\frac{6.3+(13.5/5)}{(103.5+90)/2}$ or $\frac{9.00}{96.75} = 9.30\%$

Question 44(Old PM)/RTP May'18

XL Ispat Ltd. has made an issue of 14 per cent non-convertible debentures on January 1, 2007. These debentures have a face value of ₹ 100 and is currently traded in the market at a price of ₹ 90.

Interest on these NCDs will be paid through post-dated cheques dated June 30 and December 31. Interest payments for the first 3 years will be paid in advance through post-dated cheques while for the last 2 years post-dated cheques will be issued at the third year. The bond is redeemable at par on December 31, 2011 at the end of 5 years.

Required:

(i) Estimate the current yield and YTM of the bond.
(ii) Calculate the duration of the NCD.
(iii) Assuming that intermediate coupon payments are, not available for reinvestment calculate the realised yield on the NCD.

Solution

(i) Current yield = $\frac{₹ 7}{₹ 90} \times \frac{12}{6}$ = 0.1555 or 15.55%

YTM can be determined from the following equation

7 × PVIFA (YTM, 10) + 100 × PVIF (YTM, 10) = 90

Let us discount the cash flows using two discount rates 7.5% and 9% as follows:

Year	Cash Flows	PVF@7.50%	PV@7.50%	PVF@9%	PV@9%
0	-90	1	-90	1	-90
1	7	0.930	6.51	0.917	6.419
2	7	0.865	6.055	0.842	5.894
3	7	0.805	5.635	0.772	5.404
4	7	0.749	5.243	0.708	4.956
5	7	0.697	4.879	0.650	4.550
6	7	0.648	4.536	0.596	4.172
7	7	0.603	4.221	0.547	3.829
8	7	0.561	3.927	0.502	3.514
9	7	0.522	3.654	0.460	3.220
10	107	0.485	51.90	0.422	45.154
			6.560		**-2.888**

Let us discount the cash flows using two discount rates 7.50% and 9% as follows:

Now we use interpolation formula

$$7.50 + \frac{6.560}{6.560 - (-2.888)} \times 1.50\%$$

$$7.50 + \frac{6.560}{9.448} \times 1.50\% = 7.50\% + 1.041\%$$

YTM = 8.541% or 8.54%

Note: Students can also compute the YTM using rates other than 15% and 18%.

The duration can be calculated as follows:

Year	Cash Flow	PVF@ 8.54%	PV @ 8.54%	Proportion of NCD value	Proportion of NCD value × time
1	7	0.921	6.447	0.0717	0.0717
2	7	0.849	5.943	0.0661	0.1322
3	7	0.782	5.474	0.0608	0.1824
4	7	0.721	5.047	0.0561	0.2244
5	7	0.664	4.648	0.0517	0.2585
6	7	0.612	4.284	0.0476	0.2856
7	7	0.563	3.941	0.0438	0.3066
8	7	0.519	3.633	0.0404	0.3232
9	7	0.478	3.346	0.0372	0.3348
10	107	0.441	47.187	0.5246	5.2460
			89.95		**7.3654**

Duration = 7.3654 half years i.e. 3.683 years.

(ii) Realized Yield can be calculated as follows:

$$\frac{(7 \times 10) + 100}{(1 + R)^{10}} = 90$$

$$(1 + R)^{10} = \frac{170}{90}$$

R = $\left(\frac{170}{90}\right)^{1/10} - 1 = 0.06380$ or 6.380% for half yearly and 12.76% annually

Question 45(Old PM)

MP Ltd. issued a new series of bonds on January 1, 2010. The bonds were sold at par (₹1,000), having a coupon rate 10% p.a. and mature on 31st December, 2025. Coupon payments are made semi annually on June 30th and December 31st each year. Assume that you purchased an outstanding MP Ltd. bond on 1st March, 2018 when the going interest rate was 12%.

Required:

(i) What was the YTM of MP Ltd. bonds as on January 1, 2010?

(ii) What amount you should pay to complete the transaction? Of that amount how much should be accrued interest and how much would represent bonds basic value.

Solution

(i) Since the bonds were sold at par, the original YTM was 10%.

YTM = $\frac{\text{Interest}}{\text{Principal}} = \frac{₹\,100}{₹\,1000} = 10\%$

(ii) Price of the bond as on 1st July, 2018 = ₹ 50 x 9.712 + ₹ 1,000 x 0.417

= ₹ 485.60 + ₹ 417

= ₹ 902.60

Total value of the bond on the next = ₹ 902.60 + ₹ 50 interest date = ₹ 952.60

Therefore, Value of bond at purchase date $= ₹\ 952.60 \times \frac{1}{(1+0.06)^{2/3}}$

$= ₹\ 952.60 \times 0.9620$ (by using excel)

$= ₹\ 916.40$†

The amount to be paid to complete the transaction is ₹ 916.40. Out of this amount ₹ 48.10 represent accrued interest* and ₹ 868.30 represent the bond basic value.

† Alternatively, it can also be calculated as follows:

$= ₹952.60 \times \frac{1}{(1+0.06\times\frac{2}{3})}$

$= ₹\ 952.60 \times \frac{1}{(1+0.04)}$

$= ₹\ 915.56$

The amount to be paid to complete the transaction is ₹ 915.96. Out of this amount ₹ 48.08 represent accrued interest* and ₹ 867.88 represent the bond basic value.

*Alternatively, Accrued Interest can also be calculated as follows:

Accrued Interest on Bonds = $1{,}000 \times \frac{10}{100} \times \frac{2}{12} = 16.67$

Question 46(Study Material TYK Q 25)/Similar Q asked in PP December'21/RTP Nov'22

ABC Ltd. has ₹ 300 million, 12 percent bonds outstanding with six years remaining to maturity. Since interest rates are falling, ABC Ltd. is contemplating of refunding these bonds with a ₹ 300 million issue of 6 - year bonds carrying a coupon rate of 10 per cent. Issue cost of the new bond will be ₹ 6 million and the call premium is 4 percent. ₹ 9 million being the unamortized portion of issue cost of old bonds can be written off no sooner the old bonds are called off. Marginal tax rate of ABC Ltd. is 30 percent. You are required to analyse the bond refunding decision.

Solution

(i) Calculation of initial outlay:

		₹ (million)
(a)	Face value	300
	Add:- Call premium	12
	Cost of calling old bonds	**312**
(b)	Gross proceed of new issue	300
	Less: Issue costs	6
	Net proceeds of new issue	**294**
(c)	Tax savings on call premium and unamortized cost 0.30 (12 + 9)	6.3

	Therefore,Initial outlay = ₹ 312 million – ₹ 294 million – ₹ 6.3 million	₹ 11.7

(ii) Calculation of net present value of refunding the bond:-

	₹ (million)
Saving in annual interest expenses [300 x (0.12 – 0.10)]	6.00
Less:- Tax saving on interest and amortization {0.30 x [6 + (9-6)/6]}	1.95
Annual net cash saving	**4.05**
PVIFA (7%, 6 years)	4.766
Therefore, Present value of net annual cash saving	19.30 million
Less:- Initial outlay	11.70 million
Net present value of refunding the bond	**7.60 million**

Decision: The bonds should be refunded

Question 47(MTP Nov'21)(PP Nov'18

M/s Transindia Ltd. is contemplating calling ₹ 3 crores of 30 years, ₹ 1,000 bond issued 5 years ago with a coupon interest rate of 14 per cent. The bonds have a call price of ₹ 1,140 and had initially collected proceeds of ₹ 2.91 crores due to a discount of ₹ 30 per bond. The initial floating cost was ₹ 3,60,000. The Company intends to sell ₹ 3 crores of 12 per cent coupon rate, 25 years bonds to raise funds for retiring the old bonds. It proposes to sell the new bonds at their par value of ₹ 1,000. The estimated floatation cost is ₹ 4,00,000. The company is paying 40% tax and its after tax cost of debt is 8 per cent. As the new bonds must first be sold and their proceeds, then used to retire old bonds, the company expects a two months period of overlapping interest during which interest must be paid on both the old and new bonds. What is the feasibility of refunding bonds?

Solution

NPV for bond refunding

	₹
PV of annual cash flow savings (W.N. 2) (3,49,600 x PVIFA 8%, 25) i.e. 10.675	37,31,980
Less: Initial investment (W.N. 1)	29,20,000
NPV	8,11,980

Recommendation: Refunding of bonds is recommended as NPV is positive.

Working Notes:

1) Initial investment:

(a)	Call Premium		
	Before tax (1,140 – 1,000) X 30,000	42,00,000	
	Less tax @ 40%	16,80,000	
	After tax cost of call prem.		25,20,000
(b)	Flotation Cost		4,00,000
(c)	Overlapping Interest		

	Before tax (0.14 x 2/12 x 3 crores)	7,00,000	
	Less: tax @ 40%	2,80,000	**4,20,000**
(d)	Tax saving on unamortised discount on old bond 25/30 x 9,00,000 x 0.4		(3,00,000)
(e)	Tax savings from unamortised floatation		
	Cost of old bond 25/30 x 3,60,000 x 0.4		(1,20,000)
			29,20,000

2) Annual cash flow savings:

(a)	Old bond		
	(i) Interest cost (0.14 x 3 crores)	42,00,000	
	Less tax @ 40%	16,80,000	25,20,000
	(ii) Tax savings from amortisation of discount 9,00,000/30 x 0.4		(12,000)
	(iii) Tax savings from amortization of floatation cost 3,60,000/30 x 0.4		(4,800)
	Annual after tax cost payment under old Bond (A)		**25,03,200**
(b)	New Bond		
	(i) Interest cost before tax (0.12 x 3 crores)	36,00,000	
	Less tax @ 40%	14,40,000	
	After tax interest		21,60,000
	(ii) Tax savings from amortization of floatation cost (0.4 x 4,00,000/25)		(6,400)
	Annual after tax payment under new Bond (B)		**21,53,600**
	Annual Cash Flow Saving (A) – (B)		**3,49,600**

Question 48(Study Material TYK Q 18)/Similar Q in PP July'21/MTP Sep'22/RTP Nov'22

Rahul Ltd. has surplus cash of ₹ 100 lakhs and wants to distribute 27% of it to the shareholders. The company decides to buy back shares. The Finance Manager of the company estimates that its share price after re-purchase is likely to be 10% above the buyback price - if the buyback route is taken. The number of shares outstanding at present is 10 lakhs and the current EPS is ₹ 3.

You are required to determine:

(i) The price at which the shares can be re-purchased, if the market capitalization of the company should be ₹ 210 lakhs after buyback,

(ii) The number of shares that can be re-purchased, and

(iii) The impact of share re-purchase on the EPS, assuming that net income is the same.

Solution

(i) Let P be the buyback price decided by Rahul Ltd.

Market Capitalisation after Buyback

1.1P (Original Shares – Shares Bought Back)

$= 1.1P\left(10 \text{ lakhs} - \frac{27\% \text{ of } 100\text{lakhs}}{P}\right)$

= 11 lakhs x P – 27 lakhs x 1.1 = 11 lakhs P – 29.7 lakhs

Again, 11 lakhs P – 29.7 lakhs

or 11 lakhs P = 210 lakhs + 29.7 lakhs

or P = $\frac{239.7}{11} = ₹ 21.79$ per share

(ii) Number of Shares to be Bought Back :-

$\frac{27 \text{ lakhs}}{₹ 21.79}$ = 1.24 lakhs (Approx) or 123910 share

(iii) New Equity Shares:-

10 lakhs – 1.24 lakhs = 8.76 lakhs or 1000000 – 123910 = 876090 shares

Therefore, EPS = $\frac{3 \times 10 \text{ lakhs}}{8.76 \text{ lakhs}} = ₹ 3.43$

Thus, EPS of Rahul Ltd., increases to ₹ 3.43.

Question 49(Same as Q 48)/MTP April'18

Abhishek Ltd. has a surplus cash of ₹ 90 lakhs and wants to distribute 30% of it to the shareholders. The Company decides to buyback shares. The Finance Manager of the Company estimates that its share price after re-purchase is likely to be 10% above the buyback price; if the buyback route is taken. The number of shares outstanding at present is 10 lakhs and the current EPS is ₹3.

You are required to determine:

a) The price at which the shares can be repurchased, if the market capitalization of the company should be ₹ 200 lakhs after buyback.
b) The number of shares that can be re-purchased.
c) The impact of share re-purchase on the EPS, assuming the net income is same.

Solution

a) **Let P be the buyback price decided by Abhishek Ltd.**

Market Capitalisation after Buyback

1.1P (Original Shares – Shares Bought Back)

$= 1.1P\left(10 \text{ lakhs} - \frac{30\% \text{ of } 90\text{lakhs}}{P}\right)$

= 11 lakhs x P – 27 lakhs x 1.1 = 11 lakhs x P – 29.7 lakhs

Market capitalization rate after buyback is 200 lakhs.

Thus, we have

11 lakhs x P -29.7 lakhs = ₹ 200 lakhs

or 11P = 200 + 29.7

or P = $\frac{229.7}{11} = ₹ 20.88$

b) **Number of Shares to be Bought Back** :-

$= \frac{27 \text{ lakhs}}{20.88} = 1.29 \text{ lakhs (Approximately)}$

c) **New Equity Shares:-**

= (10 - 1.29) lakhs = 8.71 lakhs

Therefore, EPS = $\frac{3 \times 10 \text{ lakhs}}{8.71 \text{ lakhs}} = \frac{30 \text{ L}}{8.71 \text{ L}} = ₹ 3.44$

Thus, EPS of Abhishek Ltd., increases to ₹ 3.44.

Question 50(Old PM)

XYZ company has current earnings of ₹ 3 per share with 5,00,000 shares outstanding. The company plans to issue 40,000, 7% convertible preference shares of ₹ 50 each at par. The preference shares are convertible into 2 shares for each preference shares held. The equity share has a current market price of ₹ 21 per share.

a) What is preference share's conversion value?
b) What is conversion premium?
c) Assuming that total earnings remain the same, calculate the effect of the issue on the basic earning per share (a) before conversion (b) after conversion.
d) If profits after tax increases by ₹ 1 million what will be the basic EPS (a) before conversion and (b) on a fully diluted basis?

Solution

(i) Conversion value of preference share

Conversion Ratio x Market Price

X ₹ 21 = ₹ 42

(ii) Conversion Premium

(₹ 50/ ₹ 42) – 1 = 19.05%

(iii) Effect of the issue on basic EPS

	₹
Before Conversion	
Total (after tax) earnings ₹ 3 × 5,00,000	15,00,000
Dividend on Preference shares	1,40,000
Earnings available to equity holders	13,60,000
No. of shares	5,00,000
EPS	2.72
On Diluted Basis	
Earnings	15,00,000

No of shares (5,00,000 + 80,000)	5,80,000
EPS	2.59

(iii) EPS with increase in Profit

	₹
Before Conversion	
Earnings	25,00,000
Dividend on Pref. shares	1,40,000
Earning for equity shareholders	23,60,000
No. of equity shares	5,00,000
EPS	4.72
On Diluted Basis	
Earnings	25,00,000
No. of shows	5,80,000
EPS	4.31

Question 51(Study Material TYK Q 22)

A convertible bond with a face value of ₹ 1,000 is issued at ₹ 1,350 with a coupon rate of 10.5%. The conversion rate is 14 shares per bond. The current market price of bond and share is ₹ 1,475 and ₹ 80 respectively. What is the premium over conversion value?

Solution

Conversion rate is 14 shares per bond.

Market price of share ₹ 80

Conversion Value 14 x ₹ 80 = ₹ 1120

Market price of bond = ₹ 1475

Premium over Conversion Value (₹ 1475 - ₹ 1120) = $\frac{355}{1120} \times 100 = 31.7\%$

Question 52(Study Material TYK Q 24)/MTP April'18/Similar Q asked in PP July'21

The data given below relates to a convertible bond:

Face value	₹ 250
Coupon rate	12%
No. of shares per bond	20
Market price of share	₹ 12
Straight value of bond	₹ 235
Market price of convertible bond	₹ 265

Calculate:

(i) Stock value of bond.
(ii) The percentage of downside risk.
(iii) The conversion premium
(iv) The conversion parity price of the stock.

Solution

(i) Stock value or conversion value of bond

12 × 20 = ₹ 240

(ii) Percentage of the downside risk

$$\frac{₹\,265 - ₹\,235}{₹\,235} = 0.1277 \text{ or } 12.77\% \text{ or } \frac{₹\,265 - ₹\,235}{₹\,265} = 0.1132 \text{ or } 11.32\%$$

This ratio gives the percentage price decline experienced by the bond if the stock becomes worthless.

(iii) Conversion Premium

$$\frac{\text{Market Price} - \text{Conversion Value}}{\text{Conversion Value}} \times 100$$

$$\frac{₹\,265 - ₹\,240}{₹\,240} \times 100 = 10.42\%$$

(iv) Conversion Parity Price

$$\frac{\text{Bond Price}}{\text{No. of shares on Conversion}}$$

$$\frac{₹\,265}{20} = ₹\,13.25$$

This indicates that if the price of shares rises to ₹ 13.25 from ₹ 12 the investor will neither gain nor lose on buying the bond and exercising it. Observe that ₹ 1.25 (₹ 13.25 – ₹ 12.00) is 10.42% of ₹ 12, the Conversion Premium.

Question 53(Old PM)

Pineapple Ltd has issued fully convertible 12 percent debentures of ₹ 5,000 face value, convertible into 10 equity shares. The current market price of the debentures is ₹ 5,400. The present market price of equity shares is ₹ 430.

Calculate:

(i) The conversion percentage premium, and
(ii) The conversion value

Solution

(i) As per the conversion terms 1 Debenture = 10 equity share and since face value of one debenture is ₹ 5000 the value of equity share becomes ₹ 500 (5000/10).

The conversion terms can also be expressed as:

1 Debenture of ₹ 500 = 1 equity share.

The cost of buying ₹ 500 debenture (one equity share) is:

$$₹\,500 \times \frac{5400}{500} = ₹\,540$$

Market Price of share is ₹ 430. Hence conversion premium in percentage is:

$$\frac{540 - 430}{430} \times 100 = 25.58\%$$

(ii) The conversion value can be calculated as follows:

Conversion value = Conversion ratio X Market Price of Equity Shares

= 10 × ₹ 430 = ₹ 4300

Question 54(Old PM)/MTP Aug'18

GHI Ltd., AAA rated company has issued, fully convertible bonds on the following terms, a year ago:

Face value of bond	₹ 1000
Coupon (interest rate)	8.5%
Time to Maturity (remaining)	3 years
Interest Payment	Annual, at the end of year
Principal Repayment	At the end of bond maturity
Conversion ratio (Number of shares per bond)	25
Current market price per share	₹ 45
Market price of convertible bond	₹ 1175

AAA rated company can issue plain vanilla bonds without conversion option at an interest rate of 9.5%.

Required: Calculate as of today:

(i) Straight Value of bond.
(ii) Conversion Value of the bond.
(iii) Conversion Premium.
(iv) Percentage of downside risk.
(v) Conversion Parity Price.

T	1	2	3
PVIF0.095, t	0.9132	0.8340	0.7617

Solution

(i) Straight Value of Bond

₹ 85 x 0.9132 + ₹ 85 x 0.8340 + ₹ 1085 x 0.7617 = ₹ 974.96

(ii) Conversion Value

Conversion Ratio x Market Price of Equity Share

= ₹ 45 x 25 = ₹ 1,125

(iii) Conversion Premium

Conversion Premium = Market Conversion Price - Market Price of Equity Share

$$= \frac{₹\,1{,}175}{25} - ₹\,45 = ₹\,2$$

or = ₹ 1,175 - ₹ 45 x 25 = ₹ 50

or $\frac{₹\,1{,}175 - ₹\,1{,}125}{1{,}125} = 4.47\%$

(iv) Percentage of Downside Risk

$$= \frac{₹\,1{,}175 - ₹\,974.46}{₹\,974.96} \times 100 = 20.52\% \text{ or } \frac{₹\,1{,}175 - ₹\,974.46}{₹\,1{,}175} = 17.02$$

(v) Conversion Parity Price

$$\frac{\text{Bond Price}}{\text{No. of Share on Conversion}}$$

$$= \frac{₹\,1{,}175}{25} = ₹\,47$$

Question 55(Old PM)/RTP Nov'21

The following data is related to 8.5% Fully Convertible (into Equity shares) Debentures issued by JAC Ltd. at ₹ 1000.

Market Price of Debenture	₹ 900
Conversion Ratio	30
Straight Value of Debenture	₹ 700
Market Price of Equity share on the date of Conversion	₹ 25
Expected Dividend Per Share	₹ 1

You are required to calculate:

(i) Conversion Value of Debenture
(ii) Market Conversion Price
(iii) Conversion Premium per share
(iv) Ratio of Conversion Premium
(v) Premium over Straight Value of Debenture
(vi) Favourable income differential per share
(vii) Premium payback period

Solution

(i) Conversion Value of Debenture

= Market Price of one Equity Share x Conversion Ratio

= ₹ 25 X 30 = ₹ 750

(ii) Market Conversion Price

$$= \frac{\text{Market Price of Convertible Debenture}}{\text{Conversion Ratio}}$$

$$= \frac{₹\,900}{30} = ₹\,30$$

(iii) Conversion Premium per share

Market Conversion Price – Market Price of Equity Share

= ₹ 30 – ₹ 25 = ₹ 5

(iv) Ratio of Conversion Premium

$$\frac{\text{Conversion premium per share}}{\text{Market Price of Equity Share}} = \frac{₹\,5}{₹\,25} = 20\%$$

(v) Premium over Straight Value of Debenture

$$\frac{\text{Market Price of Convertible Bond}}{\text{Straight Value of Bond}} - 1 = \frac{₹\,900}{₹\,700} - 1 = 28.6\%$$

(vi) Favourable income differential per share

$$\frac{\text{Coupon Interest from Debenture} - \text{Conversion Ratio} \times \text{Dividend Per Share}}{\text{Conversion Ratio}}$$

$$\frac{₹\,85 - 30 \times ₹\,1}{30} = ₹\,1.833$$

(vii) Premium payback period

$$\frac{\text{Conversion Premium per share}}{\text{Favourable Income Differential Per Share}} = \frac{₹\,5}{₹\,1.833} = 2.73 \text{ years}$$

Question 56(Old PM)

Tiger Ltd. is presently working with an Earning Before Interest and Taxes (EBIT) of ₹ 90 lakhs. Its present borrowings are as follows:

	₹ In lakhs
12% term loan	300
Working capital borrowings:	
From Bank at 15%	200
Public Deposit at 11%	100

The sales of the company are growing and to support this, the company proposes to obtain additional borrowing of ₹ 100 lakhs expected to cost 16%. The increase in EBIT is expected to be 15%.

Calculate the change in interest coverage ratio after the additional borrowing is effected and comment on the arrangement made.

Solution

Calculation of Present Interest Coverage Ratio

Present EBIT = ₹ 90 lakhs

Interest charges (Present)	₹ lakhs
Term loan @ 12%	36.00
Bank Borrowings @ 15%	30.00
Public Deposit @ 11%	11.00
	77.00

Present Interest Coverage Ratio $= \frac{\text{EBIT}}{\text{Interest Charges}}$

$= \frac{₹\ 90\ \text{lakhs}}{₹\ 77\ \text{lakhs}} = 1.169$

Calculation of Revised Interest Coverage Ratio

Revised EBIT (115% of ₹ 90 lakhs)	₹103.50 lakhs
Proposed interest charges	
Existing charges	₹ 77.00 lakhs
Add: Additional charges (16% of additional Borrowings i.e. ₹ 100 lakhs)	₹ 16.00 lakhs
Total	**₹ 93.00 lakhs**

Revised Interest Coverage Ratio = $\frac{₹\ 103.50\ \text{lakhs}}{₹\ 93\ .00\ \text{lakhs}} = 1.113$

Analysis: With the proposed increase in the sales the burden of interest on additional borrowings of ₹ 100 lakhs will adversely affect the interest coverage ratio which has been reduced. (i.e. from 1.169 to 1.113).

Question 57

The HLL has ₹ 8.00 crore of 10% mortgage bonds outstanding under an open-end scheme. The scheme allows additional bonds to be issued as long as all of the following conditions are met:

1) Pre – tax interest coverage $\left(\frac{\text{Income before tax+Bond Interest}}{\text{Bond Interest}}\right)$ remains greater than 4
2) Net depreciated value of mortgage assets remains twice the amount of the mortgage debt.
3) Debt-to-equity ratio remains below 0.50

The HLL has net income after taxes of ₹ 2 crores and a 40% tax-rate, ₹ 40 crores in equity and ₹ 30 crores in depreciated assets, covered by the mortgage.

Assuming that 50% of the proceeds of a new issue would be added to the base of mortgaged assets and that the company has no Sinking Fund payments until next year, how much more 10% debt could be sold under each of the three conditions? Which protective covenant is binding?

Solution

Let x be the crores of Rupees of new 10% debt which would be sold under each of the three given conditions. Now, the value of x under each of the three conditions is as follows:

1) Pre – tax interest coverage$\left(\frac{\text{Income before tax+Bond Interest}}{\text{Bond Interest}}\right)$ remains greater than 4

₹ 2 crores$\frac{(1-0.4)+8 \text{ crores } \times 0.1+\text{x } \times 0.1}{(8 \text{ crores } \times 0.1)+(\text{x } \times \text{ } 0.1)}=4$

Or $\frac{₹ 3.33 \text{ crores}+0.80 \text{ crores}+0.10\text{x}}{(0.80 \text{ cro} \quad ₹ 0.10\text{x})}=4$

Or $\frac{₹ 4.13 \text{ crores}+0.10\text{x}}{₹ 0.80 \text{ crores}+ ₹ 0.10\text{x}}=4$

Or ₹ 4.13 crores + 0.10x = 4(₹ 0.80 crores + ₹ 0.10x)

Or ₹ 4.13 crores + 0.10x = ₹ 3.2 crores + ₹ 0.40x

Or ₹ 0.30x = 0.93

Or x = ₹ 0.93/0.30

Or x = ₹ 3.10 crores

Additional mortgage required shall be a maximum of ₹ 3.10 crores

2) Net depreciated value of mortgage assets remains twice the amount of mortgage debt.

(Assuming that 50% of the proceeds of new issue would be added to the base of mortgage assets.)

i.e. $\frac{₹ 30 \text{ crores}+0.5\text{x}}{₹ 8 \text{ crores}+\text{x}}=2$

or ₹ 30 crores + 0.5x = 2(₹ 8 crores + x)

or ₹ 1.5x = ₹ 14 crores

or = $\frac{₹ 14 \text{ crores}}{1.5}$

or x = ₹ 9.33 crores

Additional mortgage required to satisfy condition No. 2 is ₹ 9.33 crores

Debt to equity ratio remains below 5

i.e. $\frac{₹ 8 \text{ crores}+\text{x}}{₹ 40 \text{ crores}}=0.50$

or ₹ 8 crores + x = ₹ 20 crores

or x = ₹ 12 crores

Since all the conditions are to be met, the least i.e. ₹ 3.10 crores (as per condition – 1) can be borrowed by issuing additional bonds.

Thus, binding conditions are met and it limits the amount of new debt to ₹ 3.10 crore.

Question 58 (Old PM)/MTP April'19

The following data is available for a bond:

Face value	₹ 1,000
Coupon Rate	11%
Years to Maturity	6
Redemption value	₹ 1,000
Yield to maturity	15%

(Round - off your answers to 3 decimals)

Calculate the following in respect of the bond:

(i) Current Market Price.
(ii) Duration of the Bond.
(iii) Volatility of the Bond.
(iv) Expected market price if increases in required yield is by 100 basis points.
(v) Expected market price if decreases in required yield is by 75 basis points.

Solution

(i) Calculation of Market Price:

$$TM = \frac{\text{Coupon Interest} + \left(\frac{\text{Discount or premium}}{\text{Years left}}\right)}{\frac{\text{Face value} + \text{Market value}}{2}}$$

(ii) Discount or premium – YTM is more than coupon rate, market price is less than Face Value i.e. at discount.

Let x be the market price

$$0.15 = \frac{110 + \left(\frac{(1000 - x)}{6}\right)}{\frac{1000 + x}{2}}$$

x = ₹ 834.48

Alternatively, it can also be calculated using Tabular Method.

(iii) Duration

Year	Cash Flow	P.V. @ 15%		Proportion of Bond value	Proportion of Bond value x times (years)
1	110	.870	95.70	0.113	0.113
2	110	.756	83.16	0.098	0.196
3	110	.658	72.38	0.085	0.255
4	110	.572	62.92	0.074	0.296
5	110	.497	54.67	0.064	0.320
6	1110	.432	479.52	0.565	3.39
			848.35	**1.000**	**4.570**

Duration of the bond is 4.570 years

(iv) Volatility

Volatility of the bond = $\frac{\text{Duration}}{(1+\text{yields})} = \frac{4.570}{1.15} = 3.974$

The expected market price if increase in required yield is by 100 basis points.

= ₹ 834.48 x 1.00(3.974/100) = ₹ 33.162

Hence expected market price is ₹ 834.48 - ₹ 33.162 = ₹ 801.318

Alternatively, this can also be calculated as follows:

₹ 848.35 x 1.00 (3.794/100) = 33.71

Hence expected market price is ₹ 848.35 - ₹ 33.71 = ₹ 814.64

Thus, the market price will decrease.

(v) The expected market price if decrease in required yield is by 75 basis points.

= ₹ 834.48 x 0.75(3.974/100) = ₹ 24.87

Hence expected market price is ₹ 834.48 + ₹ 24.87 = ₹ 859.35

Alternatively, this can also be calculated as follows:

848.35 x 0.75 (3.974/100) = ₹ 25.29

Hence, expected market price = 848.35 – 25.29 = ₹ 823.06

Thus, the market price will increase

Question 59 (Study Material TYK Q 26)

The following data are available for a bond

Face value	₹ 1,000
Coupon Rate	16%
Years to Maturity	6
Redemption value	₹ 1,000
Yield to maturity	17%

What is the current market price, duration and volatility of this bond? Calculate the expected market price, if increase in required yield is by 75 basis points.

Solution

1) **Calculation of Market price:**

$$\text{TM} = \frac{\text{Coupon Interest} + \left(\frac{\text{Discount or premium}}{\text{Years left}}\right)}{\frac{\text{Face value} + \text{Market value}}{2}}$$

Discount or premium – YTM is more than coupon rate, market price is less than Face Value i.e. at discount.

Let x be the market price

$$0.17 = \frac{160 + \left(\frac{(1000 - x)}{6}\right)}{\frac{1000 + x}{2}}$$

x = ₹ 960.26

Alternatively, the candidate may attempt by

160(PVIAF 17%,6) + 1,000 (PVIF 17%,6)

= 160 (3.589) + 1,000 (0.390) = 574.24 + 390 = 964.24

2) Duration

Year	Cash flow	P.V. @ 17%		Proportion of bond value	Proportion of bond value x time (years)
1	160	.855	136.80	0.142	0.142
2	160	.731	116.96	0.121	0.246
3	160	.624	99.84	0.103	0.309
4	160	.534	85.44	0.089	0.356
5	160	.456	72.96	0.076	0.380
6	1160	.390	452.40	0.469	2.814
			964.40	**1.000**	**4.247**

Duration of the Bond is 4.247 years

Alternatively, as per Short Cut Method

$$D = \frac{1 + \text{YTM}}{\text{YTM}} - \frac{(1 + \text{YTM}) + t(c - \text{YTM})}{c[(1 + \text{YTM})^t - 1] + \text{YTM}}$$

Where YTM = Yield to Maturity

c = Coupon Rate

t = Years to Maturity

$$= \frac{1.17}{0.17} - \frac{1.17 + 6(0.16 - 0.17)}{0.16[(1.17)^6 - 1] + 0.17}$$

D = 4.24 years

3) Volatility

Volatility of the bonds = $\frac{\text{Durations}}{(1+\text{yields})} = \frac{4.247}{1.17} = 3.63$ Or $= \frac{4.2422}{1.17} = 3.6258$

4) The expected market price if increase in required yield is by 75 basis points.

= ₹ 960.26 x .75 (3.63/100) = ₹ 26.142

Hence expected market price is ₹ 960.26 – ₹ 26.142 = ₹ 934.118

Hence, the market price will decrease

This portion can also be alternatively done as follows

= ₹ 964.40 x .75 (3.63/100) = ₹ 26.26

then the market price will be = ₹ 964.40 - ₹ 26.26 = ₹ 938.14

Question 60 (Study Material TYK Q 27)/RTP Nov'21/MTP Aug'18/MTP March'22

Mr. A will need ₹ 1,00,000 after two years for which he wants to make one time necessary investment now. He has a choice of two types of bonds. Their details are as below:

	Bond X	Bond Y
Face value	₹ 1,000	₹ 1,000
Coupon	7% payable annually	8% payable annually
Years to maturity	1	4
Current price	₹ 972.73	₹ 936.52
Current yield	10%	10%

Advice Mr. A whether he should invest all his money in one type of bond or he should buy both the bonds and, if so, in which quantity? Assume that there will not be any call risk or default risk.

Solution

Duration of Bond X

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	1070	.909	972.63	1.000	1.000

Duration of the Bond is 1 year

Duration of Bond Y

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	80	.909	72.72	0.077	0.077
2	80	.826	66.08	0.071	0.142
3	80	.751	60.08	0.064	0.192
4	1080	.683	737.64	0.788	3.152
			936.52	**1.000**	**3.563**

Duration of the Bond is 3.563 years

Let x1 be the investment in Bond X and therefore investment in Bond Y shall be (1 - x1). Since the required duration is 2 years the proportion of investment in each of these two securities shall be computed as follows:

2 = x1 + (1 - x1) 3.563

x1 = 0.61

Accordingly, the proportion of investment shall be 61% in Bond X and 39% in Bond Y respectively.

Amount of investment

Bond X	Bond Y
PV of ₹ 1,00,000 for 2 years @ 10% x 61% = ₹ 1,00,000 (0.826) x 61% = ₹ 50,386 No. of Bonds to be purchased = ₹ 50,386/₹ 972.63 = 51.80 i.e. approx. 52 bonds	PV of ₹ 1,00,000 for 2 years @ 10% x 39% = ₹ 1,00,000 (0.826) x 39% = ₹ 32,214 No. of Bonds to be purchased = ₹ 32,214/₹ 936.52 = 34.40 i.e. approx. 34 bonds

Note: The investor has to keep the money invested for two years. Therefore, the investor can invest in both the bonds with the assumption that Bond X will be reinvested for another one year on same returns.

Further, in the above computation, Modified Duration can also be used instead of Duration.

Question 61 (Old PM)

Mr. A is planning for making investment in bonds of one of the two companies X Ltd. and Y Ltd. The detail of these bonds is as follows:

Company	Face Value	Coupon Rate	Maturity Period
X Ltd.	₹ 10,000	6%	5 Years
Y Ltd.	₹ 0,000	4%	5 Years

The current market price of X Ltd.'s bond is ₹ 10,796.80 and both bonds have same Yield To Maturity (YTM). Since Mr. A considers duration of bonds as the basis of decision making, you are required to calculate the duration of each bond and you decision.

Solution

To calculate duration of bond we need YTM, which shall be calculated as follows:

Let us try NPV of Bond @ 5%

$$= \frac{600}{(1.05)^1} + \frac{600}{(1.05)^2} + \frac{600}{(1.05)^3} + \frac{600}{(1.05)^4} + \frac{10{,}600}{(1.05)^5} - 10{,}796.80$$

= ₹ 571.43 + ₹ 544.22 + ₹ 518.30 + ₹ 493.62 + ₹ 8,305.358 - ₹ 10,796.80 = - ₹ 363.85

Let us now try NPV @ 4%

$$= \frac{600}{(1.04)^1} + \frac{600}{(1.04)^2} + \frac{600}{(1.04)^3} + \frac{600}{(1.04)^4} + \frac{10{,}600}{(1.04)^5} - 10{,}796.80$$

= ₹ 576.92 + ₹ 554.73 + ₹ 533.40 + ₹ 512.88 + ₹ 712.43 – ₹ 10,796.80 = ₹ 93.56

Let us now interpolation formula

$$= 4\% + \frac{93.56}{93.56 - (-363.85)} \times (5\% - 4\%)$$

$$= 4\% + \frac{93.56}{93.56 + 363.85}$$

$= 4\% + \frac{93.56}{457.41} = 4.20\%$

Duration of X Ltd.' s Bond

Year	Cash flow	P.V. @ 4.2%		Proportion of bond value	Proportion of bond value x time (years)
1	600	0.9597	575.82	0.0533	0.0533
2	600	0.9210	552.60	0.0512	0.1024
3	600	0.8839	530.34	0.0491	0.1473
4	600	0.8483	508.98	0.0472	0.1888
5	10600	0.8141	8,629.46	0.7992	3.9960
			10,797.20	**1.0000**	**4.4878**

Duration of the Bond is 4.4878 years say 4.49 years.

Duration of Y Ltd.'s Bond

Year	Cash flow	P.V. @ 4.2%		Proportion of bond value	Proportion of bond value x time (years)
1	400	0.9597	383.88	0.0387	0.0387
2	400	0.9210	368.40	0.0372	0.0744
3	400	0.8839	353.56	0.0357	0.1071
4	400	0.8483	339.32	0.0342	0.1368
5	10400	0.8141	8,466.64	0.8542	4.2710
			9,911.80	**1.0000**	**4.6280**

Duration of the Bond is 4.6280 years say 4.63 years.

Decision: Since the duration of Bond of X Ltd. is lower and also carrying higher interest rate hence it should be preferred.

Question 62 (Old PM)

Find the current market price of a bond having face value ₹ 1,00,000 redeemable after 6 year maturity with YTM at 16% payable annually and duration 4.3202 years. Given $1.16^6 = 2.4364$.

Solution

The formula for the duration of a coupon bond is as follows:

$$= \frac{1 + \text{YTM}}{\text{YTM}} - \frac{(1 + \text{YTM}) + \text{t}(\text{c} - \text{YTM})}{\text{c}[(1 + \text{YTM})^{\text{t}} - 1] + \text{YTM}}$$

Where

YTM = Yield to Maturity

c = Coupon Rate

t = Years to Maturity

Accordingly, since YTM =0.16 and t = 6

$4.3202 = \frac{1.16}{0.16} - \frac{1.16+6(c-0.16)}{c[(1.16)^6-1]+0.16}$

$4.3202 = 7.25 - \frac{1.16+(6c-0.96)}{1.4364c+0.16}$

$\frac{1.16 + 6c - 0.96}{1.4364c + 0.16} = 2.9298$

$0.2 + 6c = 4.20836472c + 0.468768$

$1.79163528c = 0.268768$

$C = 0.150012674$

Therefore, C = 0.15

Where c = Coupon rate

Therefore, current price = ₹ (1,00,000/- x 0.15 x 3.685 + 1,00,000/- x 0.410) = ₹ 96,275/-.

Alternatively, it can also be calculated as follows:

Let x be annual coupon payment. Accordingly, the duration (D) of the Bond shall be

Year	CF	PVIF 16% PV (CF)	PV (CF)
1	X	0.862	0.862x
2	X	0.743	0.743x
3	X	0.641	0.641x
4	X	0.552	0.552x
5	X	0.476	0.476x
6	x +100000	0.410	0.410x + 41000
			3.684x + 41000

$$D = \frac{0.862x}{3.684\,x + 41000} \times 1 + \frac{0.743x}{3.684\,x + 41000} \times 2 + \frac{0.641x}{3.684\,x + 41000} \times 3 + \frac{0.552x}{3.684\,x + 41000} \times 4$$

$$+ \frac{0.476x}{3.684\,x + 41000} \times 5 + \frac{(0.410x + 41000)}{3.684\,x + 41000} \times 6$$

$4.3202 = \frac{11.319x + 246000}{3.684x + 41000}$

x = ₹ 14,983 i.e. 14.98% say 15%

Accordingly, current price of the Bond shall be:

= 1,00,000 × 0.15 × PVAF (16%, 6) + 1,00,000 × PVF (16%, 6)

= 15,000 × 3.685 + 1,00,000 × 0.410 = ₹ 96,275

Question 63 (Old PM)/MTP March'18/PP May'18

Closing values of BSE Sensex from 6th to 17th day of the month of January of the year 200X were as follows:

Days	Date	Day	Sensex
1	6	THU	14522
2	7	FRI	14925
3	8	SAT	No Trading
4	9	SUN	No Trading
5	10	MON	15222
6	11	TUE	16000
7	12	WED	16400
8	13	THU	17000
9	14	FRI	No Trading
10	15	SAT	No Trading
11	16	SUN	No Trading
12	17	MON	18000

Calculate Exponential Moving Average (EMA) of Sensex during the above period. The 31 days simple moving average of Sensex can be assumed as 15,000. The value of exponent for 31 days EMA is 0.062.

Give detailed analysis on the basis of your calculations.

Solution

	1	2	3	4	5
Date	Sensex	EMA for Previous day	1-2	3×0.062	EMA 2 + 4
6	14522	15000	(478)	(29.636)	14970.364
7	14925	14970.364	(45.364)	(2.812)	14967.55
10	15222	14967.55	254.45	15.776	14983.32
11	16000	14983.32	1016.68	63.034	15046.354
12	16400	15046.354	1353.646	83.926	15130.28
13	17000	15130.28	1869.72	115.922	15246.202
17	18000	15246.202	2753.798	170.735	15416.937

Conclusion – The market is bullish. The market is likely to remain bullish for short term to medium term if other factors remain the same. On the basis of this indicator (EMA) the investors / brokers can take long position.

Question 64 (Old PM)/MTP Oct'18/MTP April'21

The closing value of Sensex for the month of October, 2007 is given below:

Date Closing	Sensex Value
1.10.07	2800
3.10.07	2780
4.10.07	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360
22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	3260

You are required to test the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance.

Following value can be used :

Value of t at 5% is 2.101 at 18 degrees of freedom

Value of t at 10% is 1.734 at 18 degrees of freedom

Solution

Date	Closing Sensex	Sign of Price Charge
1.10.07	2800	
3.10.07	2780	-
4.10.07	2795	+
5.10.07	2830	+
8.10.07	2760	-
9.10.07	2790	+
10.10.07	2880	+
11.10.07	2960	+
12.10.07	2990	+
15.10.07	3200	+
16.10.07	3300	+

17.10.07	3450	+
19.10.07	3360	-
22.10.07	3290	-
23.10.07	3360	+
24.10.07	3340	-
25.10.07	3290	-
29.10.07	3240	-
30.10.07	3140	-
31.10.07	3260	+

Total of sign of price changes (r) = 8
No of Positive changes = n1 = 11

No. of Negative changes = n2 = 8

$\mu_{r=} \frac{2n_1n_2}{n_1+n_2}+1$

$\mu = \frac{2\times11\times8}{11+8} + 1 = \frac{176}{19} + 1 = 10.26$

$\hat{\sigma}_r = \sqrt{\frac{2n_1n_2(2n_1n_2-n_1-n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$

$\hat{\sigma}_r = \sqrt{\frac{(2\times11\times8)(2\times11\times8-11-8)}{(11+8)^2(11+8-1)}} = \sqrt{\frac{176\times157}{(19)^2\,(18)}} = \sqrt{4.252}$ = 2.06

Since too few runs in the case would indicate that the movement of prices is not random. We employ a two- tailed test the randomness of prices.

Test at 5% level of significance at 18 degrees of freedom using t- table

The lower limit $= \mu - t \times \hat{\sigma}_r$ = 10.26 – 2.101 x 2.06 = 5.932

Upper limit $= \mu - t \times \hat{\sigma}_r$ = 10.26 + 2.101 x 2.06 = 14.588

Test At 10% level of significance at 18 degrees of freedom

Lower limit = 10.26 – 1.734 × 2.06 = 6.688

Upper limit = 10.26 + 1.734 × 2.06 = 13.832

As seen r lies between these limits. Hence, the market exhibits weak form of efficiency.

*For a sample of size n, the t distribution will have n-1 degrees of freedom.

Question 65 (Old PM)
M/s X Ltd. has paid a dividend of ₹ 2.5 per share on a face value of ₹ 10 in the financial year ending on 31st March, 2009. The details are as follows:

Current market price of share	₹ 60
Growth rate of earnings and dividends	10%
Beta of share	0.75
Average market return	15%
Risk free rate of return	9%

Calculate the intrinsic value of the share.

Solution

Intrinsic Value $P_0 = \frac{D_1}{k-g}$

Using CAPM

K =$R_f + \beta (R_m - R_f)$

R_f = Risk Free Rate

β = Beta of Security

R_m = Market Return

= 9% + 0.75 (15% - 9%) = 13.5%

P = $\frac{2.5 \times 1.1}{0.135-0.10} = \frac{2.75}{0.035} =$ ₹ 78.57

Question 66 (Old PM)/MTP Oct'18

Capital structure of Sun Ltd., as at 31.3.2003 was as under:

	(₹ in lakhs)
Equity share capital	80
8% Preference share capital	40
12% Debentures	64
Reserves	32

Sun Ltd., earns a profit of ₹ 32 lakhs annually on an average before deduction of income-tax, which works out to 35%, and interest on debentures.

Normal return on equity shares of companies similarly placed is 9.6% provided:

a) Profit after tax covers fixed interest and fixed dividends at least 3 times.
b) Capital gearing ratio is 0.75.
c) Yield on share is calculated at 50% of profits distributed and at 5% on undistributed profits.

Sun Ltd., has been regularly paying equity dividend of 8%.

Compute the value per equity share of the company assuming:

(i) 1% for every one time of difference for Interest and Fixed Dividend Coverage.
(ii) 2% for every one time of difference for Capital Gearing Ratio.

Solution

a) Calculation of Profit after tax (PAT)

	₹
Profit before interest and tax (PBIT)	32,00,000
Less: Debenture interest (₹ 64,00,000 × 12/100)	7,68,000
Profit before tax (PBT)	24,32,000
Less: Tax @ 35%	8,51,200
Profit after tax (PAT)	15,80,800
Less: Preference Dividend	
(₹ 40,00,000 × 8/100) 3,20,000	
Equity Dividend (₹ 80,00,000 × 8/100) 6,40,000	9,60,000
Retained earnings (Undistributed profit)	6,20,800

Calculation of Interest and Fixed Dividend Coverage

$$= \frac{\text{PAT+Debenture Interest}}{\text{Debenture Interest+Preference Dividend}}$$

$$= \frac{15,80,800+7,68,000}{7,68,000+ 3,20,000} = \frac{23,48,800}{10,88,000} = 2.16 \text{ times}$$

b) Calculation of Capital Gearing Ratio

$$\text{Capital Gearing Ratio} = \frac{\text{Fixed interest bearing funds}}{\text{Equity Shareholders' funds}}$$

$$= \frac{\text{Preference Share Capital + Debentures}}{\text{Equity Share Capital + Reserves}} = \frac{40,00,000 + 64,00,000}{80,00,000 + 32,00,000} = \frac{1,04,00,000}{1,12,00,000} = 0.93$$

c) Calculation of Yield on Equity Shares:

Yield on equity shares is calculated at 50% of profits distributed and 5% on undistributed profits: (₹)

50% on distributed profits (₹ 6,40,000 × 50/100)	3,20,000
5% on undistributed profits (₹ 6,20,800 × 5/100)	31,040
Yield on equity shares	3,51,040
Yield on equity shares % = $\frac{\text{Yield on shares}}{\text{Equity Share Capital}} \times 100$ $= \frac{3,51,040}{80,00,000} \times 100 = 4.39\% \text{ or, } 4.388\%$	

Calculation of Expected Yield on Equity shares

(i) Interest and fixed dividend coverage of Sun Ltd. is 2.16 times but the industry average is 3 times. Therefore, risk premium is added to Sun Ltd. Shares @ 1% for every 1 time of difference. Hence,

Risk Premium = 3.00 – 2.16 (1%) = 0.84 (1%) = 0.84%

(ii) Capital Gearing ratio of Sun Ltd. is 0.93 but the industry average is 0.75 times. Therefore, risk premium is added to Sun Ltd. shares @ 2% for every 1 time of difference. Hence,

Risk Premium = (0.75 - 0.93) (2%) = 0.18 (2%) = 0.36%

	(%)
Normal return expected	9.60
Add: Risk premium for low interest and fixed dividend coverage	0.84
Add: Risk premium for high interest gearing ratio	0.36
	10.80
Value of Equity Share $= \frac{\text{Actual yield}}{\text{Expected yield}} \times \text{Paid} - \text{up value of share} = \frac{4.39}{10.80} \times 100$	₹ 40.65

Question 67 (Old PM)/MTP Oct'19

A Ltd. has issued convertible bonds, which carries a coupon rate of 14%. Each bond is convertible into 20 equity shares of the company A Ltd. The prevailing interest rate for similar credit rating bond is 8%. The convertible bond has 5 years maturity. It is redeemable at par at ₹ 100. The relevant present value table is as follows.

Present values	t1	t2	t3	t4	t5
PVIF0.14, t	0.877	0.769	0.675	0.592	0.519
PVIF0.08, t	0.926	0.857	0.794	0.735	0.681

You are required to estimate:

(Calculations be made upto 3 decimal places)

(i) current market price of the bond, assuming it being equal to its fundamental value,

(ii) minimum market price of equity share at which bond holder should exercise conversion option; and

(iii) duration of the bond.

Solution

(i) Current Market Price of Bond

Time	CF	PVIF 8% PV (CF)	PV (CF)
1	14	0.926	12.964
2	14	0.857	11.998
3	14	0.794	11.116
4	14	0.735	10.290
5	114	0.681	77.634
		Σ PV (CF) i.e. P0 =	**124.002**
Say			**124**

(ii) Minimum Market Price of Equity Shares at which Bondholder should exercise conversion option:

$$\frac{124.00}{20.00} = \text{Rs. } 6.20$$

(iii) Duration of the Bond

Year	Cash flow	P.V. @ 8%		Proportion of bond value	Proportion of bond value x time (years)
1	14	0.926	12.964	0.105	0.105
2	14	0.857	11.998	0.097	0.194
3	14	0.794	11.116	0.089	0.267
4	14	0.735	10.290	0.083	0.332
5	114	0.681	77.634	0.626	3.130
			124.002	**1.000**	**4.028**

Question 68 (Old PM)

XYZ Ltd. paid a dividend of ₹ 2 for the current year. The dividend is expected to grow at 40% for the next 5 years and at 15% per annum thereafter. The return on 182 days T - bills is 11% per annum and the market return is expected to be around 18% with a variance of 24%.

The co-variance of XYZ's return with that of the market is 30%. You are required to calculate the required rate of return and intrinsic value of the stock.

Solution

$$\beta = \frac{\text{Covariance of Market Return and Security Return}}{\text{Variance of Market Return}}$$

$$\beta = \frac{30\%}{24\%} = 1.25$$

Expected Return = Rf + β (Rm - Rf)

= 11% + 1.25(18% - 11%)

= 11% + 8.75% = 19.75%

Intrinsic Value

Year	Dividend (₹)	PVF (19.75%,n)	Present Value (₹)
1	2.80	0.835	2.34
2	3.92	0.697	2.73
3	5.49	0.582	3.19
4	7.68	0.486	3.73
5	10.76	0.406	4.37
			16.36

PV of Terminal Value = $\frac{10.76(1.15)}{0.1975-0.15} \times 0.406 = ₹\ 105.77$

Intrinsic Value = ₹ 16.36 + ₹ 105.77 = ₹ 122.13

Question 69 (Study Material TYK Q 28)
RBI sold a 91- day T- Bill of face value of ₹ 100 at an yield of 6%. What was the issue price?

Solution
Let the issue price be x

By the terms of the issue of the T- Bills:

$$6\% = \frac{(100 - x)}{x} \times \frac{365}{91} \times 100$$

$$\frac{6 \times 91 \times x}{36{,}500} = (100 - x)$$

0.01496x = 100 – x

$$x = \frac{100}{1.01496} = ₹\,98.53$$

Question 70 (Study Material TYK Q 29)
Wonderland Limited has excess cash of ₹ 20 lakhs, which it wants to invest in short term marketable securities. Expenses relating to investment will be ₹ 50,000.

The securities invested will have an annual yield of 9%.

The company seeks your advice
(i) as to the period of investment so as to earn a pre-tax income of 5%. (discuss)
(ii) the minimum period for the company to breakeven its investment expenditure overtime value of money.

Solution

(i) Pre-tax Income required on investment of ₹ 20,00,000

Let the period of Investment be 'P' and return required on investment ₹ 1,00,000 (₹ 20,00,000 x 5%)

Accordingly,

$$\left(₹\,20{,}00{,}000 \times \frac{9}{100} \times \frac{P}{12}\right) - ₹\,50{,}000 = ₹\,1{,}00{,}000$$

P = 10 months

(ii) Break-Even its investment expenditure

$$\left(₹\,20{,}00{,}000 \times \frac{9}{100} \times \frac{P}{12}\right) - ₹\,50{,}000 = 0$$

P = 3.33 months

Question 71 (Study Material TYK Q 30/MTP Nov'21)

Z Co. Ltd. issued commercial paper worth ₹10 crores as per following details:

Date of issue	16th January, 2019
Date of maturity	17th April, 2019
No. of days	91
Interest Rate	12.04% p. an.

What was the net amount received by the company on issue of CP? (Charges of intermediary may be ignored)

Solution

The company had issued commercial paper worth ₹10 crores

No. of days Involves= 91 days

Interest rate applicable = 12.04 % p.a.

Interest for 91 days = $12.04\% \times \frac{91 \text{ days}}{365 \text{ days}} = 3.002\%$

$= \text{or } ₹\ 10 \text{ crores} \times \frac{3.002}{(100 + 3.002)} = ₹\ 29{,}14{,}507$

= or ₹ 29.14507 Lakhs

Therefore, Net amount received at the time of issue :- ₹ 10.00 Crores – ₹ 0.29151 Crores

= ₹ 9.70849 Crores

Alternatively, it can also be computed as follows:

$$\text{Price} = \frac{₹\ 10 \text{ Crores}}{\left(1 + 12.04\% \text{ X } \frac{91 \text{ days}}{365 \text{ days}}\right)} = ₹\ 9.70855 \text{ Crores}$$

Question 72 (Study Material TYK Q 31)

Bank A enter into a Repo for 14 days with Bank B in 10% Government of India Bonds 2028 @ 5.65% for ₹ 8 crore. Assuming that clean price (the price that does not have accrued interest) be ₹ 99.42 and initial Margin be 2% and days of accrued interest be 262 days. You are required to determine.

(i) Dirty Price

(ii) Repayment at maturity. (consider 360 days in a year)

Solution

(i) Dirty Price

= Clean Price + Interest Accrued

$$= 99.42 + 100 \times \frac{10}{100} \times \frac{262}{360} = 106.70$$

(ii) First Leg (Start Proceed)

$$= \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Intial Margin}}{100}$$

$$= ₹\,8{,}00{,}00{,}000 \times \frac{106.70}{100} \times \frac{100 - 2}{100} = ₹\,8{,}36{,}52{,}800$$

$$\text{Second Leg (Repayment at Maturity)} = \text{Start Proceed} \times \left(1 + \text{Repo rate} \times \frac{\text{No.of Days}}{360}\right)$$

$$= ₹\,8{,}36{,}52{,}800 \times \left(1 + 0.0565 \times \frac{14}{360}\right)$$

$$= ₹\,8{,}38{,}36{,}604$$

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1 (RTP Nov'19/MTP March'18/MTP April'19)

A hypothetical company ABC Ltd. issued a 10% Debenture (Face Value of ₹ 1000) of the duration of 10 years is currently trading at ₹ 850 per debenture. The bond is convertible into 50 equity shares being currently quoted at ₹17 per share.

If yield on equivalent comparable bond is 11.80%, then calculate the spread of yield of the above bond from this comparable bond.

The relevant present value table is as follows.

Present Values	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
PVIF 0.11, t	0.901	0.812	0.731	0.659	0.593	0.535	0.482	0.434	0.391	0.352
PVIF 0.13, t	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376	0.333	0.295

Solution

Conversion Price = ₹ 50 x 17 = ₹ 850

Intrinsic Value = ₹ 850

Accordingly the yield (r) on the bond shall be:

₹ 850 = ₹ 100 PVAF (r, 10) + ₹ 1000 PVF (r, 10)

Let us discount the cash flows by 11%

850 = 100 PVAF (11%, 10) + 1000 PVF (11%, 10)

850 = 100 x 5.890 + 1000 x 0.352

= 91

Now let us discount the cash flows by 13%

850 = 100 PVAF (13%, 10) + 1000 PVF (13%, 10)

850 = 100 x 5.426 + 1000 x 0.295

= - 12.40

Accordingly, IRR

$$11\% + \frac{90.90}{90.90 - (-12.40)} \times (13\% - 11\%)$$

$$11\% + \frac{90.90}{103.30} \times (13\% - 11\%)$$

= 12.76%

The spread from comparable bond = 12.76% - 11.80% = 0.96%

Question 2 (RTP Nov'20)

Today being 1st January 2019, Ram is considering to purchase an outstanding Corporate Bond having a face value of ₹ 1,000 that was issued on 1st January 2017 which has 9.5% Annual Coupon and 20 years of original maturity (i.e. maturing on 31 st December 2027). Since the bond was issued, the interest rates have been on downside and it is now selling at a premium of ₹ 125.75 per bond. Determine the prevailing interest on the similar type of Bonds if it is held till the maturity which shall be at Par.

PV Factors:

	1	2	3	4	5	6	7	8	9
6%	0.943	0.890	0.840	0.792	0.747	0.705	0.665	0.627	0.592
8%	0.926	0.857	0.794	0.735	0.681	0.630	0.583	0.540	0.500

Solution

To determine the prevailing rate of interest for the similar type of Bonds we shall compute the YTM of this Bond using IRR method as follows:

M = ₹ 1000

Interest = ₹ 95 (0.095 x ₹ 1000)

n = 9 years

V0 = ₹ 1125.75 (₹ 1000 + ₹ 125.75)

YTM can be determined from the following equation

₹ 95 x PVIFA (YTM, 9) + ₹ 1000 x PVIF (YTM, 9) = ₹ 1125.75

Let us discount the cash flows using two discount rates 8% and 10% as follows:

Year	Cash Flows	PVF@6%	PV@6%	PVF@8%	PV@8%
0	-1125.75	1	-1125.75	1	-1125.75
1	95	0.943	89.59	0.926	87.97
2	95	0.890	84.55	0.857	81.42
3	95	0.840	79.80	0.794	75.43
4	95	0.792	75.24	0.735	69.83
5	95	0.747	70.97	0.681	64.70
6	95	0.705	66.98	0.630	59.85
7	95	0.665	63.18	0.583	55.39
8	95	0.627	59.57	0.540	51.30
9	1095	0.592	648.24	0.500	547.50
			112.37		**-32.36**

Now we use interpolation formula

$$6.00\% + \frac{112.37}{112.37 - (-32.36)} \times 2.00\%$$

$$6.00\% + \frac{112.37}{144.73} \times 2.00\% = 6.00\% + 1.553\%$$

YTM = 7.553% say 7.55%

Thus, prevailing interest rate on similar type of Bonds shall be approx. 7.55%.

Question 3 (RTP Nov'20)

The following data is available for NNTC bond:

Face Value	₹ 1000
Coupon rate	7.50%
Years to maturity	8 years
Redemption Value	₹ 1000
YTM	8%

Calculate:

(i) The current market price, duration and volatility of the bond.

(ii) The expected market price if the decrease in required yield by 50 bps.

Solution

(i) Current Market Price of Bond shall be computed as follows:

Year	Cash flows	PVF@8%	PV@8%
1	75	0.926	69.45
2	75	0.857	64.28
3	75	0.794	59.55
4	75	0.735	55.13
5	75	0.681	51.08
6	75	0.630	47.25
7	75	0.583	43.73
8	1075	0.540	580.50
			970.97

Thus, the current market price of the Bond shall be ₹ 970.97

Alternatively, using the Short - cut method the Market Price of Bond can also be computed as follows:

Interest + (Discount / Premium) / Years to maturity

(Face value + market value) / 2

Let market price be x

0.08 = 75 + (1000 – X) / 8

(1000 + X) / 2

Thus, Value of X i.e. the price of Bond shall be ₹ 969.70

For the duration of the bond, we have to see the future cash flow and discount them as follows:

Year	CF	PV @ 8%	DCF	Proportion	Prop* Time (Yrs)
1	75	0.926	69.45	0.071	0.071

2	75	0.857	64.28	0.066	0.132
3	75	0.794	59.55	0.061	0.183
4	75	0.735	55.13	0.057	0.228
5	75	0.681	51.08	0.053	0.265
6	75	0.630	47.25	0.049	0.294
7	75	0.583	43.73	0.045	0.315
8	1075	0.540	580.50	0.598	4.784
		Total	970.97	1.000	6.272

(ii) Volatility of the bond = Duration / (1+ Yield) = 6.272/1.08 = 5.81

If there is decrease in required yield by 50 bps the expected market price of the Bond shall be increased by:
= ₹ 970.97 x 0.50 (5.81 / 100) = ₹ 28.21

Hence expected market price is ₹ 970.97 + ₹ 28.21 = ₹ 999.18

Alternatively, this portion using Bond Price as per Short-cut method can also be computed as follows:
= ₹ 969.70 x 0.50 (5.81 / 100) = ₹ 28.17

then the market price will be = ₹ 969.70 + ₹ 28.17 = ₹ 997.87

Question 4 (RTP May'21/Similar to Q 17 Pragya Ltd))
KLM Limited has issued 90,000 equity shares of ₹ 10 each. KLM Limited's shares are currently selling at ₹ 72. The company has a plan to make a rights issue of one new equity share at a price of ₹ 48 for every four shares held.

You are required to:

a) Calculate the theoretical post – rights price per share and analyse the change
b) Calculate the theoretical value of the right alone.
c) Suppose Mr. A who is holding 100 shares in KLM Ltd. is not interested in subscribing to the right issue, then advice what should he do.

Solution

a) Calculation of theoretical Post – rights (ex – right) price per share

Ex – right value = $\left[\frac{MN+}{N+R}\right]$

Where,

M = Market price,
N = Number of old shares for a right share
S = Subscription price
R = Right share offer

= $\left[\frac{₹\ 72 \times 4 + ₹\ 48 \times 1}{4+1}\right]$ = ₹ 67.20

Thus, post right issue the price of share has reduced by ₹ 4.80 per share.

b) Calculation of theoretical value of the rights alone:

= Ex - right price – Cost of rights share

= ₹ 67.20 – ₹ 48 = ₹ 19.20

Or

$= \frac{₹\ 67.20 - ₹\ 48}{4}$ = ₹ 4.80

(iii) If Mr. A is not interested in subscribing to the right issue, he can renounce his right eligibility @ ₹ 19.20 per right and can earn a gain of ₹ 480.

Question 5 (MTP May'20)

A company has an EPS of Rs. 2.5 for the last year and the DPS of Rs. 1. The earnings is expected to grow at 2% a year in long run. Currently it is trading at 7 times its earnings. If the required rate of return is 14%, compute the following:

(i) An estimate of the P/E ratio using Gordon growth model.

(ii) The Long-term growth rate implied by the current P/E ratio

Solution

(i) Estimation of P/E Ratio using Gordon Growth Model

$$k_e = \frac{D_1}{P} + g$$

$$0.14 = \frac{1\ (1.02)}{P} + 0.02$$

P = ₹ 8.50

PE Ratio = $\frac{₹\ 8.50}{₹\ 2.50} = 3.40$

(ii) Long Term Growth Rate implied

Based on Current PE Ratio, the price per share = Rs. 2.50 x 7 Times = Rs. 17.50

We know that

P = D0 (1+g) / (k e – g)

Rs. 17.50 = Rs. 1(1 + g) / (0.14 – g)

17.50 x 0.14 – 17.50g = 1 + g

g = 0.0784 i.e. 7.84%

Question 6 (MTP March'21)

The following data are available for three bonds A, B and C. These bonds are used by a bond portfolio manager to fund an outflow scheduled in 6 years. Current yield is 9%. All bonds have face value of Rs.100 each and will be redeemed at par. Interest is payable annually.

Bond	Maturity (Years)	Coupon rate
A	10	10%
B	8	11%
C	5	9%

(i) Calculate the duration of each bond.

(ii) Advise the percentage amount to bond portfolio manager to be invested in bonds B and C to immunise the portfolio and he has been asked to keep 45% of the portfolio money in Bond A.

(iii) Evaluate whether the portfolio is still immunized if after the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. The new duration of bonds are: Bond A = 7.15 Years, Bond B = 6.03 Years and Bond C = 4.27 years.

(iv) Advise the new percentage of B and C bonds that are needed to immunize the portfolio. Bond A remaining at 45% of the portfolio.

Present values be used as follows :

Present Values	t1	t2	t3	t4	t5
PVIF0.09, t	0.917	0.842	0.772	0.708	0.650

Present Values	t6	t7	t8	T9	t10
PVIF0.09, t	0.596	0.547	0.502	0.460	0.4224

Solution

'(i) **Calculation of Bond Duration**

Bond A

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	10	0.917	9.17	0.086	0.086
2	10	0.842	8.42	0.079	0.158
3	10	0.772	7.72	0.073	0.219
4	10	0.708	7.08	0.067	0.268
5	10	0.650	6.50	0.061	0.305
6	10	0.596	5.96	0.056	0.336
7	10	0.547	5.47	0.051	0.357
8	10	0.502	5.02	0.047	0.376
9	10	0.460	4.60	0.043	0.387
10	110	0.4224	46.46	0.437	4.370
			106.40	1.000	6.862

Duration of the bond is 6.862 years or 6.86 year

Bond B

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	11	0.917	10.087	0.091	0.091
2	11	0.842	9.262	0.083	0.166
3	11	0.772	8.492	0.076	0.228
4	11	0.708	7.788	0.070	0.280
5	11	0.650	7.150	0.064	0.320
6	11	0.596	6.556	0.059	0.354
7	11	0.547	6.017	0.054	0.378
8	111	0.502	55.772	0.502	4.016
			111.224	1.000	5.833

Duration of the bond B is 5.833 years or 5.84 years

Bond *C*

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	9	0.917	8.253	0.082	0.082
2	9	0.842	7.578	0.076	0.152
3	9	0.772	6.948	0.069	0.207
4	9	0.708	6.372	0.064	0.256
5	109	0.650	70.850	0.709	3.545
			100.00	1.000	4.242

Duration of the bond *C* is 4.242 years or 4.24 years

'(ii) **Amount of Investment required in Bond B and *C***

Period required to be immunized	6.000 Year
Less: Period covered from Bond A	3.087 Year
To be immunized from B and *C*	**2.913 Year**

Let proportion of investment in Bond B and *C* is b and c respectively then

$b + c = 0.55$ (1)

$5.883b + 4.242c = 2.913$ (2)

On solving these equations, the value of b and c comes 0.3534 or 0.3621 and 0.1966 or 0.1879 respectively and accordingly, the % of investment of B and *C* is 35.34% or 36.21% and 19.66 % or 18.79% respectively.

'(iii) **With revised yield the Revised Duration of Bond stands**

$0.45 \times 7.15 + 0.36 \times 6.03 + 0.19 \times 4.27 = 6.20$ year

No portfolio is not immunized as the duration of the portfolio has been increased from 6 years to 6.20 years.

'(iv) **New percentage of B and C bonds that are needed to immunize the portfolio.**

Period required to be immunized	6.0000 Year
Less: Period covered from Bond A	3.2175 Year
To be immunized from B and C	**2.7825 Year**

Let proportion of investment in Bond B and C is b and c respectively, then b + c = 0.55

6.03b + 4.27c = 2.7825 b = 0.2466

On solving these equations, the value of b and c comes 0.2466 and 0.3034 respectively and accordingly, the % of investment of B and C is 24.66% or 25% and 30.34 % or 30.00% respectively.

Question 7

You are interested in buying some equity stocks of RK Ltd. The company has 3 divisions operating in different industries. Division A captures 10% of its industries sales which is forecasted to be Rs. 50 crore for the industry. Division B and C captures 30% and 2% of their respective industry's sales, which are expected to be Rs. 20 crore and Rs. 8.5 crore respectively. Division A traditionally had a 5% net income margin, whereas divisions B and C had 8% and 10% net income margin respectively. RK Ltd. has 3,00,000 shares of equity stock outstanding, which sell at Rs. 250.

The company has not paid dividend since it started its business 10 years ago. However, from the market sources you come to know that RK Ltd. will start paying dividend in 3 years time and the pay-out ratio is 30%. Expecting this dividend, you would like to hold the stock for 5 year. By analysing the past financial statements, you have determined that RK Ltd.'s required rate of return is 18% and that P/E ratio of 10 for the next year and on ending P/E ratio of 20 at the end of the fifth year are appropriate.

Evaluate:

(i) Whether you will be in purchasing RK Ltd. equity at this time based on your one year forecast?

(ii) Price you will like to pay for the stock of RK Ltd if you expect earnings to grow @ 15% continuously.

Ignore taxation.

PV factors are given below:

Years	1	2	3	4	5
PVIF@ 18%	0.847	0.718	0.609	0.516	0.437

Solution

Working Notes:

Computation of Earning Per Share (EPS)

Particulars		Amount (Rs.)
Margin of Division A	(Rs. 50 crore x 10% x 5%)	25,00,000
Margin of Division B	(Rs. 20 crore x 30% x 8%)	48,00,000
Margin of Division C	(Rs. 8.5 crore x 2% x 10%)	1,70,000

		74,70,000
No. of Equity Shares		3,00,000
EPS		Rs. 24.90

(i) **Market Price based on One Year Forecast**

Expected Market Price at the end of the year = Rs. 24.90 x 10 = Rs. 249

PV of the Expected Price = Rs. 249 x 0.847 = Rs. 210.90

I would NOT like to purchase the share as the expected market price of shares is less than its current price of Rs. 250.

(ii) **If Earning is expected to grow @ 15%**

Year	EPS (Rs.)	Dividend (Rs.)	PVF@18%	PV (Rs.)
1	28.64	---	0.847	---
2	32.93	---	0.718	---
3	37.87	11.36	0.609	6.92
4	43.55	13.07	0.516	6.74
5	50.08	15.02	0.437	6.56
				20.22

Share Price after 5 years = $\frac{15.02\ (1.15)}{0.18 - 0.15}$ = Rs. 575.77

PV of the Market Price after 5 years = Rs. 575.77 x 0.437 = Rs. 251.61

Total PV of Inflows = Rs. 20.22 + Rs. 251.61 = Rs. 271.83

Thus, the maximum price I would be willing to pay for the share shall be Rs. 271.83.

Question 8(MTP April'21)

ABC Ltd. wants to issue 9% Bonds redeemable in 5 years at its face value of Rs. 1,000 each. The annual spot yield curve for similar risk class of Bond is as follows:

Year	Interest Rate
1	12%
2	11.62%
3	11.33%
4	11.06%
5	10.80%

(i) Evaluate the expected market price of the Bond if it has a Beta value of 1.10 due to its popularity because of lesser risk.

(ii) Interpret the nature of the above yield curve and reasons for the same.

Note: Use PV Factors upto 4 decimal points and value in Rs. upto 2 decimal points.

Solution

(i) For finding expected market price first we shall calculate Intrinsic Value of Bond as follows:

PV of Interest + PV of Maturity Value of Bond

Forward rate of interests

1st Year	12%
2nd Year	11.62%
3rd Year	11.33%
4th Year	11.06%
5th Year	10.80%

PV of interest = $\frac{\text{Rs } 90}{(1+0.12)} + \frac{\text{Rs } 90}{(1+0.1162)^2} + \frac{\text{Rs } 90}{(1+0.1133)^3} + \frac{\text{Rs } 90}{(1+0.1106)^4} + \frac{\text{Rs } 90}{(1+0.1080)^5}$

= Rs. 90 x 0.8929 + Rs. 90 x 0.8026 + Rs. 90 x 0.7247 + Rs. 90 x 0.6573 + Rs. 90 x 0.5988

= Rs. 80.36 + Rs. 72.23 + Rs. 65.22 + Rs. 59.16 + Rs. 53.89

= Rs. 330.86

PV of Maturity Value of Bond = $\frac{₹\ 1000}{(1+0.1080)^5}$

= Rs. 1,000 x 0.5988 = Rs. 598.80

Intrinsic value of Bond = Rs. 330.86 + Rs. 598.80 = Rs. 929.66

Expected Price = Intrinsic Value x Beta Value

= Rs. 929.66 x 1.10 = Rs. 1,022.63

(ii) The given yield curve is inverted yield curve.

The main reason for this shape of curve is expectation for forth coming recession when investors are more interested in Short-term rates over the long term.

Question 9

ABC Ltd. is considering a project X, which is normally distributed and has mean return of Rs. 2 crore with Standard Deviation of Rs. 1.60 crore.

In case ABC Ltd. loses on any project more than Rs. 1.00 crore there will be financial difficulties. Determine the probability the company will be in financial difficulty.

Given: Standard Normal Distribution Table (Z-Score) providing area between Mean and Z score

Z Score	Area
1.85	0.4678
1.86	0.4686
1.87	0.4693
1.88	0.4699
1.89	0.4706

Solution

For calculating probability of financial difficulty, we shall calculate the area under Normal Curve corresponding to the Z Score obtained from the following equation (how many SD is away from Mean Value of financial difficulty):

$$z = \frac{x - \mu}{\sigma}$$

$$= \frac{-1.00 \text{ crore} - 2.00 \text{ crore}}{1.60 \text{ crore}}$$

= -1.875 say 1.875

Corresponding area from Z Score Table by using interpolation shall be found as follows:

Z Score	Area under Normal Curve
1.87	0.4693
1.88	0.4699
0.01	0.0006

The corresponding value of 0.005 Z score = $0.005 \times \frac{0.0006}{0.01} = 0.0003$

Thus the Value of 1.875 shall be = 0.4693 + 0.0003 = 0.4696

Thus the probability the company shall be in financial difficulty is 46.96%.

Question 10(MTP Oct'21/Similar Q asked in PP Nov'20)

An investor is considering purchasing the equity shares of LX Ltd., whose current market price (CMP) is 150. The company is proposing a dividend of ₹ 6 for the next year. LX is expected to grow @ 18% per annum for the next four years. The growth will decline linearly to 14% per annum after first four years. Thereafter, it will stabilize at 14% per annum infinitely. The required rate of return is 18% per annum.

You are required to determine:

(i) The intrinsic value of one share

(ii) Whether it is worth to purchase the share at this price

T	1	2	3	4	5	6	7	8
PVIF (18, t)	0.847	0.718	0.609	0.516	0.437	0.370	0.314	0.266

Solution

D1 = ₹ 6

D2 = ₹ 6 (1.18) = ₹ 7.08

D3 = ₹ 6 $(1.18)^2$ = ₹ 8.35

D4 = ₹ 6 $(1.18)^3$ = ₹ 9.86

D5 = ₹ 9.86 (1.17) = ₹ 11.54

D6 = ₹ 9.86 (1.17) (1.16) = ₹ 13.38

D7 = ₹ 9.86 (1.17) (1.16) (1.15) = ₹ 15.39

D8 = ₹ 9.86 (1.17) (1.16) (1.15) (1.14) = ₹ 17.54

$$P = \frac{D_1}{(1 + k_e)} + \frac{D_2}{(1 + k_e)^2} + \frac{D_3}{(1 + k_e)^3} + \frac{D_4}{(1 + k_e)^4} + \frac{D_5}{(1 + k_e)^5} + \frac{D_6}{(1 + k_e)^6} + \frac{D_7}{(1 + k_e)^7} + \frac{TV}{(1 + k_e)^7}$$

$TV = \frac{D_8}{(k_e - g)} = \frac{17.54}{0.18 - 0.14}$ = 438.50

$$P = \frac{6.00}{(1 + 0.18)} + \frac{7.08}{(1 + 0.18)^2} + \frac{8.35}{(1 + 0.18)^3} + \frac{9.86}{(1 + 0.18)^4} + \frac{11.54}{(1 + 0.18)^5} + \frac{13.38}{(1 + 0.18)^6} + \frac{15.39}{(1 + 0.18)^7} + \frac{438.50}{(1 + 0.18)^7}$$

= 6.00 x 0.847 + 7.08 x 0.718 + 8.35 x 0.609 + 9.86 x 0.516 + 11.54 x 0.437 + 13.38 x 0.370 + 15.39 x 0.314 + 438.50 x 0.314

= ₹ 172.85

Since the Intrinsic Value of share is ₹ 172.85 while it is selling at ₹ 150 hence it is under - priced and better to acquire it.

Question 11(PP Nov'20)

The following data are available for a bond:

Face Value ₹ 10,000 to be redeemed at par on maturity

Coupon rate 8.5 per cent per annum

Years to Maturity 5 years

Yield to Maturity (YTM) 10 per cent

You are required to calculate:

(i) Current market price of the Bond,

(ii) Macaulay's Duration,

(iii) Volatility of the Bond,

(iv) Convexity of the Bond,

(v) Expected market price, if there is a decrease in the YTM by 200 basis points

a) By Macaulay's Duration based estimate

b) By Intrinsic Value Method.

Given

Years	1	2	3	4	5
PVIF (10%, n)	0.909	0.826	0.751	0.683	0.621
PVIF (8%, n)	0.926	0.857	0.794	0.735	0.681

(7 Marks)

Solution

(i) Current Market Price of Bond

= ₹ 850 (PVIAF 10%, 5) + ₹ 10,000 (PVIF 10%, 5)

= ₹ 850 (3.79) + ₹ 10,000 (0.621) = ₹ 3,221.50 + ₹ 6,210 = ₹ 9,431.5

(ii) Macaulay's Duration

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	850	0.909	772.65	0.082	0.082
2	850	0.826	702.10	0.074	0.148
3	850	0.751	638.35	0.068	0.204
4	850	0.683	580.55	0.062	0.248
5	10,850	0.621	6,737.85	0.714	3.57
			9431.50	1.000	4.252

Duration of the Bond is 4.252 years

(iii) Volatility of Bond

Volatility of Bonds = $\frac{\text{Duration}}{(1+\text{YTM})} = \frac{4.252}{1.10}$ = 3.865

(iv) Convexity of Bond

$C^* \times (\Delta Y)^2 \times 100$

$C^* = V+ + V- - 2V0$

$2V_0 (\Delta Y)^2$

Year	Cash flow	P.V. @ 8%		P.V @12%	
1	850	0.926	787.10	0.892	758.20
2	850	0.857	728.45	0.797	677.45
3	850	0.794	674.90	0.712	605.20
4	850	0.735	624.75	0.636	540.60
5	10,850	0.681	7388.85	0.567	6,151.95
			10204.05		8,733.40

$$C^* = \frac{10,204.05 + 8,733.40 - 2 \times 9,431.50}{2 \times 9,431.50 \times (0.02)^2}$$

$= \frac{74.45}{7.5452}$ = 9.867

Convexity of Bond = 9.867 x $(0.02)^2$ x 100 = 0.395%

(v) The expected market price if decrease in YTM by 200 basis points.

a. By Macaulay's duration-based estimate

= ₹ 9431.50 x 2 (3.865 / 100) = ₹ 729.05

Hence expected market price is ₹ 9431.50 + ₹ 729.05 = ₹ 10,160.55

Hence, the market price will increase.

b. By Intrinsic Value method

Intrinsic Value at YTM of 10%	₹ 9,431.50
Intrinsic Value at YTM of 8%	₹ 10,204.05
Price increased by	₹ 772.55

Hence, expected market price is ₹ 10,204.05

Question 12(PP Jan'21)

Mr. X is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days.

Days	Open	High	Low	Close
1	33470.94	33513.79	33438.03	33453.99
2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.60	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335.00	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95
18	33322.81	33345.98	33317.44	33319.67
19	33317.51	33321.18	33294.19	33302.32
20	33290.86	33324.96	33279.62	33319.61

You are required:

To test the Weak Form of Market Efficiency using Auto-Correlation test, taking time lag of 10 days. (8 Marks)

Solution

Period 1	Closing Prices	Change	Period 2	Closing Prices	Change
1	33453.99		11	33251.53	
2	33434.83	-19.16	12	33285.89	34.36
3	33431.93	- 2.90	13	33329.28	43.39
4	33383.41	- 48.52	14	33284.17	- 45.11
5	33370.93	- 12.48	15	33298.78	14.61
6	33340.75	- 30.18	16	33325.38	26.6
7	33330.98	-9.77	17	33329.95	4.57

8	33335.08	4.1	18	33319.67	-10.28
9	33301.97	- 33.11	19	33302.32	-17.35
10	33259.03	- 42.94	20	33319.61	17.29

X	Y	X2	Y2	XY
-19.16	34.36	367.11	1180.61	-658.34
-2.90	43.39	8.41	1882.69	-125.83
-48.52	-45.11	2354.19	2034.91	2188.74
-12.48	14.61	155.75	213.45	-182.33
-30.18	26.6	910.83	707.56	-802.79
-9.77	4.57	95.45	20.88	-44.65
4.1	-10.28	16.81	105.68	-42.15
-33.11	-17.35	1096.27	301.02	574.46
-42.94	17.29	1843.84	298.94	-742.43
∑X = -194.96	∑Y = 68.08	∑X2 = 6848.66	∑Y2 = 6745.74	∑XY = 164.68
$\bar{X}$ = - 21.66	$\bar{Y}$ = 7.56			

$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n(\bar{X})^2} = \frac{164.68 - 9(-21.66)(7.56)}{6848.66 - 9(-21.66)^2} = 0.624$

$a = \bar{Y} - b\bar{X} = 7.56 - 0.624(-21.66) = 21.08$

$r^2 = \frac{a\sum Y + b\sum XY - n(\bar{Y})^2}{\sum Y^2 - n(\bar{Y})^2} = \frac{21.08(68.08) + 0.624(164.68) - 9(7.56)^2}{6745.74 - 9(7.56)^2}$

$r^2 = 0.164$

$r = 0.405$

There is moderate degree of correlation between the returns of two periods hence it can be concluded that the market does not show the weak form of efficiency.

Question 13

Following are the yields on Zero Coupon Bonds (ZCB) having a face value of ₹ 1,000

Maturity (Years)	Yield to Maturity (YTM)
1	10%
2	11%
3	12%

Assume that the term structure of interest rate will remain the same.

You are required to

(i) Calculate the implied one year forward rates

(ii) Expected Yield to Maturity and prices of one year and two-year Zero-Coupon Bonds at the end of the first year. (4 Marks)

Solution

(i) Calculation of Forward Rates

Maturity	YTM (%)	PVIF	Face value	Price	Forward rate	
1	10	0.909	1,000	909.09		
2	11	0.812	1,000	811.62	0.1201 i.e.	12.01%
3	12	0.712	1,000	711.78	0.1403 i.e.	14.03%

(ii) Calculation of Expected Prices and YTM

Maturity	Forward rate	Face value	Price	YTM	
2	0.1201	1,000	$\frac{1000}{1+0.1201} = 892.78$	0.1201 i.e.	12.01%
3	0.1403	1,000	$\frac{1000}{(1+0.1201)(1+0.1403)}$ = 782.93	0.1302* i.e.	13.02%

$* \sqrt{\left(\frac{1000}{782.93}\right) - 1}$ = 0.1302

Question 14(MTP May 2023)

The Balance Sheet of M/s. Sundry Ltd. as on 31-03-2020 is follows:(₹ in lakhs)

Liabilities	₹	Assets	₹
Share Capital	300	Fixed Assets	600
Reserves	200	Inventory	500
Long Term Loan	400	Receivables	240
Short Term Loan	300	Cash	60
Payables & Provisions	200		
Total	1400	Total	1400

Sales for the year was ₹ 600 lakhs. The sales are expected to grow by 20% during the year. The profit margin and dividend pay-out ratio are expected to be 4% and 50% respectively.

The company further desires that during the current year Sales to Short Term Loan and Payables and Provision should be in the ratio of 4 : 3. Ratio of fixed assets to Long Term Loans should be 1.5. Debt Equity Ratio should not exceed 1.5.

You are required to determine:

(i) The amount of External Fund Requirement (EFR)

(ii) The amount to be raised from Short Term, Long Term and Equity funds. (8 Marks)

Solution

(i) External Funds Requirement (EFR): (₹ in lakhs)

	(₹)
Expected sales (₹ 600 + 20% of ₹ 600)	720.00

Profit margin @ 4%	28.80
Dividend payout ratio @ 50%	14.40
Balance to be ploughed back (A)	14.40
Additional funds required (₹ 1400 - ₹ 200*) x 0.20 (B)	240.00
Balance to be met from external source (B - A)	225.60

* As current liabilities shall also be increased proportionately with increase in sales.

(ii) Amount to be raised from different sources with following conditions:

- Sales to short term loans and payables & provisions 4:3
- Ratio of fixed assets to long term loans 1.5
- Debt equity ratio should not exceed 1.5

1) Amount to be raised from short term funds:

	(₹ in lakhs)
New amount of short-term loans and payables & provision $\left(\frac{3}{4} \times 600\right)$	450
Less: Existing Amount of short-term loans and payables & provision	500
Amount to be raised from short term funds	Nil

2) Amount to be raised from Long term funds:

	(₹ in lakhs)
New fixed assets (₹ 600 + 20% of ₹ 600)	720
New long-term loans (₹ 720 / 1.5)	480
Less: Existing long-term loans	400
Amount to be raised from Long term funds	**80**

3) Amount to be raised from equity funds:

	(₹ in lakhs)
Amount to be raised from external sources	225.60
Less: Amount to be raised from short term funds	----
Less: Amount to be raised from Long term funds	80.00
Balance amount to be raised from equity funds	**145.60**

Question 15(P P July'21)

Following financial data are available of RK Ltd., for the year ended on 31 -03-2020:

Particulars	₹ (in Million)
8% Debentures	125
10% Bonds	50
Equity Shares of ₹ 10 each	100
Reserves and Surplus	300
Total Assets	600
Assets Turnover Ratio	1.1

Effective Interest Rate	8%
Effective tax rate	40%
Operating margin	10%
Dividend pay-out ratio	16.67%
Required rate of return by investors	15%
Current market price of share	₹ 14

You are required to:

(i) Prepare the income statement of RK Ltd., for the year ended on 31-03-2020.
(ii) Calculate the sustainable growth rate.
(iii) Find out the fair price of the company's share using dividend discount model.
(iv) Advice whether the share is under - priced or overpriced. (8 Marks)

Solution

Workings:

Asset turnover ratio = 1.1

Total Assets = ₹ 600 million

Turnover ₹ 600 million × 1.1 = ₹ 660 million

Effective interest rate = $\frac{\text{Interest}}{\text{Liabilities}}$ = 8%

Liabilities = ₹ 125 million + ₹ 50 million = 175 million

Interest = ₹ 175 million x 0.08 = ₹ 14 million

Operating Margin = 10%

Hence operating cost = (1 - 0.10) ₹ 660 million = ₹ 594 million

Dividend Payout = 16.67%

Tax rate = 40%

(i) Income statement

	(₹ Million)
Sale	660
Less: Operating Exp	594
EBIT	66
Less: Interest	14
EBT	52
Less: Tax @ 40%	20.80
EAT	31.20
Less: Dividend @ 16.67%	5.20
Retained Earnings	26.00

(ii) SGR = ROE (1-b) S

ROE = $\frac{\text{PAT}}{\text{NW}}$ and NW = ₹ 100 million + ₹ 300 million = ₹ 400 million

ROE = $\frac{31.2\ million}{400\ million}$ x 100 = 7.8%

SGR = 0.078(1 - 0.1667) = 6.5% or $\frac{0.078 \times 0.8333}{1-0.078 \times 0.8333}$= 6.95%

(iii) Calculation of fair price of share using dividend discount model

Po = $\frac{D_0\ (1+g)}{k_e - g}$

Dividends = $\frac{₹\ 5.2\ million}{₹\ 10\ million}$ = ₹ 0.52 per share

Growth Rate = 6.5% or 6.95%

Hence P0 = $\frac{0.52\ (1+0.065)}{0.15-0.065} = \frac{0.5538}{0.085}$ = ₹ 6.52 or $\frac{0.52\ (1+0.0695)}{0.15-0.0695} = \frac{0.5561}{0.0805}$ = ₹ 6.91

(iv) Since the current market price of share is ₹ 14, the share is overvalued. Hence the investor should not invest in the company.

Question 16(PP Dec'21)

Following are the details of X Ltd. and Y Ltd.:

Particulars	X Ltd.	Y Ltd.
Dividend per Share	₹ 4	₹ 4
Growth Rate	10%	10%
Beta	0.9	1.2
Current Market Price per Share	₹ 150	₹ 70

Other Information:

Risk Free Rate of Return	7%
Market Rate of Return	14%

(i) Calculate the price of shares of both the companies.
(ii) Write the comment on the valuation on the basis of price calculated and current market price.
(iii) As an investor what course of action should be followed? (8 Marks)

Solution

(i) Calculation of Prices of shares of both companies

	X Ltd.	Y Ltd.
Beta	0.9	1.20
Cost of Equity using CAPM	7% + 0.9 [14% - 7%] = 13.30%	7% + 1.20 [14% - 7%] = 15.40%
Growth Rate	10%	10%
Price of Share	$\frac{4 \times 1.10}{0.133 - 0.10} = \frac{4.40}{0.033}$	$\frac{4 \times 1.10}{0.154 - 0.10} = \frac{4.40}{0.054}$
	= ₹ 133.33	= ₹ 81.48

(ii) and (iii)

Name of Company	Current Market Price	Value of the Share	Valuation	Action of the Investor
X Ltd.	₹ 150.00	₹ 133.33	Overvalued / overpriced	Not to Invest / to be sold
Y Ltd.	₹ 70.00	₹ 81.48	Undervalued / under-priced	Invest / to be purchased

Alternatively, if the given figure of Dividend is considered as Dividend Expected (D1) then solution will be as follows:

	X Ltd.	Y Ltd.
Beta	0.9	1.20
Cost of Equity using CAPM	7% + 0.9 [14% - 7%]	7% + 1.20 [14% - 7%]
	= 13.30%	= 15.40%
Growth Rate	10%	10%
Price of Share	$\frac{4.00}{0.133-0.10}=\frac{4.00}{0.033}$	$\frac{4.00}{0.154-0.10}=\frac{4.00}{0.054}$
	= ₹ 121.21	= ₹ 74.07

(ii) and (iii)

Name of Company	Current Market Price	Value of the Share	Valuation	Action of the Investor
X Ltd.	₹ 150.00	₹ 121.21	Overvalued / overpriced	Not to Invest / to be sold
Y Ltd.	₹ 70.00	₹ 74.07	Undervalued / under-priced	Invest / to be purchased

Question 17(MTP April'22)

The following data are available for a bond:

Face Value	₹ 10,000 to be redeemed at par on maturity
Coupon rate	8.5%
Years to Maturity	5 years
Yield to Maturity (YTM)	10%

EVALUATE the change in the expected market price of the Bond, if there is a decrease in the YTM by 200 basis points based on

(i) By Macaulay's Duration after making Convexity Adjustment.

(ii) By Intrinsic Value Method.

Given

Years	1	2	3	4	5
PVIF (10%, n)	0.909	0.826	0.751	0.683	0.621
PVIF (8%, n)	0.926	0.857	0.794	0.735	0.681

Solution

(i) Current Market Price of Bond

= Rs 850 (PVIAF 10%, 5) + Rs 10,000 (PVIF 10%, 5)

= Rs 850 (3.79) + Rs 10,000 (0.621) = Rs 3,221.50 + Rs 6,210 = Rs 9,431.5

(ii) Macaulay's Duration

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	850	0.909	772.65	0.082	0.082
2	850	0.826	702.10	0.074	0.148
3	850	0.751	638.35	0.068	0.204
4	850	0.683	580.55	0.062	0.248
5	10,850	0.621	6,737.85	0.714	3.57
			9431.50	1.000	4.252

Duration of the Bond is 4.252 years

(vi) Volatility of Bond

Volatility of Bonds = $\frac{\text{Duration}}{(1+\text{YTM})} = \frac{4.252}{1.10}$ = 3.865

(vii) Convexity of Bond

$C^* \times (\Delta Y)^2 \times 100$

$C^* = V+ + V- - 2V0$

$2V_0 (\Delta Y)^2$

Year	Cash flow	P.V. @ 8%		P.V @12%	
1	850	0.926	787.10	0.892	758.20
2	850	0.857	728.45	0.797	677.45
3	850	0.794	674.90	0.712	605.20
4	850	0.735	624.75	0.636	540.60
5	10,850	0.681	7388.85	0.567	6,151.95
			10204.05		8,733.40

$$C^* = \frac{10,204.05 + 8,733.40 - 2 \times 9,431.50}{2 \times 9,431.50 \times (0.02)^2}$$

$= \frac{74.45}{7.5452}$ = 9.867

Convexity of Bond = 9.867 x $(0.02)^2$ x 100 = 0.395%

(i) The expected market price if decrease in YTM by 200 basis points.

By Macaulay's duration-based estimate

% Change in Price of Bond 3.865 x 2% + 0.395% = 8.125%

Change in Expected Market Price Rs 9431.50 x (8.125/100) = Rs 766.31

Hence expected market price is Rs 9431.50 + Rs 766.31 = Rs 10,197.81

(ii) The expected market price if there is a decrease in YTM by 200 basis points using Intrinsic Value method

Intrinsic Value at YTM of 10%	₹ 9,431.50
Intrinsic Value at YTM of 8%	₹ 10,204.05
Price increased by	₹ 772.55

Hence, expected market price is ` 10,204.05

Evaluation: Thus, from above it can be evaluated that duration combined with the convexity adjustment does a better job of estimating the sensitivity of a bond's price change.

Question 18(PP May'22)

Closing Values of NIFTY Index from 3rd to 12th day of the month of January 2022 were as follows:

Days	Date	Closing Values of NIFTY Index
1	03/01/2022	17626
2	04/01/2022	17805
3	05/01/2022	17925
4	06/01/2022	17746
5	07/01/2022	17813
6	10/01/2022	18003
7	11/01/2022	18056
8	12/01/2022	18212

The simple moving average of NIFTY Index for the month of December 2021 was 17174.

You are required to calculate

(i) The value of exponent for 15 days EMA.

(ii) The exponential moving average (EMA) of NIFTY during the above period. (Calculations to be done up to 2 decimals only)

(iii) Analyse the buy & sell signal on the basis of your calculations (8 Marks)

Solution

(i) Value of Exponent for 15 Days EMA

$= \frac{2}{n+1} = 1.25$

(ii) $EMA_t = a \times P_t + (1 - a)(EMA_{(t-1)})$ Where, a = exponent, Pt = Price of today

Date	Sensex	EMA for Previous day (EMA (t – 1))	1-2	3 × 0.125	EMA 2 + 4
	1	2	3	4	5

03/01/2022	17626	17174	452	56.50	17230.50
04/01/2022	17805	17230.50	574.50	71.81	17302.31
05/01/2022	17925	17302.31	622.69	77.84	17380.15
06/01/2022	17746	17380.15	365.85	45.73	17425.88
07/01/2022	17813	17425.88	387.12	48.39	17474.27
10/01/2022	18003	17474.27	528.73	66.09	17540.36
11/01/2022	18056	17540.36	515.64	64.45	17604.82
12/01/2022	18212	17604.82	607.18	75.90	17680.71

(iii) A buy (bullish) signal is generated when actual price line (NIFTY in the give case) rises through the moving average, while a sell a (bearish) signal is generated when actual NIFTY level declines through the moving averages. In the case under consideration the price line of NIFTY never breaches the 15 -day EMA line. In-fact it is hovering around the 15-day EMA line only.

Question 19(MTP Sep'22)(Delete)

Mr. X wants to buy shares of A Ltd. (having a Beta of 2) at current market price of ₹ 500 each having face value of ₹ 100. He is expecting a bonus at the ratio of 1: 4 during the fifth year. Annual expected dividend is 20% and the same rate is expected to be maintained throughout the holding period. He intends to sell the shares at the end of 7 th year and expect that the market price shall be doubled during this holding period. Incidental expenses for purchase of shares are estimated to be 5% of the market price. The risk-free rate of return and market rate of return are 5% and 7.50% respectively.

ADVISE Mr. X should buy this share or not. If so, then recommend the maximum price should he pay for each share. Note: Assume no tax on dividend income and capital gain. (8 Marks)

Solution

First, we shall compute the Cost of Equity using CAPM as follows:

ke = Rf + β(Rm – Rf)

= 5% + 2(7.50% - 5.00%)

= 10%

P.V. of dividend stream and sales proceeds

Year	Dividend/Sale	PVF(10%)	PV(₹)
1	₹ 20/-	0.909	18.18
2	₹ 20/-	0.826	16.52
3	₹ 20/-	0.751	15.02
4	₹ 20/-	0.683	13.66
5	₹ 25/-	0.621	15.53
6	₹ 25/-	0.564	14.10
7	₹ 25/-	0.513	12.83
7	₹ 1,250/-(₹ 1,000 x 1.25)	0.513	641.25
			747.09
Less: Cost of Share (₹ 500 x 1.05)			525.00
Net Gain			**222.09**

Since Mr. X is gaining ₹ 222.09 per share, he should buy the share. Maximum price Mr. A should be ready to pay is ₹ 747.09.

Question 20(MTP Oct'22)

The Bank BK enters into a Repo for 9 days with Bank NE in 6% Government bonds 2022 for an amount of ₹ 2 crore. The other relevant details are as follows:

First Leg Payment(Start Proceed)	₹ 2,00,06,750
Second Leg Payment (Repayment Proceed)	₹ 2,00,31,759
Initial Margin	1.25%
Days of accrued interest	240

Assume 360 days in a year.

CALCULATE:

1) Repo Rate
2) Dirty Price and
3) Clean Price

Solution

1) Second Leg (Repayment at Maturity) $= \text{Start Proceed} \times \left(1 + \text{Repo Rate} \times \frac{\text{No.of Days}}{360}\right)$

₹ 2,00,31,759 $= ₹\ 2,00,06,750 \times \left(1 + \text{Repo Rate} \times \frac{9}{360}\right)$

₹ 1.00125 $= \left(1 + \text{Repo Rate} \times \frac{9}{360}\right)$

Repo Rate = 0.05 = 5%

2) First Leg (Start Proceed) $= \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100-\text{Intial Margin}}{100}$

₹ 2,00,06,750 $= ₹\ 2,00,00,000 \times \frac{\text{Dirty Price}}{100} \times \frac{100 - 1.25}{100}$

10003.375 = 98.75 x Dirty Price

Dirty Price = ₹ 101.30

3) Dirty Price = Clean Price + Interest Accrued

101.30 $= \text{Clean Price} + 100 \times 6\% \times \frac{240}{360}$

Clean Price = ₹ 97.30

Question 21(RTP May'23)

From the following information, compute the effective rate of interest per annum as well as the total cost of funds to Nirmal Ltd., which is planning a Commercial Paper (CP) issue:

Issue Price of CP	4,87,750
Face Value	5,00,000
Maturity Period	3 Months
Issue Expenses:	
Brokerage	0.15% for 3 months
Rating Charges	0.55% p.a.
Stamp Duty	0.20% for 3 months

Solution

Nominal Interest or Bond Equivalent Yield =

$$100 \times \frac{F - P}{P} \times \frac{12}{M}$$

Where

F= Face Value

P= Issue Price

$= 100 \times \frac{500000 - 487750}{487750} \times \frac{12}{3}$

= 0.025115 x 4 x 100 = 10.046 = 10.05% p. an.

Effective Interest Rate = $\left(1 + \frac{0.1005}{4}\right)4 - 1$ = 10.435% p.an

Cost of Funds to the Company

Effective Interest	10.435%
Brokerage (0.150 x 4)	0.60%
Rating Charge	0.55%
Stamp duty (0.20 x 4)	0.80%
	12.385%

Chapter 5

CORPORATE VALUATION

Space for your notings of Formulae or important points

Question 1 (Study Material TYK Q. 9)

With the help of the following information of Jatayu Limited compute the Economic Value Added:

Capital Structure	Equity capital	₹ 160 Lakhs
	Reserves and Surplus	₹ 140 lakhs
	10% Debentures	₹ 400 lakhs
Cost of equity	14%	
Financial Leverage	1.5 times	
Income Tax Rate	30%	

Solution

Financial Leverage = PBIT/PBT

1.5 = PBIT / (PBIT – Interest)

1.5 = PBIT / (PBIT – 40)

1.5 (PBIT – 40) = PBIT

1.5 PBIT – 60 = PBIT

1.5 PBIT – PBIT = 60

0.5 PBIT = 60

or PBIT = $\frac{60}{0.5}$ = ₹ 120 lakhs

NOPAT = PBIT – Tax = ₹ 120 lakhs (1 – 0.30) = ₹ 84 lakhs.

Weighted Average Cost of Capital (WACC)

= 14% x (300 / 700) + (1 – 0.30) x (10%) x (400 / 700) = 10%

EVA = NOPAT – (WACC Total Capital)

EVA = ₹ 84 lakhs – 0.10 x ₹ 700 lakhs

EVA = ₹ 14 lakhs

Question 2 (Study Material TYK Q. 10)

RST Ltd.'s current financial year's income statement reported its net income after tax as ₹ 25,00,000. The applicable corporate income tax rate is 30%.

Following is the capital structure of RST Ltd. at the end of current financial year:

	₹
Debt (Coupon rate = 11%)	40 lakhs
Equity (Share Capital + Reserves & Surplus)	125 lakhs
Invested Capital	165 lakhs

Following data is given to estimate cost of equity capital:

Equity Beta of RST Ltd.	1.36
Risk –free rate i.e. current yield on Govt. bonds	8.5%
Average market risk premium (i.e. Excess of return on market portfolio over risk-free rate)	9%

Required:
(i) Estimate Weighted Average Cost of Capital (WACC) of RST Ltd.; and
(ii) Estimate Economic Value Added (EVA) of RST Ltd.

Solution

Cost of Equity as per CAPM

Ke = Rf + β x Market Risk Premium
= 8.5% + 1.36 x 9%
= 8.5% + 12.24% = 20.74%

Cost of Debt kd = 11% (1 – 0.30) = 7.70%

WACC (ko) $= k_e \times \frac{E}{E+D} + k_d \times \frac{D}{E+D}$

$= 20.74 \times \frac{125}{165} + 7.70 \times \frac{40}{165} = 15.71 + 1.87 = 17.58\%$

Taxable Income = ₹ 25,00,000 / (1 - 0.30)
= ₹ 35,71,429 or ₹ 35.71 lakhs

Operating Income = Taxable Income + Interest
= ₹ 35,71,429 + ₹ 4,40,000
= ₹ 40,11,429 or ₹ 40.11 lacs

EVA = EBIT (1-Tax Rate) – WACC x Invested Capital
= ₹ 40,11,429 (1 – 0.30) – 17.58% x ₹ 1,65,00,000
= ₹ 28,08,000 – ₹ 29,00,700 = - ₹ 92,700

Question 3 (Study Material TYK Q. 11)
Tender Ltd has earned a net profit of ₹ 15 lacs after tax at 30%. Interest cost charged by financial institutions was ₹ 10 lacs. The invested capital is ₹ 95 lacs of which 55% is debt. The company maintains a weighted average cost of capital of 13%. Required,
(a) Compute the operating income
(b) Compute the Economic Value Added (EVA).
(c) Tender Ltd. has 6 lac equity shares outstanding. How much dividend can the company pay before the value of the entity starts declining?

Solution

Taxable Income = ₹ 15 lac / (1-0.30)
= ₹ 21.43 lacs or ₹ 21,42,857

Operating Income = Taxable Income + Interest
= ₹ 21,42,857 + ₹ 10,00,000
= ₹ 31,42,857 or ₹ 31.43 lacs

EVA = EBIT (1-Tax Rate) – WACC x Invested Capital
= ₹ 31,42,857 (1 – 0.30) – 13% x ₹ 95,00,000
= ₹ 22,00,000 – ₹ 12,35,000 = ₹ 9,65,000

EVA Dividend = $\frac{₹\ 9,65,000}{₹\ 6,00,000} = 1.6083$

Question 4 (Study Material TYK Q. 12)/MTP March'18/MTP Oct'19/MTP April'21
The following information is given for 3 companies that are identical except for their capital structure:

	Orange	Grape	Apple
Total invested capital	1,00,000	1,00,000	1,00,000
Debt/assets ratio	0.8	0.5	0.2
Shares outstanding	6,100	8,300	10,000
Pre tax cost of debt	16%	13%	15%
Cost of equity	26%	22%	20%
Operating Income (EBIT)	25,000	25,000	25,000

The tax rate is uniform 35% in all cases.

(i) Compute the Weighted average cost of capital for each company.
(ii) Compute the Economic Valued Added (EVA) for each company.
(iii) Based on the EVA, which company would be considered for best investment? Give reasons.
(iv) If the industry PE ratio is 11x, estimate the price for the share of each company.
(v) Calculate the estimated market capitalisation for each of the Companies.

Solution

(i) Working for calculation of WACC

	Orange	Grape	Apple
Total debt	80,000	50,000	20,000
Post tax Cost of debt	10.40%	8.45%	9.75%
Equity Fund	20,000	50,000	80,000

WACC

Orange:	(10.4 x 0.8) + (26 x 0.2)	=	13.52%
Grape:	(8.45 x 0.5) + (22 x 0.5)	=	15.225%
Apple:	(9.75 x 0.2) + (20 x 0.8)	=	17.95%

(ii)

	Orange	Grape	Apple
WACC	13.52	15.225	17.95
EVA [EBIT (1-T)-(WACC x Invested Capital)]	2,730	1,025	-1,700

(iii) Orange would be considered as the best investment since the EVA of the company is highest and its weighted average cost of capital is the lowest.

(iv) Estimated Price of each company shares

	Orange	Grape	Apple
EBIT (₹)	25,000	25,000	25,000
Interest (₹)	12,800	6,500	3,000
Taxable Income (₹)	12,200	18,500	22,000
Tax 35% (₹)	4,270	6,475	7,700
Net Income (₹)	7,930	12,025	14,300
Shares	6,100	8,300	10,000
EPS (₹)	1.30	1.45	1.43
Stock Price (EPS x PE Ratio) (₹)	14.30	15.95	15.73

Since the three entities have different capital structures they would be exposed to different degrees of financial risk. The PE ratio should therefore be adjusted for the risk factor.

(v) Market Capitalisation

Estimated Stock Price (₹)	14.30	15.95	15.73
No. of shares	6,100	8,300	10,000
Estimated Market Cap (₹)	87,230	1,32,385	1,57,300

Question 5 (Study Material TYK Q. 13)/MTP March'19/RTP Nov'22

Delta Ltd.'s current financial year's income statement reports its net income as ₹ 15,00,000. Delta's marginal tax rate is 40% and its interest expense for the year was ₹ 15,00,000. The company has ₹ 1,00,00,000 of invested capital, of which 60% is debt. In addition, Delta Ltd. tries to maintain a Weighted Average Cost of Capital (WACC) of 12.6%.

(i) Compute the operating income or EBIT earned by Delta Ltd. in the current year.

(ii) What is Delta Ltd.'s Economic Value Added (EVA) for the current year?

(iii) Delta Ltd. has 2,50,000 equity shares outstanding. According to the EVA you computed in (ii), how much can Delta pay in dividend per share before the value of the company would start to decrease? If Delta does not pay any dividends, what would you expect to happen to the value of the company?

Solution

(i) Taxable income = Net Income / (1 – 0.40)
or, Taxable income = ₹ 15,00,000 / (1 – 0.40) = ₹ 25,00,000
Again, taxable income = EBIT – Interest
or, EBIT = Taxable Income + Interest
= ₹ 25,00,000 + ₹ 15,00,000 = ₹ 40,00,000

(ii) EVA = EBIT (1 – T) – (WACC x Invested capital)
= ₹ 40,00,000 (1 – 0.40) – (0.126 x ₹ 1,00,00,000)

= ₹ 24,00,000 – ₹ 12,60,000 = ₹ 11,40,000

(iii) EVA Dividend = ₹ 11,40,000 / 2,50,000 = ₹ 4.56

If Delta Ltd. does not pay a dividend, we would expect the value of the firm to increase because it will achieve higher growth, hence a higher level of EBIT. If EBIT is higher, then all else equal, the value of the firm will increase.

Question 6 (Study Material TYK Q. 14)

The following data pertains to XYZ Inc. engaged in software consultancy business as on 31 December 2010. ($ Million)

Income from consultancy	935.00
EBIT	180.00
Less: Interest on Loan	18.00
EBT	**162.00**
Tax @ 35%	56.70
	105.30

Balance Sheet ($ Million)

Liabilities	Amount	Assets		Amount
Equity Stock	100	Land and Building		200
(10 million share @ $ 10 each)		Computers & Softwares		295
		Current Assets:		
Reserves & Surplus	325	Debtors	150	
Loans	180	Bank	100	
Current Liabilities	180	Cash	40	**290**
	785			**785**

With the above information and following assumption you are required to compute

(a) Economic Value Added®

(b) Market Value Added.

Assuming that:

(i) WACC is 12%.

(ii) The share of company currently quoted at $ 50 each

Solution

(a) Determination of Economic Value Added (EVA)

	$ Million
EBIT	180.00
Less: Taxes @ 35%	63.00
Net Operating Profit after Tax	117.00
Less: Cost of Capital Employed [W. No.1]	72.60
Economic Value Added	44.40

(b) Determination of Market Value Added (MVA)

	$ Million
Market value of Equity Stock [W. No. 2]	500
Equity Fund [W. No. 3]	425
Market Value Added	75

Working Notes:

(1)	Total Capital Employed	
	Equity Stock	$ 100 Million
	Reserve and Surplus	$ 325 Million
	Loan	$ 180 Million
		$ 605 Million
	WACC	12%
	Cost of Capital employed $ 605 Million x 12%	$ 72.60 Million
(2)	Market Price per equity share (A)	$ 50
	No. of equity share outstanding (B)	10 Million
	Market value of equity stock (A) x (B)	$ 500 Million
(3)	Equity Fund	
	Equity Stock	$ 100 Million
	Reserves & Surplus	$ 325 Million
		$ 425 Million

Question 7 (Study Material TYK Q. 15)

Herbal Gyan is a small but profitable producer of beauty cosmetics using the plant AloeVera. This is not a high tech business, but Herbal's earnings have averaged around ₹ 12 lakh after tax, largely on the strength of its patented beauty cream for removing the pimples.

The patent has eight years to run, and Herbal has been offered ₹ 40 lakhs for the patent rights. Herbal's assets include ₹ 20 lakhs of working capital and ₹ 80 lakhs of property, Plant, and equipment. The patent is not shown on Herbal's books.

Suppose Herbal's cost of capital is 15 percent. What is its Economic Value Added (EVA)?

Solution

EVA = Income earned – (Cost of capital x Total Investment)

Total Investments

Particulars	Amount
Working capital	₹ 20 lakhs
Property, plant, and equipment	₹ 80 lakhs
Patent rights	₹ 40 lakhs
Total	₹ 140 lakhs

Cost of Capital 15%

EVA= ₹ 12 lakh – (0.15 x ₹ 140 lakhs) = ₹ 12 lakh – ₹ 21 lakh = -₹ 9 lakh

Thus, Herbal Gyan has a negative EVA of ₹ 9 lakhs.

Question 8 (Study Material TYK Q. 16)

Constant Engineering Ltd. has developed a high tech product which has reduced the Carbon emission from the burning of the fossil fuel. The product is in high demand. The product has been patented and has a market value of ₹ 100 Crore, which is not recorded in the books. The Net Worth (NW) of Constant Engineering Ltd. is ₹200 Crore. Long term debt is ₹ 400 Crore. The product generates a revenue of ₹ 84 Crore. The rate on 365 days Government bond is 10 percent per annum. Market portfolio generates a return of 12 percent per annum. The stock of the company moves in tandem with the market. Calculate Economic Value added of the company

Solution

EVA = Income Earned – (Cost of Capital x Total Investment)

Total Investments

	Amount (₹ Crore)
Net Worth	200.00
Long Term Debts	400.00
Patent Rights	100.00
Total	700.00

WACC (ko) $= k_e \times \frac{E}{E+D} + k_d \times \frac{D}{E+D}$

$= 12 \times \frac{300}{700} + 10 \times \frac{400}{700} = 5.14\% + 5.71\% = 10.85\%$

EVA = Profit Earned – WACC x Invested Capital

= ₹ 84 Crore – 10.85% x ₹ 700 Crore

= ₹ 8.05 Crore

Question 9(Illustration 1)

There is a privately held company X Pvt. Ltd that is operating into the retail space, and is now scouting for angel investors. The details pertinent to valuing X Pvt. Ltd are as follows –

The company has achieved break even this year and has an EBITDA of 90. The unleveraged beta based on the industry in which it operates is 1.8, and the average debt to equity ratio is hovering at 40:60. The rate of return provided by risk free liquid bonds is 5%. The EV is to be taken at a multiple of 5 on EBITDA. The accountant has informed that the EBITDA of 90 includes an extraordinary gain of 10 for the year, and a potential write off of preliminary sales promotion costs of 20 are still pending. The internal assessment of rate of market return for the industry is 11%. The FCFs for the next 3 years are as follows:

	Y1	Y2	Y3
Future Cash flows	100	120	150

The pre-tax cost of debt is 12%. Assume a tax regime of 30%.

What is the potential value to be placed on X Pvt. Ltd?

Solution

The levered beta of the company will be 1.8 [1+(1-0.3) * 40 / 60)] = 2.64

The adjusted EBITDA would be 90 –10 – 20 = 60

The EV will be multiple of 5 on the 60 obtained above = 300

The Cost of equity in accordance with CAPM = r (f) + β (Rm – Rf)
= 5% + 2.64 (11% - 5%) = 20.84%

The WACC = Cost of Equity + Cost of Debt
= 20.84 (60/100) + 12.0 (1-0.3) (40/100)
= 15.864

Finally, the future cash flows can be discounted at the WACC obtained above as under

	Y1	Y2	Y3
Future Cash flows	100	120	150
Discount factor	0.863	0.745	0.643
PVs of cash flows	86.30	89.40	96.45
Value of the Firm			**272.15**

Question 10(Illustration 2)

A Ltd. made a Gross Profit of ₹ 10,00,000 and incurred Indirect Expenses of ₹ 4,00,000. The number of issued Equity Shares is 1,00,000. The company has a Debt of ₹ 3,00,000 and Surplus Funds to the tune of ₹ 5,00,000. The market related details are as follows:

Risk Free Rate of Return	4.5%
Market Rate of Return	12%
β of the Company	0.9

Determine:

a) Per Share Earning Value of the Company.
b) Equity Value of the company if applicable EBITDA multiple is 5.

Solution

a) Capitalization Rate using CAPM
4.5% + 0.9(12% - 4.5%) = 11.25%

Calculation of Earning Value Per Share

	(₹ 000)
Gross Profit	1000
Less: Indirect Expenses	(400)
EBITDA	**600**
Earning Value of Company (600 / 0.1125)	5333.33
Number of Shares	1,00,000
Earning Value Per Share	₹ 53.33

b) Equity Value of Company

	(₹ 000)
EBITDA	600
EBITDA Multiple	5
Capitalized Value	**3000**
Less: Debt	(300)
Add: Surplus Funds	500
Equity Value	**3200**

Now let us see how EV can be arrived at using Balance Sheet approach in the following illustration.

Question 11(Illustration 3)

The balance sheet of H K Ltd. is as follows:

	₹ 000
Non-Current Assets	1000
Current Assets	
Trade Receivables	500
Cash and cash equivalents	500
Total	**2000**
Shareholders' funds	800
Long Term Debt	200
Current Liabilities and Provisions	1000
Total	**2000**

The shares are actively traded and the Current Market Price (CMP) is ₹ 12 per share. Shareholder funds represent 70,000 shares of ₹ 10 each and rest is retained earnings. Calculate the Enterprise Value of HK Ltd.

Solution

Shares outstanding	70,000
CMP	₹ 12
Market Capitalization	₹ 8,40,000
Add: Debt	₹ 2,00,000
Less: Cash & Cash equivalents	(₹ 5,00,000)
Enterprise Value (EV)	**₹ 5,40,000**

Question 12(Illustration 4(Similar Q asked in MTP Aug'18))

Using the chop-shop approach (or Break-up value approach), assign a value for Cornett GMBH. whose stock is currently trading at a total market price of € 4 million. For Cornett, the accounting data set forth in three business segments: consumer wholesaling, specialty services, and assorted centers. Data for the firm's three segments are as follows:

Business segment	Segment sales	Segment assets	Segment income
Consumer wholesaling	€ 1,500,000	€ 750,000	€ 100,000
Specialty services	€ 800,000	€ 700,000	€ 150,000
Assorted centers	€ 2,000,000	€ 3,000,000	€ 600,000

Industry data for "pure - play" firms have been compiled and are summarized as follows:

Business segment	Capitalization/sales	Capitalization/assets	Capitalization/ operating income
Consumer wholesaling	0.75	0.60	10.00
Specialty services	1.10	0.90	7.00
Assorted centers	1.00	0.60	6.00

Solution

Cornett, GMBH. – Break-up valuation

Business Segment	Capital-to-Sales	Segment Sales	Theoretical Values
Consumer wholesaling	0.75	€ 1,500,000	€ 1,125,000
Specialty services	1.10	€ 800,000	€ 880,000
Assorted centers	1.00	€ 2,000,000	€ 2,000,000
Total value			€ 4,005,000

Business Segment	Capital-to-Sales	Segment Sales	Theoretical Values
Consumer wholesaling	0.60	€ 750,000	€ 450,000
Specialty services	0.90	€ 700,000	€ 630,000
Assorted centers	0.60	€ 3,000,000	€ 1,800,000
Total value			€ 2,880,000

Business Segment	Capital-to-Sales	Segment Sales	Theoretical Values
Consumer wholesaling	10.00	€ 100,000	€ 1,000,000
Specialty services	7.00	€ 150,000	€ 1,050,000
Assorted centers	6.00	€ 600,000	€ 3,600,000
Total value			€ 5,650,000

Average theoretical value = $\frac{4,005,000+2,880,000+5,650,000}{3}$ = 4,178,333.33 say 4,178,000

Average theoretical value of Cornett GMBH. = € 4,178,000

Question 13(Illustration 5)

Compute EVA of A Ltd. with the following information:

			All Figure are in ₹ Lac
Profit and Loss Statement		Balance Sheet	
Revenue	1000	PPE	1000
Direct Costs	-390	Current Assets	300
Selling, General & Admin. Exp.	-200		**1300**
EBIT	**410**	Equity	700
Interest	-10	Reserves	100
EBT	**400**	Non-Current Borrowings	100
Tax Expense	-120	Current Liabilities & Provisions	400
EAT	**280**		**1300**

Assume Bad Debts provision of ₹ 20 Lac is included in the SGA, and same amount is reduced from

the trade receivables in current assets.
Also assume that the pre - tax Cost of Debt is 12%, Tax Rate is 30% and Cost of Equity (i.e. shareholder's expected return) is 8.45%.

Solution

Step I: Computation of NOPAT

NOPAT	
EBIT	410
Less: Taxes	-123
Add: Non-Cash Expenses	20
NOPAT	307

Step II: Finding out the Invested Capital:

Invested Capital	
Total Assets	1300
Less: Non-Interest-bearing liabilities	-400
	900
Add: Non-Cash adjustment	20
	920

Note: It is assumed that the current liabilities also include the 100 of tax liability.

Step III: Compute the WACC

WACC = Cost of equity + Cost of debt

In this case, WACC = (800 / 900 * 8.45%) + [100 / 900 * 12% (1 - 0.30)] = 8.44%

Step IV: Find out the Capital Charge

Capital Charge = Invested Capital * WACC = 920 * 8.44% = 77.65

Step V: EVA = Adjusted NOPAT – Capital Charge = 307 – 77.65 = 229.35

RTP, MTP & PREVIOUS YEAR QUUESTIONS

Question 1(PP Dec'21)

Following is the information of M/s. DY Ltd. for the year ending 31/03/2021:

Particulars	
Sales	₹ 1000 Lakh
Operating Expenses Including Interest	₹ 620 Lakh
8% Debentures	₹ 250 Lakh
Equity Share Capital (Face value of ₹ 10 each)	₹ 250 Lakh
Reserves and Surplus	₹ 250 Lakh
Market Value of DY Ltd	₹ 900 Lakh
Corporate Tax Rate	30%
Risk free Rate of Return	7%
Market Rate of Return	12%
Equity Beta	1.4

You are required to-

(i) Calculate Weighted Average Cost of Capital of DY Ltd.

(ii) Calculate Economic Value Added

(iii) Calculate Market Value Added (8 Marks)

Solution

(i) Weighted Average Cost of Capital of DY Ltd.

Cost of Equity as per CAPM

Ke = Rf + β x Market Risk Premium

= 7% + 1.4 x [12% - 7%]

= 7% + 7% = 14%

Cost of Debt kd = 8 % (1 – 0.30) = 5.60 %

WACC (ko) $= k_e \times \frac{E}{E+D} + k_d \times \frac{D}{E+D} = 14.00 \times \frac{500}{750} + 5.60 \times \frac{250}{750}$

= 9.33% + 1.87% = 11.20%

(ii) Economic Value Added (EVA) of DY Ltd.

		₹ Lakhs
Sales		
Operating Expenses (excluding interest)	₹ 620	
	₹ 20	₹ 600
		₹ 400
Less: Tax @ 30%		₹ 120
Net Operating Profit after Tax (NOPAT)		₹ 280

Calculation of Capital Employed

	₹ Lakhs
Equity Share Capital	250
Reserves & Surplus	250
8% Debentures	250
Total Capital Employed	**750**

EVA = NOPAT – (WACC x Total Capital)

EVA = ₹ 280 Lakh – 0.1120 x ₹ 750 lakhs

EVA = 196.00 lakhs

(iii) Determination of Market Value Added (MVA)

	₹ Lakh
Market value of Equity Stock [₹ 900 Lakh - ₹ 250 Lakh]	650
Equity Fund [₹ 250 Lakh + ₹ 250 Lakh]	500
Market Value Added	**150**

Alternatively, it can also be computed as follows:

	₹ Lakh
Market value of DY Ltd.	900
Capital employed [₹ 250 Lakh + ₹ 250 Lakh + ₹ 250 Lakh]	750
Market Value Added	**150**

Question 2(PP May'22)

Calculate the value of share from the following Information:

Profit of the company (After tax)	₹ 560 crores
Equity share capital of the Company	₹ 1900 crores
Par value of share	₹ 50 each
Debt ratio (Debt/Debt + Equity)	43%
Long run growth rate of the company	7%
Beta 0.1 (Risk free Interest rate)	9.5%
Market return	12.6%
Capital expenditure per share	₹ 53
Depreciation per share	₹ 45
Increase in working capital	₹ 4.62 per share

(8 Marks)

Solution

Number of Shares = $\frac{₹ 1900 \text{ Crores}}{₹ 50}$ = 38 Crores

EPS = $\frac{\text{PAT}}{\text{No of Shares}}$ = 38 Crores

EPS = ₹ 560 Crores / 38 Crores = ₹ 14.737

Cost of Equity = Rf + ß (Rm – Rf)

= 9.5 + 0.1 (12.6 – 9.5) = 9.81%

FCFE = Net income – [(1-b) (capex – dep) + (1-b) (ΔWC)]

FCFE = 14.737 – [(1-0.43) (53-45) + (1-0.43) (4.62)]

= 14.737 – [4.56 + 2.6334] = 7.5436

$$P = \frac{FCFE(1+g)}{Ke-g} = \frac{7.5436(1.07)}{0.0981-0.07} = \frac{8.0716}{0.0281} = ₹\ 287.25$$

Chapter 6

MERGERS & ACQUISITONS

Space for your notings of Formulae or important points

Question 1 (Study Material TYK Q. 3)/MTP Oct'20

MK Ltd. is considering acquiring NN Ltd. The following information is available:

Company	Earning after Tax (₹)	No. of Equity Shares	Market Value Per Share (₹)
MK Ltd.	60,00,000	12,00,000	200.00
NN Ltd.	18,00,000	3,00,000	160.00

Exchange of equity shares for acquisition is based on current market value as above. There is no synergy advantage available.

(i) Find the earning per share for company MK Ltd. after merger, and

(ii) Find the exchange ratio so that shareholders of NN Ltd. would not be at a loss.

Solution

(i) Earning per share of company MK Ltd after merger:

Exchange ratio 160 : 200 = 4 : 5.

that is 4 shares of MK Ltd. for every 5 shares of NN Ltd.

Therefore, Total number of shares to be issued = 4/5 x 3,00,000 = 2,40,000 Shares.

Therefore, Total number of shares of MK Ltd. and NN Ltd.=12,00,000 (MK Ltd.) + 2,40,000 (NN Ltd.) = 14,40,000 Shares

Total profit after tax	= ₹ 60,00,000	MK Ltd.
	= ₹ 18,00,000	NN Ltd.
	= ₹ 78,00,000	

Therefore, EPS. (Earning Per Share) of MK Ltd. after merger
₹ 78,00,000 / 14,40,000 = ₹ 5.42 per share

(ii) To find the exchange ratio so that shareholders of NN Ltd. would not be at a Loss:

Present earning per share for company MK Ltd. = ₹ 60,00,000 / 12,00,000 = ₹ 5.00

Present earning per share for company NN Ltd. = ₹ 18,00,000 / 3,00,000 = ₹ 6.00

Therefore, Exchange ratio should be 6 shares of MK Ltd. for every 5 shares of NN Ltd.

Therefore, Shares to be issued to NN Ltd. = 3,00,000 x 6 / 5 = 3,60,000 shares

Now, total No. of shares of MK Ltd. and NN Ltd. =12,00,000 (MK Ltd.) + 3,60,000 (NN Ltd.) = 15,60,000 shares

Therefore, EPS after merger = ₹ 78,00,000 / 15,60,000 = ₹ 5.00 per share

Total earnings available to shareholders of NN Ltd. after merger = 3,60,000 shares x ₹ 5.00 = ₹ 18,00,000.

This is equal to earnings prior merger for NN Ltd.

Therefore, Exchange ratio on the basis of earnings per share is recommended.

Question 2(Old PM)

K. Ltd. is considering acquiring N. Ltd., the following information is available:

Company	Profit after Tax	Number of Equity shares	Market value per share
K. Ltd.	50,00,000	10,00,000	200.00
N. Ltd.	15,00,000	2,50,000	160.00

Exchange of equity shares for acquisition is based on current market value as above. There is no synergy advantage available:

(i) Find the earning per share for company K. Ltd. after merger.

(ii) Find the exchange ratio so that shareholders of N. Ltd. would not be at a loss.

Solution

(i) Earning per share for company K. Ltd. after Merger:

Exchange Ratio 160 : 200 = 4: 5

That is 4 shares of K. Ltd. for every 5 shares of N. Ltd.

Therefore, Total number of shares to be issued =

Therefore, Total number of shares of K. Ltd. and N. Ltd.	=10,00,000	K. Ltd.
	+ 2,00,000	N. Ltd
	12,00,000	
Total profit after Tax =	₹ 50,00,000	K. Ltd.
	₹ 15,00,000	N Ltd.
	₹ 65,00,000	

Therefore, E.P.S. (Earning per share) of K. Ltd. after Merger

$= \frac{₹\ 65,00,000}{12,00,000} = ₹\ 5.42$ Per share

(ii) To find the Exchange Ratio so that shareholders of N. Ltd. would not be at a Loss:

Present Earnings per share for company K. Ltd.

$= \frac{₹\ 50,00,000}{₹\ 10,00,000} = ₹\ 5.00$

Present Earnings Per share for company N. Ltd.

$= \frac{₹\ 15,00,000}{₹\ 2,50,000} = ₹\ 6.00$

Therefore, Exchange Ratio should be 6 shares of K. Ltd. for every 5 shares of N Ltd.

Therefore, Shares to be issued to N. Ltd.

$\frac{2,50,000 \times 6}{5} = 3,00,000$ shares

Therefore, Total No. of Shares of K. Ltd. and N. Ltd.

=	10,00,000	K. Ltd.
	+ 3,00,000	N. Ltd
	13,00,000	

Therefore, E.P.S. After Merger = $\frac{65,00,000}{13,00,000} = ₹\ 5.00$ Per share

Total Earnings Available to Shareholders of N. Ltd. after Merger = ₹ 3,00,000 × ₹ 5.00 = ₹ 15,00,000

This is equal to Earnings prior Merger for N. Ltd.

Therefore, Exchange Ratio on the Basis of Earnings per share is recommended.

Question 3(Study Material TYK Q 12)

M Co. Ltd. is studying the possible acquisition of N Co. Ltd., by way of merger. The following data are available in respect of the companies:

Particulars	M Co. Ltd.	N Co. Ltd.
Earnings after tax (`)	80,00,000	24,00,000
No. of equity shares	16,00,000	4,00,000
Market value per share (`)	200	160

(i) If the merger goes through by exchange of equity and the exchange ratio is based on the current market price, what is the new earning per share for M Co. Ltd.?

(ii) N Co. Ltd. wants to be sure that the earnings available to its shareholders will not be diminished by the merger. What should be the exchange ratio in that case?

Solution

(i) Calculation of new EPS of M Co. Ltd.

No. of equity shares to be issued by M Co. Ltd. to N Co. Ltd.

= 4,00,000 shares × ₹ 160 / ₹ 200 = 3,20,000 shares

Total no. of shares in M Co. Ltd. after acquisition of N Co. Ltd.

= 16,00,000 + 3,20,000 = 19,20,000

Total earnings after tax [after acquisition]

= 80,00,000 + 24,00,000 = 1,04,00,000

EPS = $\frac{₹\ 1,04,00,000}{19,20,000 \text{ equity shares}} = ₹\ 5.42$

(ii) Calculation of exchange ratio which would not diminish the EPS of N Co. Ltd. after its merger with M Co. Ltd.

Current EPS:

M Co. Ltd. = $\frac{₹\ 80,00,000}{16,00,000 \text{ equity shares}} = ₹ 5$

N Co. Ltd. = $\frac{₹\ 24,00,000}{4,00,000 \text{ equity shares}} = ₹ 6$

Exchange ratio = 6 / 5 = 1.20

No. of new shares to be issued by M Co. Ltd. to N Co. Ltd.

= 4,00,000 × 1.20 = 4,80,000 shares

Total number of shares of M Co. Ltd. after acquisition

= 16,00,000 + 4,80,000 = 20,80,000 shares

EPS [after merger] = $\frac{₹\ 1,04,00,000}{20,80,000 \text{ shares}} = ₹ 5$

Total earnings in M Co. Ltd. available to new shareholders of N Co. Ltd.

= 4,80,000 × ₹ 5 = ₹ 24,00,000

Recommendation: The exchange ratio (6 for 5) based on market shares is beneficial to shareholders of 'N' Co. Ltd.

Question 4(Study Material TYK Q 6)/PP May'18

A Ltd. wants to acquire T Ltd. and has offered a swap ratio of 1:2 (0.5 shares for every one share of T Ltd.). Following information is provided:

	A Ltd.	T. Ltd.
Profit after tax	₹ 18,00,000	₹ 3,60,000
Equity shares outstanding (Nos.)	6,00,000	1,80,000
EPS	₹ 3	₹ 2
PE Ratio	10 times	7 times
Market price per share	₹ 30	₹ 14

Required:

(i) The number of equity shares to be issued by A Ltd. for acquisition of T Ltd.
(ii) What is the EPS of A Ltd. after the acquisition?
(iii) Determine the equivalent earnings per share of T Ltd.
(iv) What is the expected market price per share of A Ltd. after the acquisition, assuming its PE multiple remains unchanged?
(v) Determine the market value of the merged firm.

Solution

(i)	The number of shares to be issued by A Ltd.:	
	The Exchange ratio is 0.5	
	So, new Shares = 1,80,000 x 0.5 = 90,000 shares.	
(ii)	EPS of A Ltd. After a acquisition:	

	Total Earnings	(₹ 18,00,000 + ₹ 3,60,000)	₹ 21,60,000
	No. of Shares	(6,00,000 + 90,000)	6,90,000
	EPS	(₹ 21,60,000 / 6,90,000)	₹ 3.13
(iii)	Equivalent EPS of T Ltd.:		
	No. of new Shares		0.5
	EPS		₹ 3.13
	Equivalent EPS (₹ 3.13 x 0.5)		₹ 1.57
(iv)	New Market Price of A Ltd. (P/E remaining unchanged):		
	Present P/E Ratio of A Ltd.		10 times
	Expected EPS after merger		₹ 3.13
	Expected Market Price (₹ 3.13 x 10)		₹ 31.30
(v)	Market Value of merged firm:		
	Total number of Shares		6,90,000
	Expected Market Price		₹ 31.30
	Total value (6,90,000 x 31.30)		₹ 2,15,97,000

Question 5(Study Material TYK Q 4)

ABC Ltd. is intending to acquire XYZ Ltd. by merger and the following information is available in respect of the companies:

	ABC Ltd.	XYZ Ltd.
Number of equity shares	10,00,000	6,00,000
Earnings after tax (`)	50,00,000	18,00,000
Market value per share (`)	42	28

Required:

(i) What is the present EPS of both the companies?

(ii) If the proposed merger takes place, what would be the new earning per share for ABC Ltd.? Assume that the merger takes place by exchange of equity shares and the exchange ratio is based on the current market price.

(iii) What should be exchange ratio, if XYZ Ltd. wants to ensure the earnings to members are same as before the merger takes place?

Solution

(i) Earnings per share = Earnings after tax / No. of equity shares

ABC Ltd. = ₹ 50,00,000 / 10,00,000 = ₹ 5

XYZ Ltd. = ₹ 18,00,000 / 6,00,000 = ₹ 3

(ii) Number of Shares XYZ Limited's shareholders will get in ABC Ltd. based on market value per share = ₹ 28 / 42 x 6,00,000 = 4,00,000 shares

Total number of equity shares of ABC Ltd. after merger = 10,00,000 + 4,00,000 = 14,00,000 shares

Earnings per share after merger = ₹ 50,00,000 + 18,00,000 / 14,00,000 = ₹ 4.86

(iii) Calculation of exchange ratio to ensure shareholders of XYZ Ltd. to earn the same as was before merger:

Shares to be exchanged based on EPS = (₹ 3 / ₹ 5) x 6,00,000 = 3,60,000 shares

EPS after merger = (₹ 50,00,000 + 18,00,000) / 13,60,000 = ₹ 5

Total earnings in ABC Ltd. available to shareholders of XYZ Ltd. = 3,60,000 x ₹ 5 = ₹ 18,00,000.

Thus, to ensure that Earning to members are same as before, the ratio of exchange should be 0.6 share for 1 share.

Question 6(Study Material TYK Q 9)/PP Nov'19

XYZ Ltd., is considering merger with ABC Ltd. XYZ Ltd.'s shares are currently traded at ₹ 20. It has 2,50,000 shares outstanding and its earnings after taxes (EAT) amount to ₹ 5,00,000. ABC Ltd., has 1,25,000 shares outstanding; its current market price is ₹ 10 and its EAT are ₹ 1,25,000. The merger will be effected by means of a stock swap (exchange). ABC Ltd., has agreed to a plan under which XYZ Ltd., will offer the current market value of ABC Ltd.'s shares:

(i) What is the pre – merger earnings per share (EPS) and P / E ratios of both the companies?

(ii) If ABC Ltd.'s P / E ratio is 6.4, what is its current market price? What is the exchange ratio? What will XYZ Ltd.'s post – merger EPS be?

(iii) What should be the exchange ratio; if XYZ Ltd.'s pre – merger and post – merger EPS are to be the same?

Solution

(i) Pre - merger EPS and P / E ratios of XYZ Ltd. and ABC Ltd.

Particulars	XYZ Ltd.	ABC Ltd.
Earnings after taxes	5,00,000	1,25,000
Number of shares outstanding	2,50,000	1,25,000
EPS	2	1
Market Price per share	20	10
P / E Ratio (times)	10	10

(ii) **Current Market Price of ABC Ltd. if P/E ratio is 6.4 = ₹ 1 × 6.4 = ₹ 6.40**

Exchange ratio = $\frac{₹\ 20}{₹\ 6.40} = 3.125$ or $\frac{₹\ 6.40}{₹\ 20} = 0.32$

Post - merger EPS of XYZ Ltd.

$$= \frac{₹\ 5,00,000 + ₹\ 1,25,000}{2,50,000 + (1,25,000/3.125)}$$

$$= \frac{₹\ 6,25,000}{2,90,000} = 2.16$$

(iii) Desired Exchange Ratio

Total number of shares in post – merged company

$$\frac{\text{Post} - \text{merger earnings}}{\text{Pre} - \text{merger EPS of XYZ Ltd}} = \frac{₹\ 6,25,000}{2} = 3,12,500$$

Number of shares required to be issued = 3,12,500 – 2,50,000 = 62,500

Therefore, the exchange ratio is 62,500 : 1,25,000

$$= \frac{62,500}{1,25,000} = 0.50$$

Question 7(Study Material-Illustration 2)

Company X is contemplating the purchase of Company Y, Company X has 3,00,000 shares having a market price of ₹ 30 per share, while Company Y has 2,00,000 shares selling at ₹ 20 per share. The EPS are ₹ 4.00 and ₹ 2.25 for Company X and Y respectively. Managements of both companies are discussing two alternative proposals for exchange of shares as indicated below:

(i) In proportion to the relative earnings per share of two companies.
(ii) 0.5 share of Company X for one share of Company Y (0.5:1).

You are required:

(i) to calculate the Earnings Per share (EPS) after merger under two alternatives; and
(ii) to show the impact of EPS for the shareholders of two companies under both the alternatives.

Solution

Working Notes: Calculation of total earnings after merger

Particulars	Company X	Company Y	Total
Outstanding shares	3,00,000	2,00,000	
EPS (₹)	4	2.25	
Total earnings (₹)	12,00,000	4,50,000	16,50,000

(i)

a) Calculation of EPS when exchange ratio is in proportion to relative EPS of two companies

Company X	3,00,000
Company Y 2,00,000 x 2.25 / 4	1,12,500
Total number of shares after merger	4,12,500

Company X

EPS before merger	=	₹ 4
EPS after merger = ₹ 16,50,000 / 4,12,500 shares	=	₹ 4

Company Y

EPS before merger	=	₹ 2.25

EPS after merger		
= EPS of Merged Entity after merger x Share Exchange ratio on EPS basis = ₹ 4× 2.25/4	=	₹ 2.25

b) Calculation of EPS when share exchange ratio is 0.5 : 1

Total earnings after merger = ₹ 16,50,000

Total number of shares after merger = 3,00,000 + (2,00,000 x 0.5) = 4,00,000 shares

EPS after merger = ₹ 16,50,000/4,00,000 = ₹ 4.125

(ii) Impact of merger on EPS for shareholders of Company X and Company Y

a) Impact on Shareholders of Company X

	(₹)
EPS before merger	4.000
EPS after merger	4.125
Increase in EPS	0.125

b) Impact on Shareholders of Company Y

	(₹)
Equivalent EPS before merger	2.2500
Equivalent EPS after merger	2.0625
Decrease in EPS	0.1875

Question 8(Study Material TYK Q 7)

The following information is provided related to the acquiring Firm Mark Limited and the target Firm Mask Limited:

	Firm Mark Limited	Firm Mask Limited
Earning after tax (₹)	2,000 lakhs	400 lakhs
Number of shares outstanding	200 lakhs	100 lakhs
P/E ratio (times)	10	5

Required:

(i) What is the Swap Ratio based on current market prices?
(ii) What is the EPS of Mark Limited after acquisition?
(iii) What is the expected market price per share of Mark Limited after acquisition, assuming P/E ratio of Mark Limited remains unchanged?
(iv) Determine the market value of the merged firm.
(v) Calculate gain / loss for shareholders of the two independent companies after acquisition.

Solution

Particulars	Mark Ltd.	Mask Ltd.

EPS	₹ 2,000 Lakhs / 200 lakhs	₹ 400 lakhs / 100 lakhs
	= ₹ 10	₹ 4
Market Price	₹ 10 x 10 = ₹ 100	₹ 4 x 5 = ₹ 20

(i) The Swap ratio based on current market price is

₹ 20 / ₹ 100 = 0.2 or 1 share of Mark Ltd. for 5 shares of Mask Ltd.

(ii) No. of shares to be issued = 100 lakh x 0.2 = 20 lakhs.

EPS after merger$= \frac{₹\ 2{,}000\ \text{lakhs} + ₹\ 400\ \text{lakhs}}{200\ \text{lakhs} + 20\text{lakhs}} = ₹\ 10.91$

(iii) Expected market price after merger assuming P/E 10 times.

= ₹ 10.91 x 10 = ₹ 109.10

(iv) Market value of merged firm

= ₹ 109.10 market price x 220 lakhs shares = 240.02 crores

(v) Gain from the merger

Post - merger market value of the merged firm		₹ 240.02 crores
Less: Pre – merger market value		
Mark Ltd. 200 Lakhs x ₹ 100 =	200 crores	
Mask Ltd. 100 Lakhs x ₹ 20 =	20 crores	₹ 220.00 crores
Gain from merger		₹ 20.02 crores

Appropriation of gains from the merger among shareholders:

	Mark Ltd.	Mask Ltd.
Post - merger value	218.20 crores	21.82 crores
Less: Pre – merger market value	200.00 crores	20.00 crores
Gain to Shareholders	18.20 crores	1.82 crores

Question 9(Study Material TYK Q 2)

Elrond Limited plans to acquire Doom Limited. The relevant financial details of the two firms prior to the merger announcement are:

	Elrond Limited	Doom Limited
Market price per share	₹ 50	₹ 25
Number of outstanding shares	20 lakhs	10 Lakhs

The merger is expected to generate gains, which have a present value of ₹ 200 lakhs. The exchange ratio agreed to is 0.5.

What is the true cost of the merger from the point of view of Elrond Limited?

Solution

Shareholders of Doom Ltd. will get 5 lakh share of Elrond Limited, so they will get:

$= \frac{5 \text{ lakh}}{20 \text{ lakh} + 5 \text{ lakh}}$ = 20% of shares Elrond Limited

The value of Elrond Ltd. after merger will be:

= ₹ 50 x 20 lakh + ₹ 25 x 10 lakh + ₹ 200 lakh

= ₹ 1000 lakh + ₹ 250 lakh + ₹ 200 lakh = ₹ 1450 lakh

True Cost of Merger will be:

₹ 290 lakhs (i.e., ₹ 1450 x 20%)– ₹ 250 lakhs = ₹ 40 lakhs

Question 10(Study Material TYK Q 5)

The CEO of a company thinks that shareholders always look for EPS. Therefore, he considers maximization of EPS as his company's objective. His company's current Net Profits are ₹ 80.00 lakhs and P / E multiple is 10.5. He wants to buy another firm which has current income of ₹ 15.75 lakhs & P / E multiple of 10.

What is the maximum exchange ratio which the CEO should offer so that he could keep EPS at the current level, given that the current market price of both the acquirer and the target company are ₹ 42 and ₹ 105 respectively?

If the CEO borrows funds at 15% and buys out Target Company by paying cash, how much cash should he offer to maintain his EPS? Assume tax rate of 30%.

Solution

(i)

	Acquirer Company	Target Company
Net Profit	₹ 80 lakhs	₹ 15.75 lakhs
PE Multiple	10.50	10.00
Market Capitalization	₹ 840 lakhs	₹ 157.50 lakhs
Market Price	₹ 42	₹ 105
No. of Shares	20 lakhs	1.50 lakhs
EPS	₹ 4	₹ 10.50

Maximum Exchange Ratio 4 : 10.50 or 1 : 2.625

Thus, for every one share of Target Company 2.625 shares of Acquirer Company.

(ii) Let x lakhs be the amount paid by Acquirer company to Target Company. Then to maintain same EPS i.e. ₹ 4 the number of shares to be issued will be:

$$\frac{(80 \text{ lakhs} + 15.75 \text{ lakhs}) - 0.70 \times 15\% \times x}{20 \text{ lakhs}} = 4$$

$$\frac{95.75 - 0.105x}{20} = 4$$

x = ₹ 150 lakhs

Thus, ₹ 150 lakhs shall be offered in cash to Target Company to maintain same EPS.

Question 11(Study Material TYK Q 8)/Similar Q asked in PP Dec'21

XYZ Ltd. wants to purchase ABC Ltd. by exchanging 0.7 of its share for each share of ABC Ltd. Relevant financial data are as follows:

Equity shares outstanding	10,00,000	4,00,000
EPS (₹)	40	28
Market price per share (₹)	250	160

(i) Illustrate the impact of merger on EPS of both the companies.
(ii) The management of ABC Ltd. has quoted a share exchange ratio of 1:1 for the merger. Assuming that P/E ratio of XYZ Ltd. will remain unchanged after the merger, what will be the gain from merger for ABC Ltd.?
(iii) What will be the gain / loss to shareholders of XYZ Ltd.?
(iv) Determine the maximum exchange ratio acceptable to shareholders of XYZ Ltd.

Solution

Working Notes

a)

	XYZ Ltd.	ABC Ltd.
Equity shares outstanding (Nos.)	10,00,000	4,00,000
EPS	₹ 40	₹ 28
Profit	₹ 400,00,000	₹ 112,00,000
PE Ratio	6.25	5.71
Market price per share	₹ 250	₹ 160

b) EPS after merger

No. of shares to be issued (4,00,000 x 0.70)	2,80,000
Exiting Equity shares outstanding	10,00,000
Equity shares outstanding after merger	12,80,000
Total Profit (₹ 400,00,000 + ₹ 112,00,000)	₹ 512,00,000
EPS	₹ 40

(i) Impact of merger on EPS of both the companies

	XYZ Ltd.	ABC Ltd.
EPS after Merger	₹ 40	₹ 28
EPS before Merger	₹ 40	₹ 28*
	Nil	Nil

* ₹ 40 x 0.70

(ii) Gain from the Merger if exchange ratio is 1: 1

No. of shares to be issued	4,00,000
Exiting Equity shares outstanding	10,00,000
Equity shares outstanding after merger	14,00,000
Total Profit (₹ 400,00,000 + ₹ 112,00,000)	₹ 512,00,000
EPS	₹ 36.57
Market Price of Share (₹ 36.57 x 6.25)	₹ 228.56

Market Price of Share before Merger	₹ 160.00
Impact (Increase / Gain)	₹ 68.56

(iii) Gain / loss from the Merger to the shareholders of XYZ Ltd.

Market Price of Share	₹ 228.56
Market Price of Share before Merger	₹ 250.00
Loss from the merger (per share)	₹ 21.44

(iv) Maximum Exchange Ratio acceptable to XYZ Ltd. shareholders

	₹ Lakhs
Market Value of Merged Entity (₹ 228.57 x 1400000)	3199.98
Less: Value acceptable to shareholders of XYZ Ltd.	2500.00
Value of merged entity available to shareholders of ABC Ltd.	699.98
Market Price Per Share	250
No. of shares to be issued to the shareholders of ABC Ltd. (lakhs)	2.80

Thus maximum ratio of issue shall be 2.80 : 4.00 or 0.70 share of XYZ Ltd. for one share of ABC Ltd.

Alternatively, it can also be computed as follows:

Earning after Merger (40 x 1000000 + 28 x 400000)	₹ 512 lakhs
PE Ratio of XYZ Ltd.	6.25
Market Value of Firm after Merger (512 x 6.25)	₹ 3200 lakhs
Existing Value of Shareholders of XYZ Ltd.	₹ 2500 lakhs
Value of Merged entity available to Shareholders of ABC Ltd.	₹ 700 lakhs
Market Price per Share	₹ 250
Total No. of shares to be issued	2.8 lakh

Thus, maximum acceptable ratio shall be 2.80 : 4.00 i.e. 0.70 share of XYZ Ltd. for one share of ABC Ltd.

Question 12(Study Material TYK Q 13)

Longitude Limited is in the process of acquiring Latitude Limited on a share exchange basis. Following relevant data are available:

		Longitude Limited	Latitude Limited
Profit after Tax (PAT)	₹ in Lakhs	120	80
Number of Shares	Lakhs	15	16
Earning per Share (EPS)	₹	8	5
Price Earnings Ratio (P/E Ratio)		15	10
(Ignore Synergy)			

You are required to determine:

(i) Pre – merger Market Value per Share, and

(ii) The maximum exchange ratio Longitude Limited can offer without the dilution of

1) EPS and
2) Market Value per Share

Calculate Ratio/s up to four decimal points and amounts and number of shares up to two decimal points.

Solution

(i) Pre – Merger Market Value of Per Share

P/E Ratio x EPS

Longitude Ltd. ₹ 8 X 15 = ₹ 120.00

Latitude Ltd. ₹ 5 X 10 = ₹ 50.00

(ii) Maximum exchange ratio without dilution of EPS

1)

Pre - Merger PAT of Longitude Ltd.	₹ 120 Lakhs
Pre - Merger PAT of Latitude Ltd.	₹ 80 Lakhs
Combined PAT	₹ 200 Lakhs
Longitude Ltd. 's EPS	₹ 8
Maximum number of shares of Longitude after merger (₹ 200 lakhs / ₹ 8)	25 Lakhs
Existing number of shares	15 Lakhs
Maximum number of shares to be exchanged	10 Lakhs

Maximum share exchange ratio 10:16 or 5:8

2) Maximum exchange ratio without dilution of Market Price Per Share

Pre - Merger Market Capitalization of Longitude Ltd. (₹ 120 × 15 Lakhs)	₹ 1800 Lakhs
Pre – Merger Market Capitalization of Latitude Ltd. (₹ 50 × 16 Lakhs)	₹ 800 Lakhs
Combined Market Capitalization	₹ 2600 Lakhs
Current Market Price of share of Longitude Ltd.	₹ 120
Maximum number of shares to be exchanged of Longitude (surviving company) (₹ 2600 Lakhs / ₹ 120)	21.67 Lakhs
Current Number of Shares of Longitude Ltd.	15.00 Lakhs
Maximum number of shares to be exchanged (Lakhs)	6.67 Lakhs

Maximum share exchange ratio 6.67 : 16 or 0.4169 : 1

Question 13(Study Material TYK Q 10)/RTP Nov'19/MTP Aug'18

Following information is provided relating to the acquiring company Mani Ltd. and the target company Ratnam Ltd:

	Mani Ltd.	Ratnam Ltd.
Earnings after tax (₹ lakhs)	2,000	4,000
No. of shares outstanding (lakhs)	200	1,000
P/E ratio (No. of times)	10	5

Required:

(i) What is the swap ratio based on current market prices?
(ii) What is the EPS of Mani Ltd. after the acquisition?
(iii) What is the expected market price per share of Mani Ltd. after the acquisition, assuming its P/E ratio is adversely affected by 10%?
(iv) Determine the market value of the merged Co.
(v) Calculate gain / loss for the shareholders of the two independent entities, due to the merger.

Solution

(i) SWAP ratio based on current market prices:

EPS before acquisition:

Mani Ltd.: ₹ 2,000 lakhs / 200 lakhs:	₹10
Ratnam Ltd.: ₹ 4,000 lakhs / 1,000 lakhs	₹ 4

Market price before acquisition:

Mani Ltd.: ₹ 10 × 10	₹100
Ratnam Ltd.: ₹ 4 × 5	₹ 20
SWAP ratio: 20 / 100 or 1 / 5 i.e.	0.20

(ii) EPS after acquisition:

$\frac{₹\ (2{,}000+4{,}000)\ \text{Lakhs}}{(200+200)\ \text{Lakhs}}$ ₹ 15.00

(iii) Market Price after acquisition:

EPS after acquisition:	₹ 15.00
P/E ratio after acquisition 10 × 0.9	9 times
Market price of share (₹ 15 × 9)	₹ 135.00

(iv) Market value of the merged Co.:

₹135 × 400 lakhs share = ₹ 540.00 Crores or ₹ 54,000 Lakhs

(v) Gain / loss per share: ₹ Crore

	Mani Ltd.	Ratnam Ltd.
Total value before Acquisition	200	200
Value after acquisition	270	270
Gain (Total)	**70**	**70**
No. of shares (pre-merger) (lakhs)	200	1,000
Gain per share (₹)	35	7

Question 14(Study Material TYK Q 14)/PP May'22

P Ltd. is considering take – over of R Ltd. by the exchange of four new shares in P Ltd. for every five shares in R Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

	P Ltd	R Ltd
Profit before Tax (₹ Crore)	15	13.50
No. of Shares (Crore)	25	15
P/E Ratio	12	9
Corporate Tax Rate 30%		

You are required to determine:

(i) Market value of both the company.
(ii) Value of original shareholders.
(iii) Price per share after merger.
(iv) Effect on share price of both the company if the Directors of P Ltd. expect their own pre – merger P / E ratio to be applied to the combined earnings.

Solution

	P Ltd.	R Ltd.
Profit before Tax (₹ in crore)	15	13.50
Tax 30% (₹ in crore)	4.50	4.05
Profit after Tax (₹ in crore)	10.50	9.45
Earnings per Share (₹)	$\frac{10.50}{25}$ = ₹ 0.42	$\frac{9.45}{15}$ = ₹ 0.63
Price of Share before Merger (EPS x P/E Ratio)	₹ 0.42 x 12 = ₹ 5.04	₹ 0.63 x 9 = ₹ 5.67

(i) Market Value of company

P Ltd. = ₹ 5.04 x 25 Crore = ₹ 126 crore

R Ltd. = ₹ 5.67 x 15 Crore = ₹ 85.05 crore

Combined = ₹ 126 + ₹ 85.05 = ₹ 211.05 Crores

After Merger

	P Ltd.	R Ltd.
No. of Shares	25 crores	$15 \times \frac{4}{5} = 12$ crores
Combined	37 crores	
% of Combined Equity Owned	$\frac{25}{37} \times 100 = 67.57\%$	$\frac{12}{37} \times 100 = 32.43\%$

(ii) Value of Original Shareholders

P Ltd.	R Ltd.
₹ 211.05 crore x 67.57%	₹ 211.05 crore x 32.43%
= ₹ 142.61	= ₹ 68.44

Alternatively, it can also be computed as follows:

Combined Value of Entity	211.05 crore
No. of shares after Merger	37 crore
Value of Per Share	₹ 5.70405
Value of P Ltd. Shareholders (25 crores x ₹ 5.70405)	₹ 142.60 crore
Value of R Ltd. Shareholders (12 crores x ₹ 5.70405)	₹ 68.45 crore

(iii) Price per Share after Merger

EPS = $\frac{₹\ 19.95\ \text{crore}}{37\ \text{crore}} = ₹\ 0.539\ \text{per share}$

P/E Ratio = 12

Market Value Per Share = ₹ 0.539 X 12 = ₹ 6.47

Total Market Value = ₹ 6.47 x 37 crore = ₹ 239.39 crore

Price of Share = $\frac{\text{Market Value}}{\text{Number of Shares}} = \frac{239.39\ \text{crore}}{37\ \text{crore}} = ₹\ 6.47$

(iv) Effect on Share Price

P Ltd.

Gain / loss (-) per share = ₹ 6.47 – ₹ 5.04 = ₹ 1.43

i.e. $\frac{6.47-5.04}{5.04} \times 100 = 0.284\ \text{or}\ 28.4\%$

Therefore, Share price would rise by 28.4%

R Ltd.

$6.47 \times \frac{4}{5} = ₹\ 5.18$

Gain / loss (-) per share = ₹ 5.18 – ₹ 5.67 = (- ₹ 0.49)

i.e., $\frac{5.18-\ .67}{5.67} \times 100\ (-)\ 0.0864\ \text{or}\ (-)\ 8.64\%$

Share Price would decrease by 8.64%.

Question 15(Old PM)

Cauliflower Limited is contemplating acquisition of Cabbage Limited. Cauliflower Limited has 5 lakh shares having market value of ₹ 40 per share while Cabbage Limited has 3 lakh shares having market value of ₹ 25 per share. The EPS for Cabbage Limited and Cauliflower Limited are ₹ 3 per share and ₹ 5 per share respectively. The managements of both the companies are discussing two alternatives for exchange of shares as follows:

(i) In proportion to relative earnings per share of the two companies.
(ii) 1 share of Cauliflower Limited for two shares of Cabbage Limited.

Required:

(i) Calculate the EPS after merger under both the alternatives.

(ii) Show the impact on EPS for the shareholders of the two companies under both the alternatives

Solution

(i) Exchange ratio in proportion to relative EPS

Company	Existing No. of shares	EPS	Total earnings
Cauliflower Ltd.	5,00,000	5.00	25,00,000
Cabbage Ltd.	3,00,000	3.00	9,00,000
Total earnings			34,00,000

No. of shares after merger 5,00,000 + 1,80,000 = 6,80,000

Note: 1,80,000 may be calculated as = $\left(3{,}00{,}000 \times \frac{3.00}{5.00}\right)$

EPS for Cauliflower Ltd. after merger = $\frac{34{,}00{,}000}{6{,}80{,}000} = ₹\ 5.00$

Impact on EPS

	₹
Cauliflower Ltd. shareholders	
EPS before merger	5.00
EPS after merger	5.00
Increase/ Decrease in EPS	0.00
Cabbage Ltd.' Shareholders	
EPS before merger	3.00
EPS after the merger 5.00 x 3 / 5	3.00
Increase / Decrease in EPS	0.00

(ii) Merger effect on EPS with share exchange ratio of 1 : 2

Total earnings after merger	₹ 34,00,000
No. of shares post - merger 5,00,000 + 1,50,000 (i.e., 0.5 × 3,00,000)	6,50,000
EPS (34,00,000 ÷ 6,50,000)	5.23

Impact on EPS

	₹
Cauliflower Ltd. shareholders	
EPS before merger	5.00
EPS after merger	5.23
Increase in EPS	0.23
Cabbage Ltd. shareholders	
EPS before merger	3.000
EPS after the merger 5.23 x 0.5	2.615
Decrease in EPS	0.385

Question 16(Study Material TYK Q 1)

B Ltd. is a highly successful company and wishes to expand by acquiring other firms. Its expected high growth in earnings and dividends is reflected in its PE ratio of 17. The Board of Directors of B Ltd. has been advised that if it were to take over firms with a lower PE ratio than it own, using a share – for – share exchange, then it could increase its reported earnings per share. C Ltd. has been suggested as a possible target for a takeover, which has a PE ratio of 10 and 1,00,000 shares in issue with a share price of ₹ 15. B Ltd. has 5,00,000 shares in issue with a share price of ₹ 12.

Calculate the change in earnings per share of B Ltd. if it acquires the whole of C Ltd. by issuing shares at its market price of ₹ 12. Assume the price of B Ltd. shares remains constant.

Solution

Total market value of C Ltd is = 1,00,000 x ₹ 15	= ₹ 15,00,000
PE ratio (given)	= 10
Therefore, earnings	= ₹ 15,00,000 / 10
	= ₹ 1,50,000
Total market value of B Ltd. is = 5,00,000 x ₹ 12	= ₹ 60,00,000
PE ratio (given)	= 17
Therefore, earnings	= ₹ 60,00,000/ 17
	= ₹ 3,52,941

The number of shares to be issued by B Ltd.

₹ 15,00,000 ÷ 12	= 1,25,000
Total number of shares of B Ltd = 5,00,000 + 1,25,000	= 6,25,000
The EPS of the new firm is = (₹ 3,52,941 + ₹ 1,50,000) / 6,25,000	= ₹ 0.80
The present EPS of B Ltd is = ₹ 3,52,941 / 5,00,000	= ₹ 0.71

So the EPS affirm B will increase from ₹ 0.71 to ₹ 0.80 as a result of merger.

Question 17(Study Material- Corporate Valuation TYK Q 1)/MTP Oct'22

ABC Company is considering acquisition of XYZ Ltd. which has 1.5 crores shares outstanding and issued. The market price per share is ₹ 400 at present. ABC's average cost of capital is 12%. Available information from XYZ indicates its expected cash accruals for the next 3 years as follows:

Year	₹ Cr.
1	250
2	300
3	400

Calculate the range of valuation that ABC has to consider. (PV factors at 12% for years 1 to 3 respectively: 0.893, 0.797 and 0.712).

Solution

Valuation Based on Market Price

Market Price per share	₹ 400
Thus, value of total business is (₹ 400 x 1.5 Cr.)	₹ 600 Cr.

Valuation Based on Discounted Cash Flow

Present Value of cash flows	
(₹ 250 cr x 0.893) + (₹ 300 cr. x 0.797) + (₹ 400 cr. x 0.712)	₹ 747.15 Cr.
Value of per share (₹ 747.15 Cr. / 1.5 Cr)	₹ 498.10 per share

Range of Valuation

	Per Share ₹	Total ₹ Cr.
Minimum	400.00	600.00
Maximum	498.10	747.15

Question 18(Study Material- Corporate Valuation TYK Q 2)/Similar Q asked in PP July'21/MTP Sep'22

Eagle Ltd. reported a profit of ₹ 77 lakhs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extra ordinary items of ₹ 8 lakhs and an extra ordinary loss of ₹ 10 lakhs. The existing operations, except for the extra ordinary items, are expected to continue in the future. In addition, the results of the launch of a new product are expected to be as follows:

	₹ In lakhs
Sales	70
Material costs	20
Labour costs	12
Fixed costs	10

You are required to:

(i) Calculate the value of the business, given that the capitalization rate is 14%.

(ii) Determine the market price per equity share, with Eagle Ltd. 's share capital being comprised of 1,00,000 13% preference shares of ₹ 100 each and 50,00,000 equity shares of ₹ 10 each and the P / E ratio being 10 times.

Solution

(i) Computation of Business Value

		(₹ Lakhs)
Profit before tax $\frac{77}{1-0.30}$		110
Less: Extraordinary income		(8)
Add: Extraordinary losses		10
		112
Profit from new product	(₹ Lakhs)	

Sales	70	
Less: Material costs 20		
Labour costs 12		
Fixed costs 10	(42)	28
		140.00
Less: Taxes @ 30%		42.00
Future Maintainable Profit after taxes		98.00
Relevant Capitalisation Factor		0.14
Value of Business (₹ 98 / 0.14)		700

(ii) Determination of Market Price of Equity Share

Future maintainable profits (After Tax)	₹ 98,00,000
Less: Preference share dividends 1,00,000 shares of ₹ 100 @ 13%	₹ 13,00,000
Earnings available for Equity Shareholders	₹ 85,00,000
No. of Equity Shares	50,00,000
Earning per share = $\frac{₹\ 85,00,000}{50,00,000}$ =	₹ 1.70
PE ratio	10
Market price per share	₹ 17

Question 19(Study Material TYK Q 15)

Simple Ltd. and Dimple Ltd. are planning to merge. The total value of the companies are dependent on the fluctuating business conditions. The following information is given for the total value (debt + equity) structure of each of the two companies.

Business Condition	**Probability**	**Simple Ltd. ₹ Lacs**	**Dimple Ltd. ₹ Lacs**
High Growth	0.20	820	1050
Medium Growth	0.60	550	825
Slow Growth	0.20	410	590

The current debt of Dimple Ltd. is ₹ 65 lacs and of Simple Ltd. is ₹ 460 lacs.

Calculate the expected arately for the merged entity.

Solution

Compute Value of Equity

Simple Ltd.

₹ in Lacs

	High Growth	Medium Growth	Slow Growth
Debit + Equity	820	550	410
Less: Debt	460	460	460
Equity	360	90	-50

Since the Company has limited liability the value of equity cannot be negative therefore the value of equity under slow growth will be taken as zero because of insolvency risk and the value of debt is taken at 410 lacs. The expected value of debt and equity can then be calculated as:

Simple Ltd.

₹ in Lacs

	High Growth		Medium Growth		Slow Growth		Expected Value
	Prob.	Value	Prob.	Value	Prob.	Value	
Debt	0.20	460	0.60	460	0.20	410	450
Equity	0.20	360	0.60	90	0.20	0	126
		820		550		410	576

Dimple Ltd.

₹ in Lacs

	High Growth		Medium Growth		Slow Growth		Expected Value
	Prob.	Value	Prob.	Value	Prob.	Value	
Equity	0.20	985	0.60	760	0.20	525	758
Debt	0.20	65	0.60	65	0.20	65	65
		1050		825		590	823

Expected Values

₹ in Lacs

Equity		Debt	
Simple Ltd.	126	Simple Ltd.	450
Dimple Ltd.	758	Dimple Ltd.	65
	884		515

Question 20(Study Material TYK Q 16)/RTP Nov'18

Yes Ltd. wants to acquire No Ltd. and the cash flows of Yes Ltd. and the merged entity are given below:

(₹ In lakhs)

Year	1	2	3	4	5
Yes Ltd.	175	200	320	340	350
Merged Entity	400	450	525	590	620

Earnings would have witnessed 5% constant growth rate without merger and 6% with merger on account of economies of operations after 5 years in each case. The cost of capital is 15%.

The number of shares outstanding in both the companies before the merger is the same and the companies agree to an exchange ratio of 0.5 shares of Yes Ltd. for each share of No Ltd.

PV factor at 15% for years 1 - 5 are 0.870, 0.756; 0.658, 0.572, 0.497 respectively.

You are required to:

(i) Compute the Value of Yes Ltd. before and after merger.
(ii) Value of Acquisition and
(iii) Gain to shareholders of Yes Ltd.

Solution

(i) **Working Notes:**

Present Value of Cash Flows (CF) upto 5 years

Year End	CF of Yes Ltd. (₹ lakhs)	PVF @ 15%	PV of CF (₹ lakhs)	CF of Merged Entity (₹ lakhs)	PV of CF of Merged Entity (₹ lakhs)
1	175	0.870	152.25	400	348.00
2	200	0.756	151.20	450	340.20
3	320	0.658	210.56	525	345.45
4	340	0.572	194.48	590	337.48
5	350	0.497	173.95	620	308.14
			882.44		1679.27

PV of Cash Flows of Yes Ltd. after the forecast period

$$TV_5 = \frac{CF_5\,(1+g)}{K_e - g} = \frac{350\,(1+0.05)}{0.15-0.05} = \frac{367.50}{0.10} = ₹\,3675\ \text{lakhs}$$

PV of TV5 = ₹ 3675 lakhs x 0.497 = ₹ 1826.475 lakhs

PV of Cash Flows of Merged Entity after the forecast period

$$TV_5 = \frac{CF_5\,(1+g)}{K_e - g} = \frac{620\,(1+0.06)}{0.15-0.06} = \frac{657.20}{0.09} = ₹\,7302.22\ \text{lakhs}$$

PV of TV5 = ₹ 7302.22 lakhs x 0.497 = ₹ 3629.20 lakhs

Value of Yes Ltd.

	Before merger (₹ lakhs)	After merger (₹ lakhs)
PV of CF (1-5 years)	882.440	1679.27
Add: PV of TV5	1826.475	3629.20
	2708.915	5308.47

(ii) Value of Acquisition

= Value of Merged Entity – Value of Yes Ltd.

= ₹ 5308.47 lakhs – ₹ 2708.915 lakhs = ₹ 2599.555 lakhs

(iii) Gain to Shareholders of Yes Ltd.

Share of Yes Ltd. in merged entity = $₹\,5308.47\ \text{lakhs} \times \frac{1}{1.5} = ₹\,3538.98\ \text{lakhs}$

Gain to shareholder = Share of Yes Ltd. in merged entity – Value of Yes Ltd. before merger

= ₹ 3538.98 lakhs - ₹ 2708.915 = ₹ 830.065 lakhs

Question 21(Study Material TYK Q 11)

You have been provided the following financial data of two companies:

	Krishna Ltd.	Rama Ltd.
Earnings after taxes	₹ 7,00,000	₹ 10,00,000
No. of Equity shares (outstanding)	2,00,000	4,00,000
EPS	3.5	2.5
P/E ratio	10 times	14 times
Market price per share	₹ 35	₹ 35

Company Rama Ltd. is acquiring the company Krishna Ltd., exchanging its shares on a one – to – one basis for company Krishna Ltd. The exchange ratio is based on the market prices of the shares of the two companies.

Required:

(i) What will be the EPS subsequent to merger?
(ii) What is the change in EPS for the shareholders of companies Rama Ltd. and Krishna Ltd.?
(iii) Determine the market value of the post – merger firm. PE ratio is likely to remain the same.
(iv) Ascertain the profits accruing to shareholders of both the companies.

Solution

(i)

Exchange Ratio		1:1
New Shares to be issued		2,00,000
Total shares of Rama Ltd. (4,00,000 + 2,00,000)		6,00,000
Total earnings (₹ 10,00,000 + ₹ 7,00,000)	₹	17,00,000
New EPS (₹ 17,00,000 / 6,00,000)		₹ 2.83

(ii)

Existing EPS of Rama Ltd.		₹ 2.50
Increase in EPS of Rama Ltd (₹ 2.83 – ₹ 2.50)		₹ 0.33
Existing EPS of Krishna Ltd.		₹ 3.50
Decrease in EPS of Krishna Ltd. (₹ 3.50 – ₹ 2.83)		₹ 0.67

(iii)

P/E ratio of new firm (expected to remain same)		14 times
New market price (14 × ₹ 2.83)		₹ 39.62
Total No. of Shares		6,00,000

Total market Capitalization (6,00,000 × ₹ 39.62)	₹ 2,37,72,000
Existing market capitalization (₹ 70,00,000 + ₹ 1,40,00,000)	₹ 2,10,00,000
Total gain	₹ 27,72,000

(iv)

	Rama Ltd.	Krishna Ltd	Total
No. of shares after merger	4,00,000	2,00,000	6,00,000
Market price	₹ 39.62	₹ 39.62	₹ 39.62
Total Mkt. Values	₹ 1,58,48,000	₹ 79,24,000	₹ 2,37,72,000
Existing Mkt. values	₹ 1,40,00,000	₹ 70,00,000	₹ 2,10,00,000
Gain to share holders	₹ 18,48,000	₹ 9,24,000	₹ 27,72,000

or ₹ 27,72,000/ 3 = ₹ 9,24,000 to Krishna Ltd. and ₹ 18,48,000 to Rama Ltd. (in 2 : 1 ratio)

Question 22(Old PM)/MTP Aug'18

Using the chop – shop approach (or Break – up value approach), assign a value for Cranberry Ltd. whose stock is currently trading at a total market price of € 4 million. For Cranberry Ltd, the accounting data set forth three business segments: consumer wholesale, retail and general centers. Data for the firm's three segments are as follows:

Business Segment	Segment Sales	Segment Assets	Segment Operating Income
Wholesale	€ 225,000	€ 600,000	€ 75,000
Retail	€ 720,000	€ 500,000	€ 150,000
General	€ 2,500,000	€ 4,000,000	€ 700,000

Industry data for "pure-play" firms have been compiled and are summarized as follows:

Business Segment	Capitalization / Sales	Capitalization / Assets	Capitalization / Operating Income
Wholesale	0.85	0.7	9
Retail	1.2	0.7	8
General	0.8	0.7	4

Solution

Business Segment	Capital - to - Sales	Segment Sales	Theoretical Values
Wholesale	0.85	€ 225000	€ 191250
Retail	1.2	€ 720000	€ 864000
General	0.8	€ 2500000	€ 2000000
Total value			€ 3055250

Business Segment	Capital – to – Assets	Segment Assets	Theoretical Values
Wholesale	0.7	€ 600000	€ 420000
Retail	0.7	€ 500000	€ 350000
General	0.7	€ 4000000	€ 2800000
Total value			€ 3570000

Business Segment	Capital - to - Operating Income	Operating Income	Theoretical Values
Wholesale	9	€ 75000	€ 675000

Retail	8	€ 150000	€ 1200000
General	4	€ 700000	€ 2800000
Total value			€ 4675000

Average theoretical value = $\frac{3055250+3570000+4675000}{3} = 3766750$

Average theoretical value of Cranberry Ltd. = € 3766750

Question 23(Study Material TYK Q 17)

The following information is provided relating to the acquiring company Efficient Ltd. and the target Company Healthy Ltd.

	Efficient Ltd.	Healthy Ltd.
No. of shares (F.V. ₹ 10 each)	10.00 lakhs	7.5 lakhs
Market capitalization	500.00 lakhs	750.00 lakhs
P/E ratio (times)	10.00	5.00
Reserves and Surplus	300.00 lakhs	165.00 lakhs
Promoter's Holding (No. of shares)	4.75 lakhs	5.00 lakhs

Board of Directors of both the Companies have decided to give a fair deal to the shareholders and accordingly for swap ratio the weights are decided as 40%, 25% and 35% respectively for Earning, Book Value and Market Price of share of each company:

(i) Calculate the swap ratio and also calculate Promoter's holding % after acquisition.
(ii) What is the EPS of Efficient Ltd. after acquisition of Healthy Ltd.?
(iii) What is the expected market price per share and market capitalization of Efficient Ltd. after acquisition, assuming P/E ratio of Firm Efficient Ltd. remains unchanged?
(iv) Calculate free float market capitalization of the merged firm.

Solution

Swap Ratio

	Efficient Ltd.	Healthy Ltd.
Market capitalization	500 lakhs	750 lakhs
No. of shares	10 lakhs	7.5 lakhs
Market Price per share	₹ 50	₹ 100
P/E ratio	10	5
EPS	₹ 5	₹ 20
Profit	₹ 50 lakh	₹ 150 lakh
Share capital	₹ 100 lakh	₹ 75 lakh
Reserves and surplus	₹ 300 lakh	₹ 165 lakh
Total	₹ 400 lakh	₹ 240 lakh
Book Value per share	₹ 40	₹ 32

(i) Calculation of Swap Ratio

EPS	1 : 4 i.e.	4.0 x 40%	1.6
Book value	1 : 0.8 i.e.	0.8 x 25%	0.2
Market price	1 : 2 i.e.	2.0 x 35%	0.7
		Total	2.5

Swap ratio is for every one share of Healthy Ltd., to issue 2.5 shares of Efficient Ltd. Hence, total no. of shares to be issued 7.5 lakh x 2.5 = 18.75 lakh shares.

Promoter's holding = 4.75 lakh shares + (5 x 2.5 = 12.5 lakh shares) = 17.25 lakh i.e. Promoter's holding % is (17.25 lakh / 28.75 lakh) x 100 = 60%.

Calculation of EPS, Market price, Market capitalization and free float market capitalization.

(ii) Total No. of shares 10 lakh + 18.75 lakh = 28.75 lakh

Total capital 100 lakh + 187.5 lakh = ₹ 287.5 lakh

EPS $\frac{\text{Total Profit}}{\text{No.of shares}} = \frac{50 \text{ lakh}+150 \text{ lakh}}{28.75 \text{ lakh}} = \frac{200}{28.75} = ₹ 6.956$

Expected market price — EPS 6.956 x P/E 10 = ₹ 69.56
Market capitalization — ₹ 69.56 per share x 28.75 lakh shares
₹ 1,999.85 lakh

Free float of market capitalization = ₹ 69.56 per share x (28.75 lakh x 40%)
= ₹ 799.94 lakh

Question 24(Study Material TYK Q 18)

Abhiman Ltd. is a subsidiary of Janam Ltd. and is acquiring Swabhiman Ltd. which is also a subsidiary of Janam Ltd. The following information is given :

	Abhiman Ltd.	Swabhiman Ltd.
% Shareholding of promoter	50%	60%
Share capital	₹ 200 lacs	100 lacs
Free Reserves and surplus	₹ 900 lacs	600 lacs
Paid up value per share	₹ 100	10
Free float market capitalization	₹ 500 lacs	156 lacs
P/E Ratio (times)	10	4

Janam Ltd., is interested in doing justice to both companies. The following parameters have been assigned by the Board of Janam Ltd., for determining the swap ratio:

Book value	25%
Earning per share	50%
Market price	25%

You are required to compute

(i) The swap ratio.

(ii) The Book Value, Earning Per Share and Expected Market Price of Swabhiman Ltd., (assuming P/E Ratio of Abhiman remains the same and all assets and liabilities of Swabhiman Ltd. are taken over at book value.)

Solution

Swap Ratio

	Abhiman Ltd.	Swabhiman Ltd.
	(₹)	(₹)
Share capital	200 lacs	100 lacs
Free reserves & surplus	900 lacs	600 lacs
Total	1100 lacs	700 lacs
No. of shares	2 lacs	10 lacs
Book value for share	₹ 550	₹ 70
Promoters Holding	50%	60%
Non promoters holding	50%	40%
Free float market capitalization (Public)	500 lacs	₹ 156 lacs
Total Market Cap	1000 lacs	390 lacs
No. of shares	2 lacs	10 lacs
Market Price	₹ 500	₹ 39
P/E ratio	10	4
EPS	₹ 50.00	₹ 9.75

Calculation of SWAP Ratio

Book Value	1 : 0.1273	0.1273 x 25%	0.031825
EPS	1 : 0.195	0.195 x 50%	0.097500
Market Price	1 : 0.078	0.078 x 25%	0.019500
Total			**0.148825**

(i) SWAP Ratio is 0.148825 shares of Abhiman Ltd. for every share of Swabhiman Ltd.
Total No. of shares to be issued = 10 lakh x 0.148825 = 148825 shares

(ii) Book value, EPS & Market Price.

Total No. shares = 200000 + 148825 = 348825

Total capital = ₹ 200 lakh + ₹ 148.825 lac = ₹ 348.825 lac

Reserves = ₹ 900 lac + ₹ 551.175 lac = ₹ 1451.175 lac

Book value Per Share = $\frac{₹\ 348.825\ \text{lac} + ₹\ 1451.175\ \text{lac}}{3.48825\ \text{lac}} = ₹\ 516.02$

or ₹ 516.02 x 0.148825 = ₹ 76.80

or = $\frac{\text{Total Capital}}{\text{No.of shares}} = \frac{1100\ \text{lac} + 7\quad \text{lac}}{3.48825\ \text{lac}} = ₹\ 516.02$

EPS = $\frac{\text{Total Profit}}{\text{No.of shares}} = \frac{₹\ 100\ \text{lac} + ₹\ 97.50\ \text{lac}}{3.48825\ \text{lac}} = ₹\ 56.62$

or ₹ 56.62 x 0.148825 = ₹ 8.43

Expected market price = ₹ 56.62 x PE Ratio= ₹ 56.62 x 10 = ₹ 566.20

or ₹ 566.20 x 0.148825 = ₹ 84.26

Question 25(Study Material TYK Q 19)

The following information is provided relating to the acquiring company E Ltd., and the target company H Ltd:

Particulars	E Ltd. (₹)	H Ltd. (₹)
Number of shares (Face value ₹ 10 each)	20 Lakhs	15 Lakhs
Market Capitalization	1000 Lakhs	1500 Lakhs
P/E Ratio (times)	10.00	5.00
Reserves and surplus in ₹	600.00 Lakhs	330.00 Lakhs
Promoter's Holding (No. of shares)	9.50 Lakhs	10.00 Lakhs

The Board of Directors of both the companies have decided to give a fair deal to the shareholders. Accordingly, the weights are decided as 40%, 25% and 35% respectively for earnings (EPS), book value and market price of share of each company for swap ratio.

Calculate the following:

(i) Market price per share, earnings per share and Book Value per share;
(ii) Swap ratio;
(iii) Promoter's holding percentage after acquisition;
(iv) EPS of E Ltd. after acquisitions of H Ltd;
(v) Expected market price per share and market capitalization of E Ltd.; after acquisition, assuming P/E ratio of E Ltd. remains unchanged; and
(vi) Free float market capitalization of the merged firm.

Solution

(i)

	E Ltd.	H Ltd.
Market capitalisation	1000 lakhs	1500 lakhs
No. of shares	20 lakhs	15 lakhs
Market Price per share	₹ 50	₹ 100
P/E ratio	10	5
EPS	₹ 5	₹ 20
Profit	₹ 100 lakh	₹ 300 lakh
Share capital	₹ 200 lakh	₹ 150 lakh
Reserves and surplus	₹ 600 lakh	₹ 330 lakh
Total	₹ 800 lakh	₹ 480 lakh
Book Value per share	₹ 40	₹ 32

(ii) Calculation of Swap Ratio

EPS	1 : 4 i.e.	4.0 x 40%	1.6
Book value	1 : 0.8 i.e.	0.8 x 25%	0.2
Market price	1 : 2 i.e.	2.0 x 35%	0.7
		Total	2.5

Swap ratio is for every one share of H Ltd., to issue 2.5 shares of E Ltd. Hence, total no. of shares to be issued 15 lakh x 2.5 = 37.50 lakh shares

(iii) Promoter's holding = 9.50 lakh shares + (10 x 2.5 = 25 lakh shares) = 34.50 lakh i.e. Promoter's holding % is (34.50 lakh / 57.50 lakh) x 100 = 60%

(iv) Calculation of EPS after merger

Total No. of shares 20 lakh + 37.50 lakh = 57.50 lakh

$$\text{EPS } \frac{\text{Total Profit}}{\text{No.of shares}} = \frac{100 \text{ lakh} + 300 \text{ lakh}}{57.50 \text{ lakh}} = \frac{400}{57.50} = ₹ 6.956$$

(v) Calculation of Market price and Market capitalization after merger

Expected market price	EPS 6.956 x P/E 10 = ₹ 69.56
Market capitalization	= ₹ 69.56 per share x 57.50 lakh shares
	= ₹ 3,999.70 lakh or ₹ 4,000 lakh

(vi) Free float of market capitalization = ₹ 69.56 per share x (57.50 lakh x 40%) = ₹ 1599.88 lakh

Question 26(Study Material TYK Q 20)/RTP May'20

The following information relating to the acquiring Company Abhiman Ltd. and the target Company Abhishek Ltd. are available. Both the Companies are promoted by Multinational Company, Trident Ltd. The promoter's holding is 50% and 60% respectively in Abhiman Ltd. and Abhishek Ltd.:

	Abhiman Ltd.	Abhishek Ltd.
Share Capital (₹)	200 lakh	100 lakh
Free Reserve and Surplus (₹)	800 lakh	500 lakh
Paid up Value per share (₹)	100	10
Free float Market Capitalisation (₹)	400 lakh	128 lakh
P/E Ratio (times)	10	4

Trident Ltd. is interested to do justice to the shareholders of both the Companies. For the swap ratio weights are assigned to different parameters by the Board of Directors as follows:

Book Value		25%
EPS (Earning per share)		50%
Market Price		25%

a) What is the swap ratio based on above weights?
b) What is the Book Value, EPS and expected Market price of Abhiman Ltd. after acquisition of Abhishek Ltd. (assuming P.E. ratio of Abhiman Ltd. remains unchanged and all assets and liabilities of Abhishek Ltd. are taken over at book value).

c) Calculate:
   (i) Promoter's revised holding in the Abhiman Ltd.
   (ii) Free float market capitalization.
   (iii) Also calculate No. of Shares, Earning per Share (EPS) and Book Value (B.V.), if after acquisition of Abhishek Ltd., Abhiman Ltd. decided to :
      1) Issue Bonus shares in the ratio of 1 : 2; and
      2) Split the stock (share) as ₹ 5 each fully paid.

Solution

a) Swap Ratio

	Abhiman Ltd.	Abhishek Ltd.
Share Capital	200 Lakh	100 Lakh
Free Reserves	800 Lakh	500 Lakh
Total	**1000 Lakh**	**600 Lakh**
No. of Shares	2 Lakh	10 Lakh
Book Value per share	₹ 500	₹ 60
Promoter's holding	50%	60%
Non promoter's holding	50%	40%
Free Float Market Cap. i.e.	400 Lakh	128 Lakh
Relating to Public's holding		
Hence Total market Cap.	800 Lakh	320 Lakh
No. of Shares	2 Lakh	10 Lakh
Market Price	₹ 400	₹ 32
P/E Ratio	10	4
EPS	40	8
Profits (₹ 2 X 40 lakh)	₹ 80 lakh	-
(₹ 8 X 10 lakh)	-	₹ 80 lakh

Calculation of Swap Ratio:

Book Value	1 : 0.12 i.e.	0.12 x 25%	0.03
EPS	1 : 0.2	0.20 x 50%	0.10
Market Price	1 : 0.08	0.08 x 25%	0.02
Total			**0.15**

Swap ratio is for every one share of Abhishek Ltd., to issue 0.15 shares of Abhiman Ltd. Hence total no. of shares to be issued.

10 Lakh x 0.15 = 1.50 lakh shares

b) Book Value, EPS & Market Price

Total No of Shares 2 Lakh + 1.5 Lakh = 3.5 Lakh

Total Capital ₹ 200 Lakh + ₹ 150 Lakh = ₹ 350 Lakh

Reserves ₹ 800 Lakh + ₹ 450 Lakh = ₹ 1,250 Lakh

$$\text{Book Value} = \frac{₹\ 350\text{Lakh} + ₹\ 1250\ \text{Lakh}}{3.5\ \text{Lakh}} = ₹\ 457.14\ \text{per share}$$

$$\text{EPS} = \frac{\text{Total Profit}}{\text{No. of share}} = \frac{₹\ 80\ \text{Lakh} + ₹\ 80\ \text{lakh}}{3.5\ \text{Lakh}} = \frac{₹\ 160\ \text{Lakh}}{3.5} = ₹\ 45.71$$

Expected Market Price EPS (₹ 45.71) x P/E Ratio (10) = ₹ 457.10

c)

(i) Promoter's holding		
Promoter's Revised	Abhiman 50% i.e.	1.00 Lakh shares
Holding	Abhishek 60% i.e.	0.90 Lakh shares

	Total	1.90 Lakh shares

Promoter's % = 1.90/3.50 x 100 = 54.29%

(ii) Free Float Market Capitalisation

Free Float Market = (3.5 Lakh – 1.9 Lakh) x ₹ 457.10

Capitalisation = ₹ 731.36 Lakh

(iii) (a) & (b)

Revised Capital ₹ 350 Lakh + ₹ 175 Lakh = ₹ 525 Lakh

No. of shares before Split (F.V ₹ 100) 5.25 Lakh

No. of Shares after Split (F.V. ₹ 5) 5.25 x 20 = 105 Lakh

EPS 160 Lakh / 105 Lakh = 1.523

Book Value Cap. ₹ 525 Lakh + ₹ 1075 Lakh / No. of Shares = 105 Lakh

= ₹ 15.238 per share

Question 27(Study Material TYK Q 27)

R Ltd. and S Ltd. are companies that operate in the same industry. The financial statements of both the companies for the current financial year are as follows:

Balance Sheet

Particulars	R. Ltd. (₹)	S. Ltd (₹)
Equity & Liabilities		
Shareholders Fund		
Equity Capital (₹ 10 each)	20,00,000	16,00,000
Retained earnings	4,00,000	-
Non - current Liabilities		
16% Long term Debt	10,00,000	6,00,000
Current Liabilities	14,00,000	8,00,000
Total	**48,00,000**	**30,00,000**
Assets		
Non – current Assets	20,00,000	10,00,000
Current Assets	28,00,000	20,00,000
Total	**48,00,000**	**30,00,000**

Income Statement

	Particulars	R. Ltd. (₹)	S. Ltd. (₹)
A.	Net Sales	69,00,000	34,00,000
B.	Cost of Goods sold	55,20,000	27,20,000
C.	Gross Profit (A-B)	13,80,000	6,80,00
D.	Operating Expenses	4,00,000	2,00,000

E.	Interest	1,60,000	96,000
F.	Earnings before taxes [C-(D+E)]	8,20,000	3,84,000
G.	Taxes @ 35%	2,87,000	1,34,400
H.	Earnings After Tax (EAT)	**5,33,000**	**2,49,600**

Additional Information:

No. of equity shares	2,00,000	1,60,000
Dividend payment Ratio (D/P)	20%	30%
Market price per share	₹ 50	₹ 20

Assume that both companies are in the process of negotiating a merger through exchange of Equity shares:

You are required to:

a) Decompose the share price of both the companies into EPS & P/E components. Also segregate their EPS figures into Return On Equity (ROE) and Book Value / Intrinsic Value per share components.
b) Estimate future EPS growth rates for both the companies.
c) Based on expected operating synergies, R Ltd. estimated that the intrinsic value of S Ltd. Equity share would be ₹ 25 per share on its acquisition. You are required to develop a range of justifiable Equity Share Exchange ratios that can be offered by R Ltd. to the shareholders of S Ltd. Based on your analysis on parts (i) and (ii), would you expect the negotiated terms to be closer to the upper or the lower exchange ratio limits and why?

Solution

a) Determination of EPS, P/E Ratio, ROE and BVPS of R Ltd. & S Ltd.

	R Ltd.	S Ltd.
EAT (₹)	5,33,000	2,49,600
N	200000	160000
EPS (EAT ÷ N)	2.665	1.56
Market Price Per Share	50	20
PE Ratio (MPS / EPS)	18.76	12.82
Equity Fund (Equity Value)	2400000	1600000
BVPS (Equity Value ÷ N)	12	10
ROE (EAT ÷ EF) or	0.2221	0.156
ROE (EAT ÷ EF) x 100	22.21%	15.60%

b) Determination of Growth Rate of EPS of R Ltd.& S Ltd.

	R Ltd.	S Ltd.
Retention Ratio (1 - D/P Ratio)	0.80	0.70
Growth Rate (ROE x Retention Ratio) or	0.1777	0.1092
Growth Rate (ROE x Retention Ratio) x 100	17.77%	10.92%

c) Justifiable equity share exchange ratio
   (i) Market Price Based = MPSS / MPSR = ₹ 20 / ₹ 50 = 0.40 : 1 (lower limit)
   (ii) Intrinsic Value Based = ₹ 25 / ₹ 50 = 0.50 : 1 (max. limit)

Since R Ltd. has higher EPS, PE, ROE and higher growth expectations the negotiated term would be expected to be closer to the lower limit, based on existing share price.

Question 28(Study Material TYK Q 28)/MTP April'18/Similar Q asked in PP Jan'21

BA Ltd. and DA Ltd. both the companies operate in the same industry. The Financial statements of both the companies for the current financial year are as follows:

Balance Sheet

Particulars	BA Ltd. (₹)	DA Ltd. (₹)
Current Assets	14,00,000	10,00,000
Fixed Assets (Net)	10,00,000	5,00,000
Total (₹)	**24,00,000**	**15,00,000**
Equity capital (₹ 10 each)	10,00,000	8,00,000
Retained earnings	2,00,000	--
14% long-term debt	5,00,000	3,00,00
Current liabilities	7,00,000	4,00,000
Total (₹)	**24,00,000**	**15,00,000**

Income Statement

	BA Ltd. (₹)	DA Ltd. (₹)
Net Sales	34,50,000	17,00,000
Cost of Goods sold	27,60,000	13,60,000
Gross profit	6,90,000	3,40,000
Operating expenses	2,00,000	1,00,000
Interest	70,000	42,000
Earnings before taxes	4,20,000	1,98,00
Taxes @ 50%	2,10,000	99,000
Earnings after taxes (EAT)	**2,10,000**	**99,000**
Additional Information:		
No. of Equity shares	1,00,000	80,000
Dividend payment ratio (D/P)	40%	60%
Market price per share	₹ 40	₹ 15

Assume that both companies are in the process of negotiating a merger through an exchange of equity shares. You have been asked to assist in establishing equitable exchange terms and are required to:

(i) Decompose the share price of both the companies into EPS and P/E components; and also segregate their EPS figures into Return on Equity (ROE) and book value / intrinsic value per share components.

(ii) Estimate future EPS growth rates for each company.

(iii) Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be ₹ 20 per share on its acquisition. You are required to develop a range of justifiable equity share exchange ratios that can be offered by BA Ltd. to the shareholders of DA Ltd. Based on your analysis in part (i) and (ii), would you expect the negotiated terms to be closer to the upper, or the lower exchange ratio limits and why?

(iv) Calculate the post – merger EPS based on an exchange ratio of 0.4 : 1 being offered by BA Ltd. and indicate the immediate EPS accretion or dilution, if any, that will occur for each group of shareholders.

(v) Based on a 0.4 : 1 exchange ratio and assuming that BA Ltd.'s pre - merger P/E ratio will continue after the merger, estimate the post - merger market price. Also show the resulting accretion or dilution in pre - merger market prices.

Solution

Market price per share (MPS) = EPS x P/E ratio or P/E ratio = MPS / EPS

(i) Determination of EPS, P/E ratio, ROE and BVPS of BA Ltd. and DA Ltd.

		BA Ltd.	DA Ltd.
Earnings After Tax	(EAT)	₹ 2,10,000	₹ 99,000
No. of Shares	(N)	100000	80000
EPS	(EAT / N)	₹ 2.10	₹ 1.2375
Market price per share	(MPS)	40	15
P/E Ratio	(MPS / EPS)	19.05	12.12
Equity Funds	(EF)	₹ 12,00,000	₹ 8,00,000
BVPS	(EF / N)	12	10
ROE	(EAT / EF) × 100	17.50%	12.37%

(ii) Estimation of growth rates in EPS for BA Ltd. and DA Ltd.

Retention Ratio	(1 - D/P ratio)	0.6	0.4
Growth Rate	(ROE × Retention Ratio)	10.50%	4.95%

(iii) Justifiable equity shares exchange ratio

(a)	Intrinsic value based		= ₹ 20 / ₹ 40	= 0.5:1 (upper limit)
(b)	Market price based	= MPSDA / MPSBA	= ₹ 15 / ₹ 40	= 0.375:1 (lower limit)

Since, BA Ltd. has a higher EPS, ROE, P/E ratio and even higher EPS growth expectations, the negotiable terms would be expected to be closer to the lower limit, based on the existing share prices.

(iv) Calculation of Post – merger EPS and its effects

Particulars			BA Ltd.	DA Ltd.	Combined
EAT	(₹)	(i)	2,10,000	99,000	3,09,000
Share outstanding		(ii)	100000	80000	132000*
EPS	(₹)	(i) / (ii)	2.1	1.2375	2.341
EPS Accretion (Dilution)	(Re.)		0.241	(0.301***)	

(v) Estimation of Post – merger Market price and other effects

Particulars			BA Ltd.	DA Ltd.	Combined
EPS	(₹)	(i)	2.1	1.2375	2.341
P/E Ratio		(ii)	19.05	12.12	19.05
MPS	(₹)	(i) / (ii)	40	15	44.6

*	MPS Accretion	(₹)		4.6	2.84***	

Shares outstanding (combined) = 100000 shares + (0.40 × 80000) = 132000 shares

** EPS claim per old share = ₹ 2.34 × 0.4	₹ 0.936
EPS dilution = ₹ 1.2375 – ₹ 0.936	₹ 0.3015
***S claim per old share (₹ 44.60 × 0.4)	₹ 17.84
Less: MPS per old share	₹ 15.00
	₹ 2.84

Question 29(Study Material TYK Q 25)/RTP Nov'22

AFC Ltd. wishes to acquire BCD Ltd. The shares issued by the two companies are 10,00,000 and 5,00,000 respectively:

(i) Calculate the increase in the total value of BCD Ltd. resulting from the acquisition on the basis of the following conditions:

Current expected growth rate of BCD Ltd.		7%
Expected growth rate under control of AFC Ltd., (without any additional capital investment and without any change in risk of operations)		8%
Current Market price per share of AFC Ltd.	₹	100
Current Market price per share of BCD Ltd.	₹	20
Expected Dividend per share of BCD Ltd.	₹	0.60

(ii) On the basis of aforesaid conditions calculate the gain or loss to shareholders of both the companies, if AFC Ltd. were to offer one of its shares for every four shares of BCD Ltd.

(iii) Calculate the gain to the shareholders of both the Companies, if AFC Ltd. pays ₹ 22 for each share of BCD Ltd., assuming the P/E Ratio of AFC Ltd. does not change after the merger. EPS of AFC Ltd. is ₹ 8 and that of BCD is ₹ 2.50. It is assumed that AFC Ltd. invests its cash to earn 10%.

Solution

(i) For BCD Ltd., before acquisition

The cost of capital of BCD Ltd. may be calculated by using the following formula:

$$\frac{\text{Dividend}}{\text{Price}} + \text{Growth \%}$$

Cost of Capital i.e., Ke = (0.60 / 20) + 0.07 = 0.10

After acquisition g (i.e. growth) becomes 0.08

Therefore, price per share after acquisition = 0.60 / (0 10-0.08) = ₹ 30

The increase in value therefore is = ₹ (30 - 20) x 5,00,000 = ₹ 50,00,000/-

(ii) To shareholders of BCD Ltd. the immediate gain is ₹ 100 – ₹ 20 x 4 = ₹ 20 per share

The gain can be higher if price of shares of AFC Ltd. rise following merger which they should undertake.

To AFC Ltd. shareholders	(₹ (In lakhs)	
Value of Company now		1,000
Value of BCD Ltd.		150
		1,150
No. of shares		11.25
Therefore,Value per share	1150 / 11.25 =	₹ 102.22

Gain to shareholders of BCD Ltd. = ₹ 102.22 – ₹ (4 x 20) = ₹ 22.22

Gain to shareholders of AFC Ltd. = ₹ 102.22 – ₹ 100.00 = ₹ 2.22

(iii) Gain to shareholders of AFC Ltd:

Earnings of BCD Ltd. (5,00,000 x 2.50)	₹ 12,50,000/-
Less: Loss of earning in cash (5,00,000 x ₹ 22 x 0.10)	₹ 11,00,000/-
Net Earning	**₹ 1,50,000/-**
Number of shares	10,00,000
Net increase in earning per share	0.15
P/E ratio of AFC Ltd. = 100 / 8 = 12.50	
Therefore, Gain per share of shareholders of AFC Ltd. = 0.15 x 12.50 = ₹ 1.88	
Gain to the shareholders of BCD Ltd. ₹ (22-20) = ₹ 2/- per share	

Alternatively, it can also be computed as follows:

Post – Merger Earnings (10,00,000 x ₹ 8 + 5,00,000 x ₹ 2.5 – 11,00,000)	₹ 81,50,000
EPS after Merger $\frac{81,50,000}{10,00,000}$	₹ 8.15
PE Ratio	12.50
Post – Merger Price of Share (₹ 8.15 x 12.50)	₹ 101.875
Less: Price before merger	₹ 100.00
	₹ 1.875
Say	₹ 1.88

Question 30(Study Material TYK Q 24)/RTP May'19/MTP March'18/MTP Oct'22

Reliable Industries Ltd. (RIL) is considering a takeover of Sunflower Industries Ltd. (SIL). The particulars of 2 companies are given below:

Particulars	Reliable Industries Ltd	Sunflower Industries Ltd.
Earnings After Tax (EAT)	₹ 20,00,000	₹ 10,00,000
Equity shares O/s	10,00,000	10,00,000
Earnings per share (EPS)	2	1
PE Ratio (Times)	10	5

Required:

(i) What is the market value of each Company before merger?
(ii) Assume that the management of RIL estimates that the shareholders of SIL will accept an offer of one share of RIL for four shares of SIL. If there are no synergic effects, what is the market value of the Post - merger RIL? What is the new price per share? Are the shareholders of RIL better or worse off than they were before the merger?
(iii) Due to synergic effects, the management of RIL estimates that the earnings will increase by 20%. What are the new post – merger EPS and Price per share? Will the shareholders be better off or worse off than before the merger?

Solution

(i) Market value of Companies before Merger

Particulars	RIL	SIL
EPS	₹ 2	Re.1
P/E Ratio	10	5
Market Price Per Share	₹ 20	₹ 5
Equity Shares	10,00,000	10,00,000
Total Market Value	2,00,00,000	50,00,000

(ii) Post – Merger Effects on RIL

		₹
Post – merger earnings		30,00,000
Exchange Ratio (1:4)		
No. of equity shares o/s (10,00,000 + 2,50,000)		12,50,000
EPS: 30,00,000 / 12,50,000		2.4
PE Ratio		10
Market Value 10 x 2.4		24
Total Value (12,50,000 x 24)		3,00,00,000
Gains From Merger:		₹
Post-Merger Market Value of the Firm		3,00,00,000
Less: Pre-Merger Market Value		
RIL	2,00,00,000	
SIL	50,00,000	2,50,00,000
Total gains from Merger		50,00,000

Apportionment of Gains between the Shareholders:

Particulars	RIL (₹)	SIL (₹)
Post – Merger Market Value:		
10,00,000 x 24	2,40,00,000	--
2,50,000 x 24	-	60,00,000
Less: Pre – Merger Market Value	2,00,00,000	50,00,000
Gains from Merger:	40,00,000	10,00,000

Thus, the shareholders of both the companies (RIL + SIL) are better off than before

(iii) Post – Merger Earnings:

Increase in Earnings by 20%

New Earnings: ₹ 30,00,000 x (1+0.20)	₹ 36,00,000
No. of equity shares outstanding:	12,50,000
EPS (₹ 36,00,000 / 12,50,000)	₹ 2.88
PE Ratio	10
Market Price Per Share: = ₹ 2.88 x 10	₹ 28.80

Therefore, Shareholders will be better – off than before the merger situation.

Question 31(Study Material TYK Q 31)/MTP Sep'22

The equity shares of XYZ Ltd. are currently being traded at ₹ 24 per share in the market. XYZ Ltd. has total 10,00,000 equity shares outstanding in number; and promoters' equity holding in the company is 40%.

PQR Ltd. wishes to acquire XYZ Ltd. because of likely synergies. The estimated present value of these synergies is ₹ 80,00,000.

Further PQR feels that management of XYZ Ltd. has been over paid. With better motivation, lower salaries and fewer perks for the top management, will lead to savings of ₹ 4,00,000 p.a. Top management with their families are promoters of XYZ Ltd. Present value of these savings would add ₹ 30,00,000 in value to the acquisition.

Following additional information is available regarding PQR Ltd.:

Earnings Per Share	₹ 4
Total number of equity shares outstanding	15,00,000
Market price of equity share	₹ 40

Required:

(i) What is the maximum price per equity share which PQR Ltd. can offer to pay for XYZ Ltd.?
(ii) What is the minimum price per equity share at which the management of XYZ Ltd. will be willing to offer their controlling interest?

Solution

(i) Calculation of maximum price per share at which PQR Ltd. can offer to pay for XYZ Ltd.'s share

Market Value (10,00,000 x ₹ 24)	₹ 2,40,00,000
Synergy Gain	₹ 80,00,000
Saving of Overpayment	₹ 30,00,000
	₹ 3,50,00,000
Maximum Price (₹ 3,50,00,000 / 10,00,000)	₹ 35

Alternatively, it can also be computed as follows:

Let ER be the swap ratio then,

$$40 = \frac{24 \times 10,00,000 + 40 \times 15,00,0000 + 80,00,000 + 30,00,000}{15,00,000 + 10,00,000 \times ER}$$

ER = 0.875

MP = PE x EPS x ER= $\frac{40}{4} \times ₹4 \times 0.875 = ₹35$

(ii) Calculation of minimum price per share at which the management of XYZ Ltd.'s will be willing to offer their controlling interest

Value of XYZ Ltd.'s Management Holding (40% of 10,00,000 x ₹ 24)	₹ 96,00,000
Add: PV of loss of remuneration to top management	₹ 30,00,000
	₹ 1,26,00,000
No. of Shares	4,00,000
Minimum Price (₹ 1,26,00,000 / 4,00,000)	₹ 31.50

Question 32(Old PM)

Bank 'R' was established in 2005 and doing banking in India. The bank is facing DO OR DIE situation. There are problems of Gross NPA (Non – Performing Assets) at 40% & CAR / CRAR (Capital Adequacy Ratio / Capital Risk Weight Asset Ratio) at 4%. The net worth of the bank is not good. Shares are not traded regularly. Last week, it was traded @ ₹ 8 per share.

RBI Audit suggested that bank has either to liquidate or to merge with other bank.

Bank 'P' is professionally managed bank with low gross NPA of 5%. It has Net NPA as 0% and CAR at 16%. Its share is quoted in the market @ ₹ 128 per share. The board of directors of bank ' P ' has submitted a proposal to RBI for takeover of bank 'R' on the basis of share exchange ratio.

The Balance Sheet details of both the banks are as follows:

	Bank 'R' Amt. in ₹ lacs	Bank 'P' Amt. In ₹ lacs
Paid up share capital (F.V. ₹ 10 each)	140	500
Reserves & Surplus	70	5,500
Deposits	4,000	40,000
Other liabilities	890	2,500
Total Liabilities	**5,100**	**48,500**
Cash in hand & with RBI	400	2,500
Balance with other banks	-	2,000
Investments	1,100	15,000
Advances	3,500	27,000
Other Assets	100	2,000
Total Assets	**5,100**	**48,500**

It was decided to issue shares at Book Value of Bank 'P' to the shareholders of Bank 'R'. All assets and liabilities are to be taken over at Book Value.

For the swap ratio, weights assigned to different parameters are as follows:

Gross NPA	30%
CAR	20%
Market price	40%
Book value	10%

a) What is the swap ratio based on above weights?
b) How many shares are to be issued?
c) Prepare Balance Sheet after merger.
d) Calculate CAR & Gross NPA % of Bank 'P' after merger.

Solution

a) Swap Ratio

Gross NPA	5 :	40	i.e.	5 / 40 x 30% = 0.0375
CAR	4 :	16	i.e.	4 / 16 x 20% = 0.0500
Market Price	8 :	128	i.e.	8 / 128 x 40% = 0.025
Book Value Per Share	15 :	120	i.e.	15 / 120 x 10% = 0.0125
				0.125

Thus, for every 1 share of Bank 'R' 0.125 share of Bank 'P' shall be issued.

b) No. of equity shares to be issued:

$$\frac{₹\ 140\ \text{lac}}{₹\ 10} \times 0.125 = 1.75\ \text{lac shares}$$

c) Balance Sheet after Merger

Calculation of Capital Reserve

Book Value of Shares	₹ 210.00 lac
Less: Value of Shares issued	₹ 17.50 lac
Capital Reserve	**₹ 192.50 lac**

Balance Sheet

	₹ lac		₹ lac
Paid up Share Capital	517.50	Cash in Hand & RBI	2900.00
Reserves & Surplus	5500.00	Balance with other banks	2000.00
Capital Reserve	192.50	Investment	16100.00
Deposits	44000.00	Advances	30500.00
Other Liabilities	3390.00	Other Assets	2100.00
	53600.00		**53600.00**

d) Calculation CAR & Gross NPA % of Bank 'P' after merger

$$\text{CAR/CRWAR} = \frac{\text{Total Capital}}{\text{Risky Weighted Assets}}$$

	Bank 'R'	Bank 'P'	Merged
CAR (Given)	4%	16%	
Total Capital	₹ 210 lac	₹ 6000 lac	₹ 6210 lac
Risky Weighted Assets	₹ 5250 lac	₹ 37500 lac	₹ 42750 lac

$$\text{CAR} = \frac{₹\ 6210\ \text{lac}}{₹\ 42750\ \text{lac}} = 14.53\%$$

$$\text{GNPA Ratio} = \frac{\text{Gross NPA}}{\text{Gross Deposits}} \times 100$$

	Bank 'R'	Bank 'P'	Merged
GNPA (Given)	0.40	0.05	
	$0.40 = \frac{\text{GNPA}_R}{₹\ 3500\ \text{lac}}$	$0.40 = \frac{\text{GNPA}_S}{₹\ 27000\ \text{lac}}$	
Gross NPA	₹ 1400 lac	₹ 1350 lac	₹ 2750 lac

Question 33(Old PM)/Similar Q asked in MTP Oct'21

AB Ltd., is planning to acquire and absorb the running business of XY Ltd. The valuation is to be based on the recommendation of merchant bankers and the consideration is to be discharged in the form of equity shares to be issued by AB Ltd. As on 31.3.2006, the paid – up capital of AB Ltd. consists of 80 lakhs shares of ₹ 10 each. The highest and the lowest market quotation during the last 6 months were ₹ 570 and ₹ 430. For the purpose of the exchange, the price per share is to be reckoned as the average of the highest and lowest market price during the last 6 months ended on 31.3.06.

XY Ltd.'s Balance Sheet as at 31.3.2006 is summarised below:

	₹ lakhs
Sources	
Share Capital	
20 lakhs equity shares of ₹ 10 each fully paid	200
10 lakhs equity shares of ₹ 10 each, ₹ 5 paid	50
Loans	100
Total	350
Uses	
Fixed Assets (Net)	150
Net Current Assets	200
	350

An independent firm of merchant bankers engaged for the negotiation, have produced the following estimates of cash flows from the business of XY Ltd.:

Year ended	By way of	₹ lakhs
31.3.07	after tax earnings for equity	105
31.3.08	do	120

31.3.09	Do	125
31.3.10	Do	120
31.3.11	Do	100
	Terminal Value estimate	200

It is the recommendation of the merchant banker that the business of XY Ltd. may be valued on the basis of the average of (i) Aggregate of discounted cash flows at 8% and (ii) Net assets value. Present value factors at 8% for years

1-5:	0.93	0.86	0.79	0.74	0.68

You are required to:

(i) Calculate the total value of the business of XY Ltd.
(ii) The number of shares to be issued by AB Ltd.; and
(iii) The basis of allocation of the shares among the shareholders of XY Ltd.

Solution

Price / share of AB Ltd. for determination of number of shares to be issued = (₹ 570 + ₹ 430) / 2 = ₹ 500

Value of XY Ltd based on future cash flow capitalization (105 x 0.93) + (120 x 0.86) + (125 x 0.79) + (120 x 0.74) x (300 x 0.68)	₹ lakhs	592.40
Value of XY Ltd based on net assets	₹ lakhs	250.00
Average value (592.40 + 250) / 2		421.20
No. of shares in AB Ltd to be issued ₹ 4,21,20,000 / 500	Nos.	84240
Basis of allocation of shares		
Fully paid equivalent shares in XY Ltd. (20 + 5) lakhs		2500000
Distribution to fully paid shareholders 84240 x 20 / 25		67392
Distribution to partly paid shareholders 84240 - 67392		16848

Question 34(Study Material-Corporate Valuation TYK Q 4)/Study Material TYK Q 23)

H Ltd. agrees to buy over the business of B Ltd. effective 1st April, 2012.The summarized Balance Sheets of H Ltd. and B Ltd. as on 31st March 2012 are as follows:

Balance sheet as at 31st March, 2012 (In Crores of Rupees)

Liabilities:	H. Ltd	B. Ltd.
Paid up Share Capital		
-Equity Shares of `100 each	350.00	
-Equity Shares of `10 each		6.50
Reserve & Surplus	950.00	25.00
Total	1,300.00	31.50
Assets:		
Net Fixed Assets	220.00	0.50
Net Current Assets	1,020.00	29.00
Deferred Tax Assets	60.00	2.00
Total	1,300.00	31.50

H Ltd. proposes to buy out B Ltd. and the following information is provided to you as part of the scheme of buying:

a) The weighted average post tax maintainable profits of H Ltd. and B Ltd. for the last 4 years are ₹ 300 crores and ₹ 10 crores respectively.
b) Both the companies envisage a capitalization rate of 8%.
c) H Ltd. has a contingent liability of ₹ 300 crores as on 31st March, 2012.
d) H Ltd. to issue shares of ₹ 100 each to the shareholders of B Ltd. in terms of the exchange ratio as arrived on a Fair Value basis. (Please consider weights of 1 and 3 for the value of shares arrived on Net Asset basis and Earnings capitalization method respectively for both H Ltd. and B Ltd.)

You are required to arrive at the value of the shares of both H Ltd. and B Ltd under:

(i) Net Asset Value Method
(ii) Earnings Capitalisation Method
(iii) Exchange ratio of shares of H Ltd. to be issued to the shareholders of B Ltd. on a Fair value basis (taking into consideration the assumption mentioned in point 4 above.)

Solution

(i) Net asset value

H Ltd.	$\frac{₹\ 1300\ \text{crores} - ₹\ 300\ \text{crores}}{3.50\ \text{crores}} = ₹\ 285.71$
B Ltd.	$\frac{₹\ 31.50\ \text{crores}}{0.65\ \text{crores}} = ₹\ 48.46$

(ii) Earning capitalization value

H Ltd.	$\frac{₹\ 300\ \text{crores}/0.08}{3.50\ \text{crores}} = ₹\ 1071.43$*
B Ltd.	$\frac{₹\ 10\ \text{crores}/\ 0.08}{0.65\ \text{crores}} = ₹\ 192.31$

* Alternatively, Contingent Liability can also be deducted from this Valuation.

(iii) Fair value

H Ltd.	$\frac{₹\ 285.71\ \times 1 + ₹\ 1071.43\ \times 3}{4} = ₹\ 875$
B Ltd.	$\frac{₹\ 48.46\ \times 1 + ₹\ 192.31\ \times 3}{4} = ₹\ 156.3475$

Exchange ratio ₹ 156.3475 / ₹ 875 = 0.1787

H Ltd should issue its 0.1787 share for each share of B Ltd.

Note: In above Solution it has been assumed that the contingent liability will materialize at its full amount.

Question 35(Study Material TYK Q 21)/RTP May'18/MTP Oct'18/PP Nov'18

T Ltd. and E Ltd. are in the same industry. The former is in negotiation for acquisition of the latter. Important information about the two companies as per their latest financial statements is given below:

	T Ltd.	E Ltd.
₹ 10 Equity shares outstanding	12 Lakhs	6 Lakhs
Debt:		
10% Debentures (₹ Lakhs)	580	--
12.5% Institutional Loan (₹ Lakhs)	--	240
Earning before interest, depreciation and tax (EBIDAT) (₹ Lakhs)	400.86	115.71
Market Price / share (₹)	220.00	110.00

T Ltd. plans to offer a price for E Ltd., business as a whole which will be 7 times EBIDAT reduced by outstanding debt, to be discharged by own shares at market price.

E Ltd. is planning to seek one share in T Ltd. for every 2 shares in E Ltd. based on the market price. Tax rate for the two companies may be assumed as 30%.

Calculate and show the following under both alternatives – T Ltd.'s offer and E Ltd.'s plan:

(i) Net consideration payable.
(ii) No. of shares to be issued by T Ltd.
(iii) EPS of T Ltd. after acquisition.
(iv) Expected market price per share of T Ltd. after acquisition.
(v) State briefly the advantages to T Ltd. from the acquisition.

Note: Calculations (except EPS) may be rounded off to 2 decimals in lakhs.

Solution

As per T Ltd.'s Offer

		₹ in lakhs
(i)	**Net Consideration Payable**	
	7 times EBIDAT, i.e. 7 x ₹ 115.71 lakh	809.97
	Less: Debt	240.00
		569.97
(ii)	**No. of shares to be issued by T Ltd**	
	₹ 569.97 lakh / ₹ 220 (rounded off) (Nos.)	2,59,000
(iii)	**EPS of T Ltd after acquisition**	
	Total EBIDT (₹ 400.86 lakh + ₹ 115.71 lakh)	516.57
	Less: Interest (₹ 58 lakh + ₹ 30 lakh)	88.00
		428.57
	Less: 30% Tax	128.57
	Total earnings (NPAT)	**300.00**
	Total no. of shares outstanding	14.59 lakh
	(12 lakh + 2.59 lakh)	

	EPS (₹ 300 lakh / 14.59 lakh)	₹ 20.56
(iv)	**Expected Market Price:**	
	Pre – acquisition P/E multiple:	
	EBIDAT (₹ in lakhs)	400.86
	Less: Interest (580 X 10) (₹ in lakhs) 100	58.00
		342.86
	Less: 30% Tax (₹ in lakhs)	102.86
	EAT (₹ in lakhs)	**240.00**
	No. of shares (lakhs)	12.00
	EPS	₹ 20.00
	Hence, PE multiple 220/20	11
	Expected market price after acquisition (₹ 20.56 x 11)	₹ 226.16

As per E Ltd's Plan

		₹ in lakhs
(i)	**Net consideration payable**	
	6 lakhs shares x ₹ 110	660
(ii)	**No. of shares to be issued by T Ltd**	
	₹ 660 lakhs ÷ ₹ 220	3 lakh
(iii)	**EPS of T Ltd after Acquisition**	
	NPAT (as per earlier calculations)	300.00
	Total no. of shares outstanding (12 lakhs + 3 lakhs)	15 lakh
	Earning Per Share (EPS) ₹ 300 lakh / 15 lakh	₹ 20.00
(iv)	**Expected Market Price (₹ 20 x 11)**	220.00

Advantages of Acquisition to T Ltd

Since the two companies are in the same industry, the following advantages could accrue:

- Synergy, cost reduction and operating efficiency.
- Better market share.
- Avoidance of competition

Question 36(Study Material TYK Q 22)

The following information is relating to Fortune India Ltd. having two division, viz. Pharma Division and Fast – Moving Consumer Goods Division (FMCG Division). Paid up share capital of Fortune India Ltd. is consisting of 3,000 Lakhs equity shares of Re. 1 each. Fortune India Ltd. decided to de – merge Pharma Division as Fortune Pharma Ltd. w.e.f. 1.4.2009. Details of Fortune India Ltd. as on 31.3.2009 and of Fortune Pharma Ltd. as on 1.4.2009 are given below:

Particulars	Fortune Pharma Ltd.	Fortune India Ltd.
	₹	₹
Outside Liabilities		
Secured Loans	400 lakh	3,000 lakh
Unsecured Loans	2,400 lakh	800 lakh
Current Liabilities & Provisions	1,300 lakh	21,200 lakh
Assets		
Fixed Assets	7,740 lakh	20,400 lakh
Investments	7,600 lakh	12,300 lakh
Current Assets	8,800 lakh	30,200 lakh
Loans & Advances	900 lakh	7,300 lakh
Deferred tax / Misc. Expenses	60 lakh	(200) lakh

Board of Directors of the Company have decided to issue necessary equity shares of Fortune Pharma Ltd. of Re. 1 each, without any consideration to the shareholders of Fortune India Ltd. For that purpose following points are to be considered:

a) Transfer of Liabilities & Assets at Book value.
b) Estimated Profit for the year 2009-10 is ₹ 11,400 Lakh for Fortune India Ltd. & ₹ 1,470 lakhs for Fortune Pharma Ltd.
c) Estimated Market Price of Fortune Pharma Ltd. is ₹ 24.50 per share.
d) Average P/E Ratio of FMCG sector is 42 & Pharma sector is 25, which is to be expected for both the companies.

Calculate:

1) The Ratio in which shares of Fortune Pharma are to be issued to the shareholders of Fortune India Ltd.
2) Expected Market price of Fortune India (FMCG) Ltd.
3) Book Value per share of both the Companies immediately after Demerger.

Solution

Share holders' funds (₹ Lakhs)

Particulars	Fortune India Ltd.	Fortune Pharma Ltd.	Fortune India (FMCG) Ltd.
Assets	70,000	25,100	44,900
Outside liabilities	25,000	4,100	20,900
Net worth	45,000	21,000	24,000

1) Calculation of Shares of Fortune Pharma Ltd. to be issued to shareholders of Fortune India Ltd.

	Fortune Pharma Ltd.
Estimated Profit (₹ in lakhs)	1,470
Estimated market price (₹)	24.5
Estimated P/E	25
Estimated EPS (₹)	0.98
No. of shares lakhs	1,500

Hence, Ratio is 1 share of Fortune Pharma Ltd. for 2 shares of Fortune India Ltd.

OR for 0.50 share of Fortune Pharma Ltd. for 1 share of Fortune India Ltd.

2) Expected market price of Fortune India (FMCG) Ltd.

	Fortune India (FMCG) Ltd.
Estimated Profit (₹ in lakhs)	11,400
No. of equity shares (₹ in lakhs)	3,000
Estimated EPS (₹)	3.8
Estimated P/E	42
Estimated market price (₹)	159.60

3) Book Value Per Share

	Fortune Pharma Ltd.	Fortune India (FMCG) Ltd.
Net worth (₹ in lakhs)	21,000	24,000
No. of shares (₹ in lakhs)	1,500	3,000
Book value of shares	₹ 14	₹ 8

Question 37(Study Material TYK Q 30)/Similar Q asked in PP Jan'21)

M/s Tiger Ltd. wants to acquire M/s. Leopard Ltd. The balance sheet of Leopard Ltd. as on 31st March, 2012 is as follows:

Liabilities	₹	Assets	₹
Equity Capital (70,000 shares)	7,00,000	Cash	50,000
Retained earnings	3,00,000	Debtors	70,000
12% Debentures	3,00,000	Inventories	2,00,000
Creditors and other liabilities	3,20,000	Plants & Eqpt.	13,00,000
	16,20,000		16,20,000

Additional Information:

(i) Shareholders of Leopard Ltd. will get one share in Tiger Ltd. for every two shares. External liabilities are expected to be settled at ₹ 5,00,000. Shares of Tiger Ltd. would be issued at its current price of ₹ 15 per share. Debenture holders will get 13% convertible debentures in the purchasing company for the same amount. Debtors and inventories are expected to realize ₹ 2,00,000.

(ii) Tiger Ltd. has decided to operate the business of Leopard Ltd. as a separate division. The division is likely to give cash flows (after tax) to the extent of ₹ 5,00,000 per year for 6 years. Tiger Ltd. has planned that, after 6 years, this division would be demerged and disposed of for ₹ 2,00,000.

(iii) The company's cost of capital is 16%.

Make a report to the Board of the company advising them about the financial feasibility of this acquisition.

Net present values for 16% for ₹ 1 are as follows:

Years	1	2	3	4	5	6
PV	0.862	0.743	0.641	0.552	0.476	0.410

Solution

Calculation of Purchase Consideration

	₹
Issue of Share 35000 x ₹ 15	5,25,000
External Liabilities settled	5,00,000
13% Debentures	3,00,000
	13,25,000
Less: Realization of Debtors and Inventories	2,00,000
Cash	50,000
	10,75,000

Net Present Value = PV of Cash Inflow + PV of Demerger of Leopard Ltd. – Cash Outflow

= ₹ 5,00,000 PVAF (16%,6) + ₹ 2,00,000 PVF (16%, 6) – ₹ 10,75,000

= ₹ 5,00,000 x 3.684 + ₹ 2,00,000 x 0.410 – ₹ 10,75,000

= ₹ 18,42,000 + ₹ 82,000 – ₹ 10,75,000

= ₹ 8,49,000

Since NPV of the decision is positive it is advantageous to acquire Leopard Ltd.

Question 38(Old PM)

ABC, a large business house is planning to sell its wholly owned subsidiary KLM. Another large business entity XYZ has expressed its interest in making a bid for KLM. XYZ expects that after acquisition the annual earning of KLM will increase by 10%.

Following information, ignoring any potential synergistic benefits arising out of possible acquisitions, are available:

(i) Profit after tax for KLM for the financial year which has just ended is estimated to be ₹ 10 crore.
(ii) KLM's after – tax profit has an increasing trend of 7% each year and the same is expected to continue.
(iii) Estimated post tax market return is 10% and risk – free rate is 4%. These rates are expected to continue.
(iv) Corporate tax rate is 30%.

	XYZ	ABC	Proxy entity for KLM in the same line of business
No. of shares	100 lakhs	80 lakhs	--
Current share price	₹ 287	₹ 375	--
Dividend pay out	40%	50%	50%
Debt : Equity at market values	1 : 2	1 : 3	1 : 4
P/E ratio	10	13	12
Equity beta	1	1. 1	1.1

Assume gearing level of KLM to be the same as for ABC and a debt beta of zero.

You are required to calculate:

a) Appropriate cost of equity for KLM based on the data available for the proxy entity.
b) A range of values for KLM both before and after any potential synergistic benefits to XYZ of the acquisition.

Solution

a) β ungeared for the proxy company = 1.1 x 4 / [4 + (1 – 0.3)] = 0.9362

0.9362 = β equity geared x 3 / [3 + (1 - 0.3)]

β equity geared = 1.1546

Cost of equity = 0.04 + 1.1546 x (0.1 – 0.04) = 10.93%

b) P/E valuation

(Based on earning of ₹ 10 Crore)

	Using proxy	Using XYZ's
	Entity's P/E	P/E
Pre synergistic value	12 x ₹ 10 Crore	10 X ₹ 10 Crore
	= ₹ 120 Crore	= ₹ 100 Crore
Post synergistic value	12 x ₹ 10 Crore x 1.1	10 x ₹ 10 Crore X 1.1
	= ₹ 132 Crore	= ₹ 110 Crore

Dividend valuation model

	Based on 50% payout	Based on 40% payout
Pre synergistic value	$\frac{0.5 \times 10 \times 1.07}{0.1093 - 0.07}$	$\frac{0.4 \times 10 \times 1.07}{0.1093 - 0.07}$
	= ₹ 136.13 Crore	=₹ 108.91 Crore
Post synergistic value	$\frac{0.5 \times 10 \times 1.1 \times 1.07}{0.1093 - 0.07}$	$\frac{0.4 \times 10 \times 1.1 \times 1.07}{0.1093 - 0.07}$
	= ₹ 149.75 Crore	= ₹ 119.79 Crore

Range of valuation

Pre synergistic	₹ 100 Crore	₹ 136.13 Crore
Post synergistic	₹ 110 Crore	₹ 149.75 Crore

Question 39(Study Material TYK Q 29)(MTP Oct'19)

During the audit of the Weak Bank (W), RBI has suggested that the Bank should either merge with another bank or may close down. Strong Bank (S) has submitted a proposal of merger of Weak Bank with itself. The relevant information and Balance Sheets of both the companies are as under:

Particulars	Weak Bank (W)	Strong Bank (S)	Assigned Weights (%)
Gross NPA (%)	40	5	30
Capital Adequacy Ratio (CAR) Total Cap/Risk Weighted Assets	5	16	28

Market price per Share (MPS)	12	96	32
Book value			10
Trading on Stock Exchange	Irregular	Frequent	

Balance Sheet (₹ in lakhs)

Particulars	Weak Bank (W)	Strong Bank (S)
Paid up Share Capital (₹ 10 per share)	150	500
Reserves & Surplus	80	5,500
Deposits	4,000	44,000
Other Liabilities	890	2,500
Total Liabilities	**5,120**	**52,500**
Cash in Hand & with RBI	400	2,500
Balance with Other Banks	-	2,000
Investments	1,100	19,000
Advances	3,500	27,000
Other Assets	70	2,000
Preliminary Expenses	50	-
Total Assets	**5,120**	**52,500**

You are required to

a) Calculate Swap ratio based on the above weights:
b) Ascertain the number of Shares to be issued to Weak Bank;
c) Prepare Balance Sheet after merger; and
d) Calculate CAR and Gross NPA of Strong Bank after merger.

Solution

a) Swap Ratio

Gross NPA	5:40	5 / 40 x 30%	0.0375
CAR	5:16	5 / 16 x 28%	0.0875
Market Price	12:96	12 / 96 x 32%	0.0400
Book Value Per Share	12:120	12 / 120 x 10%	0.0100
			0.1750

Thus, for every share of Weak Bank, 0.1750 share of Strong Bank shall be issued.

Calculation of Book Value Per Share

Particulars	Weak Bank (W)	Strong Bank (S)
Share Capital (₹ Lakhs)	150	500
Reserves & Surplus (₹ Lakhs)	80	5,500
	230	6,000
Less: Preliminary Expenses (₹ Lakhs)	50	--
Net Worth or Book Value (₹ Lakhs)	180	6,000
No. of Outstanding Shares (Lakhs)	15	50
Book Value Per Share (₹)	12	120

b) No. of equity shares to be issued:

$$\frac{150}{10} \times 0.1750 = 2.625 \text{ lakh shares}$$

c) Balance Sheet after Merger

Calculation of Capital Reserve

Book Value of Shares	₹ 180.00 lac
Less: Value of Shares issued	₹ 26.25 lac
Capital Reserve	₹ 153.75 lac

Balance Sheet

	₹ lac		₹ lac
Paid up Share Capital	526.25	Cash in Hand & RBI	2900.00
Reserves & Surplus	5500.00	Balance with other banks	2000.00
Capital Reserve	153.75	Investment	20100.00
Deposits	48000.00	Advances	30500.00
Other Liabilities	3390.00	Other Assets	2070.00
	57570.00		**57570.00**

d) Calculation CAR & Gross NPA % of Bank 'S' after merger

$$\text{CAR / CRWAR} = \frac{\text{Total capital}}{\text{Risky Weighted Assets}}$$

	Weak Bank	Strong Bank	Merged
	5%	16%	
Total Capital	₹ 180 lac	₹ 6000 lac	₹ 6180 lac
Risky Weighted Assets	₹ 3600 lac	₹ 37500 lac	₹ 41100 lac

$$\text{CAR} = \frac{6180}{41100} \times 100 = 15.04\%$$

$$\text{GNPA Ratio} = \frac{\text{Gross NPA}}{\text{Gross Advances}} \times 100$$

	Weak Bank	Strong Bank	Merged
GNPA (Given)	0.40	0.05	
	0.40 = GNPAR / ₹ 3500 lac	0.05 = GNPAS / ₹ 27000 lac	
Gross NPA	₹ 1400 lac	₹ 1350 lac	₹ 2750 lac

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1(RTP Nov'20/MTP Aug'18)

The following is the Balance-sheet of Grape Fruit Company Ltd as at March 31st 2019.

Liabilities	(₹ in lakhs)	Assets	(₹ in lakhs)
Equity shares of ₹ 100 each	600	Land and Building	200
14% preference shares of ₹ 100/- each	200	Plant and Machinery	300
13% Debentures	200	Furniture and Fixtures	50
Debenture interest accrued and payable	26	Inventory	150
Loan from bank	74	Sundry debtors	70
Trade creditors	340	Cash at bank	130
		Preliminary expenses	10
		Cost of issue of debentures	5
		Profit and Loss account	525
	1440		**1440**

The Company did not perform well and has suffered sizable losses during the last few years. However, it is felt that the company could be nursed back to health by proper financial restructuring. Consequently the following scheme of reconstruction has been drawn up :

(i) Equity shares are to be reduced to ₹ 25/- per share, fully paid up;

(ii) Preference shares are to be reduced (with coupon rate of 10%) to equal number of shares of ₹ 50 each, fully paid up.

(iii) Debenture holders have agreed to forgo the accrued interest due to them. In the future, the rate of interest on debentures is to be reduced to 9 percent.

(iv) Trade creditors will forego 25 percent of the amount due to them.

(v) The company issues 6 lakh of equity shares at ₹ 25 each and the entire sum was to be paid on application. The entire amount was fully subscribed by promoters.

(vi) Land and Building was to be revalued at ₹ 450 lakhs, Plant and Machinery was to be written down by ₹ 120 lakhs and a provision of ₹ 15 lakhs had to be made for bad and doubtful debts.

Required:

a) Show the impact of financial restructuring on the company's activities.

b) Prepare the fresh balance sheet after the reconstructions is completed on the basis of the above proposals.

Solution

a) Impact of Financial Restructuring

(i) Benefits to Grape Fruit Ltd.

	(₹ in lakhs)
Reduction in equity share capital (6 lakh shares x ₹ 75 per share)	450
Reduction in preference share capital (2 lakh shares x ₹ 50 per share)	100

Waiver of outstanding debenture Interest	26
Waiver from trade creditors (₹ 340 lakhs x 0.25)	85
Revaluation of Assets	661
Appreciation of Land and Building (₹ 450 lakhs - ₹ 200 lakhs)	250
Total (A)	**911**

('ii) Amount of ₹ 911 lakhs utilized to write off losses, fictious assets and over – valued assets.

Writing off profit and loss account	525
Cost of issue of debentures	5
Preliminary expenses	10
Provision for bad and doubtful debts	15
Revaluation of Plant and Machinery (₹ 300 lakhs – ₹ 180 lakhs)	120
Total (B)	**675**
Capital Reserve (A) – (B)	236

b) Balance sheet of Grape Fruit Ltd as at 31st March 2019 (after re-construction)

(₹ in lakhs)

Liabilities	Amount	Assets		Amount
12 lakhs equity shares of ₹ 25/- each	300	Land & Building		450
10% Preference shares of ₹ 50/- each	100	Plant & Machinery		180
Capital Reserve	236	Furnitures & Fixtures		50
9% Debentures	200	Inventory		150
Loan from Bank	74	Sundry debtors	70	
Trade Creditors	255	Prov. for Doubtful Debts	-15	55
		Cash-at-Bank (Balancing figure) *		280
	1165			**1165**

*Opening Balance of ₹ 130/- lakhs + Sale proceeds from issue of new equity shares ₹ 150/- lakhs.

Question 2(RTP May'21)

ABC Ltd. is intending to acquire XYZ Ltd. by way of merger and the following information is available in respect of these companies:

	ABC Ltd.	XYZ Ltd.
Total Earnings (E) (in lakh)	₹ 1200	₹ 400
Number of outstanding shares (S) (in lakh)	400	200
Price earnings ratio (P/E)	8	7

a) Determine the maximum exchange ratio acceptable to the shareholders of ABC Ltd., if the P / E ratio of the combined firm is expected to be 8?

b) Determine the minimum exchange ratio acceptable to the shareholders XYZ Ltd., if the P / E ratio of the combined firm is expected to be 10?

Note: Make calculation in lakh multiples and compute ratio upto 4 decimal points.

Solution

a) Maximum exchange ratio acceptable to the shareholders of ABC Ltd.

Market Price of share of ABC Ltd. (₹ 3 x 8)	₹ 24
No. of Equity Shares	400 lakh
Market Capitalisation of ABC Ltd. (₹ 24 x 400 lakh)	₹ 9600 lakh
Combined Earnings (₹ 1200 + ₹ 400) lakh	₹ 1600 lakh
Combined Market Capitalisation (₹ 1600 lakh x 8)	₹ 12800 lakh
Market Capitalisation of ABC Ltd. (₹ 24 x 400 lakh)	₹ 9600 lakh
Balance for XYZ Ltd.	**₹ 3200 lakh**

Let D be the no. of equity shares to be issued to XYZ Ltd. then,

$$\frac{3200 \text{ Lakh}}{\left(\frac{1600 \text{ Lakh}}{D + 400}\right) \times 8} = D$$

D = 133.333 lakh Shares

Exchange Ratio = 133.333 / 200 = 0.6666:1

b) Minimum exchange ratio acceptable to the shareholders of XYZ Ltd.

Market Price of share of XYZ Ltd.	₹ 14.00
No. of Equity Shares	200 lakh
Market Capitalisation of XYZ Ltd. (₹ 14.00 x 200 lakh)	₹ 2800 lakh
Combined Earnings (₹ 1200 + ₹ 400) lakh	₹ 1600 lakh
Combined Market Capitalisation (₹ 1600 lakh x 10)	₹16000 lakh
Balance for ABC Ltd.	**₹ 13200 lakh**

Let D be the no. of equity shares to be issued to XYZ Ltd. then,

$$\frac{2800 \text{ Lakh}}{\left(\frac{1600 \text{ Lakh}}{D + 400}\right) \times 10} = D$$

D = 84.8485 lakh Shares

Exchange Ratio = 84.8485 / 200 = 0.4242 : 1

Question 3(MTP March'19)

The Nishan Ltd. has 35000 shares of equity stock outstanding with a book value of Rs. 20 per share. It owes debt Rs. 15,00,000 at an interest rate of 12%. Selected financial results are as follows.

Income and Cash Flow			
	Rs		Rs

EBIT	80,000	Capital Structure	
Interest	1,80,000	Debt	15,00,000
EBT	(1,00,000)	Equity	7,00,000
Tax	-		22,00,000
EAT	(1,00,000)		
Depreciation	50,000		
Principal Repayment	(75,000)		
Cash Flow	(1,25,000)		

Evaluate and Restructure the financial line items shown assuming a composition in which creditors agree to convert two thirds of their debt into equity at book value. Assume Nishan will pay tax at a rate of 15% on income after the restructuring, and that principal repayments are reduced proportionately with debt. Demonstrate as to who will control the company and by how big a margin after the restructuring? **(8 Marks)**

Solution

Creditors would convert Rs. 10,00,000 in debt to equity by accepting Rs. 1,000,000 / Rs. 20 = 50,000 shares of stock.

The remaining Rs. 5,00,000 of debt would generate interest of Rs. 5,00,000 x 0.12 = Rs. 60,000

Repayment of principal would be reduced by two thirds to Rs. 25000 per year.

The result is as follows

Income and Cash Flow			
	Rs		Rs
EBIT	80,000	Capital Structure	
Interest	60,000	Debt	5,00,000
EBT	20,000	Equity	17,00,000
Tax	3000		22,00,000
EAT	17,000		
Depreciation	50,000		
Principal Repayment	(25,000)		
Cash Flow	(1,25,000)		

After the restructuring there will be a total of (35000 + 50000) 85000 shares of equity stock outstanding. The original shareholders will still own 35000 shares (approximately 41%), while the creditors will own 50,000 shares (59%). Hence the creditors will control the company by a substantial majority.

Question 4(MTP May'20)

X Ltd. is studying the possible acquisition of Y Ltd, by way of merger. The following data are available in respect of both the companies.

Particulars	X Ltd.	Y Ltd.
Market Capitalization (Rs.)	75,00,000	90,00,000
Gross Profit Ratio	20%	20%
Inventory Turnover Ratio	5 times	4 times

Debtor Turnover Ratio	3 times	5 times
12% Debenture (Rs.)	10,00,000	-
10% Debenture (Rs.)	-	14,40,000
No. of Equity Shares	1,00,000	60,000
Operating Expenses	86%	78%
Corporate Tax Rate	30%	30%
Closing Stock (Rs.)	15,00,000	5,00,000
Debtors (Rs.)	10,00,000	8,00,000

You are required to calculate:

a) Swap ratio based on EPS & MPS respectively as weightage of 40% and 60%.
b) Post Merger EPS
c) Post Merger market price assuming same PE Ratio of X Ltd.
d) Post Merger gain or loss in EPS (12 Marks)

Solution

Working Notes:

1) Inventory Turnover Ratio = $\frac{\text{COGS}}{\text{Closing Stock}}$

X Ltd	Y Ltd
5 = $\frac{\text{COGS}}{15,00,000}$	4 = $\frac{\text{COGS}}{5,00,000}$
COGS = Rs. 75,00,000	COGS = Rs. 20,00,000
Gross Profit Ratio = 20% means COGS is 80% of Sales, then	
Sales = $\frac{75,00,000 \times 100}{80}$ = Rs. 93,75,000	Sales = $\frac{75,00,000 \times 100}{80}$ = Rs. 25,00,000

Statement of Profit

	X Ltd.	Y Ltd.
Sales	93,75,000	25,00,000
Less: Operating Exp.	80,62,500	19,50,000
EBIT	**13,12,500**	**5,50,000**
Less: Interest	1,20,000	1,44,000
EBT	**11,92,500**	**4,06,000**
Less: Tax @ 30%	3,57,750	1,21,800
EAT	**8,34,750**	**2,84,200**

	X Ltd.	Y Ltd.
No. of Shares	1,00,000	60,000

EPS (EAT / No. of Shares)	8,34,750/1,00,000 = Rs. 8.34	2,84,200 / 60,000 = Rs. 4.74
Market Price Share (Market Capitalisation / No. Shares)	75,00,000 / 1,00,000 = Rs. 75	90,00,000 / 60,000 = Rs. 150
PE Ratio (MPSI EPS)	75 / 8.34 = 8.99	150 / 4.74 = 31.65

(i) Swap Ratio = $\frac{\text{Target Co.}}{\text{Acquirer Co.}}$

	Acquirer Co	Target Co.	Weight
	X Ltd	Y Ltd	
EPS	0.34	4.74	0.40
MPS	75	150	0.60

(ii) Post-Merger EPS

$$= \frac{\text{EAT}_X + \text{EAT}_Y}{\text{No. of Shares of Both Cos.}}$$

$$= \frac{834750 + 284200}{1{,}00{,}000 + (60{,}000 \times 1.227)}$$

$$= \frac{1118950}{1{,}85{,}620}$$

= 6.03

(iii) Post-Merger market price assuming same PE of X Ltd.

MPS = PE x EPS

= 8.99 x 6.03

= Rs. 54.21

(iv) Gain or Loss to the shareholders

	Pre - Merger EPS	Post - Merger EPS
X Ltd.	Rs. 8.34	Rs. 6.99
Y Ltd.	Rs. 4.74	Rs. 6.99 x 1.427 = Rs. 9.97

While Shareholders of X Ltd. will lose EPS of Rs. 1.35 (Rs. 8.34 - Rs. 6.99) per share the shareholders of Y Ltd. stands to gain EPS of Rs. 5.23 (Rs. 9.97 - Rs. 4.74) per share.

Question 5(MTP May'20)

Equity of KGF Ltd. (KGFL) is Rs. 410 crores, its debt, is worth Rs. 170 Crores. Printer Division segments value is attributable to 74%, which has an Asset Beta (βp) of 1.45, balance value is applied on Spares and Consumables Division, which has an Asset Beta (βSC) of 1.20 KGFL Debt beta (βD) is 0.24.

You are required to calculate:

(i) Equity Beta (βE),

(ii) Ascertain Equity Beta (βE), if KGF Ltd. decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt Equity Ratio at 1.90. Assume that the present Debt Beta (βD1) is 0.35 and any further funds raised by way of Debt will have a Beta (βD2) of 0.40

Whether the new Equity Beta (βE) justifies increase in the value of equity on account of leverage? **(12 Marks)**

Solution

(i) **Equity Beta**

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta as follows:

= 1.45 x 0.74 + 1.20 x 0.26

= 1.073 + 0.312 = 1.385

Now we shall compute Equity Beta using the following formula:

$$\beta ASSET = \beta_{Equity}\left[\frac{E}{E+D\,(1-t)}\right] + \beta_{Debt}\left[\frac{D\,(1-t)}{E+D\,(1-t)}\right]$$

Accordingly,

$$1.385 = \beta_{Equity}\left[\frac{410}{410+170}\right] + \beta_{Debt}\left[\frac{170}{410+170}\right]$$

$$1.385 = \beta_{Equity}\left[\frac{410}{580}\right] + 0.24\left[\frac{170}{580}\right]$$

βEquity = 1.86

(ii) **Equity Beta on change in Capital Structure**

Amount of Debt to be raised:

Particulars	Value
Total Value of Firm (Equity Rs. 410 cr + Debt Rs. 170 cr) Desired Debt Equity Ratio	Rs.580 Cr 1.90 : 1.00
Desired Debt Level = Total Value x Debt Ratio / Debt Ratio + Equity Ratio	Rs. 380 Cr (Rs. 170 Cr)
Less: Value of Existing Debt Value of Debt to be Raised	Rs. 210 Cr

Equity after Repurchase = Total value of Firm – Desired Debt Value
= Rs. 580 Cr – Rs. 380 Cr
= Rs. 200 Cr

Weighted Average Beta of KGFL:

Source of Finance	Investment (Rs. Cr)	Weight	Beta of the Division	Weighted Beta
Equity	200	0.345	β(E = X)	0.345x
Debt – 1	170	0.293	0.35	0.103
Debt – 2	210	0.362	0.40	0.145
	580	Weighted Average Beta		0.248 + (0.345x)

βKGFL = 0.248 + 0.345x

1.385 = 0.248 + 0.345x

0.345x = 1.385 – 0.248

X = 1.137 / 0.345 = 3.296

βKGFL = 3.296

Question 6(MTP March'21)

Eager Ltd. has a market capitalization of Rs. 1,500 crores and the current market price of its share is Rs. 1,500. It made a PAT of Rs. 200 crores and the Board is considering a proposal to buy back 20% of the shares at a premium of 10% to the current market price. It plans to fund this through a 16% bank loan. The company's corporate tax rate is 30%. Calculate the post buy back Earnings Per Share (EPS). **(4 Marks)**

Solution

Existing No. of Equity Shares = $\frac{₹\ 1500\ \text{crore}}{₹\ 1500}$ = 1 Crore

No. of shares to be bought back = 1 Crore x 0.20 = 20 Lakh

Price at which share to be bought back = Rs. 1,500 + 10% of Rs. 1,500 = Rs. 1,650

Amount required for Buyback of Shares = Rs. 1,650 x 20 Lakh = Rs. 330 Crore

Amount of Loan @ 16% = Rs. 330 Crore

Statement showing Post Buyback EPS

Profit before tax (Rs. 200 crore / 0.70)	Rs. 285.7143 crore
Less: Interest on Loan (Rs. 330 Crore x 16%)	Rs. 52.8000 crore
Profit before Tax	**Rs. 232.9143 crore**
Tax	Rs. 69.8743 crore
Profit after Tax (PAT)	**Rs. 163.0400 crore**
No. of Shares Post buyback	80 Lakh
EPS (Post Buyback) (Rs. 163.0400 Crore / 80.00 Lakh)	Rs. 203.80

Question 7(MTP April'21)

C Ltd. and P Ltd. both companies operating in the same industry decided to merge and form a new entity S Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

	C Ltd.	P Ltd.
Annual Earnings after Tax (Rs. lakh)	10000	5800
No. Shares Outstanding (lakh)	4000	1000
PE Ratio (No. of Times)	8	10

The merger will be affected by means of stock swap (exchange) of 3 shares of C Ltd. for 1 share of P Ltd.

After the merger it is expected that due to synergy effects, Annual Earnings (Post Tax) are expected to be 8% higher than sum of the earnings of the two companies individually. Further, it is expected that P/E Ratio of S Ltd. shall be average of P/E Ratios of two companies before the merger.

Evaluate the extent to which shareholders of P Ltd. will be benefitted per share from the proposed merger. **(8 Marks)**

Solution

Working Notes:

(i) The Earnings of S Ltd.

	Rs. lakh
Earnings of C Ltd.	10000
Earnings of D Ltd.	5800
	15800
Growth	0.08
Earnings of S Ltd. (15800 x 1.08)	17064

(ii) Market Value of S Ltd.

	Rs. lakh
Earnings of S Ltd.	17064
P/E Ratio (10 + 8) / 2	9
Market Value of S Ltd.	153576

(iii) No of Shares in S LTd.

No. of shares of C Ltd.	4000
No. of shares issued to P Ltd.	3000
No. of shares of C Ltd.	7000

Gain to Shareholders of P Ltd

Share of Shareholders of P Ltd. in S Ltd. (3000 / 7000) x 153576	Rs. 65818.29 lakh
Market Value of P Ltd. before merger (5800 x 10)	Rs. 58000.00 lakh
Gains to Shareholders	**Rs. 7818.29 lakh**
No. of Shares (before merger)	1000 lakh
Gain Per Share	Rs. 7.82

Question 8(MTP Oct'21)

Intel Ltd., promoted by a Trans National Company, is listed on the stock exchange holding 80%. The value of the floating stock is ₹ 45 crores. The Market Price per Share (MPS) is ₹ 150.

The capitalisation rate is 20%.

The promoters holding is to be restricted to 75% as per the norms of listing requirement. The Board of Directors have decided to fall in line to restrict the Promoters' holding to 75% by issuing Bonus Shares to minority shareholders while maintaining the same Price Earnings Ratio (P/E).

You are required to calculate:

(i) Bonus Ratio;
(ii) MPS after issue of Bonus Shares; and
(iii) Free float Market capitalisation after issue of Bonus Shares. **(8 Marks)**

Solution

(i) No. of Bonus Shares to be issued:

Free Float Capitalization = ₹ 45 crore

Market Price Per Share = ₹ 150

Shares of Minority $= \frac{₹\ 45\ \text{crore}}{₹\ 150} = 30$ lacs

Minority Share Holding (100% - 80%) = 20%

Hence Total shares $= \frac{30\ \text{lacs}}{0.20} = 150$ lacs

Promoters holding 80%, = 120 lacs shares

Shares remains the same, but holding % to be taken as 75%

Hence Total shares $= \frac{120\ \text{lacs}}{0.75} = 160$ lacs

Shares of Minority = 160 lacs – 120 lacs = 40 lacs

Bonus 10 lacs for 30 lacs i.e. 1 shares for 3 shares held.

(ii) Market price after Bonus issue:

Let us compute PE with given ke as follows:

PE = $\frac{1}{k_e} = \frac{1}{0.20} = 5$

Market Price Given = ₹ 150

Hence EPS will be (₹ 150 / 5) = ₹ 30

Total No. of shares before bonus issue = 150 lacs

Accordingly, Total PAT shall be (₹ 30 x 150 lacs) = ₹ 4500 lacs

Total No. of shares after bonus issue = 150 lacs + 10 lacs = 160 lacs

EPS after Bonus Issue = ₹ 4500 lacs / 160 lacs = ₹ 28.13

Market Price After Bonus Issue = ₹ 28.13 x 5 = ₹ 140.65

(iii) Free Float Capitalization after Bonus Issue

₹ 140.65 x 40 lacs = ₹ 5,626 lacs i.e. ₹ 56.26 crore

Question 9(MTP Oct'21)

XY Ltd., a Cement manufacturing Company has hired you as a financial consultant of the company. The Cement Industry has been very stable for some time and the cement companies SK Ltd. & AS Ltd. are similar in size and have similar product market mix characteristic. Use comparable method to value the equity of XY Ltd. In performing analysis, use the following ratios:

(i) Market to book value
(ii) Market to replacement cost
(iii) Market to sales
(iv) Market to Net Income

The following data are available for your analysis:

(Amount in ₹)

	SK Ltd.	AS Ltd.	XY Ltd.
Market Value	450	400	
Book Value	400	300	250
Replacement Cost	600	550	500
Sales	550	450	500
Net Income	18	16	14

Solution

Estimation of Ratios

Sl. No.	Particulars	SK Ltd.	AS Ltd.	Average
(i)	Market to Book Value	$\left(\frac{450}{400}\right) = 1.125$	$\left(\frac{400}{300}\right) = 1.333$	1.2290
(ii)	Market to Replacement Cost	$\left(\frac{450}{600}\right) = 0.750$	$\left(\frac{400}{550}\right) = 0.727$	0.7385
(iii)	Market to Sales	$\left(\frac{450}{550}\right) = 0.818$	$\left(\frac{400}{450}\right) = 0.889$	0.8535
(iv)	Market to Net Income	$\left(\frac{450}{18}\right) = 25$	$\left(\frac{400}{16}\right) = 25$	25

Application of Ratios to XY Ltd.

Sl. No.	Particulars	XY Ltd. (₹)	Average	Indicative Value of XY Ltd. (₹)
(i)	Book Value	250	1.2290	250 x 1.2290 = 307.25
(ii)	Replacement Cost	500	0.7385	500 x 0.7385 = 369.25
(iii)	Sales	500	0.8535	500 x 0.8535 = 426.75
(iv)	Net Income	14	25	14 x 25 = 350.00
Average				₹ 363.31

Value of XY Ltd. according to the comparable method is ₹ 363.31.

Question 10(MTP Nov'21)

Snake Ltd. is taking over Lizard Ltd, both are listed companies. The PE Ratio of Lizard Ltd. has been low as 4 and high as 7 and is currently 5. Lizard Ltd.'s previous year EPS was ₹ 3.40 and current expected EPS this year to be ₹ 4.00.

Determine the different range of values of shares using P/E Model. **(6 Marks)**

Solution

The range of values using P/E Ratio and EPS either historic or projected are as follows.

EPS	Value (₹)	P/E Ratio	Value	Value of Shares
Historic	3.40	Lowest	4	13.60
Historic	3.40	Current	5	17.00
Historic	3.40	Highest	7	23.80
Expected	4.00	Lowest	4	16.00
Expected	4.00	Current	5	20.00
Expected	4.00	Highest	7	28.00

Question 11(PP Nov'20)

AB Industries has Equity Capital of ₹ 12 Lakhs, total Debt of ₹ 8 Lakhs, and annual sales of ₹ 30 Lakhs. Two mutually exclusive proposals are under consideration for the next year. The details of the proposals are as under:

Particulars	Proposal No. 1	Proposal No 2
Target Assets to Sales Ratio	0.65	0.62
Target Net Profit Margin (%)	4	5
Target Debt Equity Ratio (DER)	2:3	4:1
Target Retention Ratio (of Earnings) (%)	75	-
Annual Dividend (₹ In Lakhs)	-	0.30
New Equity Raised (₹ in Lakhs)	-	1

You are required to calculate sustainable growth rate for both the proposals. **(8 Marks)**

Solution

Sustainable Growth Rate under Proposal 1

Sales (Given)		₹ 30 Lakhs
Total Assets	₹ 30 Lakhs x 0.65	₹ 19.50 Lakhs
Net Profit	₹ 30 Lakhs x 4%	₹ 1.20 Lakhs

Equity Multiplier $\frac{\text{Equity}}{\text{Equity+Deb}} = \frac{\text{12 Lakhs}}{\text{12 Lakhs+8 Lakhs}}$ 0.6

ROE $\frac{\text{1.20 Lakhs}}{\text{19.50 Lakhs}} \times 0.60 \times 100$ 3.69%

Sustainable Growth Rate = ROE x Retention Ratio

= 3.69% x 0.75 = 2.77%

Sustainable Growth Rate under Proposal 2

New Equity = ₹ 12 Lakhs + ₹ 1 Lakh = ₹ 13 Lakhs

New Debt = ₹ 13 Lakhs x 4 = ₹ 52 Lakhs

Total Assets = ₹ 13 Lakhs + ₹ 52 Lakhs = ₹ 65 Lakhs

Sales	₹ 65 Lakhs / 0.62	₹ 104.84 Lakhs
Net Profit	₹ 104.84 Lakhs x 5%	₹ 5.242 Lakhs
Equity Multiplier	Equity = 13 Lakhs Equity +Debt = 13 Lakhs + 52 Lakhs	0.2
ROE =	$\frac{\text{5.242 Lakhs x 0.20 x 100}}{\text{65 Lakhs}}$	1.613%
Retention Ratio	$\frac{\text{5.242 Lakhs - 0.30 Lakhs}}{\text{5.242 Lakhs}}$	0.943

Sustainable Growth Rate = ROE x Retention Ratio

= 1.613% x 0.943 = 1.52%

Question 12(PP Nov'20)

ICL is proposing to take over SVL with an objective to diversify. ICL's profit after tax (PAT) has grown @ 18 per cent per annum and SVL's PAT is grown @ 15 per cent per annum. Both the companies pay dividend regularly. The summarised Profit & Loss Account of both the companies are as follows:

₹ in Crores

Particulars	ICL	SVL
Net Sales	4,545	1,500
PBIT	2,980	720
Interest	750	25
Provision for Tax	1,440	445
PAT	790	250
Dividends	235	125

	ICL		SVL	
Fixed Assets				
Land & Building (Net)	720		190	
Plant & Machinery (Net)	900		350	
Furniture & Fixtures (Net)	30	1,650	10	550
Current Assets		775		580
Less: Current Liabilities				
Creditors	230		130	
Overdrafts	35		10	
Provision for Tax	145		50	
Provision for dividends	60	470	50	240
Net Assets		1,955		890
Paid up Share Capital (₹ 10 per share)	250		125	
Reserves and Surplus	1050	1,300	660	785
Borrowing		655		105
Capital Employed		1,955		890
Market Price Per Share	52		75	

ICL's Land & Buildings are stated at current prices. SVL's Land & Buildings are revalued three years ago. There has been an increase of 30 per cent per year in the value of Land & Buildings.

SVL is expected to grow @ 18 per cent each year, after merger.

ICL's Management wants to determine the premium on the shares over the current market price which can be paid on the acquisition of SVL. You are required to determine the premium using:

(i) Net Worth adjusted for the current value of Land & Buildings plus the estimated average profit after tax (PAT) for the next five years.
(ii) The dividend growth formula.
(iii) ICL will push forward which method during the course of negotiations?

Period (t)	1	2	3	4	5
FVIF (30%, t)	1.300	1.690	2.197	2.856	3.713
FVIF (15%, t)	1.15	2.4725	3.9938	5.7424	7.7537

Solution

(i) Computation of Premium (Net Worth Formula): Amount ` in Crores

Total Assets (Fixed assets + Current Assets) = (550 + 580)	1130
Less: Liabilities (Current Liabilities + Borrowings) = (240 + 105)	345
Net Assets Value	785
Current Value of Land after growing for three years @ 30% = 190 x 2.197	417.43
Less: Book Value	190.00
Increase in the Value of land	227.43
Adjusted NAV (785 + 227.43)	1012.43
Current Profit after Tax (@15 % for 5 years i.e. 250 x 7.7537	1938.43

Average Profit for 1 year = 1938.43 / 5	387.69
Total Value of Firm (1012.43 + 387.69)	1400.12
Total Market Value = No of shares x MPS = 12.50 x 75	937.50
Premium (Total Value – Market Value)	462.62
Premium (%) = 462.62 / 937.50 * 100	49.35%

(ii) Computation of Premium (Dividend Growth Formula):

Existing Growth Rate	0.15
DPS= 125 / 12.50	10
MPS	75
Cost of Equity (D1/ MP + g) = [(10 x 1.15 / 75) + 0.15]	0.3033
Expected growth rate after merger	0.18
Expected Market Price = 10 x [1.18 / (0.3033 - 0.18)]	95.70
Premium over current market price (95.70 - 75) / 75 x100	27.60%

Alternatively, if given figure of dividend is considered as D1 then Premium over Current Market Price shall be computed as follows:

Cost of Equity $\left(\frac{D_1}{P}+g\right)$	$\left[\frac{10}{75}+0.15\right]$	0.2833
Expected Growth Rate after Merger		0.18
Expected Market Price 10.00 / (0.2833 – 0.18)		96.81
Premium over Current Market Price (96.81 - 75)/ 75 x 100		29.08%

(iii) During the course of negotiations, ICL will push forward valuation based on Growth Rate Method as it will lead to least cash outflow.

Question 13(PP Jul'21)

Long Ltd., is planning to acquire Tall Ltd., with the following data available for both the companies:

	Long Ltd.	Tall Ltd.
Expected EPS	₹ 12	₹ 5
Expected DPS	₹ 10	₹ 3
No. of Shares	30,00,000	18,00,000
Current Market Price of Share	₹ 180	₹ 50

As per an estimate Tall Ltd., is expected to have steady growth of earnings and dividends to the tune of 6% per annum. However, under the new management the growth rate is likely to be enhanced to 8% per annum without additional investment.

You are required to:

(i) Calculate the net cost of acquisition by Long Ltd., if ₹ 60 is paid for each share of Tall Ltd.

(ii) If the agreed exchange ratio is one share of Long Ltd., for every three shares of Tall Ltd., in lieu of the cash acquisition as per (i) above, what will be the net cost of acquisition?

(iii) Calculate Gain from acquisition. **(8 Marks)**

Solution

(i) Net cost of acquisition shall be computed as follows:

Cash Paid for the shares of Tall Ltd. (₹ 60 × 18,00,000)	₹ 10,80,00,000
Less: Value of Tall Ltd., as a separate entity (18,00,000 × ₹ 50)	₹ 9,00,00,000
Net Cost of acquisition of Tall Ltd.	₹ 1,80,00,000

(ii) Net Cost of acquisition in case of exchange of shares:

Exchange ratio = 1 share of long Ltd for every 3 shares of Tall Ltd.

Number of shares to be issued in Long Ltd. (18,00,000 / 3)	= 6,00,000 shares
Total no. of shares in Long Ltd. after merger (30,00,000 + 6,00,000)	= 36,00,000

Calculation of cost of Equity of Tall Ltd. Growth rate under new management after acquisition	= D1 / P0 + g = ₹ 3 / 50 + 0.06 = 12%
Value of Merged company assuming perpetual growth	= 8%
Value of merged company (₹ 180 x 30,00,000) + (₹ 3 / (0.12 - 0.08) x 18,00,000 = 54,00,00,000 + (75 X 18,00,000)	= ₹ 67,50,00,000
Value per share of merged company (67,50,00,000 / 36,00,000)	= ₹ 187.50 per share

Calculation of net cost of acquisition	
Gross cost of acquisition (6,00,000 x 187.50)	11,25,00,000
Less: CMP (18,00,000 x 50)	9,00,00,000
Net Cost of acquisition	**2,25,00,000**

Alternatively, Net Cost of Acquisition can also be computed as follows:

No. of shares issued to shareholders of Tall Ltd. in the ratio of 1:3	6,00,000
Existing price of one share of Long Ltd.	₹ 180
Value of consideration paid for acquisition of Tall Ltd.	₹ 10,80,00,000
Less: Existing Value of Tall Ltd., as a separate entity	₹ 9,00,00,000
Net Cost of acquisition of Tall Ltd.	**₹ 1,80,00,000**

(iii) Calculation of gain from acquisition:

Total Earnings of Long Ltd. (₹ 12 x 30,00,000)		₹ 3,60,00,000
Total Earnings of Tall Ltd. (₹ 5 x 18,00,000)		₹ 90,00,000
Combined Earnings		**₹ 4,50,00,000**
PE Ratio of Long Ltd. (180 / 12)		15
Value of Long Ltd. after acquisition		₹ 67,50,00,000
Less: Value of two companies separately		
Long Ltd. (₹ 180 x 30,00,000)	₹ 54,00,00,000	
Tall Ltd. (₹ 50 x 18,00,000)	₹ 9,00,00,000	**₹ 63,00,00,000**
Gain from Acquisition		₹ 4,50,00,000

Question 14(MTP Oct'22)
Despite the fact there may be some degree of overlapping in one or more common factors of unrelated Companies come together to form an entity. EXPLAIN.

Solution
Such mergers involve firms engaged in unrelated type of business operations. In other words, the business activities of acquirer and the target are neither related to each other horizontally (i.e., producing the same or competiting products) nor vertically (having relationship of buyer and supplier). In a pure conglomerate merger, there are no important common factors between the companies in production, marketing, research and development and technology. There may however be some degree of overlapping in one or more of these common factors. Such mergers are in fact, unification of different kinds of businesses under one flagship company. The purpose of merger remains utilization of financial resources, enlarged debt capacity and also synergy of managerial functions.

Question 15(RTP Nov'22)
Explain different forms of divestitures.

Solution

Different ways of divestment or demerger or divestitures are as follows:

1) **Sell off / Partial Sell off**: A sell off is the sale of an asset, factory, division, product line or subsidiary by one entity to another for a purchase consideration payable either in cash or in the form of securities. Partial Sell off, is a form of divestiture, wherein the firm sells its business unit or a subsidiary to another because it deemed to be unfit with the company's core business strategy.

   Normally, sell-offs are done because the subsidiary doesn't fit into the parent company's core strategy. The market may be undervaluing the combined businesses due to a lack of synergy between the parent and the subsidiary. So, the management and the board decide that the subsidiary is better off under a different ownership.

   Besides getting rid of an unwanted subsidiary, sell-offs also raise cash, which can be used to pay off debts. In the late 1980s and early 1990s, corporate raiders used debt to finance acquisitions.

2) **Spin-off**: In this case, a part of the business is separated and created as a separate firm. The existing shareholders of the firm get proportionate ownership. So, there is no change in ownership and the same shareholders continue to own the newly created entity in the same proportion as previously in the original firm. The management of spin-off division is however, parted with. Spin-off does not bring fresh cash. The reasons for spin off may be:
   a) Separate identity to a part/division.
   b) To avoid the takeover attempt by a predator by making the firm unattractive to him since a valuable division is spun-off.
   c) To create separate Regulated and unregulated lines of business.

3) **Split-up**: This involves breaking up of the entire firm into a series of spin off (by creating separate legal entities). The parent firm no longer legally exists and only the newly created entities survive. For instance, a corporate firm has 4 divisions namely A, B, C, D. All these 4

divisions shall be split-up to create 4 new corporate firms with full autonomy and legal status. The original corporate firm is to be wound up. Since de-merged units are relatively smaller in size, they are logistically more convenient and manageable. Therefore, it is understood that spin-off and split-up are likely to enhance shareholders value and bring efficiency and effectiveness.

4) **Equity Carve outs**: This is like spin off, however, some shares of the new company are sold in the market by making a public offer, so this brings cash. More and more companies are using equity carve-outs to boost shareholder value. A parent firm makes a subsidiary public through an initial public offering (IPO) of shares, amountin to a partial sell-off. A new publicly listed company is created, but the parent keeps a controlling stake in the newly traded subsidiary.

   A carve-out is a strategic avenue a parent firm may take when one of its subsidiaries is growing faster and carrying higher valuations than other businesses owned by the parent. A carve-out generates cash because shares in the subsidiary are sold to the public, but the issue also unlocks the value of the subsidiary unit and enhances the parent's shareholder value.

Chapter 7

PORTFOLIO MANAGEMENT

Space for your notings of Formulae or important points

MARKOWITZ THEORY

Question 1 (Study Material TYK Q. 1)

A stock costing ₹ 120 pays no dividends. The possible prices that the stock might sell for at the end of the year with the respective probabilities are:

Price	Probability
115	0.1
120	0.1
125	0.2
130	0.3
135	0.2
140	0.1

Required:

(i) Calculate the expected return.

(ii) Calculate the Standard deviation of returns.

Solution

(i) Here, the probable returns have to be calculated using the formula

$$R = \frac{D}{P_0} + \frac{P_1 - P_0}{P_0}$$

Calculation of Probable Returns

Possible prices (P1)	P1 - P0	[(P1 - P0) / P0] x 100
₹	₹	Return (per cent)
115	-5	-4.17
120	0	0.00
125	5	4.17
130	10	8.33
135	15	12.50
140	20	16.67

Alternatively, it can be calculated as follows:

Calculation of Expected Returns

Possible return Xi	Probability p (Xi)	Product X1 - p (Xi)
-4.17	0.1	-0.417
0.00	0.1	0.000
4.17	0.2	0.834
8.33	0.3	2.499
12.50	0.2	2.500
16.67	0.1	1.667
		X = 7.083

Expected return X = 7.083 per

Alternatively, it can also be calculated as follows:

Expected Price = 115 x 0.1 + 120 x 0.1 + 125 x 0.2 + 130 x 0.3 + 135 x 0.2 + 140 x 0.1 = 128.50

Return = $\frac{128.50-120}{120} \times 100 = 7.0833\%$

(ii) Calculation of Standard Deviation of Returns

Probable return Xi	Probability p (Xi)	Deviation (Xi – X)	Deviation squared (Xi – X)2	Product (Xi – X)2 p(Xi)
-4.17	0.1	-11.253	126.63	12.66
0.00	0.1	-7.083	50.17	5.017
4.17	0.2	-2.913	8.49	1.698
8.33	0.3	1.247	1.56	0.467
12.50	0.2	5.417	29.34	5.869
16.67	0.1	9.587	91.91	9.191
				σ^2 = 34.902

Variance, σ^2 = 34.902 per cent

Standard deviation, $\sigma = \sqrt{34.902}$ = 5.908 percent

Question 2 (Study Material TYK Q. 3)/RTP Nov'21/MTP March'22

Mr. A is interested to invest ₹ 1,00,000 in the securities market. He selected two securities B and D for this purpose. The risk return profile of these securities are as follows:

Security	Risk (s)	Expected Return (ER)
B	10%	12%
D	18%	20%

Co - efficient of correlation between B and D is 0.15.

You are required to calculate the portfolio return of the following portfolios of B and D to be considered by A for his investment.

(i) 100 percent investment in B only;
(ii) 50 percent of the fund in B and the rest 50 percent in D;
(iii) 75 percent of the fund in B and the rest 25 percent in D; and
(iv) 100 percent investment in D only.

Also indicate that which portfolio is best for him from risk as well as return point of view?

Solution

We have Ep = W1E1 + W3E3 + WnEn

and for standard deviation σ2p = $\sum_{i=1}^{n}\sum_{j=1}^{n} w_i\, w_j\, \sigma_{ij}$

σ2p = $\sum_{i=1}^{n}\sum_{j=1}^{n} w_i\, w_j\, p_{ij}\ \sigma_i\, \sigma_j$

Two asset portfolios

$\sigma 2p = w_1^2\sigma_1^{\ 2} + w_2^2\sigma_2^{\ 2} + 2\, w_1 w_2 \sigma_1 \sigma_2 \rho_{12}$

Substituting the respective values we get,

(i) **All funds invested in B**

Ep = 12%

σp = 10%

(ii) **50% of funds in each of B & D**

Ep = 0.50 x 12% + 0.50 x 20% = 16%

$\sigma 2p = (0.50)^2 (10\%)^2 + (0.50)^2 (18\%)^2 + 2 (0.50) (0.50) (0.15) (10\%) (18\%)$

σ2p = 25 + 81 + 13.5 = 119.50

σp = 10.93%

(iii) **75% in B and 25% in D**

Ep = 0.75% x 12% + 0.25% x 20 = 14%

$\sigma 2p = (0.75)^2 (10\%)^2 + (0.25)^2 (18\%)^2 + 2 (0.75) (0.25) (0.15) (10\%) (18\%)$

σ2p = 56.25 + 20.25 + 10.125 = 86.625

σp = 9.31%

(iv) **All funds in D**

Ep = 20%

σp = 18.0%

Portfolio	(i)	(ii)	(iii)	(iv)
Return	12	16	14	20
σ	10	10.93	9.31	18

In the terms of return, we see that portfolio (iv) is the best portfolio. In terms of risk we see that portfolio (iii) is the best portfolio.

Question 3 (Study Material TYK Q. 4)/RTP Nov'19/PP May'18

Consider the following information on two stocks, A and B:

Year	Return on A (%)	Return on B (%)
2006	10	12
2007	16	18

You are required to determine:

(i) The expected return on a portfolio containing A and B in the proportion of 40% and 60% respectively.

(ii) The Standard Deviation of return from each of the two stocks.

(iii) The covariance of returns from the two stocks.

(iv) Correlation coefficient between the returns of the two stocks.
(v) The risk of a portfolio containing A and B in the proportion of 40% and 60%.

Solution

(i) Expected return of the portfolio A and B

E (A) = (10 + 16) / 2 = 13%

E (B) = (12 + 18) / 2 = 15%

Rp = $\sum_{i-1}^{N} X_i R_i = 0.4\ (13) + 0.6\ (15) = 14.2\%$

(ii) Stock A:

Variance = 0.5 (10 – 13)^2 + 0.5 (16 – 13)^2 = 9

Standard deviation = $\sqrt{9}$ = 3%

Stock B:

Variance = 0.5 (12 – 15)^2 + 0.5 (18 – 15)^2 = 9

Standard deviation = 3%

(iii) Covariance of stocks A and B

CovAB = 0.5 (10 – 13) (12 – 15) + 0.5 (16 – 13) (18 – 15) = 9

(iv) Correlation of coefficient

rAB = $\frac{COV_{AB}}{\sigma_A \sigma_B} = \frac{9}{3 \times 3} = 1$

(v) Portfolio Risk

$$\sigma_p = \sqrt{X_A^2 \sigma_A^2 + X_B^2 \sigma_B^2 + 2X_A X_B(\sigma_A \sigma_B \sigma_{AB})}$$

$$= \sqrt{(0.4)^2(3)^2 + (0.6)^2(3)^2 + 2\ (0.4)(0.6)(3)(3)(1)}$$

$$= \sqrt{1.44 + 3.24 + 4.32} = 3\%$$

Question 4 (Study Material TYK Q. 5)/Similar Q asked in MTP March'18/MTP April'21

Following is the data regarding six securities:

	A	B	C	D	E	F
Return (%)	8	8	12	4	9	8
Risk (Standard deviation)	4	5	12	4	5	6

(i) Assuming three will have to be selected, state which ones will be picked.
(ii) Assuming perfect correlation, show whether it is preferable to invest 75% in A and 25% in C or to invest 100% in E

Solution

(i) Security A has a return of 8% for a risk of 4, whereas B and F have a higher risk for the same return. Hence, among them A dominates.

For the same degree of risk 4, security D has only a return of 4%. Hence, D is also dominated by A.

Securities C and E remain in reckoning as they have a higher return though with higher degree of risk.

Hence, the ones to be selected are A, C & E.

(ii) The average values for A and C for a proportion of 3: 1 will be:

Risk = $\frac{(3 \times 4)+(1 \times 12)}{4} = 6\%$

Return = $\frac{(3 \times 8)+(1 \times 12)}{4} = 9\%$

Therefore:	75% A	E
	25% C	_
Risk	6	5
Return	9%	9%

For the same 9% return the risk is lower in E. Hence, E will be preferable.

Question 5 (Study Material TYK Q. 6)/PP May'22

The historical rates of return of two securities over the past ten years are given. Calculate the Covariance and the Correlation coefficient of the two securities:

Years:	1	2	3	4	5	6	7	8	9	10
Security 1:	12	8	7	14	16	15	18	20	16	22
(Return per cent)										
Security 2:	20	22	24	18	15	20	24	25	22	20
(Return per cent)										

Solution

Calculation of Covariance

Year	R1	Deviation ($R_1 - \overline{R_1}$)	Deviation ($R_1 - \overline{R_1}$)^2	R2	Deviation ($R_2 - \overline{R_2}$)	Deviation ($R_2 - \overline{R_2}$)^2	Product of deviations
1	12	-2.8	7.84	20	-1	1	2.8
2	8	-6.8	46.24	22	1	1	-6.8
3	7	-7.8	60.84	24	3	9	-23.4
4	14	-0.8	0.64	18	-3	9	2.4
5	16	1.2	1.44	15	-6	36	-7.2
6	15	0.2	0.04	20	-1	1	-0.2
7	18	3.2	10.24	24	3	9	9.6
8	20	5.2	27.04	25	4	16	20.8

9	16	1.2	1.44	22	1	1	1.2
10	22	7.2	51.84	20	-1	1	-7.2
$R_1 = \frac{148}{10} = 14.8$			Σ = 207.60		$R_2 = \frac{210}{10} = 21$	Σ=84.00	

Covariance = $\frac{\sum_{i=1}^{n}[R_1 - R_2][R_2 - R_2]}{N} = -\frac{8}{10}$ = -0.8

Standard Deviation of Security 1

$$\sigma_1 = \sqrt{\frac{(R_1 - \overline{R_1})^2}{N}}$$

$$\sigma_1 = \sqrt{\frac{207.60}{10}} = \sqrt{20.76}$$

$$\sigma_1 = 4.56$$

Standard Deviation of Security 2

$$\sigma_2 = \sqrt{\frac{(R_2 - \overline{R_2})^2}{N}}$$

$$\sigma_2 = \sqrt{\frac{84}{10}} = \sqrt{8.40}$$

$$\sigma_2 = 2.90$$

Alternatively, Standard Deviation of securities can also be calculated as follows:

Year	R1	R12	R2	R22
1	12	144	20	400
2	8	64	22	484
3	7	49	24	576
4	14	196	18	324
5	16	256	15	225
6	15	225	20	400
7	18	324	24	576
8	20	400	25	625
9	16	256	22	484
10	22	484	20	400
	148	2398	210	4494

Calculation of Standard Deviation

Standard Deviation of Security 1:

$$\sigma_1 = \sqrt{\frac{N\sum R_1^2 - (\sum R_1)^2}{N^2}}$$

$$\sigma_1 = \sqrt{\frac{(10 \times 2398) - (148)^2}{10 \times 10}}$$

$$= \sqrt{\frac{23980 - 21904}{100}}$$

$= \sqrt{20.76}$ = 4.56

Standard Deviation of Security 2:

$$\sigma_2 = \sqrt{\frac{N\sum R_2^2 - (\sum R_2)^2}{N^2}}$$

$$\sigma_2 = \sqrt{\frac{(10 \times 4494) - (210)^2}{10 \times 10}}$$

$$= \sqrt{\frac{44940 - 44100}{100}}$$

$= \sqrt{\frac{840}{100}}$ = $\sqrt{8.4}$ = 2.90

Correlation Coefficient

$$r_{12} = \frac{COV}{\sigma_1\sigma_2} = \frac{-0.8}{4.56 \times 2.90} = \frac{-0.8}{13.22} = -0.0605$$

Question 6 (Study Material TYK Q. 7)/RTP May'19

An investor has decided to invest to invest ₹ 1,00,000 in the shares of two companies, namely, ABC and XYZ. The projections of returns from the shares of the two companies along with their probabilities are as follows:

Probability	ABC (%)	XYZ (%)
.20	12	16
.25	14	10
.25	-7	28
.30	28	-2

You are required to

(i) Comment on return and risk of investment in individual shares.

(ii) Compare the risk and return of these two shares with a Portfolio of these shares in equal proportions.

(iii) Find out the proportion of each of the above shares to formulate a minimum risk portfolio.

Solution

(i)

Probability	ABC (%)	XYZ (%)	1X2 (%)	1X3 (%)
(1)	(2)	(3)	(4)	(5)
0.20	12	16	2.40	3.2
0.25	14	10	3.50	2.5
0.25	-7	28	-1.75	7.0
0.30	28	-2	8.40	-0.6
Average return			12.55	12.1

Hence the expected return from ABC = 12.55% and XYZ is 12.1%

Probability	(ABC- $\overline{\mathbf{ABC}}$)	(ABC-$\overline{\mathbf{ABC}}$)^2	1 x 3	(XYZ-$\overline{\mathbf{XYZ}}$)	(XYZ-$\overline{\mathbf{XYZ}}$)^2	(1) x (6)
(1)	(2)	(3)	(4)	(5)	(6)	
0.20	-0.55	0.3025	0.06	3.9	15.21	3.04
0.25	1.45	2.1025	0.53	-2.1	4.41	1.10
0.25	-19.55	382.2025	95.55	15.9	252.81	63.20
0.30	15.45	238.7025	71.61	-14.1	198.81	59.64
			167.75			126.98

σ 2 ABC = 167.75(%)^2 ; σ ABC = 12.95%

σ 2 XYZ = 126.98(%)^2 ; σ XYZ = 11.27%

(ii) In order to find risk of portfolio of two shares, the covariance between the two is necessary here.

Probability	(ABC - $\overline{\mathbf{ABC}}$)	(XYZ - $\overline{\mathbf{XYZ}}$)	2 x 3	1 x 4
(1)	(2)	(3)	(4)	(5)
0.20	-0.55	3.9	-2.145	-0.429
0.25	1.45	-2.1	-3.045	-0.761
0.25	-19.55	15.9	-310.845	-77.71
0.30	15.45	-14.1	-217.845	-65.35
				-144.25

σ 2P = (0.52 x 167.75) + (0.52 x 126.98) + 2 x (-144.25) x 0.5 x 0.5

σ 2P = 41.9375 + 31.745 – 72.125

σ 2P = 1.5575 or 1.56(%)

σ P = $\sqrt{1.56}$ = 1.25%

E (Rp) = (0.5 x 12.55) + (0.5 x 12.1) = 12.325%

Hence, the return is 12.325% with the risk of 1.25% for the portfolio. Thus the portfolio results in the reduction of risk by the combination of two shares.

(iii) For constructing the minimum risk portfolio the condition to be satisfied is

$XABC = \frac{\sigma_X^2 - r_{AX}\sigma_A\sigma_X}{\sigma_A^2 + \sigma_X^2 - 2r_{AX}\,\sigma_A\,\sigma_X}$ or $= \frac{\sigma_X^2 - \text{Cov.}_{AX}}{\sigma_A^2 + \sigma_X^2 - 2\,\text{Cov.}_{AX}}$

σX = Std. Deviation of XYZ

σA = Std. Deviation of ABC

rAX= Coefficient of Correlation between XYZ and ABC

Cov.AX = Covariance between XYZ and ABC.

Therefore,

$$\%\ \text{ABC} = \frac{126.98 - (-144.25)}{126.98 + 167.75 - [2 \times (-144.25)]} = \frac{271.23}{583.23} = 0.46 \text{ or } 46\%$$

% ABC = 46%, XYZ = 54%

(1 – 0.46) = 0.54

CAPITAL MARKET THEORY

Question 7 (Study Material TYK Q 9)/RTP May'20

The distribution of return of security 'F' and the market portfolio 'P' is given below:

Probability	Returns %	
	F	P
0.30	30	-10
0.40	20	20
0.30	0	30

You are required to calculate the expected return of security 'F' and the market portfolio 'P', the covariance between the market portfolio and security and beta for the security.

Solution

Security F

Prob(P)	Rf	Px Rf	Deviations of F (Rf – ERf)	(Deviation)2 of F	(Deviations)^2 PX
0.3	30	9	13	169	50.7
0.4	20	8	3	9	3.6
0.3	0	0	-17	289	86.7
		ERf = 17			Varf = 141

STDEV σf = $\sqrt{141}$ = 11.87

Market Portfolio, P

RM %	PM	Exp. Return RM x PM	Dev. of P (RM-ERM)	(Dev. of P)^2	(DeV.)^2 PM	(Deviation of F) x (Deviation of P)	Dev. of F x Dev. of P) x P

-10	0.3	-3	-24	576	172.8	-312	-93.6
20	0.4	8	6	36	14.4	18	7.2
30	0.3	9	16	256	76.8	-272	-81.6
		ERM =14			VarM = 264 σ M = 16.25		= Co Var PM = - 168

Beta = $\frac{\text{Co Var } P_M}{\sigma_M^2} = \frac{-168}{264} = -.636$

Question 8 (Study Material TYK Q 10)/MTP April'19

Given below is information of market rates of Returns and Data from two Companies A and B:

	Year 2007	Year 2008	Year 2009
Market (%)	12.0	11.0	9.0
Company A (%)	13.0	11.5	9.8
Company B (%)	11.0	10.5	9.5

You are required to determine the beta coefficients of the Shares of Company A and Company B.

Solution

Company A:

Year	Return % (Ra)	Market return % (Rm)	Deviation R(a)	Deviation Rm	D Ra x DRm	Rm^2
1	13.0	12.0	1.57	1.33	2.09	1.77
2	11.5	11.0	0.07	0.33	0.02	0.11
3	9.8	9.0	-1.63	-1.67	2.72	2.79
	34.3	32.0			4.83	4.67

Average Ra = 11.43

Average Rm = 10.67

Covariance = $\frac{\sum(R_m - \bar{R}_m)(R_a - \bar{R}_a)}{N}$

Covariance = $\frac{4.83}{3} = 1.61$

Variance (σm2) = $\frac{\sum(R_m - \bar{R}_m)^2}{N}$

$= \frac{4.67}{3} = 1.557$

$\beta = \frac{1.61}{1.557} = 1.03$

Company B:

Year	Return % (Rb)	Market return % (Rm)	Deviation R(b)	Deviation Rm	D Rb x D Rm	Rm^2
1	11.0	12.0	0.67	1.33	0.89	1.77

2	10.5	11.0	0.17	0.33	0.06	0.11
3	9.5	9.0	-0.83	-1.67	1.39	2.79
	31.0	32.0			2.34	4.67

Average Rb = 10.33

Average Rm = 10.67

Covariance = $\frac{\sum(R_m - \bar{R}_m)(R_b - \bar{R}_b)}{N}$

Covariance = $\frac{2.34}{3} = 0.78$

Variance (σm2) = $\frac{\sum(R_m - \bar{R}_m)^2}{N}$

$= \frac{4.67}{3} = 1.557$

$\beta = \frac{0.78}{1.557} = 0.50$

Question 9 (Study Material TYK Q 11)

The returns on stock A and market portfolio for a period of 6 years are as follows:

Year	Return on A (%)	Return on market portfolio (%)
1	12	8
2	15	12
3	11	11
4	2	-4
5	10	9.5
6	-12	-2

You are required to determine:

(i) Characteristic line for stock A

(ii) The systematic and unsystematic risk of stock A.

Solution

(i) Characteristic line is given by

α + β Rm

$\beta_i = \frac{\sum xy - n\bar{x}\,\bar{y}}{\sum x^2 - n(\bar{x})^2}$

$\alpha_i = \bar{y} - \beta\,\bar{x}$

Return on A (Y)	Return on market (X)	xy	x^2	$(x - \bar{x})$	$(x - \bar{x})^2$	$(y - \bar{y})$	$(y - \bar{y})^2$
12	8	96	64	2.25	5.06	5.67	32.15
15	12	180	144	6.25	39.06	8.67	75.17

11	11	121	121	5.25	27.56	4.67	21.81
2	-4	-8	16	-9.75	95.06	-4.33	18.75
10	9.5	95	90.25	3.75	14.06	3.67	13.47
-12	-2_	24	4	-7.75	60.06	-18.33	335.99
38	34.5	508	439.25		240.86		497.34

$\bar{y} = {}^{38}/_{6} = 6.33$

$\bar{x} = {}^{34.5}/_{6} = 5.75$

$$\beta = \frac{\sum xy - n\bar{x}\,\bar{y}}{\sum x^2 - n(\bar{x})^2} = \frac{508 - 6(5.75)(6.33)}{439.25 - 6(5.75)^2} = \frac{508 - 218.385}{439.25 - 198.375}$$

$$= \frac{289.615}{240.875} = 1.202$$

$\alpha = \bar{y} - \beta\,\bar{x} = 6.33 - 1.202(5.75) = -0.58$

Hence the characteristic line is -0.58 + 1.202 (Rm)

(ii) Total Risk of Market = $\sigma_{m^2} = \frac{\sum(x-\bar{x})^2}{n} = \frac{240.86}{6} = 40.14\ (\%)$

Total Risk of Stock= $\frac{497.34}{6} = 82.89\ (\%)$

Systematic Risk = $\beta i^2\ \sigma^2 = (1.202)^2 \times 40.14 = 57.99\ (\%)$

Unsystematic Risk is = Total Risk – Systematic Risk

= 82.89 - 57.99 = 24.90 (%)

Question 10 (Study Material TYK Q 12)

The rates of return on the security of Company X and market portfolio for 10 periods are given below:

Period	Return of Security X (%)	Return on Market Portfolio (%)
1	20	22
2	22	20
3	25	18
4	21	16
5	18	20
6	-5	8
7	17	-6
8	19	5
9	-7	6
10	20	11

(i) What is the beta of Security X?

(ii) What is the characteristic line for Security X?

Solution

(i)

Period	R x	RM	RX - RX	RM - RM	(R X - RX) (R M - RM)	(RM - RM)^2
1	20	22	5	10	50	100
2	22	20	7	8	56	64
3	25	18	10	6	60	36
4	21	16	6	4	24	16
5	18	20	3	8	24	64
6	-5	8	-20	-4	80	16
7	17	-6	2	-18	-36	324
8	19	5	4	-7	-28	49
9	-7	6	-22	-6	132	36
10	20	11	5	-1	-5	1
	150	120			357	706
	ΣR_X	ΣR_M			å (R_X -$\bar{R}_X$) ($\bar{R}_M$ - R_M)	å (R_M -$\bar{R}_M$)^2

$\bar{R}_x = 15\ \bar{R}_M = 12$

σ 2_M = $\frac{\sum(R_M - \bar{R}_M)^2}{n} = \frac{706}{10} = 70.60$

Cov X $_M$ = $\frac{\sum(R_x - \bar{R}_x))(R_M - \bar{R}_M)}{n} = \frac{357}{10} = 35.70$

Beta x = $\frac{Cov_{XM}}{\sigma^2 M} = \frac{35.70}{70.60} = 0.505$

Alternative Solution

Period	X	Y	Y2	XY
1	20	22	484	440
2	22	20	400	440
3	25	18	324	450
4	21	16	256	336
5	18	20	400	360
6	-5	8	64	-40
7	17	-6	36	-102
8	19	5	25	95
9	-7	6	36	-42
10	20	11	121	220
	150	120	2146	2157
	X = 15	Y = 12		

$$= \frac{\sum XY - n\,\overline{XY}}{\sum X^2 - n(\bar{X})^2}$$

$$= \frac{2157 - 10 \times 15 \times 12}{2146 - 10 \times 12 \times 12} = \frac{357}{706} = 0.506$$

(ii) R_X = 15 R_M = 12

y = $\alpha + \beta x$

15 = $\alpha + 0.505 \times 12$

Alpha (α) $= 15 - (0.505 \times 12) = 8.94\%$

Characteristic line for security X = $\alpha + \beta \times R_M$
Where, R_M = Expected return on Market Index

Therefore, Characteristic line for security X = 8.94 + 0.505 R_M

Question 11 (Study Material TYK Q 8)(MTP March'19)/PP May'22

The following information are available with respect of Krishna Ltd.

Krishna Ltd.			Market		
Year	Average share price	Dividend per Share	Average Index	Dividend Yield	Return on Govt. bonds
	₹	₹			
2012	245	20	2013	4%	7%
2013	253	22	2130	5%	6%
2014	310	25	2350	6%	6%
2015	330	30	2580	7%	6%

Compute Beta Value of the Krishna Ltd. at the end of 2015 and state your observation.

Solution

(i) **Computation of Beta Value**

Calculation of Returns

$$\text{Returns} = \frac{D_1 + (P_1 - P_0)}{P_0} \times 100$$

Year	Returns
2012 - 13	$\frac{22 + (253 - 245)}{245} \times 100 = 12.24\%$
2013 - 14	$\frac{25 + (310 - 253)}{253} \times 100 = 32.41\%$
2014 - 15	$\frac{30 + (330 - 310)}{310} \times 100 = 16.13\%$

Calculation of Returns from market Index

Year	% of Index Appreciation	Dividend Yield %	Total Return %
2012-13	$\frac{(2130 - 2013)}{2013} \times 100 = 5.81\%$	5%	10.81%
2013-14	$\frac{(2350 - 2130)}{2130} \times 100 = 10.33\%$	6%	16.33%
2014-15	$\frac{(2580 - 2350)}{2350} \times 100 = 9.79\%$	7%	16.79%

Computation of Beta

Year	Krishna Ltd. (X)	Market Index (Y)	XY	Y^2
2012-13	12.24%	10.81%	132.31	116.86
2013-14	32.41%	16.33%	529.25	266.67
2014-15	16.13%	16.79%	270.82	281.90
Total	60.78%	43.93%	932.38	665.43

Average Return of Krishna Ltd. = $\frac{60.78}{3} = 20.26\%$

Average Market Return = $\frac{43.93}{3} = 14.64\%$

$$\text{Beta } (\beta) = \frac{\sum XY - n\,\overline{XY}}{\sum Y^2 - n\,(\overline{Y})^2} = \frac{932.38 - 3 \times 20.26 \times 14.64}{665.43 - 3(14.64)^2} = 1.897$$

(ii) Observation

	Expected Return (%)	Actual Return (%)	Action
2012 – 13	6%+ 1.897(10.81% - 6%) = 15.12%	12.24%	Sell
2013 – 14	6%+ 1.897(16.33% - 6%) = 25.60%	32.41%	Buy
2014 – 15	6%+ 1.897(16.79% - 6%) = 26.47%	16.13%	Sell

Question 12 (Study Material TYK Q 13)/RTP May'18/MTP Oct'19/MTP May'20)

Expected returns on two stocks for particular market returns are given in the following table:

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

You are required to calculate:

a) The Betas of the two stocks.
b) Expected return of each stock, if the market return is equally likely to be 7% or 25%.
c) The Security Market Line (SML), if the risk free rate is 7.5% and market return is equally likely to be 7% or 25%.
d) The Alphas of the two stocks.

Solution

a) The Betas of two stocks:

Aggressive stock - (40% - 4%) / (25% - 7%) = 2
Defensive stock - (18% - 9%) / (25% - 7%) = 0.50

Alternatively, it can also be solved by using the Characteristic Line Relationship as follows:

$R_s = \alpha + \beta R_m$

Where
α = Alpha
β = Beta

Rm= Market Return

For Aggressive Stock

4% = α + β (7%)
40% = α + β (25%)
36% = β (18%)
β = 2

For Defensive Stock

9% = α + β (7%)
18% = α + β (25%)
9% = β (18%)
β = 0.50

b) Expected returns of the two stocks: -
Aggressive stock - 0.5 x 4% + 0.5 x 40% = 22%
Defensive stock 0.5 x 9% + 0.5 x 18% = 13.5%

c) Expected return of market portfolio = 0.5 x 7% + 0.5% x 25% = 16%
Therefore, Market risk premium = 16% - 7.5% = 8.5%
Therefore, SML is, required return = 7.5% + βi 8.5%

d) Rs = α + βRm

For Aggressive Stock

22% = αA + 2(16%)
αA = -10%

For Defensive Stock

13.5% = αD + 0.50(16%)
αD = 5.5%

Question 13 (Study Material TYK Q 14)/RTP Nov'20

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	σ (%)	Correlation with Index, Pm
A	20	0.60
B	18	0.95
C	12	0.75

The standard deviation of market portfolio (BSE Sensex) is observed to be 15%.

(i) What is the sensitivity of returns of each stock with respect to the market?
(ii) What are the covariances among the various stocks?
(iii) What would be the risk of portfolio consisting of all the three stocks equally?

(iv) What is the beta of the portfolio consisting of equal investment in each stock?
(v) What is the total, systematic and unsystematic risk of the portfolio in (iv)?

Solution

(i) Sensitivity of each stock with market is given by its beta.

Standard deviation of market Index = 15%

Variance of market Index = 0.0225

Beta of stocks = σi r/ σ m

A = 20 × 0.60 / 15 = 0.80

B = 18 × 0.95 / 15 = 1.14

C = 12 × 0.75 / 15 = 0.60

(ii) Covariance between any 2 stocks = $\beta_1\beta_2\sigma^2 m$

Covariance matrix

Stock/Beta	0.80	1.14	0.60
A	400.000	205.200	108.000
B	205.200	324.000	153.900
C	108.000	153.900	144.000

(iii) Total risk of the equally weighted portfolio (Variance) = $400(1/3)^2 + 324(1/3)^2 + 144(1/3)^2 + 2(205.20)(1/3)^2 + 2(108.0)(1/3)^2 + 2(153.900)(1/3)^2 = 200.244$

(iv) β of equally weighted portfolio = $\beta_p = \sum \beta i/ N = \frac{0.80+1.14+0.60}{3} = 0.8467$

(v) Systematic Risk $\beta P_2 \sigma m^2 = (0.8467)^2 (15)^2 = 161.302$

Unsystematic Risk = Total Risk – Systematic Risk

= 200.244 – 161.302 = 38.942

Question 14 (Study Material TYK Q 16)/MTP Oct'18

Mr. Tempest has the following portfolio of four shares:

Name	Beta	Investment ₹ Lac.
Oxy Rin Ltd.	0.45	0.80
Boxed Ltd.	0.35	1.50
Square Ltd.	1.15	2.25
Ellipse Ltd.	1.85	4.50

The risk – free rate of return is 7% and the market rate of return is 14%. Required.

Determine the portfolio return. (ii) Calculate the portfolio Beta.

Solution

Market Risk Premium (A) = 14% – 7% = 7%

Share	Beta	Risk Premium (Beta x A) %	Risk Free Return %	Return %	Return ₹
Oxy Rin Ltd.	0.45	3.15	7	10.15	8,120
Boxed Ltd.	0.35	2.45	7	9.45	14,175
Square Ltd.	1.15	8.05	7	15.05	33,863
Ellipse Ltd.	1.85	12.95	7	19.95	89,775
Total Return					1,45,933

Total Investment ₹ 9,05,000

(i) Portfolio Return = $\frac{1,45,933}{9,05,000} \times 100 = 16.13\%$

(ii) Portfolio Beta

Portfolio Return = Risk Free Rate + Risk Premium x β = 16.13%

7% + 7b = 16.13%

β = 1.30

Alternative Approach

First, we shall compute Portfolio Beta using the weighted average method as follows:

Beta P = $0.45 \times \frac{0.80}{9.05} + 0.35 \times \frac{1.50}{9.05} + 1.15 \times \frac{2.25}{9.05} + 1.85 \times \frac{4.50}{9.05}$

= 0.45 x 0.0884 + 0.35 x 0.1657 + 1.15 x 0.2486 + 1.85 x 0.4972

= 0.0398 + 0.058 + 0.2859 + 0.9198 = 1.3035

Accordingly,

(i) Portfolio Return using CAPM formula will be as follows:
RP= RF + Beta P (RM – RF)
= 7% + 1.3035(14% - 7%) = 7% + 1.3035(7%)
= 7% + 9.1245% = 16.1245%

(ii) Portfolio Beta
As calculated above 1.3035

Question 15 (Study Material TYK Q 18)/RTP Nov'22

Amal Ltd. has been maintaining a growth rate of 12% in dividends. The company has paid dividend @ ₹ 3 per share. The rate of return on market portfolio is 15% and the risk – free rate of return in the market has been observed as10%. The beta co-efficient of the company's share is 1.2.

You are required to calculate the expected rate of return on the company's shares as per CAPM model and the equilibrium price per share by dividend growth model.

Solution

Capital Asset Pricing Model (CAPM) formula for calculation of expected rate of return is ER = Rf + β (Rm – Rf)

ER = Expected Return

β = Beta of Security

Rm = Market Return

Rf = Risk free Rate

= 10 + [1.2 (15 – 10)]

= 10 + 1.2 (5)

= 10 + 6 = 16% or 0.16

Applying dividend growth mode for the calculation of per share equilibrium price: -

$$E_R = \frac{D_1}{P_0} + q$$

or $0.16 = \frac{3(1.12)}{P_0} + 0.12$ or $0.16 - 0.12 = \frac{3.36}{P_0}$

or 0.04 P0 = 3.36 or $P_0 = \frac{3.36}{0.04} = ₹\ 84$

Therefore, equilibrium price per share will be ₹ 84.

Question 16 (Study Material TYK Q 19)

The following information is available in respect of Security

Equilibrium Return	15%
Market Return	15%
7% Treasury Bond Trading at	$140
Covariance of Market Return and Security Return	225%
Coefficient of Correlation	0.75

You are required to determine the Standard Deviation of Market Return and Security Return.

Solution

First we shall compute the β of Security X.

Risk Free Rate = $\frac{\text{Coupon Payment}}{\text{Current Market Price}} = \frac{7}{140} = 5\%$

Assuming equilibrium return to be equal to CAPM return then:

15% = Rf + βX (Rm- Rf)

15%= 5% + βX (15%- 5%)

βX = 1

or it can also be computed as follows:

$$\frac{R_m}{R_s} = \frac{15\%}{15\%} = 1$$

Standard Deviation of Market Return

$$\beta_m = \frac{Cov_{x,m}}{\sigma_m^2} = \frac{225\%}{\sigma_m^2} = 1$$

$$\sigma_m^2 = 225$$

$$\sigma_m = \sqrt{225} = 15\%$$

Standard Deviation of Security Return

$$\beta_x = \frac{\sigma_x}{\sigma_m} \times p_{xm} = \frac{\sigma_x}{15} \times 0.75 = 1$$

$$\sigma_x = \frac{15}{0.75} = 20\%$$

Question 17 (Study Material TYK Q 20)

Assuming that shares of ABC Ltd. and XYZ Ltd. are correctly priced according to Capital Asset Pricing Model. The expected return from and Beta of these shares are as follows:

Share	Beta	Expected return
ABC	1.2	19.8%
XYZ	0.9	17.1%

You are required to derive Security Market Line.

Solution

CAPM = Rf+ β (Rm –Rf)

Accordingly,
RABC = Rf + 1.2 (Rm – Rf) = 19.8
RXYZ = Rf + 0.9 (Rm – Rf) = 17.1

19.8 = Rf + 1.2 (Rm – Rf) ------(1)

17.1 = Rf + 0.9 (Rm – Rf) ------(2)

Deduct (2) from (1)
2.7 = 0.3 (Rm – Rf)
Rm – Rf = 9
Rf = Rm – 9

Substituting in equation (1)
19.8 = (Rm – 9) + 1.2 (Rm – Rm+ 9)
19.8 = Rm - 9 + 10.8
19.8 = Rm + 1.8

Then Rm = 18% and Rf = 9% Security Market Line
= Rf + β (Market Risk Premium)
= 9% + β x 9%

Question 18 (Study Material TYK Q 21)/MTP Oct'22/RTP Nov'22

A Ltd. has an expected return of 22% and Standard deviation of 40%. B Ltd. has an expected return of 24% and Standard deviation of 38%. A Ltd. has a beta of 0.86 and B Ltd. a beta of 1.24. The correlation coefficient between the return of A Ltd. and B Ltd. is 0.72. The Standard deviation of the market return is 20%. Suggest:

(i) Is investing in B Ltd. better than investing in A Ltd.?
(ii) If you invest 30% in B Ltd. and 70% in A Ltd., what is your expected rate of return and portfolio Standard deviation?
(iii) What is the market portfolios expected rate of return and how much is the risk – free rate?
(iv) What is the beta of Portfolio if A Ltd.'s weight is 70% and B Ltd.'s weight is 30%?

Solution

(i) A Ltd. has lower return and higher risk than B Ltd. investing in B Ltd. is better than in A Ltd. because the returns are higher and the risk, lower. However, investing in both will yield diversification advantage.

(ii) r_{AB} = .22 x 0.7 + .24 x 0.3 = 22.6%

σ^2_{AB} = 0.402 x 0.72 + 0.382 x 0.32 + 2 x 0.7 x 0.3 x 0.72 x 0.40 x 0.38 = 0.1374

$\sigma_{AB} = \sqrt{\sigma^2_{AB}} = \sqrt{.1374} = .37 = 37\%$ *

* Answer = 37.06% is also correct and variation may occur due to approximation.

(iii) This risk – free rate will be the same for A and B Ltd. Their rates of return are given as follows:

r_A = 22 = rf + (r_m – rf) 0.86

r_B = 24 = rf + (rm – rf) 1.24

$r_A - r_B$ = –2 = (rm – rf) (–0.38)

$r_m - r_f$ = –2 / –0.38 = 5.26%

r_A = 22 = rf + (5.26) 0.86

r_f = 17.5%*

r_B = 24 = rf + (5.26) 1.24

r_f = 17.5%*

r_m – 17.5 = 5.26

r_m = 22.76%**

*Answer = 17.47% might occur due to variation in approximation.

**Answer may show small variation due to approximation. Exact answer is 22.73%.

(iv) $\beta AB = \beta_A \times W_A + \beta_B \times W_B$

$= 0.86 \times 0.7 + 1.24 \times 0.3 = 0.974$

Question 19 (Study Material TYK Q 22)/MTP April'18

XYZ Ltd. has substantial cash flow and until the surplus funds are utilised to meet the future capital expenditure, likely to happen after several months, are invested in a portfolio of short- term equity investments, details for which are given below:

Investment	No. of shares	Beta	Market price per share ₹	Expected dividend yield
I	60,000	1.16	4.29	19.50%
II	80,000	2.28	2.92	24.00%
III	1,00,000	0.90	2.17	17.50%
IV	1,25,000	1.50	3.14	26.00%

The current market return is 19% and the risk - free rate is 11%.

Required to:

(i) Calculate the risk of XYZ's short – term investment portfolio relative to that of the market;

(ii) Whether XYZ should change the composition of its portfolio.

Solution

(i) Computation of Beta of Portfolio

Investment	No. of shares	Market Price	Market Value	Dividend Yield	Dividend	Composition	β	Weighted β
I	60,000	4.29	2,57,400	19.50%	50,193	0.2339	1.16	0.27
II	80,000	2.92	2,33,600	24.00%	56,064	0.2123	2.28	0.48
III	1,00,000	2.17	2,17,000	17.50%	37,975	0.1972	0.90	0.18
IV	1,25,000	3.14	3,92,500	26.00%	1,02,050	0.3566	1.50	0.53
			11,00,500		2,46,282	1.0000		1.46

Return of the Portfolio $= \frac{2,46,282}{11,00,500} = 0.2238$

Beta of Port Folio = 1.46

Market Risk implicit

$0.2238 = 0.11 + \beta \times (0.19 - 0.11)$

Or, $0.08\ \beta + 0.11 = 0.2238$

$$\beta = \frac{0.2238 - 0.11}{0.08} = 1.42$$

Market β implicit is 1.42 while the portfolio β is 1.46. Thus the portfolio is marginally risky compared to the market.

(ii) The decision regarding change of composition may be taken by comparing the dividend yield (given) and the expected return as per CAPM as follows:

Expected Return		Rs as per CAPM is:
Rs	=	IRF + (RM – I RF) β
For investment I Rs	=	IRF + (RM – IRF) β
	=	.11 + (.19 - .11) 1.16
	=	20.28%
For investment II, Rs	=	.11 + (.19 - .11) 2.28 = 29.24%
For investment III, Rs	=	.11 + (.19 - .11) .90
	=	18.20%
For investment IV, Rs	=	.11 + (.19 - .11) 1.50
	=	23%

Comparison of dividend yield with the expected return Rs shows that the dividend yields of investment I, II and III are less than the corresponding Rs,. So, these investments are over – priced and should be sold by the investor. However, in case of investment IV, the dividend yield is more than the corresponding Rs, so, XYZ Ltd. should increase its proportion.

Question 20 (Study Material TYK Q 33)

An investor holds two stocks A and B. An analyst prepared ex-ante probability distribution for the possible economic scenarios and the conditional returns for two stocks and the market index as shown below:

Economic scenario	Probability	Conditional Returns %		
		A	B	Market
Growth	0.40	25	20	18
Stagnation	0.30	10	15	13
Recession	0.30	-5	-8	-3

The risk – free rate during the next year is expected to be around 11%. Determine whether the investor should liquidate his holdings in stocks A and B or on the contrary make fresh investments in them. CAPM assumptions are holding true.

Solution

Expected Return on stock A = $E(A) = \sum_{i=G,S,R} P_i A_i$

(G, S & R, denotes Growth, Stagnation and Recession)

(0.40) (25) + 0.30 (10) + 0.30(-5) = 11.5%

Expected Return on 'B'

(0.40 ×20) + (0.30 × 15) +0.30 × (- 8) = 10.1%

Expected Return on Market index

(0.40 × 18) + (0.30 × 13) + 0.30 × (-3) = 10.2%

Variance of Market index

$(18 - 10.2)^2 (0.40) + (13 - 10.2)^2 (0.30) + (-3 - 10.2)^2 (0.30) = 24.34 + 2.35 + 52.27 = 78.96\%$

Covariance of stock A and Market Index M

Cov. (AM) = $\sum_{i=G,S,R}([A_i - E(A)][M_i - E(M)]\ P$

(25 - 11.5) (18 - 10.2) (0.40) + (10 - 11.5) (13 - 10.2) (0.30) + (- 5 - 11.5) (- 3 - 10.2) (0.30)

= 42.12 + (-1.26) + 65.34 = 106.20

Covariance of stock B and Market index M

(20 - 10.1) (18-10.2) (0.40) + (15 - 10.1) (13 - 10.2) (0.30) + (- 8 - 10.1) (- 3 - 10.2) (0.30) = 30.89 + 4.12 + 71.67 = 106.68

Beta for stock A = $\frac{\text{CoV (AM)}}{\text{VAR (M)}} = \frac{106.20}{78.96} = 1.345$

Beta for stock B = $\frac{\text{CoV (BM)}}{\text{VAR (M)}} = \frac{106.68}{78.96} = 1.351$

Required Return for A

R (A) = Rf +β (M-Rf)

11% + 1.345 (10.2 - 11) % = 9.924%

Required Return for B

11% + 1.351 (10.2 – 11) % = 9.92%

Alpha for Stock A

E (A) – R (A) i.e. 11.5 % – 9.924% = 1.576%

Alpha for Stock B

E (B) – R (B) i.e. 10.1% - 9.92% = 0.18%

Since stock A and B both have positive Alpha, therefore, they are UNDERPRICED. The investor should make fresh investment in them.

Question 21 (Study Material TYK Q 23)/RTP Nov'19/Similar Q asked in PP July'21

A company has a choice of investments between several different equity oriented mutual funds. The company has an amount of ₹ 1 crore to invest. The details of the mutual funds are as follows:

Mutual Fund	Beta
A	1.6
B	1.0
C	0.9
D	2.0
E	0.6

Required:

(i) If the company invests 20% of its investment in each of the first two mutual funds and an equal amount in the mutual funds C, D and E, what is the beta of the portfolio?

(ii) If the company invests 15% of its investment in C, 15% in A, 10% in E and the balance in equal amount in the other two mutual funds, what is the beta of the portfolio?

(iii) If the expected return of market portfolio is 12% at a beta factor of 1.0, what will be the

portfolios expected return in both the situations given above?

Solution

With 20% investment in each MF Portfolio Beta is the weighted average of the Betas of various securities calculated as below:

Investment	Beta (β)	Investment (` Lacs)	Weighted Investment
A	1.6	20	32
B	1.0	20	20
C	0.9	20	18
D	2.0	20	40
E	0.6	20	12
		100	122
	Weighted Beta (β) = 1.22		

With varied percentages of investments portfolio beta is calculated as follows

Investment	Beta (β)	Investment (₹ Lacs)	Weighted Investment
A	1.6	15	24
B	1.0	30	30
C	0.9	15	13.5
D	2.0	30	60
E	0.6	10	6
		100	133.5
	Weighted Beta (β) = 1.335		

Expected return of the portfolio with pattern of investment as in case (i)

= 12% × 1.22 i.e. 14.64%

Expected Return with pattern of investment as in case (ii) = 12% × 1.335 i.e., 16.02%.

Question 22 (Study Material TYK Q 24)

Suppose that economy A is growing rapidly and you are managing a global equity fund and so far you have invested only in developed-country stocks only. Now you have decided to add stocks of economy A to your portfolio. The table below shows the expected rates of return, standard deviations, and correlation coefficients (all estimates are for aggregate stock market of developed countries and stock market of Economy A).

	Developed Country Stocks	Stocks of Economy A
Expected rate of return (annualized percentage)	10	15
Risk [Annualized Standard Deviation (%)]	16	30
Correlation Coefficient (r)	0.30	

Assuming the risk – free interest rate to be 3%, you are required to determine:

a) What percentage of your portfolio should you allocate to stocks of Economy A if you want to increase the expected rate of return on your portfolio by 0.5%?

b) What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?

c) Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio?

Solution

a) Let the weight of stocks of Economy A is expressed as w, then
(1- w) ×10.0 + w ×15.0 = 10.5
i.e. w = 0.1 or 10%.

b) Variance of portfolio shall be:
$(0.9)^2 (0.16)^2 + (0.1)^2 (0.30)^2 + 2(0.9)(0.1)(0.16)(0.30)(0.30) = 0.02423$
Standard deviation is $(0.02423)^{\frac{1}{2}} = 0.15565$ or 15.6%.

c) The Sharpe ratio will improve by approximately 0.04, as shown below:

$$\text{Sharpe Ratio} = \frac{\text{Expected Return} - \text{Risk Free Rate of Return}}{\text{Standard Deviation}}$$

Investment only in developed countries: $\frac{10-3}{16} = 0.437$

With inclusion of stocks of Economy A: $\frac{10.5-3}{15.6} = 0.481$

Question 23 (Study Material TYK Q 25)/RTP Nov'18/MTP April'18

Mr. FedUp wants to invest an amount of ₹ 520 lakhs and had approached his Portfolio Manager. The Portfolio Manager had advised Mr. FedUp to invest in the following manner:

Security	Moderate	Better	Good	Very Good	Best
Amount (in ₹ Lakhs)	60	80	100	120	160
Beta	0.5	1.00	0.80	1.20	1.50

You are required to advise Mr. Fed Up in regard to the following, using Capital Asset Pricing Methodology:

(i) Expected return on the portfolio, if the Government Securities are at 8% and the NIFTY is yielding 10%.

(ii) Advisability of replacing Security 'Better' with NIFTY.

Solution

(i) Computation of Expected Return from Portfolio

Security	Beta (β)	Expected Return (r) as per CAPM	Amount (₹ Lakhs)	Weights (w)	wr
Moderate	0.50	8%+ 0.50(10% - 8%) = 9%	60	0.115	1.035
Better	1.00	8%+ 1.00(10% - 8%) = 10%	80	0.154	1.540
Good	0.80	8%+ 0.80(10% - 8%) = 9.60%	100	0.192	1.843
Very Good	1.20	8%+ 1.20(10% - 8%) =10.40%	120	0.231	2.402
Best	1.50	8%+ 1.50(10% - 8%) = 11%	160	0.308	3.388
Total			520	1	10.208

Thus Expected Return from Portfolio 10.208% say 10.21%.

Alternatively, it can be computed as follows:

$$\text{Average } \beta = 0.50 \times \frac{60}{520} + 1.00 \times \frac{80}{520} + 0.80 \times \frac{100}{520} + 1.20 \times \frac{120}{520} + 1.50 \times \frac{160}{520} = 1.104$$

As per CAPM

= 0.08 + 1.104(0.10 – 0.08) = 0.10208 i.e. 10.208%

(ii) As computed above the expected return from Better is 10% same as from Nifty, hence there will be no difference even if the replacement of security is made. The main logic behind this neutrality is that the beta of security 'Better' is 1 which clearly indicates that this security shall yield same return as market return.

Question 24 (Study Material TYK Q 29)

An investor is holding 1,000 shares of Fatlass Company. Presently the rate of dividend being paid by the company is ₹ 2 per share and the share is being sold at ₹ 25 per share in the market. However, several factors are likely to be changed during the course of the year as indicated below:

	Existing	Revised
Risk free rate	12%	10%
Market risk premium	6%	4%
Beta value	1.4	1.25
Expected growth rate	5%	9%

In view of the above factors whether the investor should buy, hold or sell the shares? And why?

Solution

On the basis of existing and revised factors, rate of return and price of share is to be calculated.

Existing rate of return

= Rf + Beta (Rm – Rf) = 12% + 1.4 (6%) = 20.4%

Revised rate of return

= 10% + 1.25 (4%) = 15%

Price of share (original)

$$P_0 = \frac{D\,(1+g)}{K_e - g} = \frac{2\,(1.05)}{.204 - .05} = \frac{2.10}{.154} = \text{Rs. } 13.63$$

Price of share (Revised)

$$P_0 = \frac{2\,(1.09)}{.15 - .09} = \frac{2.18}{.06} = \text{Rs. } 36.33$$

In case of existing market price of ₹ 25 per share, rate of return (20.4%) and possible equilibrium price of share at ₹ 13.63, this share needs to be sold because the share is overpriced (₹ 25 – 13.63) by ₹ 11.37. However, under the changed scenario where growth of dividend has been revised at 9% and the return though decreased at 15% but the possible price of share is to be at ₹ 36.33 and therefore,

in order to expect price appreciation to ₹ 36.33 the investor should hold the shares, if other things remain the same.

Question 25 (Study Material TYK Q 30)

An investor is holding 5,000 shares of X Ltd. Current year dividend rate is ₹ 3 / share. Market price of the share is ₹ 40 each. The investor is concerned about several factors which are likely to change during the next financial year as indicated below:

	Current Year	Next Year
Dividend paid / anticipated per share (₹)	3	2.5
Risk free rate	12%	10%
Market Risk Premium	5%	4%
Beta Value	1.3	1.4
Expected growth	9%	7%

In view of the above, advise whether the investor should buy, hold or sell the shares.

Solution

On the basis of existing and revised factors, rate of return and price of share is to be calculated.

Existing rate of return

= Rf + Beta (Rm – Rf)

= 12% + 1.3 (5%) = 18.5%

Revised rate of return

= 10% + 1.4 (4%) = 15.60%

Price of share (original)

$$P_0 = \frac{D\,(1+g)}{K_e - g} = \frac{3\,(1.09)}{0.185 - 0.09} = \frac{3.27}{0.095} = ₹\,34.42$$

Price of share (Revised)

$$P_0 = \frac{2.50\,(1.07)}{0.156 - 0.07} = \frac{2.675}{0.086} = ₹\,31.10$$

Market price of share of ₹ 40 is higher in comparison to current equilibrium price of ₹ 34.42 and revised equity price of ₹ 31.10. Under this situation investor should sell the share.

Question 26 (Study Material TYK Q 32)/RTP May'19/MTP April'19/Similar Q asked in MTP Oct'20

X Co., Ltd., invested on 1.4.2009 in certain equity shares as below:

Name of Co.	No. of shares	Cost (₹)
M Ltd.	1,000 (₹ 100 each)	2,00,000
N Ltd.	500 (₹ 10 each)	1,50,000

In September, 2009, 10% dividend was paid out by M Ltd. and in October, 2003, 30% dividend paid out by N Ltd. On 31.3.2010 market quotations showed a value of ₹ 220 and ₹ 290 per share for M Ltd. and N Ltd. respectively.

On 1.4.2010, investment advisors indicate (a) that the dividends from M Ltd. and N Ltd. for the year ending 31.3.2011 are likely to be 20% and 35%, respectively and (b) that the probabilities of market quotations on 31.3.2011 are as below:

Probability factor	Price / share of M Ltd.	Price / share of N Ltd.
0.2	220	290
0.5	250	310
0.3	280	330

You are required to:

(i) Calculate the average return from the portfolio for the year ended 31.3.2010;
(ii) Calculate the expected average return from the portfolio for the year 2010 - 11; and
(iii) Advise X Co. Ltd., of the comparative risk in the two investments by calculating the standard deviation in each case.

Solution

Workings:

Calculation of return on portfolio for 2009 - 10	**(Calculation in ₹ / share)**		
	M	**N**	
Dividend received during the year	10	3	
Capital gain/loss by 31.03.10			
Market value by 31.03.10	220	290	
Cost of investment	200	300	
Gain/loss	20	(-)10	
Yield	30	(-)7	
Cost	200	300	
% return	15%	(-)2.33%	
Weight in the portfolio	57	43	
Weighted average return			7.55%
Calculation of estimated return for 2010-11			
Expected dividend	20	3.5	
Capital gain by 31.03.11			
(220 x 0.2) + (250 x 0.5) + (280 x 0.3) – 220 = (253-220)	33	-	
(290 x 0.2) + (310 x 0.5) + (330 x 0.3) – 290 = (312 – 290)	-	22	
Yield	53	25.5	
*Market Value 01.04.10	220	290	
% return	24.09%	8.79%	
*Weight in portfolio (1,000x 220): (500x 290)	60.3	39.7	
Weighted average (Expected) return			18.02%

(*The market value on 31.03.10 is used as the base for calculating yield for 10-11)			

(i) Average Return from Portfolio for the year ended 31.03.2010 is 7.55%.

(ii) Expected Average Return from portfolio for the year 2010-11 is 18.02%

(iii) Calculation of Standard Deviation

M Ltd.

Exp. Market value	Exp. gain	Exp. div.	Exp Yield (1)	Prob. Factor (2)	(1) X (2)	Dev. (PM - PM)	Square of dev. (3)	(2) X (3)
220	0	20	20	0.2	4	-33	1089	217.80
250	30	20	50	0.5	25	-3	9	4.50
280	60	20	80	0.3	24	27	729	218.70
					53			σ^2_M = 441.00

Standard Deviation (σ_M) 21

N Ltd.

Exp. Market value	Exp. gain	Exp. div.	Exp Yield (1)	Prob. Factor (2)	(1) X (2)	Dev. (PN – P N)	Square of dev. (3)	(2) X (3)
290	0	3.5	3.5	0.2	0.7	-22	484	96.80
310	20	3.5	23.5	0.5	11.75	-2	4	2.00
330	40	3.5	43.5	0.3	13.05	18	324	97.20
					25.5			σ^2_N = 196.00

Standard Deviation (σ_N) 14

Alternatively based on return in percentage terms Standard Deviation can also be computed as follows:

M Ltd.

Exp. market value	Exp. gain	Exp. div.	Exp Return (1)	Prob. Factor (2)	(1) X (2)	Dev. (PM - $\overline{P_M}$)	Square of dev. (3)	(2) X (3)
220	0	20	9.09	0.2	1.82	-15.01	225.30	45.06
250	30	20	22.73	0.5	11.37	-1.37	1.88	0.94
280	60	20	36.36	0.3	10.91	12.26	150.31	45.09
					24.10			σ^2_M = 91.09

Standard Deviation (σ_M) 9.54%

N Ltd.

Exp. market value	Exp. gain	Exp. div	Exp Return (1)	Prob. Factor (2)	(1) X (2)	Dev. (PN - PN)	Square of dev. (3)	(2) X (3)
290	0	3.5	1.21	0.2	0.24	-7.58	57.46	11.49
310	20	3.5	8.10	0.5	4.05	-0.69	0.48	0.24
330	40	3.5	15.00	0.3	4.50	6.21	38.56	11.57

					8.79			σ^2_N = 23.30

Standard Deviation (σ_N) 4.83%

Share of company M Ltd. is more risky as the S.D. is more than company N Ltd.

Question 27 (Study Material TYK Q 34)/RTP May'18/MTP Aug'18/MTP Nov'21/PP May'19

Following are the details of a portfolio consisting of three shares:

Share	Portfolio weight	Beta	Expected return in %	Total variance
A	0.20	0.40	14	0.015
B	0.50	0.50	15	0.025
C	0.30	1.10	21	0.100

Standard Deviation of Market Portfolio Returns = 10%

You are given the following additional data:

Covariance (A, B) = 0.030

Covariance (A, C) = 0.020

Covariance (B, C) = 0.040

Calculate the following:

(i) The Portfolio Beta
(ii) Residual variance of each of the three shares
(iii) Portfolio variance using Sharpe Index Model
(iv) Portfolio variance (on the basis of modern portfolio theory given by Markowitz)

Solution

(i) Portfolio Beta

0.20 x 0.40 + 0.50 x 0.50 + 0.30 x 1.10 = 0.66

(ii) Residual Variance

To determine Residual Variance first of all we shall compute the Systematic Risk as follows:

$\beta^2_A \times \sigma^2_M = (0.40)^2 (0.01) = 0.0016$

$\beta^2_B \times \sigma^2_M = (0.50)^2 (0.01) = 0.0025$

$\beta^2_C \times \sigma^2_M = (1.10)^2 (0.01) = 0.0121$

Residual Variance

A 0.015 – 0.0016 = 0.0134

B 0.025 – 0.0025 = 0.0225

C 0.100 – 0.0121 = 0.0879

(iii) Portfolio variance using Sharpe Index Model

Systematic Variance of Portfolio = $(0.10)^2 \times (0.66)^2 = 0.004356$

Unsystematic Variance of Portfolio = $0.0134 \times (0.20)^2 + 0.0225 \times (0.50)^2 + 0.0879 \times (0.30)^2$

$= 0.014072$

Total Variance = 0.004356 + 0.014072 = 0.018428

(iv) Portfolio variance on the basis of Markowitz Theory

= (w A x w A x σ2A) + (w A x w B x Cov AB) + (w A x w C x Cov AC) + (w B x w A x Cov AB) + (w B x w B x σ2B) + (w B x w C x Cov BC) + (w C x w A x Cov CA) + (w C x w B x Cov CB) + (w C x w C x σ2C)

= (0.20 x 0.20 x 0.015) + (0.20 x 0.50 x 0.030) + (0.20 x 0.30 x 0.020) + (0.20 x 0.50 x 0.030) + (0.50 x 0.50 x 0.025) + (0.50 x 0.30 x 0.040) + (0.30 x 0.20 x 0.020) + (0.30 x 0.50 x 0.040) + (0.30 x 0.30 x 0.10)

= 0.0006 + 0.0030 + 0.0012 + 0.0030 + 0.00625 + 0.0060 + 0.0012 + 0.0060 + 0.0090

= 0.0363

Question 28 (Study Material TYK Q 36)/RTP May'20/RTP Nov'21

A Portfolio Manager (PM) has the following four stocks in his portfolio:

Security	No. of Shares	Market Price per share (₹)	ß
VSL	10,000	50	0.9
CSL	5,000	20	1.0
SML	8,000	25	1.5
APL	2,000	200	1.2

Compute the following:

(i) Portfolio beta.

(ii) If the PM seeks to reduce the beta to 0.8, how much risk - free investment should he bring in?

(iii) If the PM seeks to increase the beta to 1.2, how much risk – free investment should he bring in?

Solution

(i)

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	ß (x)	wx
VSL	10000	50	500000	0.4167	0.9	0.375
CSL	5000	20	100000	0.0833	1	0.083
SML	8000	25	200000	0.1667	1.5	0.250
APL	2000	200	400000	0.3333	1.2	0.400
			1200000	1		1.108

Portfolio beta 1.108

(ii) Required Beta 0.8

It should become (0.8 / 1.108) 72.2 % of present portfolio

If ₹ 12,00,000 is 72.20%, the total portfolio should be

₹ 12,00,000 × 100 / 72.20 or ₹ 16,62,050

Additional investment in zero risk should be (₹ 16,62,050 – ₹ 12,00,000) = ₹ 4,62,050

Revised Portfolio will be

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	ß (x)	wx
VSL	10000	50	500000	0.3008	0.9	0.271
CSL	5000	20	100000	0.0602	1	0.060
SML	8000	25	200000	0.1203	1.5	0.180
APL	2000	200	400000	0.2407	1.2	0.289
Risk free asset	46205	10	462050	0.2780	0	0
			1662050	1		0.800

(iii) To increase Beta to 1.2

Required beta 1.2

It should become 1.2 / 1.108 108.30% of present beta

If 1200000 is 108.30%, the total portfolio should be

1200000 × 100 / 108.30 or 1108033 say 1108030

Additional investment should be (-) 91967 i.e. Divest ₹ 91970 of Risk Free Asset

Revised Portfolio will be

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	ß (x)	wx
VSL	10000	50	500000	0.4513	0.9	0.406
CSL	5000	20	100000	0.0903	1	0.090
SML	8000	25	200000	0.1805	1.5	0.271
APL	2000	200	400000	0.3610	1.2	0.433
Risk free asset	-9197	10	-91970	-0.0830	0	0
			1108030	1		1.20

Portfolio beta 1.20

Alternative Approach

(ii) Let x be the amount of Risk-Free Asset to be acquired, then

Security	(1) × (2)	ß (x)	wx

VSL	500000	0.9	450000
CSL	100000	1	100000
SML	200000	1.5	300000
APL	400000	1.2	480000
Risk free asset	x	0	0
	1200000 + x		**1330000**

Accordingly,

$$\frac{13,30,000}{12,00,000 + x} = 0.8$$

x = 462500 i.e., value of Risk-Free Asset to be purchased to decrease beta of portfolio to 0.8.

(iii) Similarly let y the amount of Risk - Free Assets to be divest, then

$$\frac{13,30,000}{12,00,000 + x} = 1.20$$

y = -91,667 i.e. value of Risk Free Asset to be divested to increase beta of portfolio to 1.20.

SHARPE AND TREYNOR RATIO

Question 29 (Study Material TYK Q 41)/RTP Nov'18/MTP Oct'20/MTP Sep'22

The following are the data on five mutual funds:

Fund	Return	Standard Deviation	Beta
A	15	7	1.25
B	18	10	0.75
C	14	5	1.40
D	12	6	0.98
E	16	9	1.50

You are required to compute Reward to Volatility Ratio and rank these portfolios using:

- Sharpe method and
- Treynor's method

assuming the risk - free rate is 6%.

Solution

Sharpe Ratio $S = (R_p - R_f) / \sigma_p$

Treynor Ratio $T = (R_p - R_f) / \beta_p$

Where,

R_p = Return on Fund

Rf = Risk-free rate
σp = Standard deviation of Fund
βp = Beta of Fund

Reward to Variability (Sharpe Ratio)

Mutual Fund	Rp	Rf	Rp – Rf	σp	Reward to Variability	Ranking
A	15	6	9	7	1.285	2
B	18	6	12	10	1.20	3
C	14	6	8	5	1.60	1
D	12	6	6	6	1.00	5
E	16	6	10	9	1.11	4

Reward to Volatility (Treynor Ratio)

Mutual Fund	Rp	Rf	Rp – Rf	βp	Reward to Volatility	Ranking
A	15	6	9	1.25	7.2	2
B	18	6	12	0.75	16	1
C	14	6	8	1.40	5.71	5
D	12	6	6	0.98	6.12	4
E	16	6	10	1.50	6.67	3

Question 30 (Mutual Funds)(Study Material TYK Q 22)

Five portfolios experienced the following results during a 7- year period:

Portfolio	Average Annual Return (Rp) (%)	Standard Deviation (Sp)	Correlation with the market returns (r)
A	19.0	2.5	0.840
B	15.0	2.0	0.540
C	15.0	0.8	0.975
D	17.5	2.0	0.750
E	17.1	1.8	0.600
Market Risk (σm)		1.2	
Market rate of Return (Rm)	14.0		
Risk - free Rate (Rf)	9.0		

Rank the portfolios using (a) Sharpe's method, (b) Treynor's method and (c) Jensen's Alpha

Solution

Let portfolio standard deviation be σp

Market Standard Deviation = σm

Coefficient of correlation = r

Portfolio beta (βp) = $\frac{\sigma_p \, r}{\sigma_m}$

Required portfolio return (Rp) = Rf + βp (Rm – Rf)

Portfolio	Sharpe Method		Treynor Method		Jensen's Alpha	
	Ratio	Rank	Ratio	Rank	Ratio	Rank
A	4.00	IV	5.71	V	1.25	V
B	3.00	V	6.67	IV	1.50	IV
C	7.50	I	9.23	I	2.75	II
D	4.25	III	6.80	III	2.25	III
E	4.50	II	9.00	II	3.60	I

Portfolio	Beta	Return from the portfolio (Rp) (%)
A	1.75	17.75
B	0.90	13.50
C	0.65	12.25
D	1.25	15.25
E	0.90	13.50

Question 31(Study Material TYK Q 17)/RTP Nov'20/MTP March'19

Mr. Abhishek is interested in investing ₹ 2,00,000 for which he is considering following three alternatives:

(i) Invest ₹ 2,00,000 in Mutual Fund X (MFX)
(ii) Invest ₹ 2,00,000 in Mutual Fund Y (MFY)
(iii) Invest ₹ 1,20,000 in Mutual Fund X (MFX) and ₹ 80,000 in Mutual Fund Y (MFY)

Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%.

Covariance of returns of MFX, MFY and market portfolio Mix are as follow:

	MFX	MFY	Mix
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
Mix	3.370	2.800	3.100

You are required to calculate:

(i) variance of return from MFX, MFY and market return,
(ii) portfolio return, beta, portfolio variance and portfolio standard deviation,
(iii) expected return, systematic risk and unsystematic risk; and
(iv) Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Solution

(i) **Variance of Returns**

$$Cor_{i,j} = \frac{Cov(i,j)}{\sigma_i \sigma_j}$$

Accordingly, for MFX

$$1 = \frac{\text{Cov}(X, X)}{\sigma_X \sigma_X}$$

$\sigma_X^2 = 4.800$

Accordingly, for MFY

$$1 = \frac{\text{Cov}(Y, Y)}{\sigma_Y \sigma_Y}$$

$\sigma_Y^2 = 4.250$

Accordingly, for Market Return

$$1 = \frac{\text{Cov}(M, M)}{\sigma_M \sigma_M}$$

$\sigma_M^2 = 3.100$

Alternatively, by referring diagonally the given Table these values can identified as follows:

Variance X = 4.800

Variance Y = 4.250

Variance M = 3.100

(ii) **Portfolio return, beta, variance and standard deviation**

Weight of MFX in portfolio = $\frac{1,20,000}{2,00,000} = 0.60$

Weight of MFY in portfolio = $\frac{80,000}{2,00,000} = 0.40$

Accordingly, Portfolio Return

0.60 × 15% + 0.40 × 14% = 14.60%

Beta of each Fund

$$\beta = \frac{\text{Cov}(\text{Fund, Market})}{\text{Variance of Market}}$$

$$\beta_X = \frac{3.370}{3.100} = 1.087$$

$$\beta_Y = \frac{2.800}{3.100} = 0.903$$

Portfolio Beta

0.60 x 1.087 + 0.40 x 0.903 = 1.013

Portfolio Variance

$\sigma^2_{XY} = w^2_X \sigma^2_X + w^2_Y \sigma^2_Y + 2\, w_X\, w_Y\, Cov_{X,Y}$

$= (0.60)^2 (4.800) + (0.40)^2 (4.250) + 2(0.60)(0.40)(4.300)$

= 4.472

Or Portfolio Standard Deviation

$\sigma_{XY} = \sqrt{4.472} = 2.115$

(iii) **Expected Return, Systematic and Unsystematic Risk of Portfolio**

Portfolio Return = 10% + 1.0134 (12% - 10%) = 12.03%

MF X Return = 10% + 1.087 (12% - 10%) = 12.17%

MF Y Return = 10% + 0.903 (12% - 10%) = 11.81%

Systematic Risk = $\beta^2 \sigma^2$

Accordingly,

Systematic Risk of MFX = $(1.087)^2$ x 3.10 = 3.663

Systematic Risk of MFY = $(0.903)^2$ x 3.10 = 2.528

Systematic Risk of Portfolio = $(1.013)^2$ x 3.10 = 3.181

Unsystematic Risk = Total Risk – Systematic Risk

Accordingly,

Unsystematic Risk of MFX = 4.80 – 3.663 = 1.137

Unsystematic Risk of MFY = 4.250 – 2.528 = 1.722

Unsystematic Risk of Portfolio = 4.472 – 3.181 = 1.291

(iv) **Sharpe and Treynor Ratios and Alpha**

Sharpe Ratio

$\text{MFX} = \frac{15\% - 10\%}{\sqrt{4.800}} = 2.282$

$\text{MFY} = \frac{14\% - 10\%}{\sqrt{4.250}} = 1.94$

$\text{Portfolio} = \frac{14.6\% - 10\%}{2.115} = 2.175$

Treynor Ratio

$\text{MFX} = \frac{15\% - 10\%}{1.087} = 4.60$

$\text{MFY} = \frac{14\% - 10\%}{0.903} = 4.43$

$\text{Portfolio} = \frac{14.6\% - 10\%}{1.0134} = 4.54$

Alpha

MFX = 15% - 12.17% = 2.83%

MFY = 14% - 11.81% = 2.19%

Portfolio = 14.6% - 12.03% = 2.57%

Question 32(Mutual Funds)(Study Material TYK Q 23)/MTP Nov'21

There are two Mutual Funds viz. D Mutual Fund Ltd. and K Mutual Fund Ltd. Each having close ended equity schemes. NAV as on 31-12-2014 of equity schemes of D Mutual Fund Ltd. is ₹ 70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Ltd. is 62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particular	Equity Schemes	
	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard deviation	11.25	5

There is no change in portfolios during the next month and annual average cost is ₹ 3 per unit for the schemes of both the Mutual Funds.

If Share Market goes down by 5% within a month, calculate expected NAV after a month for the schemes of both the Mutual Funds.

For calculation, consider 12 months in a year and ignore number of days for particular month.

Solution

Working Notes:

(i) Decomposition of Funds in Equity and Cash Components

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
NAV on 31.12.14	₹ 70.71	₹ 62.50
% of Equity	99%	96%
Equity element in NAV	₹ 70	₹ 60
Cash element in NAV	₹ 0.71	₹ 2.50

(ii) Calculation of Beta

a) D Mutual Fund Ltd.

Sharpe Ratio = $2 = \frac{E(R) - R_f}{\sigma_D} = \frac{E(R) - R_f}{11.25}$

E(R) - Rf = 22.50

Treynor Ratio = $15 = \frac{E(R) - R_f}{\beta_D} = \frac{22.50}{\beta_D}$

BD = 22.50/15 = 1.50

b) K Mutual Fund Ltd.

Sharpe Ratio = $3.3 = \frac{E(R) - R_f}{\sigma_K} = \frac{E(R) - R_f}{5}$

E(R) - Rf = 16.50

Treynor Ratio = $15 = \frac{E(R) - R_f}{\beta_K} = \frac{16.50}{\beta_K}$

βK = 16.50/15 = 1.10

(iii) Decrease in the Value of Equity

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Market goes down by	5.00%	5.00%
Beta	1.50	1.10
Equity component goes down	7.50%	5.50%

(iv) Balance of Cash after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Cash in Hand on 31.12.14	₹ 0.71	₹ 2.50
Less: Exp. Per month	₹ 0.25	₹ 0.25
Balance after 1 month	₹ 0.46	₹ 2.25

NAV after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Value of Equity after 1 month		
70 x (1 - 0.075)	₹ 64.75	-
60 x (1 - 0.055)	-	₹ 56.70
Cash Balance	0.46	2.25
	65.21	58.95

Question 33(Study Material TYK Q 2)

Following information is available in respect of expected dividend, market price and market condition after one year.

Market condition	Probability	Market Price	Dividend per share
		₹	₹
Good	0.25	115	9
Normal	0.50	107	5
Bad	0.25	97	3

The existing market price of an equity share is ₹ 106 (F.V. ₹ 1), which is cum 10% bonus debenture of ₹ 6 each, per share. M/s. X Finance Company Ltd. had offered the buy-back of debentures at face value.

Find out the expected return and variability of returns of the equity shares if buyback offer is accepted by the investor.

And also advise – Whether to accept buyback offer?

Solution

The Expected Return of the equity share may be found as follows:

Market Condition	Probability	Total Return	Cost (*)	Net Return
Good	0.25	₹ 124	₹ 100	₹ 24
Normal	0.50	₹ 112	₹ 100	₹ 12
Bad	0.25	₹ 100	₹ 100	₹ 0

Expected Return = (24 x 0.25) + (12 x 0.50) + (0 x 0.25) = 12= $\left(\frac{12}{100}\right) \times 100 = 12\%$

The variability of return can be calculated in terms of standard deviation.

V SD = $0.25\ (24 - 12)^2 + 0.50\ (12 - 12)^2 + 0.25\ (0 - 12)^2$

= $0.25\ (12)^2 + 0.50\ (0)^2 + 0.25\ (-12)^2$

= 36 + 0 + 36

SD = $\sqrt{72}$

SD = 8.485 or say 8.49

(*) The present market price of the share is ₹ 106 cum bonus 10% debenture of ₹ 6 each; hence the net cost is ₹ 100.

M/s X Finance company has offered the buyback of debenture at face value. There is reasonable 10% rate of interest compared to expected return 12% from the market. Considering the dividend rate and market price the credit worthiness of the company seems to be very good. The decision regarding buy-back should be taken considering the maturity period and opportunity in the market. Normally, if the maturity period is low say up to 1 year better to wait otherwise to opt buy back option.

Question 34(Study Material TYK Q 26)

(**WRONG CONCEPT – DON'T BE SERIOUS – JUST MEMORISE**)

Your client is holding the following securities:

Particulars of Securities	Cost	Dividends / Interest	Market price	Beta
	₹	₹	₹	
Equity Shares:				
Gold Ltd.	10,000	1,725	9,800	0.6
Silver Ltd.	15,000	1,000	16,200	0.8
Bronze Ltd.	14,000	700	20,000	0.6
GOI Bonds	36,000	3,600	34,500	0.01

Average return of the portfolio is 15.7%, calculate:

a) Expected rate of return in each, using the Capital Asset Pricing Model (CAPM).
b) Risk free rate of return.

Solution

Particulars of Securities	Cost ₹	Dividend	Capital gain
Gold Ltd.	10,000	1,725	-200
Silver Ltd.	15,000	1,000	1,200
Bronze Ltd.	14,000	700	6,000
GOI Bonds	36,000	3,600	-1,500
Total	75,000	7,025	5,500

Expected rate of return on market portfolio

$$\frac{\text{Dividend Earned} + \text{Capital appreciation}}{\text{Intial Investment}} \times 100$$

$$\frac{₹\,7{,}025 + ₹\,5{,}500}{₹\,75{,}000} \times 100 = 16.7\%$$

Risk free return

Average of Betas = $\frac{0.6+0.8+0.6+0.01}{4}$ = Average of Betas* = 0.50

Average return = Risk free return + Average Betas (Expected return – Risk free return)

15.7 = Risk free return + 0.50 (16.7 – Risk free return)

Risk free return = 14.7%

* Alternatively, it can also be calculated through Weighted Average Beta.

Expected Rate of Return for each security is

Rate of Return	Rf + B(Rm-Rf)	Ke
Gold Ltd.	= 14.7 + 0.6 (16.7 – 14.7)	= 15.90%
Silver Ltd.	= 14.7 + 0.8 (16.7 – 14.7)	= 16.30%
Bronze Ltd.	= 14.7 + 0.6 (16.7 – 14.7	= 15.90%
GOI Bonds	= 14.7 + 0.01 (16.7 – 14.7)	= 14.72%

* Alternatively, it can also be computed by using Weighted Average Method.

Question 35(Study Material TYK Q 27)

(WRONG CONCEPT – DON'T BE SERIOUS – JUST MEMORISE)

A holds the following portfolio:

Share/Bond	Beta	Initial Price	Dividends	Market Price at end of year
		₹	₹	₹
Epsilon Ltd.	0.8	25	2	50
Sigma Ltd.	0.7	35	2	60
Omega Ltd.	0.5	45	2	135
GOI Bonds	0.01	1,000	140	1,005

Calculate:

(i) The expected rate of return of each security using Capital Asset Pricing Method (CAPM)

(ii) The average return of his portfolio. Risk - free return is 14%

Solution

(i) Expected rate of return

	Total Investments	Dividends	Capital Gains
Epsilon Ltd.	25	2	25
Sigma Ltd.	35	2	25
Omega Ltd.	45	2	90
GOI Bonds	1,000	140	_5
	1,105	146	145

Expected Return on market portfolio = $\frac{146+145}{1105} = 26.33\%$

CAPM E(Rp) = RF + β [E(RM) – RF]

Epsilon Ltd	14+0.8 [26.33-14] =	14+9.86	=	23.86%
Sigma Ltd.	14+0.7 [26.33-14] =	14+8.63	=	22.63%
Omega Ltd.	14+0.5 [26.33-14] =	14+6.17	=	20.17%
GOI Bonds	14+0.01 [26.33-14] =	14+0.12	=	14.12%

(ii) Average Return of Portfolio

$\frac{23.86 + 22.63 + 20.17 + 14.12}{4} = \frac{80.78}{4} = 20.20\%$

Alternatively, $\frac{0.8+0.7+0.5+0.01}{4} = \frac{2.01}{4} = 0.5025$

14 + 0.5025 (26.33 - 14) = 14+ 6.20 = 20.20%

Question 36(Study Material TYK Q 28)/PP Nov'19

Your client is holding the following securities:

Particulars of Securities	Cost ₹	Dividends ₹	Market Price ₹	BETA
Equity Shares:				
Co. X	8,000	800	8,200	0.8
Co. Y	10,000	800	10,500	0.7
Co. Z	16,000	800	22,000	0.5
PSU Bonds	34,000	3,400	32,300	0.2

Assuming a Risk - free rate of 15%, calculate:

(i) Expected rate of return in each, using the Capital Asset Pricing Model (CAPM).

(ii) Simple Average return of the portfolio.

Solution

Calculation of expected return on market portfolio (Rm)

Investment	Cost (₹)	Dividends (₹)	Capital Gains (₹)
Shares X	8,000	800	200
Shares Y	10,000	800	500
Shares Z	16,000	800	6,000
PSU Bonds	34,000	3,400	-1,700

	68,000	**5,800**	**5,000**

$R_m = \frac{5,800+5,000}{68,000} \times 100 = 15.88\%$

Calculation of expected rate of return on individual security:

Security

Shares X	15 + 0.8 (15.88 – 15.0)	= 15.70%
Shares Y	15 + 0.7 (15.88 – 15.0)	= 15.62%
Shares Z	15 + 0.5 (15.88 – 15.0)	= 15.44%
PSU Bonds	15 + 0.2 (15.88 – 15.0)	= 15.18%

Calculation of the Average Return of the Portfolio:

$$= \frac{15.70 + 15.62 + 15.44 + 15.18}{4} = 15.49\%$$

Question 37(Study Material TYK Q 37)(Unsystematic Risk)

A has portfolio having following features:

Security	β	Random Error σei	Weight
L	1.60	7	0.25
M	1.15	11	0.30
N	1.40	3	0.25
K	1.00	9	0.20

You are required to find out the risk of the portfolio if the standard deviation of the market index (σm) is 18%.

Solution

$$\beta_p = \sum_{i=1}^{4} X_i\beta_i$$

= 1.60 x 0.25 + 1.15 x 0.30 + 1.40 x 0.25 + 1.00 x 0.20

= 0.4 + 0.345 + 0.35 + 0.20 = 1.295

The Standard Deviation (Risk) of the portfolio is

= $[(1.295)^2 (18)^2 + (0.25)^2 (7)^2 + (0.30)^2 (11)^2 + (0.25)^2 (3)^2 + (0.20)^2 (9)^2)]$

= $[543.36 + 3.0625 + 10.89 + 0.5625 + 3.24] = [561.115]^{\frac{1}{2}} = 23.69\%$

Alternative Answer

The variance of Security's Return

$\sigma^2 = \beta i^2 \sigma^2 m + \sigma^2 \varepsilon i$

Accordingly, variance of various securities

		σ^2	Weight(w)	σ^2 X w

L	(1.60)2 (18)2 + 72 =	878.44	0.25	219.61
M	(1.15)2 (18)2 + 112 =	549.49	0.30	164.85
N	(1.40)2 (18)2 + 32 =	644.04	0.25	161.01
K	(1.00)2 (18)2 + 92 =	405.00	0.20	81
		Variance		626.47

SD = $\sqrt{626.47} = 25.03$

ARBITRAGE PRICING THEORY

Question 38(Study Material TYK Q 40)

Mr. Nirmal Kumar has categorized all the available stock in the market into the following types:

a) Small cap growth stocks
b) Small cap value stocks
c) Large cap growth stocks
d) Large cap value stocks

Mr. Nirmal Kumar also estimated the weights of the above categories of stocks in the market index. Further, the sensitivity of returns on these categories of stocks to the three important factor are estimated to be:

Category of Stocks	Weight in the Market Index	Factor I (Beta)	Factor II (Book Price)	Factor III (Inflation)
Small cap growth	25%	0.80	1.39	1.35
Small cap value	10%	0.90	0.75	1.25
Large cap growth	50%	1.165	2.75	8.65
Large cap value	15%	0.85	2.05	6.75
Risk Premium		6.85%	-3.5%	0.65%

The rate of return on treasury bonds is 4.5%

Required:

a) Using Arbitrage Pricing Theory, determine the expected return on the market index.
b) Using Capital Asset Pricing Model (CAPM), determine the expected return on the market index.
c) Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks. If the target beta for the desired portfolio is 1, determine the composition of his portfolio.

Solution

a) **Method I**

Stock's return

Small cap growth = 4.5 + 0.80 x 6.85 + 1.39 x (-3.5) + 1.35 x 0.65 = 5.9925%

Small cap value = 4.5 + 0.90 x 6.85 + 0.75 x (-3.5) + 1.25 x 0.65 = 8.8525%

Large cap growth = 4.5 + 1.165 x 6.85 + 2.75 x (-3.5) + 8.65 x 0.65 = 8.478%

Large cap value = 4.5 + 0.85 x 6.85 + 2.05 x (-3.5) + 6.75 x 0.65 = 7.535%

Expected return on market index

0.25 x 5.9925 + 0.10 x 8.8525 + 0.50 x 8.478 + 0.15 x 7.535 = 7.7526%

Method II

Expected return on the market index

= 4.5% + [0.1 x 0.9 + 0.25 x 0.8 + 0.15 x 0.85 + 0.50 x 1.165] x 6.85 + [(0.75 x 0.10 + 1.39 x 0.25 + 2.05 x 0.15 + 2.75 x 0.5)] x (-3.5) + [{1.25 x 0.10 + 1.35 x 0.25 + 6.75 x 0.15 + 8.65 x 0.50)] x 0.65

= 4.5 + 6.85 + (-7.3675) + 3.77 = 7.7525%.

b) **Using CAPM,**

Small cap growth = 4.5 + 6.85 x 0.80 = 9.98%

Small cap value = 4.5 + 6.85 x 0.90 = 10.665%

Large cap growth = 4.5 + 6.85 x 1.165 = 12.48%

Large cap value = 4.5 + 6.85 x 0.85 = 10.3225%

Expected return on market index

= 0.25 x 9.98 + 0.10 x 10.665 + 0.50 x 12.45 + 0.15 x 10.3225 = 11.33%

c) **Let us assume that Mr. Nirmal will invest X1 % in small cap value stock and X2 % in large cap growth stock**

$X_1 + X_2 = 1$

$0.90 X_1 + 1.165 X_2 = 1$

$0.90 X_1 + 1.165(1 - X_1) = 1$

$0.90 X_1 + 1.165 - 1.165 X_1 = 1$

$0.165 = 0.265 X_1$

$\frac{0.165}{0.265} = X_1$

$0.623 = X_1$, $X_2 = 0.377$

62.3% in small cap value

37.7% in large cap growth.

Question 39(Study Material TYK Q 38)/MTP Oct'18

Mr. Tamarind intends to invest in equity shares of a company the value of which depends upon various parameters as mentioned below:

Factor	Beta	Expected value in %	Actual value in %
GNP	1.20	7.70	7.70
Inflation	1.75	5.50	7.00
Interest rate	1.30	7.75	9.00
Stock market index	1.70	10.00	12.00
Industrial production	1.00	7.00	7.50

If the risk - free rate of interest be 9.25%, how much is the return of the share under Arbitrage Pricing Theory?

Solution

Return of the stock under APT

Factor	Actual value in %	Expected value in %	Difference	Beta	Diff. x Beta
GNP	7.70	7.70	0.00	1.20	0.00
Inflation	7.00	5.50	1.50	1.75	2.63
Interest rate	9.00	7.75	1.25	1.30	1.63
Stock index	12.00	10.00	2.00	1.70	3.40
Ind. Production	7.50	7.00	0.50	1.00	0.50
					8.16
Risk free rate in %					9.25
Return under APT					17.41

Question 40(Study Material TYK Q 15)

Mr. X owns a portfolio with the following characteristics:

	Security A	Security B	Risk Free security
Factor 1 sensitivity	0.80	1.50	0
Factor 2 sensitivity	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two – factor model.

(i) If Mr. X has ₹ 1,00,000 to invest and sells short ₹ 50,000 of security B and purchases ₹ 1,50,000 of security A what is the sensitivity of Mr. X's portfolio to the two factors?

(ii) If Mr. X borrows ₹ 1,00,000 at the risk - free rate and invests the amount he borrows along with the original amount of ₹ 1,00,000 in security A and B in the same proportion as described in part (i), what is the sensitivity of the portfolio to the two factors?

(iii) What is the expected return premium of factor 2?

Solution

(i) Mr. X's position in the two securities are +1.50 in security A and -0.5 in security B.

Hence the portfolio sensitivities to the two factors: -

b prop. 1 =1.50 x 0.80 + (-0.50 x 1.50) = 0.45

b prop. 2 = 1.50 x 0.60 + (-0.50 x 1.20) = 0.30

(ii) Mr. X's current position:

Security A ₹ 3,00,000 / ₹ 1,00,000 = 3

Security B - ₹ 1,00,000 / ₹ 1,00,000 = -1

Risk free asset - ₹ 100000 / ₹ 100000 = -1

b prop. 1 = 3.0 x 0.80 + (-1 x 1.50) + (- 1 x 0) = 0.90

b prop. 2 = 3.0 x 0.60 + (-1 x 1.20) + (-1 x 0) = 0.60

(iii) Expected Return = Risk Free Rate of Return + Risk Premium

Let λ_1 and λ_2 are the Value Factor 1 and Factor 2 respectively.

Accordingly

$15 = 10 + 0.80\ \lambda_1 + 0.60\ \lambda_2$

$20 = 10 + 1.50\ \lambda_1 + 1.20\ \lambda_2$

On solving equation, the value of $\lambda_1 = 0$, and risk premium of factor 2 for Securities A & B shall be as follows:

Using Security A's Return

Total Return = 15% = 10% + 0.60 λ_2

Risk Premium (λ_2) = 5%/ 0.60 = 8.33%

Alternatively using Security B's Return

Total Return = 20% = 10 + 1.20 λ_2

Risk Premium = 10% / 1.20 = 8.33%

Question 41(Derivative and Portfolio)(Old PM)

A company is long on 10 MT of copper @ ₹ 474 per kg (spot) and intends to remain so for the ensuing quarter. The standard deviation of changes of its spot and future prices are 4% and 6% respectively, having correlation coefficient of 0.75.

What is its hedge ratio? What is the amount of the copper future it should short to achieve a perfect hedge?

Solution

The optional hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma S}{\sigma F}$$

Where

σS = Standard deviation of ΔS

σF = Standard deviation of ΔF

ρ = coefficient of correlation between ΔS and ΔF

H = Hedge Ratio

ΔS = change in Spot price.

ΔF = change in Future price.

Accordingly

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

No. of contract to be short = 10 x 0.5 = 5

Amount = 5000 x ₹ 474 = ₹ 23,70,000

Question 42(Study Material TYK Q 31)

An investor has two portfolios known to be on minimum variance set for a population of three securities A, B and C having below mentioned weights:

	WA	WB	WC
Portfolio X	0.30	0.40	0.30
Portfolio Y	0.20	0.50	0.30

It is supposed that there are no restrictions on short sales.

(i) What would be the weight for each stock for a portfolio constructed by investing ₹ 5,000 in portfolio X and ₹ 3,000 in portfolio Y?

(ii) Suppose the investor invests ₹ 4,000 out of ₹ 8,000 in security A. How he will allocate the balance between security B and C to ensure that his portfolio is on minimum variance set?

Solution

(i) Investment committed to each security would be: -

	A (₹)	B (₹)	C (₹)	Total (₹)
Portfolio X	1,500	2,000	1,500	5,000
Portfolio Y	600	1,500	900	3,000
Combined Portfolio	2,100	3,500	2,400	8,000
Therefore, Stock weights	0.26	0.44	0.30	

(ii) The equation of critical line takes the following form: -

$W_B = a + bW_A$

Substituting the values of W_A & W_B from portfolio X and Y in above equation, we get

0.40 = a + 0.30b, and 0.50 = a + 0.20b

Solving above equation we obtain the slope and intercept, a = 0.70 and b= -1 and thus, the critical line is

$W_B = 0.70 - W_A$

If half of the funds is invested in security A then,

$W_B = 0.70 - 0.50 = 0.20$

Since $W_A + W_B + W_C = 1$

$W_C = 1 - 0.50 - 0.20 = 0.30$

Therefore, Allocation of funds to security B = 0.20 x 8,000 = ₹ 1,600, and Security C= 0.30 x 8,000 = ₹ 2,400

Question 43(Study Material TYK Q 35)

Ramesh wants to invest in stock market. He has got the following information about individual securities:

Security	Expected Return	Beta	σ2 ci
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	09	1	10
E	08	1.2	20
F	14	1.5	30

Market index variance is 10 percent and the risk - free rate of return is 7%. What should be the optimum portfolio assuming no short sales?

Solution

Securities need to be ranked on the basis of excess return to beta ratio from highest to the lowest.

Security	Ri	βi	Ri - Rf	$\frac{R_i - R_f}{\beta_i}$
A	15	1.5	8	5.33
B	12	2	5	2.5
C	10	2.5	3	1.2
D	9	1	2	2
E	8	1.2	1	0.83
F	14	1.5	7	4.67

Ranked Table:

Security	Ri - Rf	βi	σ^2 ei	$\frac{(R_i - R_f) \times \beta}{\sigma^2_{ei}}$	$\sum_{e=i}^{N} \frac{R_i - R_f \times \beta_i}{\sigma^2_{ei}}$	$\frac{\beta^2}{\sigma^2_{ei}}$	$\sum_{e=i}^{N} \frac{\beta^2}{\sigma^2_{ei}}$	Ci
A	8	1.5	40	0.30	0.30	0.056	0.056	1.923
F	7	1.5	30	0.35	0.65	0.075	0.131	2.814
B	5	2	20	0.50	1.15	0.20	0.331	2.668
D	2	1	10	0.20	1.35	0.10	0.431	2.542
C	3	2.5	30	0.25	1.60	0.208	0.639	2.165
E	1	1.2	20	0.06	1.66	0.072	0.711	2.047

C_A = 10 x 0.30 / [1 + (10 x 0.056)] = 1.923

C_F = 10 x 0.65 / [1 + (10 x 0.131)] = 2.814

C_B = 10 x 1.15 / [1 + (10 x 0.331)] = 2.668

C_D = 10 x 1.35 / [1 + (10 x 0.431)] = 2.542

C_C = 10 x 1.60 / [1 + (10 x 0.639)] = 2.165

C_E = 10 x 1.66 / [1 + (10 x 0.7111)] = 2.047

Cut off point is 2.814

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2}\left[\left(\left[\left[\frac{(R_i - R_f)}{\beta_i} - C\right]\right]\right)\right]$$

$$Z_A = \frac{1.5}{40}(5.33 - 2.814) = 0.09435$$

$$Z_F = \frac{1.5}{30}(4.67 - 2.814) = 0.0928$$

$$X_A = \frac{0.09435}{[0.09435 + 0.0928]} = 50.41\%$$

$$X_F = \frac{0.0928}{[0.09435 + 0.0928]} = 49.59\%$$

Funds to be invested in security A & F are 50.41% and 49.59% respectively.

Question 44(Study Material TYK Q 39)/MTP Oct'21/MTP Sep'22)

The total market value of the equity share of O.R.E. Company is ₹ 60,00,000 and the total value of the debt is ₹ 40,00,000. The treasurer estimate that the beta of the stock is currently 1.5 and that the expected risk premium on the market is 10 per cent. The treasury bill rate is 8 per cent.

Required:

(i) What is the beta of the Company's existing portfolio of assets?

(ii) Estimate the Company's Cost of capital and the discount rate for an expansion of the company's present business.

Solution

(i) $\beta_{asset} = \beta_{equity} \times \frac{V_E}{V_o} + B_{debt} \times \frac{V_D}{V_o}$

Note: Since βdebt is not given it is assumed that company debt capital is virtually riskless.

If company's debt capital is riskless than above relationship become:

Here β equity = 1.5;

$$\beta_{asset} = \beta_{equity}\frac{V_E}{V_o}$$

As b debt = 0

V_E = ₹ 60 lakhs.

V_D = ₹ 40 lakhs.

V_0 = ₹ 100 lakhs.

$\beta_{asset} = 1.5 \times \frac{60 \text{ lakhs}}{100 \text{ lakhs}}$ = 0.9

(ii) (a) If only equity is used to finance the expansion, the Cost of Capital for discounting company's expansion of

existing business shall be computed as follows:

Company's cost of equity = Rf + β_A x Market Risk premium

Where Rf = Risk free rate of return

β_A = Beta of company assets

Therefore, company's cost of equity = 8% + 0.9 x 10 = 17% and overall cost of capital shall be 17%.

(b) Alternatively, if funds expansion are raised for in same proportion as exiting capital structure, then cost of capital

shall be computed as follows:

Cost of Equity = 8% + 1.5 x 10 = 23%

Cost of Debt = 8%

WACC (Cost of Capital) = $23 \times \frac{60,00,000}{1,00,00,000} + 8\% \times \frac{40,00,000}{1,00,00,000} = 17\%$

ILLUSTRATIONS

Question 45(Illustration 1)

The following details are given for X and Y companies' stocks and the Bombay Sensex for a period of one year. Calculate the systematic and unsystematic risk for the companies' stocks. If equal amount of money is allocated for the stocks what would be the portfolio risk?

	X Stock	Y Stock	Sensex
Average return	0.15	0.25	0.06
Variance of return	6.30	5.86	2.25
β	0.71	0.685	
Correlation Co-efficient	0.424		
Co-efficient of determination (r2)	0.18		

Solution

The co-efficient of determination (r2) i.e. square of Coefficient of Correlation gives the percentage of the variation in the security's return that is explained by the variation of the market index return. In the X company stock return, 18 per cent of variation is explained by the variation of the index and 82 per cent is not explained by the index.

According to Sharpe, the variance explained by the index is the systematic risk. The unexplained variance or the residual variance is the unsystematic risk.

Company X:

Systematic risk = βi^2 x Variance of market index
= $(0.71)^2$ x 2.25 = 1.134

Unsystematic risk ($\epsilon i2$) = Total variance of security return - Systematic Risk
= 6.30 – 1.134
= 5.166

or

= Variance of Security Return ($1-r_2$)
= 6.30 X (1 - 0.18) = 6.3 X 0.82 = 5.166

Total risk = $\beta_i^2 \times \sigma_m^2 \times \epsilon_i^2$
= Systematic Risk + Unsystematic Risk
= 1.134 + 5.166 = 6.30

Company Y:

Systematic risk = $\beta i^2 \times \sigma^2_m$
= $(0.685)^2$ x 2.25 = 1.056

Unsystematic risk = Total variance of the security return - systematic risk.
= 5.86-1.056 = 4.804

Portfolio Risk

$$\sigma_p^2 = \left[\left(\sum_{i=1}^{N} X_i \beta_i\right)^2 \sigma_m^2\right] + \left[\left(\sum_{i=1}^{N} X_i{}^2 \epsilon_i{}^2\right)\right]$$

= $[(0.5 \times 0.71 + 0.5 \times 0.685)^2\ 2.25] + [(0.5)^2\ (5.166) + (0.5)^2\ (4.804)]$

= $[(0.355 + 0.3425)^2\ 2.25] + [(1.292 + 1.201)]$

= 1.0946 + 2.493 = 3.5876

Question 46(Illustration 2)

A company's beta is 1.40. The market return is 14% and the risk - free rate is 10%.

(i) What is the expected return of the company's stock based on CAPM.
(ii) If the risk premium on the market goes up by 2.50% points, what would be the revised expected return on this stock?

Solution

(i) Computation of expected return based on CAPM

Rj = Rf + β (Rm – Rf) = 10% + 1.40 (14% - 10%) = 10% + 5.6% = 15.6%

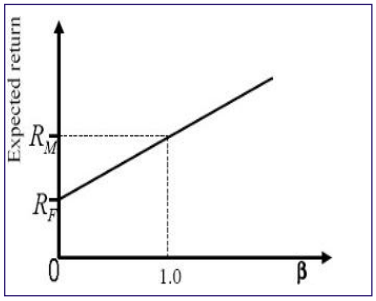
Computation of expected return if the market risk premium goes up by 2.50% points. The return from the market goes up by 2.50% i.e. 14% + 2.50% = 16.50%

(ii) Expected Return based on CAPM is given by

Rj = 10% + 1.40 (16.5% - 10%) = 10% + 1.40 × 6.5% = 10% + 9.10% = 19.10%

A graphical representation of CAPM is the Security Market Line, (SML). This line indicates the rate of return required to compensate at a given level of risk. Plotting required return on Y axis and Beta on the X - axis we get an upward sloping line which is given by (Rm - Rf), the risk premium.

The higher the Beta value of a security, higher would be the risk premium relative to the market. This upward sloping line is called the Security Market Line. It measures the relationship between systematic risk and return.



Question 47(Illustration 3)

The risk premium for the market is 10%. Assuming Beta values of Security K are 0, 0.25, 0.42, 1.00 and 1.67. Compute the risk premium on Security K.

Solution

β Value of K	Risk Premium of K
0.00	0%
0.25	2.50%
0.42	4.20%
1.00	10.00%
1.67	16.70%

Question 48(Illustration 4)

Treasury Bills give a return of 5%. Market Return is 13%

(i) What is the market risk premium?

(ii) Compute the β Value and required returns for the following combination of investments.

Treasury Bill	100	70	30	0
Market	0	30	70	100

Solution

Risk Premium Rm – Rf = 13% - 5% = 8%

β is the weighted average investing in portfolio consisting of market β = 1 and treasury bills (β = 0)

Portfolio	Treasury Bills: Market	β	Rj = Rf + β × (Rm – Rf)
1	100:0	0	5% + 0 (13% - 5%) = 5%
2	70:30	0.7(0) + 0.3(1) = 0.3	5% + 0.3 (13% - 5%) = 7.40%
3	30:70	0.3(0) + 0.7(1) = 0.7	5% + 0.7 (13% - 5%) = 10.60%
4	0:100	1	5% + 1.0 (13% - 5%) = 13%

Question 49(Illustration 5)

Pearl Ltd. expects that considering the current market prices, the equity shareholders as per Moderate Approach, should get a return of at least 15.50% while the current return on the market is 12%. RBI has closed the latest auction for ₹ 2500 crores of 182 - day bills for the lowest bid of 4.3% although there were bidders at a higher rate of 4.6% also for lots of less than ₹ 10 crores. What is Pearl ltd.'s Beta?

Solution

Determining Risk free rate: Two risk free rates are given. The aggressive approach would be to consider 4.6% while the conservative approach would be to take 4.3%. If we take the moderate value then the simple average of the two i.e. 4.45% would be considered

Application of CAPM

$R_j = R_f + \beta (R_m - R_f)$

$15.50\% = 4.45\% + \beta (12\% - 4.45\%)$

$\beta = \frac{15.50\% - 4.45\%}{12\% - 4.45\%} = \frac{11.05}{7.55} = 1.464$

Question 50(Illustration 6)/MTP March'19

The following information is available with respect of Jay Kay Ltd.

Year	Jay Kay Limited		Market		Return on Govt. Bonds
	Average Share Price (₹)	DPS (₹)	Average Index	Dividend Yield (%)	
2002	242	20	1812	4	6
2003	279	25	1950	5	5
2004	305	30	2258	6	4
2005	322	35	2220	7	5

Compute Beta Value of the company as at the end of 2005. What is your observation?

Solution

Calculation of Returns

$$\text{Returns} = \frac{D_1 + (P_1 - P_0)}{P_0} \times 100$$

Computation of Beta Value

Year	Returns
2002 – 2003	$\frac{25 + (279 - 242)}{242} \times 100 = 25.62\%$
2003 – 2004	$\frac{30 + (305 - 279)}{279} \times 100 = 20.07\%$
2004 – 2005	$\frac{35 + (322 - 305)}{305} \times 100 = 17.05\%$

Calculation of Returns from market Index

Year	% of Index Appreciation	Dividend Yield %	Total Return %
2002 - 2003	$\frac{1950 - 1812}{1812} \times 100 = 17.62\%$	5%	12.62%
2003-2004	$\frac{2258 - 1950}{1950} \times 100 = 15.79\%$	6%	21.79%
2004-05	$\frac{2220 - 2258}{2258} \times 100 = (-)1.68\%$	7%	5.32%

Computation of Beta

Year	X	Y	XY	Y2
2002-2003	25.62	12.62	323.32	159.26
2003-2004	20.07	21.79	437.33	474.80
2004-2005	17.05	5.32	90.71	28.30
	62.74	**39.73**	**851.36**	**662.36**

$$\overline{X} = \frac{62.74}{3} = 20.91, \overline{Y} = \frac{39.73}{3} = 13.24$$

$$\beta = \frac{\sum XY - n\,\overline{XY}}{\sum Y^2 - n\,\overline{Y}^2}$$

$$= \frac{851.36 - 3(20.91)(13.24)}{662.36 - 3(13.24)^2}$$

$$= \frac{851.36 - 830.55}{662.36 - 525.89} = \frac{20.81}{136.47} = 0.15$$

Question 51(Illustration 7)

Information related to an investment is as follows:

Risk free rate	10%
Market Return	15%
Beta	1.2

(i) What would be the return from this investment?
(ii) If the projected return is 18%, is the investment rightly valued?
(iii) What is your strategy?

Solution

(i) Required rate of Return as per CAPM is given by

Rj = Rf + β (Rm - Rf)

= 10 +1.2 (15-10) = 16%

(ii) Since projected return is 18%, the stock is not rightly valued rather undervalued as return as per CAPM less than Projected return.

(iii) Had this Project Return is considered as expected return, the decision should be to BUY the share.

Question 52(Illustration 8)

The expected returns and Beta of three stocks are given below

Stock	A	B	C
Expected Return (%)	18	11	15
Beta Factor	1.7	0.6	1.2

If the risk - free rate is 9% and the expected rate of return on the market portfolio is 14% which of the above stocks are over, under or correctly valued in the market? What shall be the strategy?

Solution

Required Rate of Return is given by

$$Rj = Rf + \beta (Rm-Rf)$$

For Stock A, $Rj = 9 + 1.7 (14 - 9) = 17.50\%$

Stock B, $Rj = 9 + 0.6 (14-9) = 12.00\%$

Stock C, $Rj = 9 + 1.2 (14-9) = 15.00\%$

Required Return %	Expected Return %	Valuation	Decision
17.50%	18.00%	Under Valued	Buy
12.00%	11.00%	Over Valued	Sell
15.00%	15.00%	Correctly Valued	Hold

Question 53(Illustration 9)

With the help of following data determine the return on the security X.

Factor	Risk Premium associated with the Factor	βi
Market	4%	1.3
Growth Rate of GDP	1%	0.3
Inflation	-4%	0.2

Risk Free Rate of Return is 8%.

Solution

Expected Return $= Rf + \lambda_1\beta_1 + \lambda_2\beta_2 + \lambda_3\beta_3$

$= 8\% + 1.3 \times 4\% + 0.3 \times 1\% + 0.2 \times (-4\%)$

$= 8\% + 5.2\% + 0.3\% - 0.8\%$

$= 12.7\%$

As mentioned earlier while CAPM concentrate on one factor (market risk) in its Model, APT does not specifically requires any particular type of factor to be concentrated upon. Though Stephan Ross identified change in the following factors:

- Inflation
- Level of Industrial Production
- Risk Premium
- Term Structure of Interest Rates

Further according to Ross, if no surprise happens to these macro-economic factors then actual returns shall be equal to expected. In case, if any unanticipated changes happens in these factors, then formula of APT shall be as follows:

$$E(R) = Rf + \beta_1 (EV1 - AV1) + \beta_2 (EV2 - AV2) + \ldots\ldots \beta n (EVn - AVn)$$

Where,

(EV n – AV n) = Surprise Factor due to change in the Value of Factor

Rf = Risk Free Rate of Return

βn = Sensitivity of corresponding Macro – economic factor

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1(RTP May'21)

Equity of ABC Ltd. (ABCL) is ₹ 500 Crores, its debt, is worth ₹ 290 Crores. Printer Division segments value is attributable to 64%, which has an Asset Beta (βp) of 1.55, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β sc) of 1.40 ABCL Debt beta (βD) is 0.28.

You are required to calculate:

(i) Equity Beta (βE),

(ii) Ascertain Equity Beta (βE), if ABC Ltd. decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt to Equity Ratio at 1.50. Assume that the present Debt Beta (βD1) is 0.45 and any further funds raised by way of Debt will have a Beta (βD2) of 0.50.

(iii) Whether the new Equity Beta (βE) justifies increase in the value of equity on account of leverage?

Solution

(i) **Equity Beta**

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta as follows:

= 1.55 x 0.64 + 1.40 x 0.36

= 0.992 + 0.504 = 1.496

Now we shall compute Equity Beta using the following formula:

$$\beta_{Asset} = \beta_{Equity}\left[\frac{E}{E+D\,(1-t)}\right] + \beta_{Debt}\left[\frac{D\,(1-t)}{E+D\,(1-t)}\right]$$

Accordingly,

$$1.496 = \beta_{Equity}\left[\frac{500}{500+2}\right] + \beta_{Debt}\left[\frac{290}{500+290}\right]$$

$$1.496 = \beta_{Equity}\left[\frac{500}{790}\right] + 0.28\left[\frac{290}{790}\right]$$

$$\beta_{Equity} = 2.20$$

(ii) **Equity Beta on change in Capital Structure**

Amount of Debt to be raised:

Particulars	Value (in ₹ Crore)
Total Value of Firm (Equity ₹ 500 crore + Debt ₹ 290 crore)	790
Desired Debt Equity Ratio	1.50 : 1.00
Desired Debt Level = Total Value x Debt Ratio Debt Ratio + Equity Ratio Less: Value of Existing Debt	474 (290)
Value of Debt to be Raised	**184**

Equity after Repurchase = Total value of Firm – Desired Debt Value

= ₹ 790 Crore – ₹ 474 Crore

= ₹ 316 Crore

Weighted Average Beta of ABCL:

Source of Finance	Investment (in ₹ Crore)	Weight	Beta of the Division	Weighted Beta
Equity	316	0.4	β (E = X)	0.4x
Debt – 1	290	0.367	0.45	0.165
Debt – 2	184	0.233	0.50	0.117
	790	Weighted Average Beta		0.282 + (0.4x)

$\beta_{ABCL} = 0.282 + 0.4x$

$1.496 = 0.282 + 0.4x$

$0.4x = 1.496 - 0.282$

$x = 1.214 / 0.4 = 3.035$

$\beta_{\text{New Equity}} = 3.035$

(iii) Yes, it justifies the increase as it leads to increase in the Value of Equity due to increase in Beta.

Question 2(MTP Oct'20)/Similar to Q 26

Mr. A, a HNI invested on 1.4.2014 in certain equity shares as below:

Name of Co.	No. of shares	Cost (₹)
X Ltd.	1,00,000 (₹ 100 each)	2,00,00,000
Y Ltd.	50,000 (₹ 10 each)	1,50,00,000

In September 2014, 10% dividend was paid out by X Ltd. and in October 2014, 30% dividend paid out by Y Ltd. On 31.3.2015 market quotations showed a value of ₹ 220 and ₹ 290 per share for X Ltd. and Y Ltd. respectively.

On 1.4.2015, a technical analyst indicated as follows:

(i) that the probabilities of dividends from X Ltd. and Y Ltd. for the year ending 31.3.2016 are as below:

Probability factor	Dividend from X Ltd. (%)	Dividend from Y Ltd. (%)
0.2	10	15
0.3	15	20
0.5	20	35

(ii) that the probabilities of market quotations on 31.3.2016 are as below:

Probability factor	Price / share of X Ltd.	Price / share of Y Ltd.
0.2	220	290
0.5	250	310
0.3	280	330

You are required to:

(i) Analyze the average return from the portfolio for the year ended 31.3.2015;
(ii) Analyze the expected average return from the portfolio for the year 2015-16; and
(iii) Advise Mr. A, of the comparative risk in the two investments. (12 Marks)

Solution

Solution

(i) Average return from the portfolio for the year ended 31.3.2015

Calculation of return on portfolio for 2014-15	(Calculation in ₹ / share)		
	X Ltd.	Y Ltd.	
Dividend received during the year	10	3	
Capital gain/loss by 31.03.15			
Market value by 31.03.15	220	290	
Cost of investment	200	300	
Gain / loss	20	(-)10	
Yield	30	(-)7	
Cost	200	300	
% return	15%	(-)2.33%	
Weight in the portfolio	57	43	
Weighted average return			7.55%

(ii) Average return from the portfolio for the year ended 2015-16 shall be calculated using the concept of joint probability as follows:

X Ltd.

Path	Income from Dividend (₹)	Gain from Market Price (₹)	Total Yield (₹)	Joint Prob.	Exp. Yield (₹)
1	10	220 – 220 = 0	10	0.20 x 0.20 = 0.04	0.40
2	10	250 – 220 = 30	40	0.20 x 0.50 = 0.10	4.00
3	10	280 – 220 = 60	70	0.20 x 0.30 = 0.06	4.20
4	15	220 – 220 = 0	15	0.30 x 0.20 = 0.06	0.90
5	15	250 – 220 = 30	45	0.30 x 0.50 = 0.15	6.75
6	15	280 – 220 = 60	75	0.30 x 0.30 = 0.09	6.75
7	20	220 – 220 = 0	20	0.50 x 0.20 = 0.10	2.00
8	20	250 – 220 = 30	50	0.50 x 0.50 = 0.25	12.50
9	20	280 – 220 = 60	80	0.50 x 0.30 = 0.15	12.00
Expected Yield (₹)					49.50
Market Value on 01.04.2015 (₹)					220
% Return					22.50

Y Ltd.

Path	Income from Dividend (₹)	Gain from Market Price (₹)	Total Yield (₹)	Joint Prob.	Exp. Yield (₹)
1	1.50	290 – 290 = 0	1.50	0.20 x 0.20 = 0.04	0.06

2	1.50	310 – 290 = 20	21.50	0.20 x 0.50 = 0.10	2.15
3	1.50	330 – 290 = 40	41.50	0.20 x 0.30 = 0.06	2.49
4	2.00	290 – 290 = 0	2.00	0.30 x 0.20 = 0.06	0.12
5	2.00	310 – 290 = 20	22.00	0.30 x 0.50 = 0.15	3.30
6	2.00	330 – 290 = 40	42.00	0.30 x 0.30 = 0.09	3.78
7	3.50	290 – 290 = 0	3.50	0.50 x 0.20 = 0.10	0.35
8	3.50	310 – 290 = 20	23.50	0.50 x 0.50 = 0.25	5.88
9	3.50	330 – 290 = 40	43.50	0.50 x 0.30 = 0.15	6.52
Expected Yield (₹)					24.65
Market Value on 01.04.2015 (₹)					290
% Return					8.50

Weight in portfolio (1,00,000 x 220): (50,000 x 290) 60.30 : 39.70

Weighted average (Expected) return (0.6030 x 22.50 + 0.3970 x 8.50) 16.94%

(iii) To analyze the risk of each investment we need to calculate the Standard Deviation of each investment as follows:

X Ltd.

Path	Prob. (1)	Yield (₹)	Dev. $(P_X - \bar{P}_X)$	Square of dev. (2)	(1) x (2)
1	0.04	10	-39.50	1560.25	62.41
2	0.10	40	-9.50	90.25	9.03
3	0.06	70	20.50	420.25	25.22
4	0.06	15	-34.50	1190.25	71.42
5	0.15	45	-4.50	20.25	3.04
6	0.09	75	25.50	650.25	58.52
7	0.10	20	-29.50	870.25	87.03
8	0.25	50	0.50	0.25	0.06
9	0.15	80	30.50	930.25	139.54
					σ^2_M = 456.27

Standard Deviation (σ_X) 21.36

Y Ltd.

Path	Prob. (1)	Yield (₹)	Dev. $(P_Y - \bar{P}_Y)$	Square of dev. (2)	(1) x (2)
1	0.04	1.50	-23.15	535.92	21.44
2	0.10	21.50	-3.15	9.92	0.99
3	0.06	41.50	16.85	283.92	17.04
4	0.06	2.00	-22.65	513.02	30.78
5	0.15	22.00	-2.65	7.02	1.05
6	0.09	42.00	17.35	301.02	27.09
7	0.10	3.50	-21.15	447.32	44.73
8	0.25	23.50	-1.15	1.32	0.33
9	0.15	43.50	18. 85	355.32	53.30
					σ^2_N = 196.75

Standard Deviation (σ_Y) 14.03

(iv) Although Expected Return is higher in case of X Ltd. but it also has higher risk due to High S.D.

Question 3(MTP Nov'21)

Suppose one of your HNI clients is holding the following portfolio as per his risk appetite:

Particulars	Securities
Equity Shares:	
G Ltd.	1000
S Ltd.	1000
B Ltd.	500
PSU Bonds	20,000

The other data related to each of these securities is as follows:

Cost	Dividends/ Interest	Market price	Beta
₹	₹	₹	
10,000	1,725	9,800	0.6
15,000	1,000	16,200	0.8
28,000	1400	28,300	0.6
1,800	180	1,725	0.10

Your client is interested in investing some more funds in Bonds issued by GOI.

1) Estimate the minimum rate of return that your client would expect from these Bonds keeping in view his risk appetite and assuming Market Return as 15.70%.
2) Analyze whether this portfolio has out – performed the market or not assuming Risk Free Rate of Return as 7%. **(8 Marks)**

Solution

1) **Working Notes:**

Calculation of Return on each single security

	Cost ₹ (1)	No. of Securities (2)	Total Cost (3) = (1) x (2)	Dividend / Interest	Capital gain	Total (4)	Total Income (5) = (2) x (4)	Beta (6)	(6) x (3)
G Ltd.	10,000	1000	1,00,00,000	1,725	-200	1,525	15,25,000	0.6	60,00,000
S Ltd.	15,000	1000	1,50,00,000	1,000	1,200	2,200	22,00,000	0.8	1,20,00,000
B Ltd.	28,000	500	1,40,00,000	1,400	300	1,700	8,50,000	0.6	84,00,000
PSU Bonds	1,800	20,000	3,60,00,000	180	-75	105	21,00,000	0.10	36,00,000
Total			7,50,00,000				66,75,000		3,00,00,000

Rate of Return on earned on the Portfolio

$$\frac{\text{Dividend Earned} + \text{Capital appreciation}}{\text{Initial investment}} \times 100$$

$= \frac{₹\ 66,75,000}{7,50,00,000} \times 100$ = 8.90%

Weighted Average Beta of the Portfolio

$\frac{3,00,00,000}{7,50,00,000}$ = 0.40

Expected Risk Free Rate of Return using CAPM

8.90% = Rf + 0.40 [12.7% - Rf]

8.90% = Rf + 5.08 – 0.40 Rf

3.82% = 0.60 Rf

Rf = 6.37%

Thus keeping in view the present risk appetite, the client would expect at least a return of 6.37% on Bonds.

The expected return on the Portfolio using CAPM:

= 7% + 0.40 [12.7 – 7%] = 9.28%

2) Since the actual return is 8.90% which is quite lower than expected return considering the systematic risk borne by the investor and hence portfolio has not outperformed the market rather has underperformed.

Question 4(PP Nov'19)

Following is the information about Mr. J's portfolio:

Investment in shares of ABC Ltd.	₹ 200 lakh
Investment in shares of XYZ Ltd.	₹ 200 lakh
Daily standard deviation of both shares	1%
Co-efficient of correlation between both shares	0.3

Required:

Determine the 10 days 99% Value at Risk (VAR) for Mr. J' s portfolio.

Given: The Z score from the Normal Table at 99% confidence level is 2.33. (Show your calculations up to four decimal points).

Solution

Volatility (standard deviation) of the daily change in the investment in each share in terms of rupees-

1% of ₹ 200 lakh = ₹ 2 lakh

The variance of the portfolio's daily change –

V = 22 + 22 + 2 x 0.3 x 2 x 2 = 10.4 lakh

Standard Deviation of the portfolio's daily change = $\sqrt{10.4}$ = ₹ 3.2249 lakhs

The standard deviation of the 10-day change

= ₹ 3.2249 lakhs $\times \sqrt{10}$ = ₹ 10.1981 lakhs

Therefore, the 10 – days 99% VAR = 2.33 × ₹ 10.1981 lakhs = ₹ 23.7616 lakhs

Question 5(PP Nov'20, MTP May'23)

The following are the details of three mutual funds of MFL:

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Coefficient of Determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 per cent per annum. You are required to:

(i) Rank the funds as per Sharpe's measure.

(ii) Rank the funds as per Treynor's measure.

(iii) Compare the performance with the market. (8 Marks)

Solution

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Std. Deviation	9.60	7.40	6.40	7.60
Coefficient of Determination	0.3025	0.6561	5	
Coefficient of Correlation	0.55	0.81	40.96	
Beta (β)	$\frac{9.60}{7.60} \times 0.55$	$\frac{7.40}{7.60} \times 0.81$	$\frac{6.40}{7.60} \times 0.98$	
	= 0.695	= 0.789	= 0.825	

(i) Ranking of Funds as per Sharpe Ratio

$$\text{Sharpe Ratio} = \frac{\text{Expected return} - \text{Risk Free Rate of Return}}{\text{Standard Deviation}}$$

	Growth Fund	Balanced Fund	Regular Fund
Sharpe Ratio	$\frac{7 - 9}{9.60}$ = - 0.208	$\frac{6 - 9}{7.40}$ = - 0.405	$\frac{5 - 9}{6.40}$ = - 0.625
Ranking	1	2	3

(ii) Ranking of Funds as per Treynor Ratio

$$\text{Treynor Ratio} = \frac{\text{Expected Return} - \text{Risk Free Rate of Return}}{\text{Beta}}$$

	Growth Fund	Balanced Fund	Regular Fund
Treynor Ratio	7 - 9 = - 2.878 0.695	6 - 9 = - 3.802 0.789	5 - 9 = - 4.84 0.825
Ranking	1	2	3

(iii) Comparison of performance with the Market

Sharpe Ratio	9 - 9 = 0 7.60
Treynor Ratio	9 - 9 = 0 1

Thus, the performance of funds is very poor since all values are negative as compared to market performance.

Question 6(PP Dec'21)

On 01/04/2020 Mr. K Invested in the following companies to make his portfolio:

Name of Company	No. of Equity Share Purchase	Face Value per Equity Share	Purchase Price per Equity Share
PK Ltd.	2000	₹ 10	₹ 210
KD Ltd.	1000	₹ 10	₹ 290

Mr. K expects that-

(i) Dividend for the financial year 2020-21 of PK Ltd. & KD Ltd. will be 40% & 50% respectively.

(ii) Probabilities of the Market Price as on 31/03/2021 as under-

Probability Factor	Market Value per Equity Share of PK Ltd.	Market Value per Equity Share of KD Ltd.
0.4	₹ 200	₹ 300
0.4	₹ 240	₹ 320
0.2	₹ 260	₹ 350

You are required to -

a) Calculate the Expected Market Price of Equity Shares of both the Companies as on 31/03/2021.

b) Calculate the Expected Average Return of the Portfolio for the year 2020-21. (8 Marks)

Solution

a) Expected Market Price of Shares on 31/03/2021

	PK Ltd.	KD Ltd.
(200 x 0.4) + (240 x 0.4) + (260 x 0.2)	228.00	-
(300 x 0.4) + (320 x 0.4) + (350 x 0.2)	-	318.00

b) Calculation of estimated return on Portfolio for 2020-21

	(Calculation in ₹ / share)	
	PK Ltd.	KD Ltd.
Expected dividend	4.00	5.00
Capital gain by 31.03.21	(228 – 210) = 18.00	(318 – 290) = 28.00
Yield	22.00	33.00
Market Value 01.04.20	210	290
% return	10.48%	11.38%
Weight in portfolio	59.15	40.85
(2000 x 210) : (1000 x 290)		
Weighted Average (Expected) return	10.85%	
(59.15 x 10.48%) + (40.85 x 11.38%)		

Question 7(RTP May'22)/Similar Q asked in MTP Oct'22

Mr. A is having 1 lakh shares of M/s. K Ltd. The beta of the company is 1.40. Mr. Y a financial advisor has suggested for having the following portfolio:

Security	Beta	% Holding
L	1.20	10
M	0.75	10
N	0.40	30
O	1.40	50
		100

Market Return is 12% Risk free rate is 8% Required:

You are required to CALCULATE the following for the present investment and suggested portfolio:

(i) Expected return based on CAPM and also
   1) If the market return goes up by 2.5%.
   2) If the market return goes down by 2.5%
   3) If the market is giving a negative return of 2.5%.

(ii) If the probability of market giving negative return is more, please advise Mr. A whether to continue the holdings of M/s. K Ltd. or to buy the portfolio as per the suggestion of Mr. B. If so, why?

Solution

Working Notes -

Calculation of Portfolio Beta suggested by Mr. B

Security	Beta	Wt. of Holding	Beta x Wt. of Holding
L	1.20	0.10	0.120
M	0.75	0.10	0.075
N	0.40	0.30	0.120
O	1.40	0.50	0.700
Total		1.00	1.015

Portfolio Beta is 1.015

Calculation of Expected Return based on CAPM at present situation-

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = Rm-Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c x e	g = b + f
K Ltd.	8%	1.400	12%	4%	5.600%	13.60%
Portfolio	8%	1.015	12%	4%	4.060%	12.06%

(i)

1) Calculation of Expected Return based on CAPM if market goes up by 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium= Rm- Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c X e	g = b + f
K Ltd.	8%	1.400	14.50%	6.5	9.100%	17.10%
Portfolio	8%	1.015	14.50%	6.5	6.598%	14.60%

2) Calculation of Expected Return based on CAPM if market goes down by 2.5%:

Particulars	Risk Free Rate(Rf)	Beta	Market Return	Risk Premium= Rm - Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c X e	g = b + f
K Ltd.	8%	1.400	9.50%	1.50%	2.100%	10.10%
Portfolio	8%	1.015	9.50%	1.50%	1.523%	9.52%

3) Calculation of Expected Return based on CAPM if market gives negative returns of 2.5%:

Particulars	Risk Free Rate(Rf)	Beta	Market Return	Risk Premium= Rm - Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c X e	g = b + f
K Ltd.	8%	1.400	- 2.00%	- 10.5	-14.700	-6.70
Portfolio	8%	1.015	- 2.00%	- 10.5	-10.658	-2.66

(ii) **Advice**: If the probability of market giving negative return is more, it is advisable to Mr. A to buy the portfolio suggested by Mr. B because Beta of the portfolio is less than of K Ltd.

Question 8(RTP May'22)

Mayuri is interested to construct a Portfolio of Securities X and Y. She has collected the following information:

	X	Y
Expected Return(ER)	19%	23%
Risk	14%	18%

Mayuri has 5 Portfolio options of X and Y as follows:

(i) 50% of funds in each X and Y
(ii) 75% of funds in X and 25% in Y
(iii) 25% of funds in X and 75% in Y
(iv) 60% of funds in X and 40% in Y
(v) 35% of funds in X and 65% in Y

Suppose if Co-efficient of correlation (r) between X and Y is 0.16, you are required to calculate:

(i) Expected Return under different Portfolio Options.
(ii) Risk Factor associated with these Portfolio Options.
(iii) Which Portfolio is best from the point of view of Risk?
(iv) Which Portfolio is best from the point of view of Return?

Solution

We have Ep = W1E1 + W3E3 + WnEn

and for standard deviation $\sigma^2 p = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij}$

$\sigma^2 p = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j$

Two asset portfolios

$\sigma^2 p = w^2_1\sigma^2_1 + w_2{}^2\sigma_2{}^2 + 2\, w_1 w_2 \sigma_1 \sigma_2 \rho_{12}$

Or

$\sigma p = \sqrt{w_1\sigma_1 + w_2\sigma_2} + 2\, w1w2\sigma1\sigma2\rho12$

Substituting the respective values we get,

(i) **50% of funds in each of X and Y**

Ep = 0.50 x 19% + 0.50 x 23% = 21%

$\sigma^2 p = (0.50)^2(14\%)^2 + (0.50)^2(18\%)^2 + 2\,(0.50)\,(0.50)\,(0.16)\,(14\%)\,(18\%)$

$\sigma^2 p = 49 + 81 + 20.16 = 150.16$

$\sigma p = 12.25\%$

(ii) **75% in X and 25% in Y**

Ep = 0.75 x 19% + 0.25 x 23% = 20%

$\sigma^2_p = (0.75)^2(14\%)^2 + (0.25)^2(18\%)^2 + 2\,(0.75)\,(0.25)\,(0.16)\,(14\%)\,(18\%)$

$\sigma^2_p = 110.25 + 20.25 + 15.12 = 145.62$

$\sigma_p = 12.07\%$

(iii) **25% in X and 75% in Y**

Ep = 0.25 x 19% + 0.75 x 23% = 22%

$\sigma^2_p = (0.25)^2(14\%)^2 + (0.75)^2(18\%)^2 + 2(0.25)\,(0.75)\,(0.16)\,(14\%)\,(18\%)$

$\sigma^2_p = 12.25 + 182.25 + 15.12 = 209.62$

$\sigma_p = 14.48\%$

(iv) **60% in X and 40% in Y**

Ep = 0.60 x 19% + 0.40 x 23% = 20.6%

$\sigma^2_p = (0.60)^2(14\%)^2 + (0.40)^2(18\%)^2 + 2(0.60)(0.40)(0.16)(14\%)(18\%)$

$\sigma^2_p = 70.56 + 51.84 + 19.35 = 141.75$

$\sigma_p = 11.91\%$

(v) **35% in X and 65% in Y**

Ep = 0.35 x 19% + 0.65 x 23% = 21.6%

$\sigma^2_p = (0.35)^2(14\%)^2 + (0.65)^2(18\%)^2 + 2(0.35)(0.65)(0.16)(14\%)(18\%)$

$\sigma^2_p = 24.01 + 136.89 + 18.35 = 179.25$

$\sigma_p = 13.39\%$

Portfolio	(i)	(ii)	(iii)	(iv)	(v)
Return	21	20	22	20.6	21.6
σ	12.25	12.07	14.48	11.91	13.39

In the terms of return, we see that portfolio (iii) is the best portfolio.

In terms of risk we see that portfolio (iv) is the best portfolio

Question 9(MTP Mar'22)

Details about portfolio of shares of an investor is as below

Shares	No of Shares (Lakh)	Price Per Share	Beta
A Ltd	3.00	₹ 500	1.40
B Ltd	4.00	₹ 750	1.20
C Ltd	2.00	₹ 250	1.60

The investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91. He is considering to take appropriate position on Nifty Futures which are currently traded at 8125 and each Nifty points is worth ₹200.

DETERMINE:

(i) the number of Nifty contracts to be bought/sold; and
(ii) the value of portfolio beta for 2% rise in Nifty

Solution:

(i) To determine the number of Nifty Contract to be short first we shall determine the Beta of the portfolio as follows:

Shares	No of Shares(Lakh)	Price Per Share	(1) x (2) (₹ Lakh)	% of total (w)	B (x)	Wx
	(1)	(2)				
A Ltd	3.00	₹ 500	1500	0.30	1.40	0.42

B Ltd	4.00	₹ 750	3000	0.60	1.20	0.72
C Ltd	2.00	₹ 250	500	0.10	1.60	0.16
			5000			1.30

Number of Nifty Contract to be sold

$$= \frac{(1.30-0.91) \times 5000 \text{ lakh}}{8.125 \times 200} = 120 \text{ contracts}$$

(ii) To determine the portfolio beta we shall compute the value of Portfolio after Nifty rises as follows:

The 2% rises in Nifty is accompanied by 2% x 1.30 i.e., 2.6% rise for portfolio of shares:

	(₹ Lakh)
Current Value of Portfolio of Shares	5,000
Value of Portfolio after Rise	5,130
Mark to Margin paid (8125 x 0.020 x ₹ 200 x 120)	39
Value of Portfolio after Rise of Nifty	5,091
% change in value of portfolio (5091 – 5000)/ 5000	1.82 %
% rise in the value of Nifty	2 %
Beta	0.91

Question 10(MTP May'23)

On the basis of given information, Mr. XLY want to create a portfolio equally as risky as the market and is having Rs 20,00,000 to invest.

Assets	Investment	Beta
Stock A	Rs 4,00,000	0.70
Stock B	Rs 5,00,000	1.10
Stock C	?	1.60
Debentures(D)	?	0

How do you recommend and interpret the risk scenario and investment in all the securities?

Solution

Let WA, WB, WC and WD be the weights of Stock A, B, C and Debenture respectively.

W_A = 4,00,000 ÷ 20,00,000 = 0.20

W_B = 5,00,000 ÷ 20,00,000 = 0.25

Now = $W_C + W_D = 1 - W_A - W_B = 0.55$

It is given in the question that Portfolio should be as risky as that of the market. It means Beta of the portfolio should be 1.

Hence,

W_A (0.7) + W_B (1.1) + W_C (1.6) + W_D (0) = 1

$0.2 \times 0.7 + 0.25 \times 1.1 + 1.6W_C + W_D \times 0 = 1$

$0.14 + 0.275 + 1.6W_C + 0 = 1$

$1.6W_C = 1 - 0.415$

$1.6\ W_C = 0.585$

$W_c = 0.585/1.6 = 0.3656$

Weight of Debenture (W_D) = 1- 0.2 – 0.25 – 0.3656

= 0.1844

Hence, Amount invested in Stock C

= 0.3656 × 20,00,000

= Rs 7,31,200

Amount invested in Debenture (D)

= 0.1844 × 20,00,000

= Rs 3,68,800

Thus, amount to be invested in Stock (C) is Rs 7,31,200 and in Debenture is Rs 3,68,800.

Chapter 8

MUTUAL FUNDS

Space for your notings of Formulae or important points

Question 1 (Study Material TYK Q. 1)

Mr. A can earn a return of 16 per cent by investing in equity shares on his own. Now he is considering a recently announced equity based mutual fund scheme in which initial expenses are 5.5 per cent and annual recurring expenses are 1.5 per cent. How much should the mutual fund earn to provide Mr. A return of 16 per cent?

Solution

Personal earnings of Mr. A = R_1 = 16%

Mutual Fund earnings = R_2

$$R_2 = \frac{1}{1 - \text{Initial expenses (\%)}} R_1 + \text{Recurring expenses (\%)}$$

$$= \frac{1}{1 - 0.055} \times 16\% + 1.5\%$$

= 18.43%

Mutual Fund earnings = 18.43%

Question 2 (Old PM)

Mr. X earns 10% on his investments in equity shares. He is considering a recently floated scheme of a Mutual Fund where the initial expenses are 6% and annual recurring expenses are expected to be 2%. How much the Mutual Fund scheme should earn to provide a return of 10% to Mr. X?

Solution

$$r_2 = \frac{1}{1 - \text{initial exp}} \times r_1 + \text{recurring exp.}$$

The rate of return the mutual fund should earn;

$$\frac{1}{1 - 0.06} \times 0.1 + 0.02$$

= 0.1264 or 12.64%

Question 3(Study Material TYK Q 2)

The unit price of Equity Linked Savings Scheme (ELSS) of a mutual fund is ₹ 10/-. The public offer price (POP) of the unit is ₹ 10.204 and the redemption price is ₹ 9.80.

Calculate:

(i) Front – end Load
(ii) Back – end Load

Solution

Public Offer Price = NAV / (1 – Front end Load)

Public Offer Price: ₹ 10.204 and NAV: ₹ 10

Accordingly,

10.204 = 10 / (1 – F)
F = 0.0199 say 2%

Redemption Price = NAV / (1 – Back End Load)
₹ 9.80 = 10 / (1 – Back End Load)
B = 0.0204 i.e., 2.04%

Alternative
Front End Load = $\frac{10.204-1\ .00}{10.00} = 0.0204 \text{ or } 2.04\%$

Exit Load = $\frac{10.00-9.80}{10.00} = 0.020 \text{ or } 2.00\%$

Question 4 (Study Material TYK Q 3)
A mutual fund that had a net asset value of ₹ 20 at the beginning of month – made income and capital gain distribution of ₹ 0.0375 and ₹ 0.03 per share respectively during the month, and then ended the month with a net asset value of ₹ 20.06. Calculate monthly return.

Solution

Calculation of Monthly Return on the Mutual Funds

$$r = \frac{(NAV_t - NAV_{t-1}) + I_t + G_t}{NAV_{t-1}}$$

Where,

r = Return on the mutual fund
NAVt = Net assets value at time period t
NAVt – 1 = Net assets value at time period t – 1
It = Income at time period t
Gt = Capital gain distribution at time period t

$$= \left[\frac{(₹\ 20.06 - ₹\ 20.00) + (₹\ 0.0375 + ₹\ 0.03)}{20}\right]$$

$$= \frac{0.06 + 0.0675}{20}$$

$$= \frac{0.1275}{20} = 0.006375$$

Or, r = 0.6375% p.m.
Or, = 7.65% p.a.

Question 5 (Old PM)
A mutual fund that had a net asset value of ₹ 16 at the beginning of a month, made income and capital gain distribution of ₹ 0.04 and ₹ 0.03 respectively per unit during the month, and then ended the month with a net asset value of ₹ 16.08. Calculate monthly and annual rate of return.

Solution

Calculation of monthly return on the mutual funds:

$$r = \frac{(NAV_t - NAV_{t-1}) + I_t + G_t}{NAV_{t-1}}$$

or, $r = \frac{(₹\ 16.08 - ₹\ 16.00) + (₹\ 0.04 + ₹\ 0.03)}{16}$

$= \frac{0.08 + 0.07}{16} = 0.009375$ or, $r = 0.9375\%$ or 11.25% p.a.

Question 6 (Study Material TYK Q 4) (MTP OCT 2019)

An investor purchased 300 units of a Mutual Fund at ₹ 12.25 per unit on 31st December, 2009. As on 31st December, 2010 he has received ₹ 1.25 as dividend and ₹ 1.00 as capital gains distribution per unit.

Required:

(i) The return on the investment if the NAV as on 31st December, 2010 is ₹ 13.00.

(ii) The return on the investment as on 31st December, 2010 if all dividends and capital gains distributions are reinvested into additional units of the fund at ₹ 12.50 per unit.

Solution

Return for the year (all changes on a per year basis)

Particulars	₹ / Unit
Change in price (₹ 13.00 – ₹ 12.25)	0.75
Dividend received	1.25
Capital gain distribution	1.00
Total Return	3.00

Return on investment = $\frac{3.00}{12.25} \times 100 = 24.49\%$

Alternatively, it can also be computed as follows:

$$\frac{(NAV_1 - NAV_0) + D_1 + CG_1}{NAV_0} \times 100$$

$$= \frac{(13 - 12.25) + 1.25 + 1.00}{12.25} \times 100$$

= 24.49%

If all dividends and capital gain are reinvested into additional units at ₹ 12.50 per unit the position would be:

Total amount reinvested = ₹ 2.25 x 300 = ₹ 675

Additional units added = $\frac{₹\ 675}{12.50}$ = 54 units

Value of 354 units as on 31-12-2010 = ₹ 4,602

Price paid for 300 units on 31-12-2009 (300 x ₹ 12.25) = ₹ 3,675

Return = $\frac{₹\ 4,602 - ₹\ 3,675}{₹\ 3,675} = \frac{₹\ 927}{₹\ 3,675}$ = 25.22%

Question 7 (Study Material TYK Q 5)

SBI mutual fund has a NAV of ₹ 8.50 at the beginning of the year. At the end of the year NAV increases to ₹ 9.10. Meanwhile fund distributes ₹ 0.90 as dividend and ₹ 0.75 as capital gains.

(i) What is the fund's return during the year?

(ii) Had these distributions been re-invested at an average NAV of ₹ 8.75 assuming 200 units were purchased originally. What is the return?

Solution

(i) Normal Return for the year (all changes on a per year basis)

Particulars	₹ / Unit
Change in price (₹ 9.10 – ₹ 8.50)	0.60
Dividend received	0.90
Capital gain distribution	0.75
Total Return	2.25

Return on investment = $\frac{2.25}{8.50} \times 100$ = 26.47%

(ii) If all dividends and capital gain are reinvested into additional units at ₹ 8.75 per unit the position would be:

Total amount reinvested = ₹ 1.65 x 200 = ₹ 330

Additional units added = $\frac{330}{8.75}$ = 37.71 units

Value of 237.71 units at end of year = ₹ 2,163.16

Price paid for 200 units in beginning of the year (200 x ₹ 8.50) = ₹ 1,700

Return = $\frac{₹\ 2{,}163.16 - ₹\ 1{,}700}{₹\ 1{,}700} = \frac{₹\ 463.16}{₹\ 1{,}700}$ = 27.24%

Question 8 (Study Material TYK Q 6)

The following information is extracted from Steady Mutual Fund's Scheme:

- Asset Value at the beginning of the month - ₹ 65.78
- Annualised return -15 %
- Distributions made in the nature of Income & Capital gain (per unit respectively). - ₹ 0.50 and ₹ 0.32

You are required to:

(i) Calculate the month end net asset value of the mutual fund scheme (limit your answers to two decimals).

(ii) Provide a brief comment on the month end NAV.

Solution

(i) Calculation of NAV at the end of month:

Given Annual Return = 15%

Hence Monthly Return = 1.25% (r)

$$r = \frac{(NAV_t - NAV_{t-1}) + l_t + G_t}{NAV_{t-1}}$$

$$0.0125 = \frac{(NAV_t - ₹\ 65.78) + ₹\ 0.50 + ₹\ 0.32}{₹\ 65.78}$$

0.82 = NAV $_t$ - ₹ 64.96

NAV $_t$ = ₹ 65.78

(ii) There is no change in NAV.

Question 9 (Old PM)/MTP March'19)

Orange purchased 200 units of Oxygen Mutual Fund at ₹ 45 per unit on 31st December, 2009. In 2010, he received ₹ 1.00 as dividend per unit and a capital gains distribution of ₹ 2 per unit.

Required:

(i) Calculate the return for the period of one year assuming that the NAV as on 31st December 2010 was ₹ 48 per unit.

(ii) Calculate the return for the period of one year assuming that the NAV as on 31st December 2010 was ₹ 48 per unit and all dividends and capital gains distributions have been reinvested at an average price of ₹ 46.00 per unit. Ignore taxation.

Solution

(i) **Returns for the year**

(All changes on a Per -Unit Basis)

Change in Price (₹ 48 – ₹ 45)	₹ 3.00
Dividends received:	₹ 1.00
Capital gains distribution	₹ 2.00
Total reward	₹ 6.00

Holding period reward: $\frac{₹\ 6.00}{₹\ 45} \times 100$ = 13.33%

(ii) When all dividends and capital gains distributions are re – invested into additional units of the fund @ (₹ 46 / unit)

Dividend + Capital Gains per unit = ₹ 1.00 + ₹ 2.00 = ₹ 3.00

Total received from 200 units = ₹ 3.00 x 200 = ₹ 600/-.

Additional Units Acquired = ₹ 600 / ₹ 46 = 13.04 Units.

Total No. of Units = 200 units + 13.04 units = 213.04 units.

Value of 213.04 units held at the end of the year = 213.04 units x ₹ 48 = ₹ 10225.92

Price Paid for 200 Units at the beginning of the year = 200 units x ₹ 45 = ₹ 9000.00

Holding Period Reward (10225.92 – 9000.00) = ₹ 1225.92

Holding Period Reward = $\frac{₹\ 1225.92}{₹\ 9000} \times 100$ = 13.62%

Question 10(Study Material TYK Q 7)(MTP April'18/MTP Oct'18/MTP April'21)

Cinderella Mutual Fund has the following assets in Scheme Rudolf at the close of business on 31st March, 2014.

Company	No. of Shares	Market Price Per Share
Nairobi Ltd.	25000	₹ 20
Dakar Ltd.	35000	₹ 300

Senegal Ltd.	29000	₹ 380
Cairo Ltd.	40000	₹ 500

The total number of units of Scheme Rudolf fare 10 lacs. The Scheme Rudolf has accrued expenses of ₹ 2,50,000 and other liabilities of ₹ 2,00,000. Calculate the NAV per unit of the Scheme Rudolf.

Solution

Shares	No. of shares	Price	Amount (₹)
Nairobi Ltd.	25,000	20.00	5,00,000
Dakar Ltd.	35,000	300.00	1,05,00,000
Senegal Ltd.	29,000	380.00	1,10,20,000
Cairo Ltd.	40,000	500.00	2,00,00,000
			4,20,20,000
Less: Accrued Expenses			2,50,000
Other Liabilities			2,00,000
Total Value			**4,15,70,000**
No. of Units			10,00,000
NAV per Unit (4,15,70,000 / 10,00,000)			**41.57**

Question 11(Study Material TYK Q 8)(PP May'18)

A Mutual Fund Co. has the following assets under it on the close of business as on:

Company	Shares	1st February 2012	2nd February 2012
		Market price per share	Market price per share
		₹	₹
L Ltd	20,000	20.00	20.50
M Ltd	30,000	312.40	360.00
N Ltd	20,000	361.20	383.10
P Ltd	60,000	505.10	503.90

Total No. of Units 6,00,000

(i) Calculate Net Assets Value (NAV) of the Fund.

(ii) Following information is given:
Assuming one Mr. A, submits a cheque of ₹ 30,00,000 to the Mutual Fund and the Fund manager of this company purchases 8,000 shares of M Ltd; and the balance amount is held in Bank. In such a case, what would be the position of the Fund?

(iii) Find new NAV of the Fund as on 2nd February 2012.

Solution

(i) NAV of the Fund

$$= \frac{₹\,4,00,000 + ₹\,93,72,000 + ₹\,72,24,000 + ₹\,3,03,06,000}{6,00,000}$$

$$= \frac{₹\,4,73,02,000}{6,00,000} = ₹\,78.8366 \text{ rounded to } ₹\,78.84$$

(ii) The revised position of fund shall be as follows:

Shares	No. of shares	Price	Amount (₹)
L Ltd.	20,000	20.00	4,00,000
M Ltd.	38,000	312.40	1,18,71,200
N Ltd.	20,000	361.20	72,24,000
P Ltd.	60,000	505.10	3,03,06,000
Cash			5,00,800
			5,03,02,000

No. of units of fund = $6{,}00{,}000 + \frac{30{,}00{,}000}{78.8366}$ = 6,38,053

(iii) On 2nd February 2012, the NAV of fund will be as follows:

Shares	No. of shares	Price	Amount (₹)
L Ltd.	20,000	20.50	4,10,000
M Ltd.	38,000	360.00	1,36,80,000
N Ltd.	20,000	383.10	76,62,000
P Ltd.	60,000	503.90	3,02,34,000
Cash			5,00,800
			5,24,86,800

NAV as on 2nd February 2012 = $\frac{₹\ 5{,}24{,}86{,}800}{6{,}38{,}053}$ = ₹ 82.26 per unit

Question 12(Study Material TYK Q 9)(RTP Nov'19)

On 1st April 2009 Fair Return Mutual Fund has the following assets and prices at 4.00 p.m.

Shares	No. of Shares	Market Price Per Share (₹)
A Ltd.	10000	19.70
B Ltd.	50000	482.60
C Ltd.	10000	264.40
D Ltd.	100000	674.90
E Ltd.	30000	25.90
No. of units of funds		8,00,000

Please calculate:

a) NAV of the Fund on 1st April 2009.

b) Assuming that on 1st April 2009, Mr. X, a HNI, send a cheque of ₹ 50,00,000 to the Fund and Fund Manager immediately purchases 18000 shares of C Ltd. and balance is held in bank. Then what will be position of fund.

c) Now suppose on 2 April 2009 at 4.00 p.m. the market price of shares is as follows:

Shares	₹
A Ltd.	20.30
B Ltd.	513.70
C Ltd.	290.80
D Ltd.	671.90
E Ltd.	44.20

Then what will be new NAV.

Solution

a) NAV of the Fund.

$$= \frac{₹\,1,97,000 + ₹\,2,41,30,000 + ₹\,26,44,000 + ₹\,6,74,90,000 + ₹7,77,000}{8,00,000}$$

$$= \frac{₹\,9,52,38,000}{8,00,000} = ₹\,119.0475 \text{ rounded to } ₹\,119.05$$

b) The revised position of fund shall be as follows:

Shares	No. of shares	Price	Amount (Rs.)
A Ltd.	10000	19.70	1,97,000
B Ltd.	50000	482.60	2,41,30,000
C Ltd.	28000	264.40	74,03,200
D Ltd.	100000	674.90	674,90,000
E Ltd.	30000	25.90	7,77,000
Cash			2,40,800
			10,02,38,000

No. of units of fund = $800000 + \frac{5000000}{119.0475}$ = 842000

c) On 2nd April 2009, the NAV of fund will be as follows:

Shares	No. of shares	Price	Amount (₹)
A Ltd.	10000	20.30	2,03,000
B Ltd.	50000	513.70	2,56,85,000
C Ltd.	28000	290.80	81,42,400
D Ltd.	100000	671.90	6,71,90,000
E Ltd.	30000	44.20	13,26,000
Cash			2,40,800
			10,27,87,200

NAV as on 2nd April 2009 = $\frac{₹\,10,27,87,200}{842000}$ = ₹ 122.075 per unit

Question 13(Study Material TYK Q 10)

A has invested in three Mutual Fund Schemes as per details below:

Particulars	MF A	MF B	MF C
Date of investment	01.12.2009	01.01.2010	01.03.2010
Amount of investment	₹ 50,000	₹ 1,00,000	₹ 50,000
Net Asset Value (NAV) at entry date	₹ 10.50	₹ 10	₹ 10
Dividend received upto 31.03.2010	₹ 950	₹ 1,500	Nil
NAV as at 31.03.2010	₹ 10.40	₹ 10.10	₹ 9.80

Required:

What is the effective yield on per annum basis in respect of each of the three schemes to Mr. A up to 31.03.2010?

Solution

Scheme	Investment	Unit Nos. (Investment / NAV at entry date)	Unit NAV 31.3.2010	Total NAV 31.3.2010 (Unit Nos. x Unit NAV as on 31.3.2010)
	₹	₹	₹	₹
MF A	50,000	4761.905	10.40	49,523.812
MF B	1,00,000	10,000	10.10	1,01,000
MF C	50,000	5,000	9.80	49,000

Scheme	NAV (+) / (–) (NAV as on 31.32010 – Investment)	Dividend Received	Total Yield Change in NAV + Dividend	Number of days	Effective Yield (% P.A.) (Total Yield/ Investment) x (365 / No. of days) x 100
	₹	₹	₹		%
MF A	(–)476.188	950	473.812	121	2.858%
MF B	(+)1,000	1,500	2,500	90	10.139%
MF C	(–)1,000	Nil	(–)1,000	31	(–)24%

Question 14(Study Material TYK Q 11)(Similar Q asked in PP July'21)

Mr. Sinha has invested in three Mutual fund schemes as per details below:

	Scheme X	Scheme Y	Scheme Z
Date of Investment	01.12.2008	01.01.2009	01.03.2009
Amount of Investment	₹ 5,00,000	₹ 1,00,000	₹ 50,000
Net Asset Value at entry date	₹ 10.50	₹ 10.00	₹ 10.00
Dividend received upto 31.03.2009	₹ 9,500	₹ 1,500	Nil
NAV as at 31.3.2009	₹ 10.40	₹ 10.10	₹ 9.80

You are required to calculate the effective yield on per annum basis in respect of each of the three schemes to Mr. Sinha up to 31.03.2009.

Solution

Calculation of effective yield on per annum basis in respect of three mutual fund schemes to Mr. Sinha up to 31-03-2009:

Particulars		MF X	MF Y	MF Z
(a)	Investments	₹ 5,00,000	₹ 1,00,000	₹ 50,000
(b)	Opening NAV	₹ 10.50	₹ 10.00	₹ 10.00
(c)	No. of units (a/b)	47,619.05	10,000	5,000
(d)	Unit NAV ON 31-3-2009	₹ 10.40	₹ 10.10	₹ 9.80
(e)	Total NAV on 31-3-2009 (c x d)	₹ 4,95,238.12	₹ 1,01,000	₹ 49,000
(f)	Increase / Decrease of NAV (e - a)	(₹ 4,761.88)	₹ 1,000	(₹ 1,000)
(g)	Dividend Received	₹ 9,500	₹ 1,500	Nil
(h)	Total yield (f + g)	₹ 4,738.12	₹ 2,500	(₹ 1,000)
(i)	Number of Days	121	90	31
(j)	Effective yield p.a. (h/a x 365 / i x 100)	2.859%	10.139%	(-) 23.55%

Question 15(Study Material TYK Q 12)(MTP Oct'20)

Mr. Y has invested in the three mutual funds (MF) as per the following details:

Particulars	MF 'X'	MF 'Y'	MF 'Z'
Amount of Investment (₹)	2,00,000	4,00,000	2,00,000
Net Assets Value (NAV) at the time of purchase (₹)	10.30	10.10	10
Dividend Received up to 31.03.2018 (₹)	6,000	0	5,000
NAV as on 31.03.2018 (₹)	10.25	10	10.20
Effective Yield per annum as on 31.03.2018 (%)	9.66	-11.66	24.15

Assume 1 Year = 365 days

Mr. Y has misplaced the documents of his investment. Help him in finding the date of his original investment after ascertaining the following:

(i) Number of units in each scheme;
(ii) Total NAV;
(iii) Total Yield; and
(iv) Number of days investment held.

Solution

(i) Number of Units in each Scheme

MF 'X'	$\frac{₹\ 2,00,000}{₹\ 10.30}$	= 19,417.48
MF 'Y'	$\frac{₹\ 4,00,000}{₹\ 10.10}$	= 39,603.96
MF 'Z'	$\frac{₹\ 2,00,000}{₹\ 10.00}$	= 20,000.00

(ii) Total NAV on 31.03.2018

MF 'X'	= 19,417.48 x ₹ 10.25	₹ 1,99,029.17
MF 'Y'	= 39,603.96 x ₹ 10.00	₹ 3,96,039.60
MF 'Z'	= 20,000.00 x ₹ 10.20	₹ 2,04,000.00
Total		₹ 7,99,068.77

(iii) Total Yield

	Capital Yield	Dividend Yield	Total
MF 'X'	₹ 1,99,029.17- ₹ 2,00,000		
	= - ₹ 970.83	₹ 6,000	₹ 5,029.17
MF 'Y'	₹ 3,96,039.60 - ₹ 4,00,000		
	= - ₹ 3,960.40	Nil	- ₹ 3,960.40
MF 'Z'	₹ 2,04,000 - ₹ 2,00,000		
	= ₹ 4,000	₹ 5,000	₹ 9,000.00
Total			₹ 10,068.77

Total Yield = $\frac{₹\ 10,068.77}{₹\ 8,00,000} \times 100$ = 1.2586%

(iv) No. of Days Investment Held

	MF 'X'	MF 'Y'	MF 'Z'
Let No. of days be	X	Y	Z
Initial Investment (₹)	2,00,000	4,00,000	2,00,000
Yield (₹)	5,029.17	-3,960.40	9,000.00
Yield (%)	2.5146	- 0.9901	4.5
Period of Holding (Days)	$\frac{2.5146}{9.66} \times 365$ =	$\frac{-0.9901}{-11.66} \times 365$ =	$\frac{4.5}{24.15} \times 365$ =
	= 95 Days	= 31 Days	= 68 Days
Date of Original Investment	27.12.17	01.03.18	23.01.18
Alternatively following dates can also be considered:			
Date of Original Investment	26.12.17	28.02.18	22.01.18

Question 16(Study Material TYK Q 13)

Mr. X on 1.7.2007, during the initial offer of some Mutual Fund invested in 10,000 units having face value of ₹ 10 for each unit. On 31.3.2008, the dividend paid by the M.F. was 10% and Mr. X found that his annualized yield was 153.33%. On 31.12.2009, 20% dividend was given. On 31.3.2010, Mr. X redeemed all his balance of 11,296.11 units when his annualized yield was 73.52%. What are the NAVs as on 31.3.2008, 31.3.2009 and 31.3.2010?

Solution

Yield for 9 months = (153.33 x 9/12) = 115%

Market value of Investments as on 31.03.2008 = 1,00,000/- + (1,00,000x 115%)
= ₹ 2,15,000/-

Therefore, NAV as on 31.03.2008 = (2,15,000-10,000) / 10,000= ₹ 20.50
(NAV would stand reduced to the extent of dividend pay – out, being (10,000 x 10 x 10%) = ₹ 10,000)

Since dividend was reinvested by Mr. X, additional units acquired = $\frac{₹\ 10,000}{₹\ 20.50}$ = 487.80 units

Therefore, units as on 31.03.2008 = 10, 000 + 487.80 = 10,487.80

[Alternately, units as on 31.03.2008 = (2,15,000 / 20.50) = 10,487.80]

Dividend as on 31.03.2009 = 10,487.80 x 10 x 0.2 = ₹ 20,975.60

Let X be the NAV on 31.03.2009, then number of new units reinvested will be ₹ 20,975.60 / X. Accordingly 11296.11 units shall consist of reinvested units and 10487.80 (as on 31.03.2008). Thus, by way of equation it can be shown as follows:

$$11296.11 = \frac{20975.60}{X} + 10487.80$$

Therefore, NAV as on 31.03.2009 = 20,975.60 / (11,296.11 - 10,487.80)
= ₹ 25.95

NAV as on 31.03.2010 = ₹ 1,00,000 (1 + 0.7352 x 33/12) /11296.11
= ₹ 26.75

Question 17(Old PM)/RTP May'20
On 01 – 07 – 2010, Mr. X Invested ₹ 50,000/- at initial offer in Mutual Funds at a face value of ₹ 10 each per unit. On 31-03-2011, a dividend was paid @ 10% and annualized yield was 120%. On 31-03-2012, 20% dividend and capital gain of ₹ 0.60 per unit was given. Mr. X redeemed all his 6271.98 units when his annualized yield was 71.50% over the period of holding. Calculate NAV as on 31-03-2011, 31-03-2012 and 31-03-2013.

For calculations consider a year of 12 months.

Solution
Yield for 9 months (120% x 9 / 12) = 90%
Market value of Investments as on 31.03.2011= ₹ 50,000/- + (₹ 50,000 x 90%) = ₹ 95,000/ -
Therefore, NAV as on 31.03.2011 = (₹ 95,000 - ₹ 5,000) / 5,000 = ₹ 18.00

Since dividend was reinvested by Mr. X, additional units acquired = $\frac{5,000}{18}$ = 277.78 unit

Therefore, units as on 31.03.2011 = 5,000 + 277.78 = 5,277.78

Alternatively, units as on 31.03.2011 = (₹ 95,000 / ₹ 18) = 5,277.78

Dividend as on 31.03.2012 = 5,277.78 x ₹ 10 x 0.2 =	₹ 10,555.56
Capital Gain (5277.78 x ₹ 0.60)	₹ 3,166.67
	₹ 13,722.23

Let X be the NAV on 31.03.2012, then number of new units reinvested will be ₹ 13,722.23 / X. Accordingly, 6,271.98 units shall consist of reinvested units and 5277.78 (as on 31.03.2011). Thus, by way of equation it can be shown as follows:

$$6271.98 = \frac{₹\ 13{,}722.23}{X} + 5{,}277.78$$

Therefore,
NAV as on 31.03.2012 = ₹ 13,722.23 / (6,271.98 – 5,277.78) = ₹ 13.80
NAV as on 31.03.2013 = ₹ 50,000 (1 + 0.715 x 33 / 12) / 6,271.98 = ₹ 23.65

Question 18(Study Material TYK Q 14)
Mr. X on 1.7.2012, during the initial public offer of a Mutual Fund (MF) invested ₹ 1,00,000 at Face Value of ₹ 10. On 31.3.2013, the MF declared a dividend of 10% when Mr. X calculated that his holding period return was 115%. On 31.3.2014, MF again declared a dividend of 20%. On 31.3.2015, Mr. X redeemed all his investment which had accumulated to 11,296.11 units when his holding period return was 202.17%.

Calculate the NAVs as on 31.03.2013, 31.03.2014 and 31.03.2015.

Solution

Yield for 9 months = 115%

Market value of Investments as on 31.03.2013 = 1,00,000/- + (1,00,000 x 115%)
= ₹ 2,15,000/-

Therefore, NAV as on 31.03.2013 = (2,15,000 -10,000) / 10,000 = ₹ 20.50
(NAV would stand reduced to the extent of dividend pay – out, being (₹ 100,000 x 10%) = ₹ 10,000)

Since dividend was reinvested by Mr. X, additional units acquired = $\frac{₹\ 10{,}000}{₹\ 20.50}$ = 487.80 units

Therefore, units as on 31.03.2013 = 10,000+ 487.80 = 10,487.80

[Alternately, units as on 31.03.2013 = (2,15,000 / 20.50) = 10,487.80]

Dividend as on 31.03.2014 = 10,487.80 x 10 x 0.2 = ₹ 20,975.60

Let X be the NAV on 31.03.2014, then number of new units reinvested will be ₹ 20,975.60 / X. Accordingly 11296.11 units shall consist of reinvested units and 10487.80 (as on 31.03.2013). Thus, by way of equation it can be shown as follows:

$$11296.11 = \frac{20975.60}{X} + 10487.80$$

Therefore, NAV as on 31.03.2014 = 20,975.60 / (11,296.11 - 10,487.80)
= ₹ 25.95

NAV as on 31.03.2015 = ₹ 1,00,000 (1 + 2.0217) / 11296.11
= ₹ 26.75

Question 19(Study Material TYK Q 15)/MTP March'18/PP Nov'18/MTP Sep'22

A Mutual Fund having 300 units has shown its NAV of ₹ 8.75 and ₹ 9.45 at the beginning and at the end of the year respectively. The Mutual Fund has given two options:

(i) Pay ₹ 0.75 per unit as dividend and ₹ 0.60 per unit as a capital gain, or
(ii) These distributions are to be reinvested at an average NAV of ₹ 8.65 per unit.

What difference it would make in terms of return available and which option is preferable?

Solution

Returns for the year
(All changes on a Per -Unit Basis)

Change in Price (₹ 9.45 – ₹ 8.75)	₹ 0.70
Dividends received	₹ 0.75
Capital gains distribution	₹ 0.60
Total reward	₹ 2.05

Holding Period reward: $\frac{₹2.05}{₹\ 8.75} \times 100$ = 23.43%

When all dividends and capital gains distributions are re-invested into additional units of the fund @ (₹ 8.65 / unit)

Dividend + Capital Gains per unit = ₹ 0.75 + ₹ 0.60 = ₹ 1.35

Total received from 300 units = ₹ 1.35 x 300 = ₹ 405/-.

Additional Units Acquired = ₹ 405 / ₹ 8.65 = 46.82 Units.

Total No. of Units = 300 units + 46.82 units = 346.82 units.

Value of 346.82 units held at the end of the year = 346.82 units x ₹ 9.45 = ₹ 3277.45

Price Paid for 300 Units at the beginning of the year = 300 units x ₹ 8.75 = ₹ 2,625.00

Holding Period Reward

₹ (3277.45 – 2625.00) = ₹ 652.45

Holding Period Reward $= \frac{₹\ 652.45}{₹\ 2625.00} \times 100$ = 24.85%

Conclusion: Since the holding period reward is more in terms of percentage in option – two i.e., reinvestment of distributions at an average NAV of ₹ 8.65 per unit, this option is preferable.

Question 20(Study Material TYK Q 16)/MTP May'20/MTP March'21/RTP Nov'22

On 1-4-2012 ABC Mutual Fund issued 20 lakh units at ₹ 10 per unit. Relevant initial expenses involved were ₹ 12 lakhs. It invested the fund so raised in capital market instruments to build a portfolio of ₹ 185 lakhs. During the month of April 2012, it disposed off some of the instruments costing ₹ 60 lakhs for ₹ 63 lakhs and used the proceeds in purchasing securities for ₹ 56 lakhs. Fund management expenses for the month of April 2012 was ₹ 8 lakhs of which 10% was in arrears. In April 2012 the fund earned dividends amounting to ₹ 2 lakhs and it distributed 80% of the realized earnings. On 30-4-2012 the market value of the portfolio was ₹ 198 lakhs.

Mr. Akash, an investor, subscribed to 100 units on 1-4-2012 and disposed off the same at closing NAV on 30-4-2012. What was his annual rate of earning?

Solution

	Amount	**Amount**	**Amount**
	₹ lakhs	**₹ lakhs**	**₹ lakhs**
Opening Bank (200 - 185 -12)	3.00		
Add: Proceeds from sale of securities	63.00		
Add: Dividend received	2.00	68.00	
Deduct:			
- Cost of securities purchased	56.00		
- Fund management expenses paid (90% of 8)	7.20		
- Capital gains distributed = 80% of (63 – 60)	2.40		
- Dividend distributed = 80% of 2.00	1.60	67.20	
Closing Bank			0.80
Closing market value of portfolio			198.00
			198.80
Less: Arrears of expenses			0.80
Closing Net Assets			**198.00**

Number of units (Lakhs)			**20**
Closing NAV per unit (198.00 / 20)			**9.90**

	Amount
Income received (₹ 2.40 + ₹ 1.60) / 20	₹ 0.20
Loss: Loss on disposal (₹ 200 - ₹ 198) / 20	₹ 0.10
Net earning	₹ 0.10
Initial investment	₹ 10.00
Rate of earning (monthly)	1%
Rate of earning (Annual)	12%

Question 21(Study Material TYK Q 17)/RTP May'18/PP Nov'19

Sun Moon Mutual Fund (Approved Mutual Fund) sponsored open – ended equity – oriented scheme "Chanakya Opportunity Fund". There were three plans viz. 'A' – Dividend Re – investment Plan, 'B' – Bonus Plan & 'C' – Growth Plan.

At the time of Initial Public Offer on 1.4.1999, Mr. Anand, Mr. Bacchan & Mrs. Charu, three investors invested ₹ 1,00,000 each & chosen 'B', 'C' & 'A' Plan respectively.

The History of the Fund is as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per Unit (F.V. ₹ 10)		
			Plan A	Plan B	Plan C
28.07.2003	20	-	30.70	31.40	33.42
31.03.2004	70	5 : 4	58.42	31.05	70.05
31.10.2007	40	-	42.18	25.02	56.15
15.03.2008	25	-	46.45	29.10	64.28
31.03.2008		1 : 3	42.18	20.05	60.12
24.03.2009	40	1 : 4	48.10	19.95	72.40
31.07.2009		-	53.75	22.98	82.07

On 31st July all three investors redeemed all the balance units.
Calculate annual rate of return to each of the investors.

Consider:

(i) Long – term Capital Gain is exempt from Income tax.
(ii) Short – term Capital Gain is subject to 10% Income tax.
(iii) Security Transaction Tax 0.2 per cent only on sale / redemption of units.
(iv) Ignore Education Cess.

Solution

Mrs. Charu Plan A Dividend Reinvestment (Amount in ₹)

Date	Investment	Dividend payout (%)	Dividend Re-invested (Closing Units x Face value of ₹	NAV	Units	Closing Unit Balance ∑ Units

			10 x Dividend Payout %)			
01.04.1999	1,00,000.00			10.00	10,000.00	10,000.00
28.07.2003		20	20,000.00	30.70	651.47	10,651.47
31.03.2004		70	74,560.29	58.42	1,276.28	11,927.75
30.10.2007		40	47,711.00	42.18	1,131.13	13,058.88
15.03.2008		25	32,647.20	46.45	702.85	13,761.73
24.03.2009		40	55,046.92	48.10	1,144.43	14,906.16
Redemption value 14,906.16 x 53.75						**8,01,206.10**
Less: Security Transaction Tax (STT) is 0.2%						1,602.41
Net amount received						**7,99,603.69**
Less: Short term capital gain tax @ 10% on 1,144.43 (53.64* – 48.10≈) = 6,340						634
Net of tax						**7,98,969.69**
Less: Investment						1,00,000.00
						6,98,969.69

*(53.75 – STT @ 0.2%)

≈ This value can also be taken as zero

Annual average return (%) $\frac{6,98,969.69}{1,00,000} \times \frac{12}{124} \times 100$ = 67.64%

Mr. Anand Plan B – Bonus

Date	Units	Bonus units	Total Balance	NAV per unit
01.04.1999	10,000		10,000	10
31.03.2004		12,500	22,500	31.05
31.03.2008		7,500	30,000	20.05
24.03.2009		7,500	37,500	19.95
Redemption value 37,500 x 22.98				8,61,750.00
Less: Security Transaction Tax (STT) is 0.2%				1,723.50
Net amount received				**8,60,026.50**
Less: Short term capital gain tax @ 10%(7,500 x (22.93† – 19.95≈) = 22,350)				2,235.00
Net of tax				**8,57,791.50**
Less: Investment				1,00,000.00
Net gain				**7,57,791.50**

†(22.98 – STT @ 0.2%)

≈ This value can also be taken as zero.

Annual average return (%) $\frac{7,57,791.50}{1,00,000} \times \frac{12}{124} \times 100$ = 73.33%

Mr. Bacchan Plan C – Growth

Particulars	(Amount in ₹)
Redemption value 10,000 x 82.07	8,20,700.00
Less: Security Transaction Tax (S.T.T) is .2%	1,641.40
Net amount received	**8,19,058.60**
Less: Short term capital gain tax @ 10%	0.00
Net of tax	**8,19,058.60**

Less: Investment	1,00,000.00
Net gain	**7,19,058.60**

Annual average return (%) $\frac{7,19,058.60}{1,00,000} \times \frac{12}{124} \times 100$ = 69.59%

Note: Alternatively, figure of * and † can be taken as without net of Tax because, as per Proviso 5 of Section 48 of IT Act, no deduction of STT shall be allowed in computation of Capital Gain.

Question 22(Study Material TYK Q 18)/PP May'19

A mutual fund company introduces two schemes i.e. Dividend plan (Plan – D) and Bonus plan (Plan – B). The face value of the unit is ₹ 10. On 1-4-2005 Mr. K invested ₹ 2,00,000 each in Plan – D and Plan – B when the NAV was ₹ 38.20 and ₹ 35.60 respectively. Both the plans matured on 31-3-2010.

Particulars of dividend and bonus declared over the period are as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per Unit (F.V. ₹ 10)	
			Plan D	Plan B
30-09-2005	10	-	39.10	35.60
30-06-2006	-	1:5	41.15	36.25
31-03-2007	15	-	44.20	33.10
15-09-2008	13	-	45.05	37.25
30-10-2008	-	1:8	42.70	38.30
27-03-2009	16	-	44.80	39.10
11-04-2009	-	1:10	40.25	38.90
31-03-2010	-	-	40.40	39.70

What is the effective yield per annum in respect of the above two plans?

Solution

Plan – D

Unit acquired = $\frac{2,00,000}{38.20}$ = 5235.60

Date	Units Held	Dividend		Reinvestment Rate	New Units	Total Units
		%	Amount			
01.04.2005						5235.60
30.09.2005	5235.60	10	5235.60	39.10	133.90	5369.50
31.03.2007	5369.50	15	8054.25	44.20	182.22	5551.72
15.09.2008	5551.72	13	7217.24	45.05	160.20	5711.92
27.03.2009	5711.92	16	9139.07	44.80	204	5915.92
						₹
31.03.2010	Maturity Value(₹ 40.40 x 5915.92)					2,39,003.17
	Less: Cost of Acquisition					2,00,000.00
	Total Gain					**39,003.17**

Therefore, Effective Yield = $\frac{₹\,39{,}003.17}{₹\,2{,}00{,}000} \times \frac{1}{5} \times 100$ = 3.90%

Alternatively, it can be computed by using the IRR method as follows:

NPV at 4% = - 2,00,000 + 1,96,443 = - 3,557

NPV at 2% = - 2,00,000 + 2,16,473 = 16,473

IRR = $\text{LR} + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} (\text{HR} - \text{LR})$ = $2\% + \frac{16473}{16473 \quad (-3557)} (4\% - 2\%)$ = 3.645%

Plan – B

Date	Particulars	Calculation Working	No. of Units	NAV (₹)
1.4.05	Investment	₹ 2,00,000 / 35.60 =	5617.98	35.60
30.6.06	Bonus	5617.98 / 5 =	1123.60	36.25
			6741.58	
30.10.08	"	6741.58/8 =	842.70	38.30
			7584.28	
11.4.09	"	7584.28 / 10	758.43	38.90
			8342.71	
				₹
31.3.10	Maturity Value(8342.71 x ₹ 39.70)			3,31,205.59
	Less: Investment			2,00,000.00
	Gain			**1,31,205.59**

Therefore, Effective Yield = $\frac{31{,}31{,}205.59}{2{,}00{,}000} \times \frac{1}{5} \times 100$ = 13.12%

Alternatively, it can be computed by using the IRR method as follows:

NPV at 13% = - 2,00,000 + 1,79,765 = - 20,235

NPV at 8% = - 2,00,000 + 2,25,413 = 25,413

IRR = $\text{LR} + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} (\text{HR} - \text{LR})$ = $8\% + \frac{25413}{25413 - (-2023\ )} (13\% - 8\%)$ = 10.78%

Question 23(Study Material TYK Q 19)

A mutual fund made an issue of 10,00,000 units of ₹ 10 each on January 01, 2008. No entry load was charged. It made the following investments:

Particulars	₹
50,000 Equity shares of ₹ 100 each @ ₹ 160	80,00,000
7% Government Securities	8,00,000
9% Debentures (Unlisted)	5,00,000
10% Debentures (Listed)	5,00,000
	98,00,000

During the year, dividends of ₹ 12,00,000 were received on equity shares. Interest on all types of

debt securities was received as and when due. At the end of the year equity shares and 10% debentures are quoted at 175% and 90% respectively of face value. Other investments are at par.

Find out the Net Asset Value (NAV) per unit given that operating expenses paid during the year amounted to ₹ 5,00,000. Also find out the NAV, if the Mutual fund had distributed a dividend of ₹ 0.80 per unit during the year to the unit holders.

Solution

In order to find out the NAV, the cash balance at the end of the year is calculated as follows-

Particulars	₹
Cash balance in the beginning	
(₹ 100 lakhs – ₹ 98 lakhs)	2,00,000
Dividend Received	12,00,000
Interest on 7% Govt. Securities	56,000
Interest on 9% Debentures	45,000
Interest on 10% Debentures	50,000
	15,51,000
(-) Operating expenses	5,00,000
Net cash balance at the end	**10,51,000**
Calculation of NAV	
Cash Balance	10,51,000
7% Govt. Securities (at par)	8,00,000
50,000 equity shares @ ₹ 175 each	87,50,000
9% Debentures (Unlisted) at cost	5,00,000
10% Debentures @90%	4,50,000
Total Assets	**1,15,51000**
No. of Units	10,00,000
NAV per Unit	**₹ 11.55**

Calculation of NAV, if dividend of ₹ 0.80 is paid –

Net Assets (₹ 1,15,51,000 – ₹ 8,00,000)	₹ 1,07,51,000
No. of Units	10,00,000
NAV per unit	₹ 10.75

Question 24(Study Material TYK Q 20)/RTP Nov'18

Based on the following information, determine the NAV of a regular income scheme on per unit basis:

Particulars	₹ Crores
Listed shares at Cost (ex-dividend)	20
Cash in hand	1.23
Bonds and debentures at cost	4.3
Of these, bonds not listed and quoted	1

Other fixed interest securities at cost	4.5
Dividend accrued	0.8
Amount payable on shares	6.32
Expenditure accrued	0.75
Number of units (₹ 10 face value)	20 lacs
Current realizable value of fixed income securities of face value of ₹ 100	106.5
The listed shares were purchased when Index was	1,000
Present index is	2,300
Value of listed bonds and debentures at NAV date	8

There has been a diminution of 20% in unlisted bonds and debentures. Other fixed interest securities are at cost.

Solution

Particulars	Adjusted Values
	₹ crores
Equity Shares	46.00
Cash in hand	1.23
Bonds and debentures not listed	0.80
Bonds and debentures listed	8.00
Dividends accrued	0.80
Fixed income securities	4.50
Sub total assets (A)	**61.33**
Less: Liabilities	
- Amount payable on shares	6.32
- Expenditure accrued	0.75
Sub total liabilities (B)	**7.07**
Net Assets Value (A) – (B)	**54.26**
No. of units	20,00,000
Net Assets Value per unit (₹ 54.26 crore / 20,00,000)	₹ 271.30

Question 25(Old PM)

Based on the following data, estimate the Net Asset Value (NAV) on per unit basis of a Regular Income Scheme of a Mutual Fund:

	₹ (in lakhs)
Listed Equity shares at cost (ex-dividend)	40.00
Cash in hand	2.76
Bonds & Debentures at cost of these, Bonds not listed & not quoted	8.96 2.50
Other fixed interest securities at cost	9.75
Dividend accrued	1.95
Amount payable on shares	13.54
Expenditure accrued	1.76

Current realizable value of fixed income securities of face value of ₹ 100 is ₹ 96.50. Number of Units (₹ 10 face value each); 275000

All the listed equity shares were purchased at a time when market portfolio index was 12,500. On NAV date, the market portfolio index is at 19,975.

There has been a diminution of 15% in unlisted bonds and debentures valuation. Listed bonds and debentures carry a market value of ₹ 7.5 lakhs, on NAV date. Operating expenses paid during the year amounted to ₹ 2.24 lakhs.

Solution

Particulars	Adjusted Value
	₹ lakhs
Equity Shares	63.920
Cash in hand	2.760
Bonds and debentures not listed	2.125
Bonds and debentures listed	7.500
Dividends accrued	1.950
Fixed income securities	9.409
Sub total assets (A)	**87.664**
Less: Liabilities	
- Amount payable on shares	13.54
- Expenditure accrued	1.76
Sub total liabilities (B)	**15.30**
Net Assets Value (A) – (B)	**72.364**
No. of units	2,75,000
Net Assets Value per unit (₹ 72.364 lakhs / 2,75,000)	**₹ 26.3142**

Question 26(Study Material TYK Q 21)/MTP Aug'18/MTP April'19/PP Jan'21

On 1st April, an open – ended scheme of mutual fund had 300 lakh units outstanding with Net Assets Value (NAV) of ₹ 18.75. At the end of April, it issued 6 lakh units at opening NAV plus 2% load, adjusted for dividend equalization. At the end of May, 3 Lakh units were repurchased at opening NAV less 2% exit load adjusted for dividend equalization. At the end of June, 70% of its available income was distributed.

In respect of April – June quarter, the following additional information are available:

	₹ in lakh
Portfolio value appreciation	425.47
Income of April	22.950
Income for May	34.425
Income for June	45.450

You are required to calculate:

(i) Income available for distribution;
(ii) Issue price at the end of April;
(iii) repurchase price at the end of May; and
(iv) net asset value (NAV) as on 30th June.

Solution

Calculation of Income available for Distribution

	Units	Per Unit	Total
	(Lakh)	(₹)	(₹ In lakh)
Income from April	300	0.0765	22.9500
Add: Dividend equalization collected on issue	6	0.0765	0.4590
	306	**0.0765**	**23.4090**
Add: Income from May		0.1125	34.4250
	306	**0.1890**	**57.8340**
Less: Dividend equalization paid on repurchase	3	0.1890	(0.5670)
	303	**0.1890**	**57.2670**
Add: Income from June		0.1500	45.4500
	303	**0.3390**	**102.7170**
Less: Dividend Paid		0.2373	(71.9019)
	303	**0.1017**	**30.8151**

Calculation of Issue Price at the end of April

	₹
Opening NAV	18.750
Add: Exit Load 2% of ₹ 18.750	0.375
	19.125
Add: Dividend Equalization paid on Issue Price	0.0765
	19.2015

Calculation of Repurchase Price at the end of May

	₹
Opening NAV	18.750
Less: Exit Load 2% of ₹ 18.750	(0.375)
	18.375
Add: Dividend Equalization paid on Issue Price	0.1890
	18.564

Closing NAV

		₹ (Lakh)
Opening Net Asset Value (₹ 18.75 × 300)		5625.0000
Portfolio Value Appreciation		425.4700
Issue of Fresh Units (6 × 19.2015)		115.2090
Income Received (22.950 + 34.425 + 45.450)		102.8250
		6268.504
Less: Units repurchased (3 × 18.564)	- 55.692	
Income Distributed	- 71.9019	(-127.5939)
Closing Net Asset Value		**6140.9101**
Closing Units (300 + 6 – 3) lakh		303 lakh
Therefore, Closing NAV as on 30th June		₹ 20.2760

Question 27(Study Material TYK Q 22)/RTP Nov'21

Five portfolios experienced the following results during a 7- year period:

Portfolio	Average Annual Return (Rp) (%)	Standard Deviation (Sp)	Correlation with the market returns (r)
A	19.0	2.5	0.840
B	15.0	2.0	0.540
C	15.0	0.8	0.975
D	17.5	2.0	0.750
E	17.1	1.8	0.600
Market Risk (σm)		1.2	
Market rate of Return (Rm)	14.0		
Risk-free Rate (Rf)	9.0		

Rank the portfolios using (a) Sharpe's method, (b) Treynor's method and (c) Jensen's Alpha

Solution

Let portfolio standard deviation be σp

Market Standard Deviation = σm

Coefficient of correlation = r

Portfolio beta (βp) = $\frac{\sigma_p \, r}{\sigma_m}$

Required portfolio return (Rp) = Rf + βp (Rm – Rf)

Portfolio	Beta	Return from the portfolio (Rp) (%)
A	1.75	17.75
B	0.90	13.50
C	0.65	12.25
D	1.25	15.25
E	0.90	13.50

Portfolio	Sharpe Method		Treynor Method		Jensen's Alpha	
	Ratio	Rank	Ratio	Rank	Ratio	Rank
A	4.00	IV	5.71	V	1.25	V
B	3.00	V	6.67	IV	1.50	IV
C	7.50	I	9.23	I	2.75	II
D	4.25	III	6.80	III	2.25	III
E	4.50	II	9.00	II	3.60	I

Question 28(Study Material TYK Q 23)/RTP May'19/RTP Nov'20/MTP Nov'21/PP Dec'21

There are two Mutual Funds viz. D Mutual Fund Ltd. and K Mutual Fund Ltd. Each having close ended equity schemes.

NAV as on 31-12-2014 of equity schemes of D Mutual Fund Ltd. is ₹ 70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Ltd. is 62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particular	Equity Schemes	
	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard deviation	11.25	5

There is no change in portfolios during the next month and annual average cost is ₹ 3 per unit for the schemes of both the Mutual Funds.

If Share Market goes down by 5% within a month, calculate expected NAV after a month for the schemes of both the Mutual Funds.

For calculation, consider 12 months in a year and ignore number of days for particular month.

Solution

Working Notes:

(i) Decomposition of Funds in Equity and Cash Components

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
NAV on 31.12.14	₹ 70.71	₹ 62.50
% of Equity	99%	96%
Equity element in NAV	₹ 70	₹ 60
Cash element in NAV	₹ 0.71	₹ 2.50

(ii) Calculation of Beta

(a) D Mutual Fund Ltd.

Sharpe Ratio = 2 = $\frac{E(R)-R_f}{\sigma_D} = \frac{E(R)-R_f}{11.25}$

E(R) - R_f = 22.50

Treynor Ratio = 15 = $\frac{E(R)-R_f}{\beta_D} = \frac{22.50}{\beta_D}$

βD = 22.50 / 15 = 1.50

(b) K Mutual Fund Ltd.

Sharpe Ratio= 3.3 = $\frac{E(R)-R_f}{\sigma_K} = \frac{E(R)-R_f}{5}$

E(R) - Rf = 16.50

Treynor Ratio = 15 = $\frac{E(R)-R_f}{\beta_K} = \frac{16.50}{\beta_K}$

βK = 16.50/15 = 1.10

(iii) Decrease in the Value of Equity

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Market goes down by	5.00%	5.00%
Beta	1.50	1.10
Equity component goes down	7.50%	5.50%

(iv) Balance of Cash after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Cash in Hand on 31.12.14	₹ 0.71	₹ 2.50
Less: Exp. Per month	₹ 0.25	₹ 0.25
Balance after 1 month	₹ 0.46	₹ 2.25

NAV after 1 Month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Value of Equity after 1 month		
70 x (1 - 0.075)	₹ 64.75	-
60 x (1 - 0.055)	-	₹ 56.70
Cash Balance	0.46	2.25
	65.21	58.95

Question 29(Study Material TYK Q 24)

ANP Plan, a hedge fund currently has assets of ₹ 20 crore. CA. X, the manager of fund charges fee of 0.10% of portfolio asset. In addition to it he charges incentive fee of 2%. The incentive will be linked to gross return each year in excess of the portfolio maximum value since the inception of fund. The maximum value the fund achieved so far since inception of fund about one and half year ago was ₹ 21 crores.

You are required to compute the fee payable to CA. X, if return on the fund this year turns out to be

(a) 29%, (b) 4.5%, (c) -1.8%

Solution

a) If return is 29%

	₹
Fixed fee (A) 0.10% of ₹ 20 crore	2,00,000
New Fund Value (1.29 x ₹ 20 crore)	25.80 crore
Excess Value of best achieved (25.8 crore – 21.0 crore)	4.80 crore
Incentive Fee (2% of 4.80 crores) (B)	9,60,000
Total Fee (A) + (B)	11,60,000

b) If return is 4.5%

	₹
Fixed (A) 0.10% of ₹ 20 crore	2,00,000
New Fund Value (1.045 x ₹ 20 crore)	20.90 crore
Excess Value of best achieved (20.90 crore – 21.00 crore)	(₹ 0.10 crore)
Incentive Fee (as does not exceed best achieved) (B)	Nil
Total Fee (A) + (B)	2,00,000

c) If return is (-1.8%)

No incentive only fixed fee of ₹ 2,00,000 will be paid

Question 30(Study Material TYK Q 25)/MTP Oct'21

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund she has constructed and compare the gains and losses from the technique with those from a passive buy and hold strategy. The fund consists of equities only and the ending NAVs of the fund he constructed for the last 10 months are given below:

Month Ending	NAV (₹ / unit)	Month Ending	NAV (₹ / unit)
December 2008	40.00	May 2009	37.00
January 2009	25.00	June 2009	42.00
February 2009	36.00	July 2009	43.00
March 2009	32.00	August 2009	50.00
April 2009	38.00	September 2009	52.00

Assume Sunidhi had invested a notional amount of ₹ 2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%.

You are required to determine the value of the portfolio for each level of NAV following the Constant Ratio Plan.

Solution

Constant Ratio Plan:

Stock Portfolio NAV (₹)	Value of Conservative Portfolio (₹)	Value of aggressive Portfolio (₹)	Total value of Constant Ratio Plan (₹)	Revaluation Action	Total No. of units in aggressive portfolio
40.00	1,00,000	1,00,000	2,00,000	-	2500
25.00	1,00,000	62,500	1,62,500	-	2500
	81,250	81,250	1,62,500	Buy 750 units	3250
36.00	81,250	1,17,000	1,98,250	-	3250
	99,125	99,125	1,98,250	Sell 496.53 units	2753.47
32.00	99,125	88,111.04	1,87,236.04	-	2753.47
38.00	99,125	1,04,631.86	2,03,756.86	-	2753.47
	1,01,878.43	1,01,878.43	2,03,756.86	Sell 72.46 units	2681.01
37.00	1,01,878.50	99,197.37	2,01,075.87	-	2681.01
42.00	1,01,878.50	1,12,602.42	2,14,480.92	-	2681.01
43.00	1,01,878.50	1,15,283.43	2,17,161.93	-	2681.01
50.00	1,01,878.50	1,34,050.50	2,35,929	-	2681.01
	1,17,964.50	1,17,964.50	2,35,929	Sell 321.72 units	2359.29
52.00	1,17,964.50	1,22,683.08	2,40,647.58	-	2359.29

Hence, the ending value of the mechanical strategy is ₹ 2,40,647.58 and buy & hold strategy is ₹ 2,60,000.

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1(PP Nov'20)

M/S. Corpus an AMC, on 1.04.2015 has floated two schemes viz. Dividend Plan and Bonus Plan. Mr. X, an investor has invested in both the schemes. The following details (except the issue price) are available:

Date	Dividend %	Bonus Ratio	Net Asset Value per Unit	
			Dividend Plan	Bonus Plan
1.04.2015			?	?
31.12.2016		1 :4 (One unit on 4 units held)	47	40
31.03.2017	12		48	42
31.03.2018	10		50	39
31.12.2018		1 :5 (One unit on 5 units held)	46	43
31.03.2019	15		45	42
31.03.2020	-	-	49	44

Additional details

Investment (₹)	₹ 9,20,000	₹ 10,00,000
Average Profit (₹)	₹ 27, 748.60	
Average Yield (%)		6.40

You are required to calculate the issue price of both the schemes as on 1.04.2015. (10 Marks)

Solution

(i) Dividend Plan

(a) Average Annual gain over a period of 5 Years	27748.60
(b) Total gain over a period of 5 years (a * 5)	138743
(c) Initial Investment	920000
(d) Total value of investment (b + c)	1058743
(e) NAV as on 31.3.2020	49
(f) Number of units at the end of the period as on 31.03.2019 (d / e)	21607

	1	2	3	4 = (2*3)	5	6 = 1 / (4 + 5) * 4	7
Period	Units held	Rate	Unit value	Dividend	NAV	New Units*	Balance Units Pre Dividend
31.03.2019	21607	0.15	10	1.5	45	697	20910
31.03.2018	20910	0.1	10	1	50	410	20500
31.03.2017	20500	0.12	10	1.2	48	500	20000

Issue Price as on 01 04.2015 Investment 920000/ Units purchased 20000 (c / i) = ₹ 46

* Let the units issued be X

X = (Closing Units / NAV + Dividend) x Dividend

(ii) **Bonus Plan**

(a)	Average Yield	0.064
(b)	Investment	1000000
(c)	Gain over a period of 5 years (a * b * 5)	320000
(d)	Market Value as on 31.03.2019 (b + c)	1320000
(e)	NAV as on 31.03.2020	44
(f)	Total units as on 31.03.2020 (d/e)	30000
(g)	No of units as on 31.03.2018 Pre bonus = 30000 * 5 / (5 + 1)	25000
(h)	No of units as on 31.12.2016 Pre bonus = 25000 * 4 / (4 + 1)	20000
(i)	Issue Price as on 01.04.2015 Investment 1000000 / Units purchased 20000 (b / h)	50

Question 2(PP Nov'20)

The following are the details of three mutual funds of MFL:

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Coefficient of Determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 per cent per annum. You are required to:

(i) Rank the funds as per Sharpe's measure.

(ii) Rank the funds as per Treynor's measure.

(iii) Compare the performance with the market. (8 Marks)

Solution

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Std. Deviation	9.60	7.40	6.40	7.60
Coefficient of Determination	0.3025	0.6561	0.9604	
Coefficient of Correlation	0.55	0.81	0.98	
Beta (β)	$\frac{9.60 \text{ X } 0.55}{7.60}$	$\frac{7.40 \text{ X } 0.81}{7.60}$	$\frac{6.40 \text{ X } 0.98}{7.60}$	
	= 0.695	= 0.789	= 0.825	

(i) Ranking of Funds as per Sharpe Ratio

$$\text{Sharpe Ratio} = \frac{\text{Expected Return} - \text{Risk Free Rate of Return}}{\text{Standard Deviation}}$$

	Growth Fund	Balanced Fund	Regular Fund
Sharpe Ratio	$\frac{7-9}{9.60}$	$\frac{6-9}{7.40}$	$\frac{5-9}{6.40}$
	= - 0.208	= - 0.405	= - 0.625
Ranking	1	2	3

(ii) Ranking of Funds as per Treynor Ratio

Treynor Ratio = $\frac{\text{Expected Return}-\text{Ris Free Rate of Return}}{\text{Beta}}$

	Growth Fund	Balanced Fund	Regular Fund
Sharpe Ratio	$\frac{7-9}{0.695}$	$\frac{6-9}{0.789}$	$\frac{5-9}{0.825}$
	= - 2.878	= - 3.802	= - 4.84
Ranking	1	2	3

(iii) Comparison of performance with the Market

Sharpe Ratio	$\frac{9-9}{7.60}$	0
Treynor Ratio	$\frac{9-9}{1}$	0

Thus, the performance of funds is very poor since all values are negative as compared to market performance.

Question 3(PP May'22)

Mr. D had invested in three mutual funds (MF) as per the following details:

Particulars	MF 'A'	MF 'B'	MF 'C'
Amount of Investment	2,00,000	5,00,000	4,00,000
NAV at the time of purchase	10.00	25.00	20.00
Dividend Yield up to 31.03.2022	3%	5%	4%
NAV as on 31.03.2022	10.50	22.80	20.80
Annualized Yield as on 31.03.2022	9.733%	- 11.185%	15%

Assume 1 Year = 365 Days.

Mr. D has misplaced the documents of his investments. You are required to help Mr. D to find out the following:

(i) Number of units allotted in each scheme,
(ii) Value of his investments as on 31.03.2022,
(iii) Holding period of his investments in number of days as on 31.03.2022
(iv) Dates of original investments
(v) Total Return on investments,

(vi) Assuming past performance of all three schemes will continue for next one year, what action the investor should take? What will be the expected return for the next one year after the above action?

(vii) Will your answer as above point no. (vi) changes if the Mutual fund charges exit load of 5% if the investment is redeemed within one year? If so, advise the investor what and when the action to be taken to optimise the returns. (8 Marks)

Solution

(i) Number of Units in each Scheme

MF '*A*'	₹ 2,00,000 / ₹ 10.00	= 20,000
MF '*B*'	₹ 5,00,000 / ₹ 25.00	= 20,000
MF '*C*'	₹ 4,00,000 / ₹ 20.00	= 20,000

(ii) Value of Investment on 31.03.2022

MF '*A*'	= 20,000 x ₹ 10.50	₹ 2,10,000
MF '*B*'	= 20,000 x ₹ 22.80	₹ 4,56,000
MF '*C*'	= 20,000 x ₹ 20.80	₹ 4,16,000
Total		₹ 10,82,000

(iii) Yield on Each Fund

	Capital Yield	Dividend Yield	Total	Yield (%)
MF '*A*'	₹ 2,10,000 - ₹ 2,00,000	₹ 6,000	₹ 16,000.00	8.00
	= ₹ 10,000			
MF '*B*'	₹ 4,56,000 - ₹ 5,00,000	₹ 25,000	- ₹ 19,000.00	-3.80
	= - ₹ 44,000			
MF '*C*'	₹ 4,16,000 - ₹ 4,00,000	₹ 16,000	₹ 32,000.00	8.00
	= ₹ 16,000			
Total			₹ 29,000.00	

No. of Days Investment Held

	MF '*A*'	MF '*B*'	MF '*C*'
Period of Holding (Days)	8.00 x 365 / 9.733	-3.80 x 365 / -11.185	8.00 x 365 / 15.00
	= 300 Days	= 124 Days	= 195 Days

(iv) Date of Original Investment

	MF '*A*'	MF '*B*'	MF '*C*'
Date of Original Investment	04.06.21	27.11.21	17.09.21

(v) Total Yield = $\frac{29,00,000}{11,00,000} \times 100 = 2.636\ \%$

(vi) If past of all three schemes will continue for next one year, the investor should redeem the units of MFs 'A' and 'B' and invest the proceeds in MF 'C'. The expected return next will be 15%.

(vii) If the Mutual funds are charging exit load of 5%, if investment is redeemed within one year, then investor should get redeemed units of MF 'B' now and units of MF 'A' after 65 days.

Question 4(PP May'22)

A mutual fund made an issue of New Fund Offer (NFO) on 01/01/2021 of 10.00 Lakh Units of ₹ 10 each. No entry load was charged. It made the following investments:

Particulars	(₹)
25,000 Equity Shares of XYZ Ltd., ₹ 100 each @ ₹ 320	80,00,000
5% Government Securities	4,00,000
10% NCDs Unlisted	5,00,000
8% Listed Debentures	10,00,000

During the year, dividends of ₹ 8.00 lakhs were received on equity shares. Interest on all types of debt securities were received. On 31st December 2021 equity shares were appreciated by 15% while listed debentures were quoted at 20% premium.

XYZ Ltd., on 15th December 2021 in its AGM declared the interim dividend of 10% and bonus shares at 1:10 with the record date of 28th December 2021.

(i) Find out the NAV per unit as on 31st December given that the operating expenses paid during the year amounting to ₹ 3,00,000.

(ii) Find out the NAV, if the MF had distributed a dividend of, ₹ 0.50 per unit during the year to the investors.

(iii) If you are the investor, find out what is the annualised return you have got. (8 Marks)

Solution

(i) In order to find out the NAV, the cash balance at the end of the year is calculated as follows:

Particulars	₹
Cash Balance in Beginning (₹ 100 Lakhs - ₹ 99 Lakhs)	1,00,000
Dividend Received	8,00,000
Interest on 5 % Govt Securities	20,000
Interest on 10 % NCDs	50,000
Interest on 8 % Debentures	80,000
Interim Dividend	2,50,000
	13,00,000
Less: Operating Expenses	3,00,000
Net Cash Balance at the end	**10,00,000**
Calculation of NAV	₹

Cash Balance	10,00,000
5% Government Securities(at Par)	4,00,000
27,500 equity shares @ ₹ 368 each	1,01,20,000
10% NCDs Unlisted at Cost	5,00,000
8% Listed Debentures @ 120%	12,00,000
Total Assets	1,32,20,000
Number of Units	10,00,000
NAV Per Unit	₹ 13.22

(ii) Calculation of NAV, if dividend of ₹ 0.50 is paid

Net Assets	1,27,20,000
Number of Units	10,00,000
NAV Per Unit	₹ 12.72

(iii) Annualised Return

$= \frac{13.22 - 10.00}{10.00} \times 100 = 32.20\%$

Or

$= \frac{\{[12.72 - 10.00] + 0.50\}}{10.00} \times 100 = 32.20\%$

Question 5(MTP Oct'22)

M/s. Strong an AMC has floated a dividend bonus plan on 1st April, 2016 at a certain net asset value (NAV). The fund has a robust growth and has declared a bonus of 1:5(1 bonus unit for 5 right units held) on 30th September, 2017 and a second bonus of 1:4(1 bonus unit for 4 right units held) on 30th September 2019. The fund, as on 31st March2021, has generated an average yield of 17.5%.

Mr. Optimistic has made an investment of ₹ 16 lakhs in the plan before the declaration of the first bonus and remain invested thereafter.

The following information is also available

Date	01.04.2016	30.09.2017	30.09.2019	31.03.2021
NAV	?	85	92	100

CALCULATE the opening NAV, which is required by Mr. Optimistic to calculate the capital appreciation. (4 Marks)

Solution

Particulars	
(a) Amount invested by Mr. Optimistic as on 01/04/2016	₹ 16,00,000
(b) Gain during 5 years (16,00,000 x 17.5% x 5 years)	₹ 14,00,000
(c) Value of investment as on 31/03/2021 (a + b)	₹ 30,00,000
(d) NAV as on 31/03/2021	₹ 100 per Unit
(e) Total number of units as on 31/03/2021 (c / d)	30000 Units
Total units before second bonus = 30,000 x 4/5	24000 Units

Total units before first bonus = 24,000 x 5/6	20000 Units
NAV as on 01/04/2016 = 16,00,000/ 20000	₹ 80 per Unit

Question 6(MTP Oct'22)

The Asset Management Company of the mutual fund (MF) has declared a dividend of 9.98% on the units under the dividend reinvestment plan for the year ended 31st March, 2021. The investors are issued additional units for the dividend at the rate of closing Net Asset Value (NAV) for the year as per the conditions of the scheme. The closing NAV was ₹ 24.95 as on 31st March, 2021. An investor Mr. X who is having 20,800 units at the year-end has made an investment in the units before the declaration of the dividend and at the rate of opening NAV plus an entry load of ₹ 0.04. The NAV has appreciated by 25% during the year. Assume the face value of the unit as ₹ 10.00.

CALCULATE:

1) Opening NAV,
2) Number of the units purchased,
3) Original amount of the investment.

Solution

1) Let N be the opening NAV, then
   N (1 + 0.25) = ₹ 24.95
   N = ₹ 19.96 i.e.,
   beginning NAV = ₹ 19.96

2) Let X be the number of units purchased
   Then ending units = 20,800

   Accordingly,

$$20{,}800 = X + \frac{0.998\,X}{24.95}$$

$$20{,}800 = \frac{24.95\,X + 0.998\,X}{24.95}$$

$$X = 20{,}000$$

   Thus, number of units to be purchased = 20,000

3) Original Amount of Investment

Initial NAV	₹ 19.96
Entry Load	₹ 0.04
	₹ 20.00
Number of Funds Purchased	20,000
Amount of Investment	₹ 4,00,000

Chapter 9

INTERNATIONAL FINANCIAL MANAGEMENT

Space for your notings of Formulae or important points

Question 1 (Study Material TYK Q. 1)/RTP Nov'19

ABC Ltd. is considering a project in US, which will involve an initial investment of US $ 1,10,00,000. The project will have 5 years of life. Current spot exchange rate is ₹ 48 per US $. The risk – free rate in US is 8% and the same in India is 12%. Cash inflow from the project is as follows:

Year	Cash inflow
1	US $ 20,00,000
2	US $ 25,00,000
3	US $ 30,00,000
4	US $ 40,00,000
5	US $ 50,00,000

Calculate the NPV of the project using foreign currency approach. Required rate of return on this project is 14%.

Solution

(1 + 0.12) (1 + Risk Premium) = (1 + 0.14)

Or, 1 + Risk Premium = 1.14/1.12 = 1.0179

Therefore, Risk adjusted dollar rate is = 1.0179 x 1.08 = 1.099 – 1 = 0.099

Calculation of NPV

Year	Cash flow (Million) US $	PV Factor at 9.9%	P.V.
1	2.00	0.910	1.820
2	2.50	0.828	2.070
3	3.00	0.753	2.259
4	4.00	0.686	2.744
5	5.00	0.624	3.120
			12.013
Less: Investment			11.000
NPV			**1.013**

Therefore, Rupee NPV of the project is = ₹ (48 x 1.013) Million= ₹ 48.624 Million

Question 2 (Study Material almost same as Illustration 4)/RTP May'21/MTP March'18/MTP April'18/MTP April'21

Odessa Limited has proposed to expand its operations for which it requires fund of $ 15 million, net of issue expenses which amount to 2% of the issue size. It proposed to raise the funds though a GDR issue. It considers the following factors in pricing the issue:

(i) The expected domestic market price of the share is Rs. 300
(ii) 3 shares underly each GDR
(iii) Underlying shares are priced at 10% discount to the market price
(iv) Expected exchange rate is Rs. 60 / $

You are required to compute the number of GDR's to be issued and cost of GDR to Odessa Limited, if 20% dividend is expected to be paid with a growth rate of 20%

Solution

Net Issue Size = $15 million

Gross Issue = $\frac{\$\ 15\ \text{million}}{0.98} = \$\ 15.306\ \text{million}$

Issue Price per GDR in ₹ (300 x 3 x 90%)	₹ 810
Issue Price per GDR in $ (₹ 810 / ₹ 60)	$ 13.50
Dividend Per GDR (D1) ₹ 2* x 3	₹ 6

* Assumed to be based on Face Value of ₹ 10 each share

Net Proceeds Per GDR (₹ 810 x 0.98)	₹ 793.80

a) Number of GDR to be issued

$$\frac{\$\ 15.306\ \text{million}}{\$\ 13.50} = 1.1338\ \text{million}$$

b) Cost of GDR to Odessa Ltd

$$k_e = \frac{6.00}{793.80} + 0.20 = 20.76\%$$

Question 3 (Study Material TYK Q 2)/RTP May'18/RTP Nov'22

A USA based company is planning to set up a software development unit in India. Software developed at the Indian unit will be bought back by the US parent at a transfer price of US $ 10 millions. The unit will remain in existence in India for one year; the software is expected to get developed within this time frame.

The US based company will be subject to corporate tax of 30 per cent and a withholding tax of 10 per cent in India and will not be eligible for tax credit in the US. The software developed will be sold in the US market for US $ 12.0 millions. Other estimates are as follows:

Rent for fully furnished unit with necessary hardware in India	₹ 15,00,000
Man power cost (80 software professional will be working for 10 hours each day)	₹ 400 per man hour
Administrative and other costs	₹ 12,00,000

Advice the US company on the financial viability of the project. The rupee – dollar rate is ₹ 48 / $.

Note: Assume 365 days a year.

Solution

Proforma profit and loss account of the Indian software development unit

	₹	₹
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower (₹ 400 x 80 x 10 x 365)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		**36,05,00,000**
Less: Tax		10,81,50,000
Earnings after tax		**25,23,50,000**

Less: Withholding tax (TDS)		2,52,35,000
Repatriation amount (in rupees)		**22,71,15,000**
Repatriation amount (in dollars)		$ 4.7 million

Advise: The cost of development software in India for the US based company is $ 5.268 million. As the USA based Company is expected to sell the software in the US at $ 12.0 million, it is advised to develop the software in India.

Alternatively, it is assumed that since foreign subsidiary has paid taxes it will not pay withholding taxes then solution will be as under:

	₹	₹
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower (₹ 400 x 80 x 10 x 365)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		**36,05,00,000**
Less: Tax		10,81,50,000
Earnings after tax		**25,23,50,000**
Repatriation amount (in rupees)		25,23,50,000
Repatriation amount (in dollars)		$ 5,257,292

Advise: The cost of development software in India for the US based company is $ 4.743 million. As the USA based Company is expected to sell the software in the US at $ 12.0 million, it is advised to develop the software in India.

Alternatively, if it assumed that first the withholding tax @ 10% is being paid and then its credit is taken in the payment of corporate tax then solution will be as follows:

	₹	₹
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower (₹ 400 x 80 x 10 x 365)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		**36,05,00,000**
Less: Withholding Tax		3,60,50,000
Earnings after Withholding tax @ 10%		**32,44,50,000**
Less: Corporation Tax net of Withholding Tax		7,21,00,000
Repatriation amount (in rupees)		**25,23,50,000**
Repatriation amount (in dollars)		$ 5,257,292

Advise: The cost of development software in India for the US based company is $ 4.743 million. As the USA based Company is expected to sell the software in the US at $ 12.0 million, it is advised to develop the software in India.

Question 4 (Study Material TYK Q 3)/MTP Aug'18

XY Limited is engaged in large retail business in India. It is contemplating for expansion into a country of Africa by acquiring a group of stores having the same line of operation as that of India.

The exchange rate for the currency of the proposed African country is extremely volatile. Rate of inflation is presently 40% a year. Inflation in India is currently 10% a year. Management of XY Limited expects these rates likely to continue for the foreseeable future.

Estimated projected cash flows, in real terms, in India as well as African country for the first three years of the project are as follows:

	Year – 0	Year – 1	Year – 2	Year – 3
Cashflows in Indian ₹ ('000)	- 50,000	- 1,500	- 2,000	- 2,500
Cashflows in African Rands ('000)	- 2,00,000	+ 50,000	+ 70,000	+ 90,000

XY Ltd. assumes the year 3 nominal cash flows will continue to be earned each year indefinitely. It evaluates all investments using nominal cash flows and a nominal discounting rate. The present exchange rate is African Rand 6 to ₹ 1.

You are required to calculate the net present value of the proposed investment considering the following:

(i) African Rand cash flows are converted into rupees and discounted at a risk adjusted rate.
(ii) All cash flows for these projects will be discounted at a rate of 20% to reflect it's high risk.
(iii) Ignore taxation.

	Year – 1	Year – 2	Year – 3
PVIF @ 20%	0.833	0.694	0.579

Solution

Calculation of NPV

Year	0	1	2	3
Inflation factor in India	1.00	1.10	1.21	1.331
Inflation factor in Africa	1.00	1.40	1.96	2.744
Exchange Rate (as per IRP)	6.00	7.6364	9.7190	12.3696
Cash Flows in ₹ '000				
Real	- 50000	- 1500	- 2000	- 2500
Nominal (1)	- 50000	- 1650	- 2420	- 3327.50
Cash Flows in African Rand ₹ '000				
Real	- 200000	50000	70000	90000
Nominal	- 200000	70000	137200	246960
In Indian ₹ '000 (2)	- 33333	9167	14117	19965
Net Cash Flow in ₹ '000 (1) + (2)	- 83333	7517	11697	16637
PVF @ 20%	1	0.833	0.694	0.579
PV	- 83333	6262	8118	9633

NPV of 3 years = - 59320 (₹ '000)

NPV of Terminal Value = $\frac{16637}{0.20} \times 0.579 = 48164\ (₹\ '000)$

Total NPV of the Project = -59320 (₹ 000) + 48164 (₹ '000) = -11156 (₹ 000)

Question 5 (Study Material TYK Q 4)/RTP Nov'18/MTP Oct'18/MTP May'20/PP Nov'19/PP July'21/MTP Oct'22

A multinational company is planning to set up a subsidiary company in India (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The initial project cost (consisting of Plant and Machinery including installation) is estimated to be US $ 500 million. The net working capital requirements are estimated at US $ 50 million. The company follows straight line method of depreciation. Presently, the company is exporting two million units every year at a unit price of US $ 80, its variable cost per unit being US $ 40.

The Chief Financial Officer has estimated the following operating cost and other data in respect of proposed project:

Variable operating cost will be US $ 20 per unit of production;

(i) Additional cash fixed cost will be US $ 30 million p.a. and project's share of allocated fixed cost will be US $ 3 million p.a. based on principle of ability to share;
(ii) Production capacity of the proposed project in India will be 5 million units;
(iii) Expected useful life of the proposed plant is five years with no salvage value;.
(iv) Existing working capital investment for production & sale of two million units through exports was US $ 15 million;
(v) Export of the product in the coming year will decrease to 1.5 million units in case the company does not open subsidiary company in India, in view of the presence of competing MNCs that are in the process of setting up their subsidiaries in India;
(vi) Applicable Corporate Income Tax rate is 35%, and
(vii) Required rate of return for such project is 12%.

Assuming that there will be no variation in the exchange rate of two currencies and all profits will be repatriated, as there will be no withholding tax, estimate Net Present Value (NPV) of the proposed project in India.

Present Value Interest Factors (PVIF) @ 12% for five years are as below:

Year	1	2	3	4	5
PVIF	0.8929	0.7972	0.7118	0.6355	0.5674

Solution

Financial Analysis whether to set up the manufacturing units in India or not may be carried using NPV technique as follows:

(i) Incremental Cash Outflows

	$ Million
Cost of Plant and Machinery	500.00
Working Capital	50.00
Release of existing Working Capital	(15.00)
	535.00

(ii) Incremental Cash Inflow after Tax (CFAT)

a) Generated by investment in India for 5 years

	$ Million
Sales Revenue (5 million x $ 80)	400.00
Less: Costs	
Variable Cost (5 million x $ 20)	100.00
Fixed Cost	30.00
Depreciation ($ 500 million / 5)	100.00
EBIT	170.00
Taxes @ 35%	59.50
EAT	110.50
Add: Depreciation	100.00
CFAT (1 – 5 years)	210.50

b) Cash flow at the end of the 5 years (Release of Working Capital) 35.00

c) Cash generation by exports (Opportunity Cost)

	$ Million
Sales Revenue (1.5 million x $ 80)	120.00
Less: Variable Cost (1.5 million x $ 40)	60.00
Contribution before tax	60.00
Tax @ 35%	21.00
CFAT (1 - 5 years)	**39.00**

d) Additional CFAT attributable to Foreign Investment

	$ Million
Through setting up subsidiary in India	210.50
Through Exports in India	39.00
CFAT (1-5 years)	**171.50**

(iii) Determination of NPV

Year	CFAT ($ Million)	PVF@12%	PV ($ Million)
1 – 5	171.50	3.6048	618.2232
5	35	0.5674	19.8590
			638.0822
Less: Initial Outflow			535.0000
			103.0822

Since NPV is positive the proposal should be accepted.

Question 6 (Study Material TYK Q 5)/RTP May'20/Similar Q asked in PP Dec'21

XYZ Ltd., a company based in India, manufactures very high-quality modem furniture and sells to a small number of retail outlets in India and Nepal. It is facing tough competition. Recent studies on marketability of products have clearly indicated that the customers are now more interested in variety and choice rather than exclusivity and exceptional quality. Since the cost of quality wood in India is very high, the company is reviewing the proposal for import of woods in bulk from Nepalese supplier.

The estimate of net Indian (₹) and Nepalese Currency (NC) cash flows in Nominal terms for this proposal is shown below:

Year	Net Cash Flow (in millions)			
	0	1	2	3
NC	-25.000	2.600	3.800	4.100
Indian (₹)	0	2.869	4.200	4.600

The following information is relevant:

1) XYZ Ltd. evaluates all investments by using a discount rate of 9% p.a. All Nepalese customers are invoiced in NC. NC cash flows are converted to Indian (₹) at the forward rate and discounted at the Indian rate.
2) Inflation rates in Nepal and India are expected to be 9% and 8% p.a. respectively. The current exchange rate is ₹ 1= NC 1.6

Assuming that you are the finance manager of XYZ Ltd., calculate the net present value (NPV) and modified internal rate of return (MIRR) of the proposal.

You may use following values with respect to discount factor for ₹ 1 @ 9%.

	Present Value	Future Value
Year 1	0.917	1.188
Year 2	0.842	1.090
Year 3	0.772	1

Solution

Working Notes:

(i) Computation of Forward Rates

End of Year	NC	NC / ₹
1	$\text{NC } 1.60 \times \left[\frac{(1+0.09)}{(1+0.08)}\right]$	1.615
2	$\text{NC } 1.615 \times \left[\frac{(1+0.09)}{(1+0.08)}\right]$	1.630
3	$\text{NC } 1.630 \times \left[\frac{(1+0.09)}{(1+0.08)}\right]$	1.645

(ii) NC Cash Flows converted in Indian Rupees

Year	NC (Million)	Conversion Rate	₹ (Million)
0	-25.00	1.600	-15.625
1	2.60	1.615	1.61
2	3.80	1.630	2.33
3	4.10	1.645	2.49

Net Present Value (₹ Million)

Year	Cash Flow in India	Cash Flow in Nepal	Total	PVF @ 9%	PV
0	---	-15.625	-15.625	1.000	-15.625
1	2.869	1.61	4.479	0.917	4.107

2	4.200	2.33	6.53	0.842	5.498
3	4.600	2.49	7.09	0.772	5.473
					-0.547

Modified Internal Rate of Return

	Year			
	0	1	2	3
Cash Flow (₹ Million)	-15.625	4.479	6.53	7.09
Year 1 Cash Inflow reinvested for 2 years (1.188 x 4.479)				5.32
Year 2 Cash Inflow reinvested for 1 years (1.090 x 6.53)				7.12
				19.53

$$MIRR = \sqrt[n]{\frac{\text{Terminal cash Flow}}{\text{Intial outlay}}} - 1 = \sqrt[3]{\frac{19.53}{15.625}} - 1 = 0.0772 \text{ say } 7.72\%$$

Question 7 (Study Material Illustration 1)/MTP Nov'21

Perfect Inc., a U.S. based Pharmaceutical Company has received an offer from Aidscure Ltd., a company engaged in manufacturing of drugs to cure Dengue, to set up a manufacturing unit in Baddi (H.P.), India in a joint venture.

As per the Joint Venture agreement, Perfect Inc. will receive 55% share of revenues plus a royalty @ US $ 0.01 per bottle. The initial investment will be ₹ 200 crores for machinery and factory. The scrap value of machinery and factory is estimated at the end of five (5) year to be ₹ 5 crores. The machinery is depreciable @ 20% on the value net of salvage value using Straight Line Method. An initial working capital to the tune of ₹ 50 crores shall be required and thereafter ₹ 5 crores each year.

As per GOI directions, it is estimated that the price per bottle will be ₹ 7.50 and production will be 24 crores bottles per year. The price in addition to inflation of respective years shall be increased by ₹ 1 each year. The production cost shall be 40% of the revenues.

The applicable tax rate in India is 30% and 35% in US and there is Double Taxation Avoidance Agreement between India and US. According to the agreement tax credit shall be given in US for the tax paid in India. In both the countries, taxes shall be paid in the following year in which profit have arisen / remittance received.

The Spot rate of $ is ₹ 57. The inflation in India is 6% (expected to decrease by 0.50% every year) and 5% in US.

As per the policy of GOI, only 50% of the share can be remitted in the year in which they are realised and remaining in the following year.

Though WACC of Perfect Inc. is 13% but due to risky nature of the project it expects a return of 15%.

Determine whether Perfect Inc. should invest in the project or not (from subsidiary point of view).

Solution

Working Notes:

1) Estimated Exchange Rates (Using PPP Theory)

Year	0	1	2	3	4	5	6
Exchange rate *	57	57.54	57.82	57.82	57.54	56.99	56.18

2) Share in sales

Year	1	2	3	4	5
Annual Units in crores	24	24	24	24	24
Price per bottle (₹)	7.50	8.50	9.50	10.50	11.50
Price fluctuating Inflation Rate	6.00%	5.50%	5.00%	4.50%	4.00%
Inflated Price (₹)	7.95	8.97	9.98	10.97	11.96
Inflated Sales Revenue (₹ Crore)	190.80	215.28	239.52	263.28	287.04
Sales share @ 55%	104.94	118.40	131.74	144.80	157.87

3) Royalty Payment

Year	1	2	3	4	5
Annual Units in crores	24	24	24	24	24
Royalty in $	0.01	0.01	0.01	0.01	0.01
Total Royalty ($ Crore)	0.24	0.24	0.24	0.24	0.24
Exchange Rate	57.54	57.82	57.82	57.54	56.99
Total Royalty (₹ Crore)	13.81	13.88	13.88	13.81	13.68

4) Tax Liability (₹ Crore)

Year	1	2	3	4	5
Sales Share	104.94	118.40	131.74	144.80	157.87
Total Royalty	13.81	13.88	13.88	13.81	13.68
Total Income	118.75	132.28	145.61	158.61	171.55
Less: Expenses					
Production Cost (Sales share x 40%)	41.98	47.36	52.69	57.92	63.15
Depreciation (195 x 20%)	39.00	39.00	39.00	39.00	39.00
PBT	37.77	45.92	53.92	61.69	69.40
Tax on Profit @30%	11.33	13.78	16.18	18.51	20.82
Net Profit	26.44	32.14	37.74	43.18	48.58

5) Free Cash Flow (₹ Crore)

Year	0	1	2	3	4	5	6
Sales Share	0.00	104.94	118.40	131.74	144.80	157.87	0.00
Total Royalty	0.00	13.81	13.88	13.88	13.81	13.68	0.00

Production Cost	0.00	- 41.98	- 47.36	- 52.69	- 57.92	- 63.15	0.00
Initial Outlay	- 200.00	0.00	0.00	0.00	0.00	0.00	0.00
Working Capital	- 50.00	- 5.00	- 5.00	- 5.00	- 5.00	70.00	0.00
Scrap Value	0.00	0.00	0.00	0.00	0.00	5.00	0.00
Tax on Profit	0.00	0.00	- 11.33	- 13.78	- 16.18	- 18.51	- 20.82
Free Cash Flow	- 250.00	71.77	68.59	74.15	79.51	164.89	- 20.82

6) Remittance of Cash Flows (₹ Crore)

Year	0	1	2	3	4	5	6
Free Cash Flow	- 250.00	71.77	68.59	74.15	79.51	164.89	-20.82
50% of Current Year Cash Flow	0.00	35.89	34.29	37.07	39.76	82.45	0.00
Previous Year remaining cash flow	0.00	0.00	35.88	34.30	37.08	39.75	82.44
Total Remittance	- 250.00	35.88	70.17	71.37	76.84	122.20	61.62

NPV of Project under Appraisal

Year	0	1	2	3	4	5	6
Total Remittance (₹ Crore)	- 250.00	35.88	70.17	71.37	76.84	122.20	61.62
Exchange Rate	57.00	57.54	57.82	57.82	57.54	56.99	56.18
Remittance ($ mn)	- 43.86	6.24	12.14	12.34	13.35	21.44	10.97
US Tax @ 35% ($ mn)	0.00	0.00	2.18	4.25	4.32	4.67	7.50
Indian Tax ($ mn)	0.00	0.00	1.96	2.38	2.82	3.25	3.71
Net Tax ($ mn)	0.00	0.00	0.22	1.87	1.51	1.42	3.79
Net Cash Flow ($ mn)	**- 43.86**	**6.24**	**11.92**	**10.47**	**11.84**	**20.02**	**7.18**
PVF @ 15%	1.000	0.870	0.756	0.658	0.572	0.497	0.432
Present Value ($ mn)	- 43.86	5.43	9.01	6.89	6.77	9.95	3.10
Net Present Value ($ mn)							= - 4.15

Decision: Since NPV of the project is negative, Perfect inc. should not invest in the project.

* Estimated exchange rates have been calculated by using the following formula:

Expected spot rate = Current Spot Rate x expected difference in inflation rates

$$E(S1) = S_0 \times \frac{(1+l_d)}{(1+l_f)}$$

Where,

E(S1) is the expected Spot rate in time period 1

S0 is the current spot rate (Direct Quote)

ld is the inflation in the domestic country (home country)

lf is the inflation in the foreign country

Question 8 (Study Material Illustration 2)

Its Entertainment Ltd., an Indian Amusement Company is happy with the success of its Water Park in India. The company wants to repeat its success in Nepal also where it is planning to establish a Grand Water Park with world class amenities. The company is also encouraged by a marketing research report on which it has just spend ₹ 20,00,000 lacs.

The estimated cost of construction would be Nepali Rupee (NPR) 450 crores and it would be completed in one years' time. Half of the construction cost will be paid in the beginning and rest at the end of year. In addition, working capital requirement would be NPR 65 crores from the year end one. The after tax realizable value of fixed assets after four years of operation is expected to be NPR 250 crores. Under the Foreign Capital Encouragement Policy of Nepal, company is allowed to claim 20% depreciation allowance per year on reducing balance basis subject to maximum capital limit of NPR 200 crore. The company can raise loan for theme park in Nepal @ 9%.

The water park will have a maximum capacity of 20,000 visitors per day. On an average, it is expected to achieve 70% capacity for first operational four years. The entry ticket is expected to be NPR 220 per person. In addition to entry tickets revenue, the company could earn revenue from sale of food and beverages and fancy gift items. The average sales expected to be NPR 150 per visitor for food and beverages and NPR 50 per visitor for fancy gift items. The sales margin on food and beverages and fancy gift items is 20% and 50% respectively. The park would open for 360 days a year.

The annual staffing cost would be NPR 65 crores per annum. The annual insurance cost would be NPR 5 crores. The other running and maintenance costs are expected to be NPR 25 crores in the first year of operation which is expected to increase NPR 4 crores every year. The company would apportion existing overheads to the tune of NPR 5 crores to the park.

All costs and receipts (excluding construction costs, assets realizable value and other running and maintenance costs) mentioned above are at current prices (i.e. 0 point of time) which are expected to increase by 5% per year.

The current spot rate is NPR 1.60 per rupee. The tax rate in India is 30% and in Nepal it is 20%.

The average market return is 11% and interest rate on treasury bond is 8%. The company's current equity beta is 0.45. The company's funding ratio for the Water Park would be 55% equity and 45% debt.

Being a tourist Place, the amusement industry in Nepal is competitive and very different from its Indian counterpart. The company has gathered the relevant information about its nearest competitor in Nepal. The competitor's market value of the equity is NPR 1850 crores and the debt

is NPR 510 crores and the equity beta is 1.35.

State whether Its Entertainment Ltd. should undertake Water Park project in Nepal or not.

Solution

Working Notes:

1) Calculation of Cost of Funds/ Discount Rate

Competing Company's Information	
Equity Market Value	1850.00
Debt Market Value	510.00
Equity Beta	1.35

Assuming debt to be risk free i.e. beta is zero, the beta of competitor is un-geared as follows:

Asset Beta = $\text{Equity Beta} \times \frac{E}{E+D(1-t)} = 1.35 \times \frac{1850}{1850+ 510\ (1-0.20)} = 1.106$

Equity beta for Its Entertainment Ltd. in Nepal

Assets beta in Nepal	1.106
Ratio of funding in Nepal	
Equity	55.00%
Debt	45.00%

(i) $1.106 = \text{Equity Beta} \times \frac{55}{55+45\ (1-0.20)}$

Equity Beta = 1.83

Cost of Equity as per CAPM

Market Return 11.00%

Risk free return 8.00%

Cost of Equity = Risk free return + β (Market Return - Risk free return)

= 8.00% + 1.83(11.00% - 8.00%) = 13.49%

WACC = 13.49% x 0.55 + 9%(1- 0.20) x 0.45 = 10.66%

(ii) Present Value Factors at the discount rate of 10.66%

Year	0	1	2	3	4	5
PVAF	1.000	0.904	0.817	0.738	0.667	0.603

(iii) Calculation of Capital Allowances

Year	1	2	3	4
Opening Balance (NPR Crore)	200.00	160.00	128.00	102.40
Less: Depreciation (NPR Crore)	40.00	32.00	25.60	20.48
Closing Balance (NPR Crore)	**160.00**	**128.00**	**102.40**	**81.92**

Calculation of Present of Free Cash Flow

Year	0	1	2	3	4	5
Expected Annual visitors			5040000	5040000	5040000	5040000
Entry ticket price per visitor (NPR)			242.55	254.68	267.41	280.78
Profit from sale of Food and Beverages per visitor (NPR)			33.08	34.73	36.47	38.29
Profit from sale of Fancy Gift Items per visitor (NPR)			27.56	28.94	30.39	31.91
Revenue per visitor (NPR)			303.19	318.35	334.27	350.98
Total Revenue (NPR crores)			**152.81**	**160.45**	**168.47**	**176.89**
Less:						
Annual Staffing Cost (NPR crores)			71.66	75.25	79.01	82.96
Annual Insurance Costs (NPR crores)			5.51	5.79	6.08	6.38
Other running and maintenance costs (NPR crores)			25.00	29.00	33.00	37.00
Depreciation Allowances (NPR crores)			40.00	32.00	25.60	20.48
Total Expenses (NPR crores)			142.17	142.04	143.69	146.82
PBT (NPR crores)			**10.64**	**18.41**	**24.78**	**30.07**
Tax on Profit (NPR crores)			2.13	3.68	4.96	6.01
Net Profit (NPR crores)			8.51	14.73	19.82	24.06
Add: Depreciation Allowances (NPR crores)			40	32	25.6	20.48
Part Construction Cost (NPR crores)						
After tax assets realisation value (NPR crores)	-225	-225				250
Working capital (NPR crores)		-65	- 3.25	- 3.41	- 3.58	75.25
Net cash Flow (NPR crores)	-225	-290	45.26	43.32	41.84	369.79
PVF at discount rate	1.00	0.904	0.817	0.738	0.667	0.603
Present Values (NPR crores)	- 225.00	- 262.16	36.98	31.97	27.91	222.98
Net Present Value (NPR crores)						-167.32

Decision: Since NPV of the project is negative the Entertainment Ltd. should not undertake Water Park project in Nepal.

Question 9 (Study Material Illustration 3)

Opus Technologies Ltd., an Indian IT company is planning to make an investment through a wholly owned subsidiary in a software project in China with a shelf life of two years. The inflation in China is estimated as 8 percent. Operating cash flows are received at the year end.

For the project an initial investment of Chinese Yuan (CN ¥) 30,00,000 will be in land. The land will be sold after the completion of project at estimated value of CN ¥ 35,00,000. The project also requires an office complex at cost of CN ¥ 15,00,000 payable at the beginning of project. The complex will be depreciated on straight-line basis over two years to a zero – salvage value. This complex is expected to fetch CN ¥ 5,00,000 at the end of project.

The company is planning to raise the required funds through GDR issue in Mauritius. Each GDR will have 5 common equity shares of the company as underlying security which are currently trading at ₹ 200 per share (Face Value = ₹ 10) in the domestic market. The company has currently paid the dividend of 25% which is expected to grow at 10% p.a. The total issue cost is estimated to be 1 percent of issue size.

The annual sales is expected to be 10,000 units at the rate of CN ¥ 500 per unit. The price of unit is expected to rise at the rate of inflation. Variable operating costs are 40 percent of sales. Fixed operating costs will be CN ¥ 22,00,000 per year and expected to rise at the rate of inflation.

The tax rate applicable in China for income and capital gain is 25 percent and as per GOI Policy no further tax shall be payable in India. The current spot rate of CN ¥ 1 is ₹ 9.50. The nominal interest rate in India and China is 12% and 10% respectively and the international parity conditions hold

You are required to

a) Identify expected future cash flows in China and determine NPV of the project in CN ¥.
b) Determine whether Opus Technologies should go for the project or not assuming that there neither there is restriction on the transfer of funds from China to India nor any charges / taxes payable on the transfer of funds.

Solution

Working Notes:

1) Calculation of Cost of Capital (GDR)

Current Dividend (D0)	2.50
Expected Dividend (D1)	2.75
Net Proceeds (₹ 200 per share – 1%)	198.00
Growth Rate	10.00%

$$k_e = \frac{2.75}{198} + 0.10 = 0.1139 \text{ i.e. } 11.39\%$$

2) Calculation of Expected Exchange Rate as per Interest Rate Parity

Year	Expected Rate
1	$= 9.50 \times \frac{(1+0.12)}{(1+0.10)} = 9.67$
2	$= 9.50 \times \frac{(1+0.12)^2}{(1+0.10)^2} = 9.85$

3) Realization on the disposal of Land net of Tax

	CN ¥
Sale value at the end of project	3500000.00
Cost of Land	(3000000.00)
Capital Gain	**500000.00**
Tax paid	(125000.00)
Amount realized net of tax	**3375000.00**

4) Realization on the disposal of Office Complex

	(CN ¥)
Sale value at the end of project	500000.00
WDV	0.00
Capital Gain	**500000.00**
Tax paid	(125000.00)
Amount realized net of tax (A)	**375000.00**

5) Computation of Annual Cash Inflows

Year	1	2
Annual Units	10000	10000
Price per bottle (CN ¥)	540.00	583.20
Annual Revenue (CN ¥)	5400000.00	5832000.00
Less: Expenses		
Variable operating cost (CN ¥)	2160000.00	2332800.00
Depreciation (CN ¥)	750000.00	750000.00
Fixed Cost per annum (CN ¥)	2376000.00	2566080.00
PBT (CN ¥)	114000.00	183120.00
Tax on Profit (CN ¥)	28500.00	45780.00
Net Profit (CN ¥)	85500.00	137340.00
Add: Depreciation (CN ¥)	750000.00	750000.00
Cash Flow	835500.00	887340.00

a) Computation of NPV of the project in CN ¥ (CN ¥)

Year	0	1	2
Initial Investment	- 4500000.00		
Annual Cash Inflows		835500.00	887340.00
Realization on the disposal of Land net of Tax			3375000.00
Realization on the disposal of Office Complex			375000.00
Total	- 4500000.00	835500.00	4637340.00
PVF @11.39%	1.000	0.898	0.806
PV of Cash Flows	- 4500000.00	750279.00	3737696.00
NPV			**-12,025**

b) Evaluation of Project from Opus Point of View

(i) Assuming that inflow funds are transferred in the year in which same are generated i.e. first year and second year.

Year	0	1	2
Cash Flows (CN ¥)	-4500000.00	835500.00	4637340.00
Exchange Rate (₹ / CN ¥)	9.50	9.67	9.85
Cash Flows (₹)	-42750000.00	8079285.00	45677799.00
PVF @ 12%	1.00	0.893	0.797
	-42750000.00	7214802.00	36405206.00
NPV			**870008.00**

(ii) Assuming that inflow funds are transferred at the end of the project i.e. second year.

Year	0	2
Cash Flows (CN ¥)	- 4500000.00	5472840.00
Exchange Rate (₹ / CN ¥)	9.50	9.85
Cash Flows (₹)	- 42750000.00	53907474.00
PVF	1.00	0.797
	- 42750000.00	42964257.00
NPV		**214257.00**

Though in terms of CN ¥ the NPV of the project is negative but in ₹ it has positive NPV due to weakening of ₹ in comparison of CN ¥. Thus, Opus can accept the project.

Question 10 (Study Material Illustration 4)/PP May'18/Similar Q asked in PP May'22

X Ltd. is interested in expanding its operation and planning to install manufacturing plant at US. For the proposed project it requires a fund of $ 10 million (net of issue expenses / floatation cost). The estimated floatation cost is 2%. To finance this project it proposes to issue GDRs

You as financial consultant is required to compute the number of GDRs to be issued and cost of the GDR with the help of following additional information.

(i) Expected market price of share at the time of issue of GDR is ₹ 250 (Face Value ₹ 100)
(ii) 2 Shares shall underly each GDR and shall be priced at 10% discount to market price.
(iii) Expected exchange rate ₹ 60 / $.
(iv) Dividend expected to be paid is 20% with growth rate 12%.

Solution

Net Issue Size = $ 10 million

Gross Issue = $\frac{\$\ 10\ \text{million}}{0.98} = \$\ 10.204\ \text{million}$

Issue Price per GDR in ₹ (250 x 2 x 90%)	₹ 450
Issue Price per GDR in $ (₹ 450 / ₹ 60)	$ 7.50
Dividend Per GDR (D1) (₹ 20 x 2)	₹ 40
Net Proceeds Per GDR (₹ 450 x 0.98)	₹ 441.00

Number of GDR to be issued $\frac{\$\ 10\ \text{million}}{\$\ 7.50} = 1.3605\ \text{million}$

Cost of GDR to X Ltd. $k_e = \frac{40.00}{441.00} + 0.12 = 21.07\%$

RTP, MTP & PREVIOUS YEAR QUESTIONS

Question 1 (RTP May'19)

The directors of Implant Inc. wishes to make an equity issue to finance a $ 10 m (million) expansion scheme which has an excepted Net Present Value of $ 2.2 m and to re – finance an existing $ 6 m 15% Bonds due for maturity in 5 years' time. For early redemption of these bonds there is a $ 3,50,000 penalty charges. The Co. has also obtained approval to suspend these pre – emptive rights and make a $ 15 m placement of shares which will be at a price of $ 0.5 per share. The floatation cost of issue will be 4% of Gross proceeds. Any surplus funds from issue will be invested in IDRs which is currently yielding 10% per year.

The Present capital structure of Co. is as under:

	'000
Ordinary Share ($1 per share)	7,000
Share Premium	10,500
Free Reserves	25,500
	43,000
15% Term Bonds	6,000
11% Debenture (2012-2020)	8,000
	57,000

Current share price is $ 2 per share and debenture price is $ 103 per debenture. Cost of capital of Co. is 10%. It may be further presumed that stock market is semi-strong form efficient and no information about the proposed use of funds from the issue has been made available to the public. You are required to calculate expected share price of company once full details of the placement and to which the finance is to be put, are announced.

Solution

In semi – strong form of stock market, the share price should accurately reflect new relevant information when it is made publicly available including Implant Inc. expansion scheme and redemption of the term loan.

The existing Market Value $ 2 x 7,000,000		$ 14,000,000
The new investment has an expected NPV		$ 2,200,000
Proceeds of New Issue		$ 15,000,000
Issue Cost of		($ 600,000)
PV of Benefit of early redemption		
Interest of $ 900,000 ($,6,000,000 x 15 %) x 3.791	3,411,900	
PV of Repayment in 5 years $ 6,000,000 x 0.621	3,726,000	
	7,137,900	
Redemption Cost Now	(6,000,000)	
Penalty charges	**(350,000)**	**787,900**
Expected Total Market value		31,387,900
New No. of shares (30 Million + 7 Million)		37,00,000
Expected Share Price of Company		$ 0.848

Question 2 (MTP May'20/MTP March '21)

The Treasury desk of a global bank incorporated in UK wants to invest GBP 200 million on 1st January, 2019 for a period of 6 months and has the following options:

The Equity Trading desk in Japan wants to invest the entire GBP 200 million in high dividend yielding Japanese securities that would earn a dividend income of JPY 1,182 million. The dividends are declared and paid on 29th June. Post dividend, the securities are expected to quote at a 2% discount. The desk also plans to earn JPY 10 million on a stock borrow lending activity because of this investment. The securities are to be sold on June 29 with a T+1 settlement and the amount remitted back to the Treasury in London.

The Fixed Income desk of US proposed to invest the amount in 6 month G-Secs that provides a return of 5% p.a.

The exchange rates are as follows:

Currency Pair	1 Jan 2019 (Spot)	30 Jun 2019 (Forward)
GBP - JPY	148.0002	150.0000
GBP- USD	1.28000	1.30331

As a treasurer, advise the bank on the best investment option. What would be your decision from a risk perspective? You may ignore taxation. (8 Marks)

Solution

Yield from Investment in Equity Trading Index in Japan

Conversion of GBP 200 million in JPY (148.0002)	JPY 29600.04 Million
Dividend Income	JPY 1182.00 Million
Stock Lending	JPY 10.00 Million
Investment Value at End	JPY 29008.0392 Million
Amount available at End	JPY 30200.0392 Million
Forward Rate of 30.06.2019	JPY 150 / GBP
Amount to be Remitted back to London	GBP 201.3336 Million
Gain = 201.3336 – 200	GBP 1.3336 Million

Fixed Income Desk of US

Conversion of GBP 200 million in USD (1.28000)	USD 256.00 Million
Add: Interest @ 5% p.a. for 6 months	USD 6.40 Million
Amount available at End	USD 262.40 Million
Forward Rate of 30.06.2019	USD 1.30331 / GBP
Amount to be Remitted back to London	GBP 201.3335 Million
Gain = 201.3335 – 200	GBP 1.3335 Million

Decision: Investment in Japanese Yen is preferred over the investment in USD G- Sec as there is a marginal gain. From a risk perspective, the company should go for Option-2 Investment in G-Secs as they are risk free

or

The equivalent amount at the end of 6 months shall be almost same in both the options. The bank can go for any of the options.

However, from risk perspective, the investment in fixed income desk of US is more beneficial as the chance of variation in fixed income securities is less as compared to Equity Desk.

Question 3 (PP Nov'20, MTP May'23)

The Management of a multinational company TL Ltd. is engaged in construction of Infrastructure Project. A proposal to construct a Toll Road in Nepal is under consideration of the Management.

The following information is available:

The initial investment will be in purchase of equipment costing USD 250 lakhs. The economic life of the equipment is 10 years. The depreciation on the equipment will be charged on straight line method.

EBIDTA to be collected from the Toll Road is projected to be USD 33 lakhs per annum for a period of 20 years.

To encourage investment Nepalese government is offering a 15 year term loan of USD 150 lakhs at an interest rate of 6 per cent per annum. The interest is to be paid annually. The loan will be repaid at the end of 15 year in one tranche.

The required rate of return for the project under all equity financing is 12 per cent per annum.

Post tax cost of debt is 5.6 per cent per annum. Corporate Tax Rate is 30 per cent.

All cash Flows will be in USD. Ignore inflation.

You are required to advise the management on the viability of the proposal by using Adjusted Net Present Value method.

Given

PVIFA (12%, 10) = 5.650, PVIFA (12%, 20) = 7.469, PVIFA (8%,15) = 8.559, PVIF (8%, 15) = 0.315.

(8 Marks)

Solution

Net Present Value (All Equity Financed) – Base NPV

Particulars	Period	USD Lakhs	PVF @ 12%	PV (USD Lakhs)
Initial Investment	0	(250.00)	1.000	(250.000)
EBIDTA	1 to 20	33.00	7.469	246.477
Tax	1 to 20	(9.90)	7.469	(73.943)
Depreciation	1 to 10	(25.00)		
Tax Saving on Dep	1 to 10	7.50	5.650	42.375
NPV				(35.091)

Present Value of Impact of Financing by Debt

Particulars	Period	USD Lakhs	PVF @ 8%	PV (USD Lakhs)
Loan	0	150.00	1.000	150.000
Interest	1 to 15	(9.00)	8.559	(77.031)
Tax Saving on Interest	1 to 15	2.70	8.559	23.109
Repayment of Principal	15	(150.00)	0.315	(47.250)
NPV				48.828

Adjusted Present Value of the Project

= Base NPV + PV of Impact of Financing

= - US$ 35.091 + US $ 48.828 lakh

= US$ 13.737 lakh

Advise: Since APV is positive, TL Ltd. should accept the project.

Alternatively, if instead of PV of overall impact of Financing the PV of impact of tax shield on Interest is considered then APV shall be computed as follows:

= Base NPV + PV of Tax Shield on Interest

= - US $ 35.091 + US $ 23.109 lakh

= - US $ 11.982 lakh

Advise: Since APV is negative, TL Ltd. should not accept the project.

Question 4 (PP Nov'20)

ICL an Indian MNC is executing a plant in Sri Lanka. It has raised ₹ 400 billion. Half of the amount will be required after six months' time. ICL is looking an opportunity to invest this amount on 1st April,2020 for a period of six months. It is considering two underlying proposals:

Market	Japan	US
Nature of Investment	Index Fund (JPY)	Treasury Bills (USD)
Dividend (in billions)	25	-
Income from stock lending (in billions)	11.9276	-
Discount on initial investment at the end	2%	-
Interest	-	5 per cent per annum
Exchange Rate (1st April, 2020)	JPY/INR 1.58	USD/INR 0.014
Exchange Rate (30th September, 2020)	JPY/INR 1.57	USD/INR 0.013

You, as an Investment Manager, is required to suggest the best course of option. (8 Marks)

Solution

Investment in JPY (in billions)

Particulars	Currency INR	ER	Currency JPY
Available amount	200	1.58	316
Dividend Income			25
Stock Lending Income			11.9276
Investment value at the end after discount @ 2%			309.68
Amount available at the end			**346.6076**
Conversion as on 30-09-2020		1.57	₹ 220.7692
Gain			₹ 20.7692

Investment in USD (in billions)

Particulars	Currency INR	ER	Currency USD
Available amount	200	0.014	2.80
Interest for 6 months @ 5% p.a.			0.07
Amount available at the end			**2.87**
Conversion as on 30-09-2020		0.013	₹ 220.7692
Gain			₹ 20.7692

The equivalent amount is same in both the options so ICL is indifferent.

However, USD is more stable, and Treasury Bills are risk free, so investment in Treasury Bills (USD) is suggested.

Question 5 (PP Jan'21, MTP May'23) (8 Marks)

A proposed foreign investment involves creation of a plant with an annual output of 1 million units. The entire production will be exported at a selling price of USD 10 per unit. At the current rate of exchange dollar cost of local production equals to USD 6 per unit. Dollar is expected to decline by 10% or 15%. The change in local cost of production and probability from the expected current level will be as follows:

Decline in value of USD (%)	Reduction in local cost of production (USD/unit)	Probability
0	-	0.4
10	0.30	0.4
15	0.15 Additional reduction	0.2

The plant at the current rate of exchange will have a depreciation of USD 1 million annually. Assume local Tax rate as 30%.

You are required to find out:

(i) Annual Cash Flow After Tax (CFAT) under all the different scenarios of exchange rate.

(ii) Expected value of CFAT assuming no repatriation of profits.

(iii) Viability of the investment proposal assuming an initial investment of USD 25 million on plant and working capital with a required rate of return of 11% on investment and on the basis of CFAT arrived under option (ii). The CFAT will grow @ 3% per annum in perpetuity.

Solution

(i) Calculation of Annual CFAT

	Scenario 1	Scenario 2	Scenario 3
Annual Sales (in units) (A)	10,00,000	10,00,000	10,00,000
	US $	US $	US $
Selling price p.u.	10.00	10.00	10.00
Cost p.u.	6.00	5.70	5.55
Profit p.u. (B)	4.00	4.30	4.45
Total Profit (A x B)	40,00,000	43,00,000	44,50,000
Less: Depreciation	10,00,000	9,00,000	8,50,000
PBT	30,00,000	34,00,000	36,00,000

Less: Tax @ 30%	9,00,000	10,20,000	10,80,000
PAT	21,00,000	23,80,000	25,20,000
Add: Depreciation	10,00,000	9,00,000	8,50,000
Expected CFAT (US $)	31,00,000	32,80,000	33,70,000

(ii) Expected Value of CFAT

= US $ 31,00,000 x 0.4 + US $ 32,80,000 x 0.4 + US $ 33,70,000 x 0.2

= US $ 32,26,000

(iii) Viability of proposal:

Expected CFAT = US $ 32,26,000

Expected Growth Rate = 3%

Expected Value of inflow in perpetuity $= \frac{\text{US \$ 32,26,000 (1.03)}}{0.11-0.03} = \frac{33,22,780}{0.08}$

= US $ 4,15,34,750

	US $
Value of Inflows	4,15,34,750
Less: Initial Outlay	2,50,00,000
NPV of project	**1,65,34,750**

Since NPV is positive, project is viable.

Question 6 (PP Jan'21) (8 Marks)

X Ltd., an Indian company, is considering a proposal to make an investment of USD 1,65,00,000 in Latin America. The project will have a life of 5 years. The current spot exchange rate is INR / USD 72. All investments and revenues will occur in USD. The USD and INR risk free rates are 8% and 12% respectively. The following cash flow is expected form the project.

Year	Cash inflow (USD)
1	30,00,000
2	37,50,000
3	45,00,000
4	60,00,000
5	75,00,000

Assume required rate of return on the project as 14%.

You are required to calculate:

(i) The viability of the project using foreign currency approach.

(ii) What will be the impact if there is a withholding tax of 10% applicable on the project.

Solution

(i) Viability of the Project

(1 + 0.12) (1 + Risk Premium) = (1 + 0.14)

Or, 1 + Risk Premium = 1.14 / 1.12 = 1.0179
Therefore, Risk adjusted dollar rate is = 1.0179 x 1.08 = 1.099 – 1 = 0.099

Calculation of NPV

Year	Cash flow (Million) US$	PV Factor at 9.9%	P.V.
1	3.00	0.910	2.730
2	3.75	0.828	3.105
3	4.50	0.753	3.389
4	6.00	0.686	4.116
5	7.50	0.624	4.680
			18.02
Less: Investment			16.50
NPV			**1.52**

Therefore, Rupee NPV of the project is = ₹ 72 x US $ 1.52 Million
= ₹ 109.44 Million

Project is viable as the NPV is positive.

(ii) If there is a withholding tax of 10%

Total PV of Cash Inflows	US$ 18.02 Million
Less: Withholding Tax @ 10%	US$ 1.802 Million
PV of Cash Inflow after Withholding Tax	**US$ 16.218 Million**
Less: Initial Investment	US$ 16.50 Million
NPV	**(US$ 0.282 Million)**

Therefore, Rupee NPV of the project is = ₹ 72 x (US $ 0.282 Million)
= - ₹ 20.304 Million
Thus, if there is a withholding tax of 10% then the project will not be viable.

Question 7 (PP Dec'21)
A US company wants to set up a manufacturing plant in India which requires an initial outlay of ₹ 8 Million. It is expected to have a useful life of 5 years with a salvage of ₹ 2 Million. The company follows straight line method of depreciation. To support additional level of activity, investment would require one time additional working capital of ₹ 1 Million.

Since the cost of production lower in India, the variable cost of production would be ₹ 30 per unit. Additional fixed cost per annum is estimated at ₹ 0.5 Million. The company is projecting its annual sales to 80000 units at the price of ₹ 100 per unit. Applicable tax rate to the company is 34% and its cost of capital is 8%.

Inflation rates in US and India are expected to be 8% and 9% respectively. The current exchange rate is ₹ 72 per US Dollar.
Assuming that all profit will be repatriated every year and there will be no withholding taxes, estimate the net present value of the proposed project in India and evaluate its feasibility.

PVF @ 8% for the five years are as under:

Rate	1 Year	2 Year	3 Year	4 Year	5 Year
8%	0.926	0.857	0.794	0.735	0.681

(8 Marks)

Solution

Working Notes:

(i) Initial Investment in US $

Particulars	Amount
Initial Outlay	₹ 80,00,000
Additional Working Capital	₹ 10,00,000
Total	**₹ 90,00,000**
Exchange Rate	₹ 72 / US $
Initial Investment in US $	US $ 1,25,000

(ii) Expected Exchange Rates

Year		₹ / USD
1	$₹ 72.00 \times \frac{(1+0.09)}{(1+0.08)}$	72.67
2	$₹ 72.67 \times \frac{(1+0.09)}{(1+0.08)}$	73.34
3	$₹ 73.34 \times \frac{(1+0.09)}{(1+0.08)}$	74.02
4	$₹ 74.02 \times \frac{(1+0.09)}{(1+0.08)}$	74.71
5	$₹ 74.71 \times \frac{(1+0.09)}{(1+0.08)}$	75.40

(iii) Annual Cash Inflows

Particulars	Amount (₹)
Sales (80000 X ₹ 100)	80,00,000
Less: Variable Cost (80000 x ₹ 30)	24,00,000
Additional Fixed Cost	**5,00,000**
Depreciation (₹ 80,00,000 - ₹ 20,00,000)/5	12,00,000
Profit Before Tax (PBT)	**39,00,000**
Less: Tax @ 34%	13,26,000
	25,74,000
Add: Depreciation	12,00,000
	37,74,000

(iv) Amount repatriated each year in US $

Year		in ₹	Expected Exchange Rate (₹ / US $)	in US $
1	Annual Cash Flow	37,74,000	72.67	51,933.40
2	---do----	37,74,000	73.34	51,458.96
3	---do----		74.02	50,986.22

4	---do----	37,74,000	74.71	50,513.33
5	---do----	37,74,000	75.40	50,053.05

(v) Release of Working Capital in US $ at the end (₹ 10,00,000 / ₹ 75.40) = US $ 13,262.60

(vi) Salvage Value of Project in US $ (₹ 20,00,000 / ₹ 75.40) = US $ 26,525.20

NPV of the proposed project

Particulars	Period	Cash Flows ($)	PVF @ 8%	PV ($)
Initial Outlay	0	(1,25,000.00)	1.000	(1,25,000.00)
Annual Cash Flow	1	51,933.40	0.926	48,090.33
---do----	2	51,458.96	0.857	44,100.33
---do----	3	50,986.22	0.794	40,483.06
---do----	4	50,513.33	0.735	37,127.30
---do----	5	50,053.05	0.681	34,086.13
Release of Working Capital	5	13,262.60	0.681	9,031.83
Salvage Value of the Project	5	26,525.20	0.681	18,063.66
				1,05,982.64

Since the NPV of the project is positive, it is feasible.

Question 8 (PP May'22)
What are Foreign Currency Convertible Bonds? What are their advantages?

Solution

A type of convertible bond issued in a currency different than the issuer's domestic currency. In other words, the money being raised by the issuing company is in the form of a foreign currency. A convertible bond is a mix between a debt and equity instrument. It acts like a bond by making regular coupon and principal payments, but these bonds also give the bondholder the option to convert the bond into stock.

Advantages of FCCBs

a) The convertible bond gives the investor the flexibility to convert the bond into equity at a price or redeem the bond at the end of a specified period, normally three years if the price of the share has not met his expectations.
b) Companies prefer bonds as it leads to delayed dilution of equity and allows company to avoid any current dilution in earnings per share that a further issuance of equity would cause.
c) FCCBs are easily marketable as investors enjoys option of conversion into equity if resulting to capital appreciation. Further investor is assured of a minimum fixed interest earnings.

Question 9 (MTP Oct'22)
There exists a vast difference between Project and Parent cash flow.

Solution

There exists a big difference between the project and parent cash flows due to tax rules, exchange controls. Management and royalty payments are returns to the parent firm. The basis on which a

project shall be evaluated depend on one's own cash flows, cash flows accruing to the parent firm or both.

Evaluation of a project on the basis of own cash flows entails that the project should compete favourably with domestic firms and earn a return higher than the local competitors. If not, the shareholders and management of the parent company shall invest in the equity/government bonds of domestic firms. A comparison cannot be made since foreign projects replace imports and are not competitors with existing local firms. Project evaluation based on local cash flows avoid currency conversion and eliminates problems associated with fluctuating exchange rate changes.

For evaluation of foreign project from the parent firm's angle, both operating and financial cash flows actually remitted to it form the yardstick for the firm's performance and the basis for distribution of dividends to the shareholders and repayment of debt/interest to lenders. An investment has to be evaluated on basis of net after tax operating cash flows generated by the project. As both types of cash flows (operating and financial) are clubbed together, it is essential to see that financial cash flows are not mixed up with operating cash flows.

Question 10 (RTP Nov'22)
Briefly explain how a Centralized Cash Management system helps MNCs in their treasury management.

Solution
A Centralized Cash Management system helps MNCs in their treasury management as follows:

a) To maintain minimum cash balance during the year.
b) To manage judiciously liquidity requirements of the centre.
c) To optimally use various hedging strategies so that MNC's foreign exchange exposure is minimised.
d) To aid the centre to generate maximum returns by investing all cash resources optimally.
e) To aid the centre to take advantage of multinational netting so that transaction costs and currency exposure are minimised.
f) To make maximum utilization of transfer pricing mechanism so that the firm enhances its profitability and growth.
g) To exploit currency movement correlations:
    i. Payables & receivables in different currencies having positive correlations.
    ii. Payables of different currencies having negative correlations.
    iii. Pooling of funds allows for reduced holding – the variance of the total cash flows for the entire group will be smaller than the sum of the individual variances.

Chapter 10

START-UP FINANCE

Space for your notings of Formulae or important points

THE BASICS OF STARTUP FINANCING

Startup financing means some initial infusion of money needed to turn an idea (by starting a business) into reality.
While starting out, big lenders like banks etc. are not interested in a startup business.

So that leaves one with the option of selling some assets, borrowing against one's home, asking loved ones i.e. family and friends for loans etc.
But that involves a lot of risk, including the risk of bankruptcy and strained relationships with friends and family.

A good way to get success in the field of entrepreneurship is to speed up initial operations as quickly as possible to get to the point where outside investors can see and feel the business venture, as well as understand that a person has taken some risk reaching it to that level.

SOME OF THE INNOVATIVE WAYS TO FINANCE A STARTUP

Every startup needs access to capital, whether for funding product development, acquiring machinery and inventory or paying salaries to its employee.

Most entrepreneurs think first of bank loans as the primary source of money, only to find out that banks are really the least likely benefactors for startups.

So, innovative measures include maximizing non-bank financing.

Some of the sources for funding a startup:

i. **Personal financing**: This is important because most of the investors will not put money into a deal if they see that you have not contributed any money from your personal sources.

ii. **Personal credit lines**: One qualifies for personal credit line based on one's personal credit efforts. Credit cards are a good example of this. However, banks provide this facility only when the business has enough cash flow to repay the line of credit.

iii. **Family and friends**: These are the people who generally believe in you, without even thinking that your idea works or not. However, the loan obligations to friends and relatives should always be in writing as a promissory note or otherwise.

iv. **Peer-to-peer lending**: In this process group of people come together and lend money to each other. Many small and ethnic business groups having similar faith or interest generally support each other in their start up endeavors.

v. **Crowdfunding**: Crowdfunding is the use of small amounts of capital from a large number of individuals to finance a new business initiative. Crowdfunding makes use of the easy accessibility of vast networks of people through social media and crowdfunding websites to bring investors and entrepreneurs together.

vi. **Vendor financing**: Vendor financing is the form of financing in which a company lends money to one of its customers so that he can buy products from the company itself. Vendor financing also takes place when many manufacturers and distributors are convinced to defer payment until the goods are sold. This means extending the payment terms to a longer period for e.g. 30 days payment period can be extended to 45 days or 60 days.

vii. **Factoring accounts receivables**: In this method, a facility is given to the seller who has sold the good on credit to fund his receivables till the amount is fully received. So, when the goods are sold on credit, and the credit period is for example 6 months, factor will pay most of the sold amount up front and rest of the amount later.

viii. **Purchase order financing**: Purchase order financing companies often advance the required funds directly to the supplier.

ix. **Microloans**: Microloans are small loans that are given by individuals at a lower interest to a new business venture. These loans can be issued by a single individual or aggregated across a number of individuals who each contribute a portion of the total amount.

PITCH PRESENTATION

Pitch presentation is a short and brief presentation (not more than 20 minutes) to investors explaining about the prospects of the company and why they should invest into the startup business.

Pitch presentation can be made either during face-to-face meetings or online meetings with potential investors, customers, partners, and co-founders.

Here, some of the methods have bee highlighted below as how to approach a pitch presentation:

i. **Introduction**: To start with, first step is to give a brief account of yourself i.e. who are you? What are you doing? But care should be taken to make it short and sweet. Also, use this opportunity to get your investors interested in your company. One can also talk up the most interesting facts about one's business, as well as any huge milestones one may have achieved.

ii. **Team**: The next step is to introduce the audience the people behind the scenes. The reason is that the investors will want to know the people who are going to make the product or service successful. Moreover, the investors are not only putting money towards the idea but they are also investing in the team.

iii. **Problem**: Further, the promoter should be able to explain the problem he is going to solve and solutions emerging from it. Further the investors should be convinced that the newly introduced product or service will solve the problem convincingly.

For instance, when Facebook was launched in 2004, it added some new features which give it a more professional and livelier look in comparison to Orkut which was there for some time.

It enabled Facebook to become an instant hit among the people. Further, customers have no privacy while using Orkut. However, in Facebook, you can view a person's profile only if he adds you to his list.

These simple yet effective advantages that Facebook has over Orkut make it an extremely popular social networking site.

iv. **Solution**: It is very important to describe in the pitch presentation as to how the company is planning to solve the problem.

For instance, when Flipkart first started its business in 2007, it brought the concept of e-commerce in India

But when they started, payment through credit card was rare. So, they introduced the system of payment on the basis of cash on delivery which was later followed by other e-commerce companies in India.

The second problem was the entire supply chain system. Delivering goods on time is one of the most important factors that determine the success of an ecommerce company. Flipkart addressed this issue by launching their own supply chain management system to deliver orders in a timely manner.

These innovative techniques used by Flipkart enabled them to raise large amount of capital from the investors.

v. **Marketing/Sales**: This is a very important part where investors will be deeply interested. The market size of the product must be communicated to the investors. This can include profiles of target customers, but one should be prepared to answer questions about how the promoter is planning to attract the customers.

vi. **Projections or Milestones**: It is true that it is difficult to make financial projections for a startup concern. If an organization doesn't have a long financial history, an educated guess can be made. Projected financial statements can be prepared which gives an organization a brief idea about where is the business heading.

Financial projections include three basic documents that make up a business's financial statements.

- **Income statement**: This project how much money the business will generate by projecting income and expenses, such as sales, cost of goods sold, expenses and capital.

- **Cash flow statement**: A projected cash flow statement will depict how much cash will be coming into the business and out of that cash how much cash will be utilized into the business.

- **Balance sheet:** The balance sheet shows the business's overall finances including assets, liabilities and equity.

vii. **Competition**: Every business organization has competition even if the product or service offered is new and unique. It is necessary to highlight in the pitch presentation as to how the products or services are different from their competitors. If any of the competitors have been acquired, their complete details like name of the organization, acquisition prices etc. should also be highlighted.

viii. **Business Model**: The term business model is a wide term denoting core aspects of a business including purpose, business process, target customers, offerings, strategies, infrastructure, organizational structures, sourcing, trading practices, and operational processes and policies including culture.

Further, as per Investopedia, a business model is the way in which a company generates revenue and makes a profit from company operations.

A business model can be illustrated with the help of an example.

There are two companies – company A and company B. Both the companies are engaged in the business of renting movies. Prior to the advent of internet both the companies rent movies physically. Both the companies made ` 5 crore as revenues. Cost of goods sold was ` 4 crore. So, the companies made ` 1 crore as gross profit. After the introduction of internet, company A started to offer movies online instead of renting or selling it physically. This change affected the business model of company A positively. Revenue is still ` 5 crore but the significant part is that cost of goods sold is now ` 2 crore only. This is because online sales lead to significant reduction of storage and distribution costs. So, the gross profit increases from 20% to 60%. Therefore, Company A isn't making more in sales, but it figured out a way to revolutionize its business model, which greatly reduces costs. Managers at company A have an additional 40% more in margin to play with than managers at company A. Managers at company A have little room for error and they have to tread carefully.

Hence, every investor wants to get his money back, so it's important to tell them in a pitch presentation as to how they should plan on generating revenue. It is better to show the investors a list of the various revenue streams for a business model and the timeline for each of them. Further, how to price the product and what does the competitor charge for the same or similar product shall also be highlighted. It is also beneficial to discuss the lifetime value of the customer and what should be the strategy to keep him glued to their product.

ix. **Financing**: If a startup business firm has raised money, it is preferable to talk about how much money has already been raised, who invested money into the business and what they did about it.

If no money has been raised till date, an explanation can be made regarding how much work has been accomplished with the help of minimum funding that the company is managed to raise.

It is true that investors like to see entrepreneurs who have invested their own money.

MODES OF FINANCING FOR STARTUPS

(i) **Bootstrapping:**

An individual is said to be boot strapping when he or she attempts to found and build a company from personal finances or from the operating revenues of the new company.

A common mistake made by most founders is that they make unnecessary expenses towards marketing, offices and equipment they cannot really afford.

So, it is true that more money at the inception of a business leads to complacency and wasteful expenditure.

On the other hand, investment by startups from their own savings leads to cautious approach. It curbs wasteful expenditures and enable the promoter to be on their toes all the time.

Here are some of the methods in which a startup firm can bootstrap:

a) **Trade Credit**:

When a person is starting his business, suppliers are reluctant to give trade credit. They will insist on payment of their goods supplied either by cash or by credit card.

However, a person may visit to the supplier's office. If the business organization is small, the owner can be directly contacted.

On the other hand, if it is a big firm, the Chief Financial Officer can be contacted and convinced about the financial plan.

The owner or financial officer has to be explained about the business and the need to get the first order on credit in order to launch the venture. The trick here is to get the goods shipped and sell them before paying to them.

One can also borrow to pay for the good sold but there is interest cost also. So trade credit is one of the most important way to reduce the amount of working capital one needs. This is especially true in retail operations.

b) **Factoring**:

This is a financing method where accounts receivable of a business organization is sold to a commercial finance company to raise capital.

The process of factoring may reduce costs associated with maintaining accounts receivable such as bookkeeping, collections and credit verifications.

In addition to reducing internal costs of a business, factoring also frees up money that would otherwise be tied to receivables.

c) **Leasing**:

Another popular method of bootstrapping is to take the equipment on lease rather than purchasing it. It will reduce the capital cost and also help lessee to claim tax exemption.

So, it is better to a take a photocopy machine, an automobile or a van on lease to avoid paying out lump sum money which is not at all feasible for a startup organization.

(ii) Angel Investors:

Angel investors invest in small startups or entrepreneurs. Often, angel investors are among an entrepreneur's family and friends. The capital angel investors provide may be a one-time investment to help the business propel or an ongoing injection of money to support and carry the company through its difficult early stages.

Angel investors provide more favorable terms compared to other lenders, since they usually invest in the entrepreneur starting the business rather than the viability of the business.

Angel investors are focused on helping startups take their first steps, rather than the possible profit they may get from the business. Essentially, angel investors are the opposite of venture capitalists.

Angel investors typically use their own money, unlike venture capitalists who take care of pooled money from many other investors and place them in a strategically managed fund.

Angel investors who seed startups that fail during their early stages lose their investments completely.
This is why professional angel investors look for opportunities for a defined exit strategy, acquisitions or initial public offerings (IPOs).

(iii)**Venture Capital Fund**:

Structure of Venture Capital Fund in India
Three main types of fund structure exist: one for domestic funds and two for offshore ones:

A. **Domestic Funds**: Domestic Funds (i.e. one which raises funds domestically) are usually structured as:
   i. a domestic vehicle for the pooling of funds from the investor, and
   ii. a separate investment adviser that carries those duties of asset manager.

   The choice of entity for the pooling vehicle falls between a trust and a company

B. Offshore Funds: Two common alternatives available to offshore investors are: the "offshore structure" and the "unified structure"

   Offshore structure: Under this structure, an investment vehicle (an LLC or an LP organized in a jurisdiction outside India) makes investments directly into Indian portfolio

companies. Typically, the assets are managed by an offshore manager, while the investment advisor in India carries out the due diligence and identifies deals.

Unified Structure: When domestic investors are expected to participate in the fund, a unified structure is used. Overseas investors pool their assets in an offshore vehicle that invests in a locally managed trust, whereas domestic investors directly contribute to the trust.

Concept of Venture Capital Fund

Venture capital means funds made available for startup firms and small businesses with exceptional growth potential.

Venture capital is money provided by professionals who alongside management invest in young, rapidly growing companies that have the potential to develop into significant economic contributors.

Venture Capitalists generally

- Finance new and rapidly growing companies
- Purchase equity securities
- Assist in the development of new products or services
- Add value to the company through active participation.

Characteristics of Venture Capital Financing

(i) **Long time horizon**: The fund would invest with a long-time horizon in mind. Minimum period of investment would be 3 years and maximum period can be 10 years.

(ii) **Equity Participation**: Most of the time, VC would be investing in the form of equity of a company. This would help the VC participate in the management and help the company grow. Besides, a lot of board decisions can be supervised by the VC if they participate in the equity of a company.

(iii) **Lack of liquidity**: When VC invests, it assumes that there would be less liquidity on the equity it gets and accordingly it would be investing in that format. They adjust this liquidity premium against the price and required return.

(iv) **High Risk**: VC would not hesitate to take risk. It works on principle of high risk and high return. So, high risk would not eliminate the investment choice for a venture capital.

Advantages of bringing VC in the company

- It injects long- term equity finance which provides a solid capital base for future growth.
- The venture capitalist is a business partner, sharing both the risks and rewards.
- The venture capitalist is able to provide practical advice and assistance to the company based on past experience with other companies which were in similar situations.
- The venture capitalist also has a network of contacts in many areas that can add value to the company.
- The venture capitalist may be capable of providing additional rounds of funding should it be required to finance growth.

- Venture capitalists are experienced in the process of preparing a company for an Initial Public Offering (IPO) of its shares onto the stock exchanges or overseas stock exchange such as NASDAQ.
- They can also facilitate a trade sale.

Stages of funding for VC

1. **Seed Money**: Low level financing needed to prove a new idea.
2. **Start-up**: Early-stage firms that need funding for expenses associated with marketing and product development.
3. **First-Round**: Early sales and manufacturing funds.
4. **Second-Round**: Working capital for early stage companies that are selling product, but not yet turning in a profit.
5. **Third Round**: Also called Mezzanine financing, this is expansion money for a newly profitable company.
6. **Fourth-Round**: Also called bridge financing, it is intended to finance the "going public" process.

Risk in each stage is different. An indicative Risk matrix is given below:

Financial Stage	Period (Funds locked in years)	Risk Perception	Activity to be financed
Seed Money	7-10	Extreme	For supporting a concept or idea or R&D for product development.
Start Up	5-9	Very High	Initializing prototype operations or developing
First Stage	3-7	High	Start commercials production and marketing.
Second Stage	3-5	Sufficiently High	Expand market and growing working capital need
Third Stage	1-3	Medium	Market expansion, acquisition & product development for profit making company.
Fourth Stage	1-3	Low	Facilitating public issue

VC Investment Process

The entire VC Investment process can be segregated into the following steps:

1) **Deal Origination:** VC operates directly or through intermediaries. Mainly many practicing Chartered Accountants would work as intermediary and through them VC gets the deal.

   Before sourcing the deal, the VC would inform the intermediary or its employees about the following so that the sourcing entity does not waste time :

   - Sector focus
   - Stages of business focus
   - Promoter focus
   - Turn over focus

2) **Screening:** Once the deal is sourced the same would be sent for screening by the VC. The screening is generally carried out by a committee consisting of senior level people of the VC. Once the screening happens, it would select the company for further processing.

3) **Due Diligence**: The screening decision would take place based on the information provided by the company. Once the decision is taken to proceed further, the VC would now carry out due diligence. This is mainly the process by which the VC would try to verify the veracity of the documents taken. This is generally handled by external bodies, mainly renowned consultants.

4) **Deal Structuring**: Once the case passes through the due diligence it would now go through the deal structuring. The deal is structured in such a way that both parties win. In many cases, the convertible structure is brought in to ensure that the promoter retains the right to buy back the share. Besides, in many structures to facilitate the exit, the VC may put a condition that promoter has also to sell part of its stake along with the VC. Such a clause is called tag- along clause.

5) **Post Investment Activity**: In this section, the VC nominates its nominee in the board of the company.

   The company has to adhere to certain guidelines like strong MIS, strong budgeting system, strong corporate governance and other covenants of the VC and periodically keep the VC updated about certain mile-stones.

   If milestone has not been met the company has to give explanation to the VC.

6) **Exit plan**: At the time of investing, the VC would ask the promoter or company to spell out in detail the exit plan.

   Mainly, exit happens in two ways:
   a) One way is 'sell to third party(ies)'. This sale can be in the form of IPO or Private Placement to other VCs.
   b) The second way to exit is that promoter would give a buy back commitment at a pre agreed rate (generally between IRR of 18% to 25%).

   In many deals, the promoter would get the first right to buy back.

STARTUP INDIA INITIATIVE

Startup India scheme was initiated by the Government of India on 16th of January, 2016. The definition of startup was provided which is applicable only in case of Government Schemes.

Startup means an entity, incorporated or registered in India:

- Upto a period of ten years from the date of incorporation/ registration, if it is incorporated as a private limited company or registered as a partnership firm or a limited liability partnership in India.

- With annual turnover not exceeding Rs 100 Crore in any of the financial years since incorporation/ registration
- Working towards innovation, development, deployment or commercialization of new products, processes or services driven by technology or intellectual property.

Provided that such entity is not formed by splitting up, or reconstruction, of a business already in existence.

Incorporated as either a Private Limited Company or a Registered Partnership Firm or a Limited Liability Partnership

Question 1 (MTP Oct'20, RTP Nov'21, RTP May'20, MTP Mar'19, MTP Oct'21, May'19, Dec'21, MTP Sep'22)

Explain some of the innovative sources for funding a start-up.

Solution

Every startup needs access to capital, whether for funding product development, acquiring and inventory, or paying salaries to its employee. Most entrepreneurs think first of bank loans as the primary source of money, only to find out that banks are really the least likely benefactors for startups. So, innovative measures include maximizing non-bank financing. Here are some of the sources for funding a startup:

i. **Personal financing**: It may not seem to be innovative but you may be surprised to note that most budding entrepreneurs never thought of saving any money to start a business. This is important because most of the investors will not put money into a deal if they see that you have not contributed any money from your personal sources.

ii. **Personal credit lines**: One qualifies for personal credit line based on one's personal credit efforts. Credit cards are a good example of this. However, banks are very cautious while granting personal credit lines. They provide this facility only when the business has enough cash flow to repay the line of credit.

iii. **Family and friends**: These are the people who generally believe in you, without even thinking that your idea works or not. However, the loan obligations to friends and relatives should always be in writing as a promissory note or otherwise.

iv. **Peer-to-peer lending**: In this process group of people come together and lend money to each other. Peer to peer to lending has been there for many years. Many small and ethnic business groups having similar faith or interest generally support each other in their start up endeavors.

v. **Crowdfunding**: Crowdfunding is the use of small amounts of capital from a large number of individuals to finance a new business initiative. Crowdfunding makes use of the easy accessibility of vast networks of people through social media and crowdfunding websites to bring investors and entrepreneurs together.

vi. **Microloans**: Microloans are small loans that are given by individuals at a lower interest to a new business ventures. These loans can be issued by a single individual or aggregated across a number of individuals who each contribute a portion of the total amount.

vii. **Vendor financing**: Vendor financing is the form of financing in which a company lends money to one of its customers so that he can buy products from the company itself. Vendor financing also takes place when many manufacturers and distributors are convinced to defer payment until the goods are sold. This means extending the payment terms to a longer period for e.g. 30 days payment period can be extended to 45 days or 60 days. However, this depends on one's credit worthiness and payment of more money.

viii. **Purchase order financing**: The most common scaling problem faced by startups is the inability to find a large new order. The reason is that they don't have the necessary cash to produce and deliver the product. Purchase order financing companies often advance the required funds directly to the supplier. This allows the transaction to complete and profit to flow up to the new business.

ix. **Factoring accounts receivables**: In this method, a facility is given to the seller who has sold the good on credit to fund his receivables till the amount is fully received. So, when the goods are sold on credit, and the credit period (i.e., the date upto which payment shall be made) is for example 6 months, factor will pay most of the sold amount up front and rest of the amount later. Therefore, in this way, a startup can meet his day-to-day expenses.

Question 2(MTP Oct'18, MTP April'22, July'21, MTP May'20, MTP Sep'22)
What do you mean by Pitch Presentation in context of Start-up Business?
OR
Explain the basic documents that are required to make up Financial Presentations during Pitch Presentation.

Solution
Pitch presentation is a short and brief presentation (not more than 20 minutes) to investors explaining about the prospects of the company and why they should invest into the startup business. So, pitch deck presentation is a brief presentation basically using PowerPoint to provide a quick overview of business plan and convincing the investors to put some money into the business. Pitch presentation can be made either during face-to-face meetings or online meetings with potential investors, customers, partners, and co- founders. Here, some of the methods have been highlighted below as how to approach a pitch presentation:

i. **Introduction:** To start with, first step is to give a brief account of yourself i.e. who are you? What are you doing? But care should be taken to make it short and sweet. Also, use this opportunity to get your investors interested in your company. One can also talk up the most interesting facts about one's business, as well as any huge milestones one may have achieved.

ii. **Team:** The next step is to introduce the audience the people behind the scenes. The reason is that the investors will want to know the people who are going to make the product or service successful. Moreover, the investors are not only putting money towards the idea but they are also investing in the team. Also, an attempt should be made to include the background of the promoter, and how it relates to the new company. Moreover, if possible, it can also be highlighted that the team has worked together in the past and achieved significant results.

iii. **Problem**: Further, the promoter should be able to explain the problem he is going to solve and solutions emerging from it. Further the investors should be convinced that the newly introduced product or service will solve the problem convincingly. For instance, when Facebook was launched in 2004, it added some new features which give it a more professional and livelier look in comparison to Orkut which was there for some time. It enabled Facebook to become an instant hit among the people. Further, customers have no privacy while using Orkut.

iv. **Solution:** It is very important to describe in the pitch presentation as to how the company is planning to solve the problem. For instance, when Flipkart first started its business in 2007, it brought the concept of e- commerce in India but when they started, payment through credit card was rare. So, they introduced the system of payment on the basis of cash on delivery which was later followed by other e-commerce companies in India. The second problem was the entire supply chain system. Delivering goods on time is one of the most important factors that determine the success of an ecommerce company. Flipkart addressed this issue by launching their own supply chain management system to deliver orders in a timely manner. These innovative techniques used by Flipkart enabled them to raise large amount of capital from the investors.

v. **Marketing/Sales**: This is a very important part where investors will be deeply interested. The market size of the product must be communicated to the investors. This can include profiles of target customers, but one should be prepared to answer Questions about how the promoter is planning to attract the customers. If a business is already selling goods, the promoter can also brief the investors about the growth and forecast future revenue.

vi. **Projections or Milestones**: It is true that it is difficult to make financial projections for a startup concern. If an organization doesn't have a long financial history, an educated guess can be made. Projected financial statements can be prepared which gives an organization a brief idea about where is the business heading? It tells us that whether the business will be making profit or loss?
Financial projections include three basic documents that make up a business's financial statements.

- **Income statement**: This projects how much money the business will generate by projecting income and expenses, such as sales, cost of goods sold, expenses and capital. For your first year in business, you'll want to create a monthly income statement. For the second year, quarterly statements will suffice. For the following years, you'll just need an annual income statement.

- **Cash flow statement**: A projected cash flow statement will depict how much cash will be coming into the business and out of that cash how much cash will be utilized into the business. At the end of each period (e.g. monthly, quarterly, annually), one can tally it all up to show either a profit or loss.

- **Balance sheet**: The balance sheet shows the business's overall finances including assets, liabilities and equity. Typically, one will create an annual balance sheet for one's financial projections.

vii. **Competition**: Every business organization has competition even if the product or service offered is new and unique. It is necessary to highlight in the pitch presentation as to how the products or services are different from their competitors. If any of the competitors have been acquired, their complete details like name of the organization, acquisition prices etc. should also be highlighted.

viii. **Business Model**: The term business model is a wide term denoting core aspects of a business including purpose, business process, target customers, offerings, strategies, infrastructure, organizational structures, sourcing, trading practices, and operational processes and policies including culture.

ix. **Financing**: If a startup business firm has raised money, it is preferable to talk about how much money has already been raised, who invested money into the business and what they did about it. If no money has been raised till date, an explanation can be made regarding how much work has been accomplished with the help of minimum funding that the company is managed to raise.

Question 3(May'18, MTP April'22, MTP May'20)

Explain the advantages of bringing venture capital in the company.

Solution

Advantages of bringing VC in the company:

- It injects long- term equity finance which provides a solid capital base for future growth.
- The venture capitalist is a business partner, sharing both the risks and rewards. Venture capitalists are rewarded with business success and capital gain.
- The venture capitalist is able to provide practical advice and assistance to the company based on past experience with other companies which were in similar situations.
- The venture capitalist also has a network of contacts in many areas that can add value to the company.
- The venture capitalist may be capable of providing additional rounds of funding should it be required to finance growth.
- Venture capitalists are experienced in the process of preparing a company for an initial public offering (IPO) of its shares onto the stock exchanges or overseas stock exchange such as NASDAQ.
- They can also facilitate a trade sale.

Question 4(Nov'18, MTP Oct'19, MTP Nov'21, MTP Mar'22, MTP Oct'20, MTP Mar'21, PP May'22)
Explain Angel Investors. OR

Briefly explain how Angel Investors finance the Startups. OR

Who are Angel Investors and how they are different from Venture Capitalists.

Solution

Angel investors invest in small startups or entrepreneurs. Often, angel investors are entrepreneur's family and friends. The capital angel investors provide may be a one-time investment to help the business propel or an ongoing injection of money to support and carry the company through its difficult early stages. Angel investors provide more favorable terms compared to other lenders, since they usually invest in the entrepreneur starting the business rather than the viability of the business. Angel investors are focused on helping startups take their first steps, rather than the possible profit they may get from the business. Essentially, angel investors are the opposite of venture capitalists.

Angel investors are also called informal investors, angel funders, private investors, seed investors or business angels. These are affluent individuals who inject capital for startups in exchange for ownership equity or convertible debt. Some angel investors invest through crowdfunding platforms online or build angel investor networks to pool in capital.

Angel investors typically use their own money, unlike venture capitalists who take care of pooled money from many other investors and place them in a strategically managed fund. Though angel investors usually represent individuals, the entity that actually provides the fund may be a limited liability company, a business, a trust or an investment fund, among many other kinds of vehicles.

Angel investors who seed startups that fail during their early stages lose their investments completely. This is why professional angel investors look for opportunities for a defined exit strategy, acquisitions or initial public offerings (IPOs).

Question 5(MTP Mar'18, MTP April'18, MTP Oct'19, RTP Nov'19)
Compare and contrast startups and entrepreneurship. Describe the priorities and challenges which startups in India are facing.

Solution

Differences between a startup and entrepreneurship

Startups are different from entrepreneurship. The major differences between them have been discussed in the following paragraphs:

(i) Startup is a part of entrepreneurship. Entrepreneurship is a broader concept and it includes a startup firm.
(ii) The main aim of startup is to build a concern, conceptualize the idea which it has developed into a reality and build a product or service. On the other hand, the major objective of an already established entrepreneurship concern is to attain opportunities with regard to the resources they currently control.
(iii) A startup generally does not have a major financial motive whereas an established entrepreneurship concern mainly operates on financial motive.

Priorities and challenges which startups in India are facing

The priority is on bringing more and more smaller firms into existence. So, the focus is on need based, instead of opportunity based entrepreneurship. Moreover, the trend is to encourage self -employment rather than large, scalable concerns.

The main challenge with the startup firms is getting the right talent. And, paucity of skilled workforce can hinder the chances of a startup organization's growth and development. Further, startups had to comply with numerous regulations which escalates its cost. It leads to further delaying the chances of a breakeven or even earning some amount of profit.

Question 6(MTP Aug'18, July'21, Jan'21)
Explain various stages of Venture Capital Funding.

Solution

Stages of Venture Capital Funding:

1) **Seed Money**: Low level financing needed to prove a new idea.
2) **Start-up:** Early stage firms that need funding for expenses associated with marketing and product development.
3) **First-Round**: Early sales and manufacturing funds.
4) **Second-Round**: Working capital for early stage companies that are selling product, but not yet turning in a profit.
5) **Third Round**: Also called Mezzanine financing, this is expansion money for a newly profitable company.
6) **Fourth-Round**: Also called bridge financing, it is intended to finance the "going public" process.

Question 7(MTP April'19, RTP Nov'20, RTP May'18, MTP April'21, MTP Sep'22)
Discuss Bootstrapping as a mode of financing for startups. OR

An individual attempts to found and build a company from personal finances or from the operating revenues of the new company. What this method is called? Discuss any two methods. (NOV 2020)

Solution

Bootstrapping as a mode of financing for start ups

An individual is said to be boot strapping when he or she attempts to found and build a company from personal finances or from the operating revenues of the new company. A common mistake made by most founders is that they make unnecessary expenses towards marketing, offices and equipment they cannot really afford. So, it is true that more money at the inception of a business leads to complacency and wasteful expenditure. On the other hand, investment by startups from their own savings leads to cautious approach. It curbs wasteful expenditures and enable the promoter to be on their toes all the time.

Here are some of the methods in which a startup firm can bootstrap:

(i) **Trade Credit**: When a person is starting his business, suppliers are reluctant to give trade credit. They will insist on payment of their goods supplied either by cash or by credit card. However, a way out in this situation is to prepare a well-crafted financial plan. The next step is to pay a visit to the supplier's office. If the business organization is small, the owner can be directly contacted. On the other hand, if it is a big firm, the Chief Financial Officer can be contacted and convinced about the financial plan.

Communication skills are important here. The financial plan has to be shown. The owner or the financial officer has to be explained about the business and the need to get the first order on credit in order to launch the venture. The owner or financial officer may give half the order on credit and balance on delivery. The trick here is to get the goods shipped and sell them before paying to them. One can also borrow to pay for the good sold. But there is interest cost also. So trade credit is one of the most important ways to reduce the amount of working capital one needs. This is especially true in retail operations. When you visit your supplier to set up your order during your startup period, ask to speak directly to the owner of the business if it's a small company. If it's a larger business, ask to speak to the chief financial officer or any other person who approves credit. Introduce yourself. Show the officer the financial plan that you have prepared. Tell the owner or financial officer about your business, and explain that you need

to get your first orders on credit in order to launch your venture. The owner or financial officer may give half the order on credit, with the balance due upon delivery. Of course, the trick here is to get the goods shipped, and sell them before one has to pay for them. One could borrow money to pay for the inventory, but you have to pay interest on that money. So trade credit is one of the most important ways to reduce the amount of working capital one needs. This is especially true in retail operations.

(ii) **Factoring**: This is a financing method where accounts receivable of a business organization is sold to a commercial finance company to raise capital. The factor then got hold of the accounts receivable of a business organization and assumes the task of collecting the receivables as well as doing what would've been the paperwork. Factoring can be performed on a non-notification basis. It means customers may not be told that their accounts have been sold. However, there are merits and demerits to factoring. The process of factoring may actually reduce costs for a business organization. It can actually reduce costs associated with maintaining accounts receivable such as bookkeeping, collections and credit verifications. If comparison can be made between these costs and fee payable to the factor, in many cases it has been observed that it even proved fruitful to utilize this financing method. In addition to reducing internal costs of a business, factoring also frees up money that would otherwise be tied to receivables. This is especially true for businesses that sell to other businesses or to government; there are often long delays in payment that this would offset. This money can be used to generate profit through other avenues of the company. Factoring can be a very useful tool for raising money and keeping cash flowing.

(iii) **Leasing**: Another popular method of bootstrapping is to take the equipment on lease rather than purchasing it. It will reduce the capital cost and also help lessee (person who take the asset on lease) to claim tax exemption. So, it is better to a take a photocopy machine, an automobile or a van on lease to avoid paying out lump sum money which is not at all feasible for a startup organization. Further, if you are able to shop around and get the best kind of leasing arrangement when you're starting up a new business, it's much better to lease. It's better, for example, to lease a photocopier, rather than pay $3,000 for it; or lease your automobile or van to avoid paying out $8,000 or more. There are advantages for both the startup businessman using the property or equipment (i.e. the lessee) and the owner of that property or equipment (i.e. the lessor.) The lessor enjoys tax benefits in the form of depreciation on the fixed asset leased and may gain from capital appreciation on the property, as well as making a profit from the lease. The lessee benefits by making smaller payments retain the ability to walk away from the equipment at the end of the lease term. The lessee may also claim tax benefit in the form of lease rentals paid by him.

Question 8(RTP July'21, Nov'19, Dec'21)
Venture capital financing is unique way of financing a startup. Discuss.

Solution
Yes, Venture Capital Financing is unique manner of financing a startup as it possesses the following characteristics:

(i) **Long time horizon:** The fund would invest with a long-time horizon in mind. Minimum period of investment would be 3 years and maximum period can be 10 years.

(ii) **Lack of liquidity:** When VC invests, it takes into account the liquidity factor. It assumes that there will be less liquidity on the equity it gets and accordingly it would be investing in that format. They adjust this liquidity premium against the price and required return.

(iii) **High Risk**: VC would not hesitate to take risk. It works on principle of high risk and high return. So, high risk would not eliminate the investment choice for a venture capital.

(iv) **Equity Participation**: Most of the time, VC would be investing in the form of equity of a company. This would help the VC participate in the management and help the company grow. Besides, a lot of board decisions can be supervised by the VC if they participate in the equity of a company.

Question 9(RTP Nov'18, MTP Mar'22, MTP Mar'21, Nov'19, May'22)
Explain startup India initiative. OR

EXPLAIN the conditions that need to be met for considering an entity to be called as a Startup.

Solution

Startup India scheme was initiated by the Government of India on 16th of January, 2016. As per GSR Notification 127 (E) dated 19th February 2019, an entity shall be considered as a Startup:

(i) Upto a period of ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.
(ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.
(iii) Entity is working towards innovation, development or improvement of products or processes or services, or if it is a scalable business model with a high potential of employment generation or wealth creation.

Question 10(MTP Oct'21)
"For a Venture Capitalist while the risk is different in each stage of financing so the risk perception and activity to be financed". Explain this statement.

Solution

Yes, risk in each stage is different stage of Venture Capital financing and so risk perception and activity to be financed as per indicative Risk matrix is given below:

Financial Stage	Period (Funds locked in years)	Risk Perception	Activity to be financed
Seed Money	7-10	Extreme	For supporting a concept or idea or R&D for product development and involves low level of financing.

Start Up	5-9	Very High	Initializing prototypes operations or developing products and its marketing.
First Stage	3-7	High	Started commercials production and marketing.
Second Stage	3-5	Sufficiently high	Expanding market and growing working capital need though not earning profit.
Third Stage	1-3	Medium	Market expansion, acquisition & product development for profit making company. Also called Mezzanine Financing.
Fourth Stage	1-3	Low	Facilitating public issue i.e. going public. Also called Bridge Financing.

Question 11(MTP Nov'21)
Explain alternatives available to offshore investors for making investments in Venture Capital Funds in India.

Solution
Two common alternatives available to offshore investors are: the "offshore structure" and the "unified structure".

Offshore structure: Under this structure, an investment vehicle (an LLC or an LP organized in a jurisdiction outside India) makes investments directly into Indian portfolio companies. Typically, the assets are managed by an offshore manager, while the investment advisor in India carries out the due diligence and identifies deals.

Unified Structure: When domestic investors are expected to participate in the fund, a unified structure is used. Overseas investors pool their assets in an offshore vehicle that invests in a locally managed trust, whereas domestic investors directly contribute to the trust. This is later device used to make the local portfolio investments.

Question 12(MTP Nov'21)
Explain the term 'Cyber Risk'.

Solution
Cyber Risk can be defined as the risk of damages due to lawsuits / compensation on account of being a victim of cyber-attack, due to which data of customers, vendors or any other counter-party can be leaked to an unauthorized, malevolent entity.

Question 13(RTP Nov21)
Can a company with no commercial operations raise capital via an IPO? Discuss.

Solution
Although the statement "a company with no commercial operation can launch an IPO" appears to be absurd but this is a fact that even if company does not have any business, it can float an IPO. In recent time the concept of Special Purpose Acquisition Companies (SPACs) has come into existence wherein an entity is set up with the objective to raise funds through an IPO to finance a merger or acquisition of an unidentified target within a specific time period. It is commonly known as a blank cheque company.

The main objective of SPAC is to raise money, despite having any operations or revenues. The money raised from the public is kept in an escrow account, which can be accessed while making the acquisition. However, in case the acquisition is not made within stipulated period of time of the IPO, the SPAC is delisted and the money is returned to the investors. Shareholders have the option to redeem their shares if they are not interested in participating in the proposed merger. Finally, if the merger is approved by shareholders, it is executed, and the target private company or companies become public entities. Once a formal merger agreement has been executed the SPAC target is usually publicly announced.

New investment opportunities in Indian companies have resurfaced and have set up new platform for SPAC transactions. The implementation of SPACs might face certain challenges since India does not have a specific regulatory framework guarding these transactions.

The current regulatory framework in India does not support the SPAC transactions. Further as per the Companies Act, 2013, the Registrar of Companies is authorized to strike-off the name of companies that do not commence operation within one year of incorporation. SPACs generally take 2 to 3 years to identify a target and performing due diligence and before it could get operationalized its name can be stricken off and hence enabling provisions relating to SPAC need to be inserted in the Companies Act in order to make it functional in India.

Though, SPACs do not find acceptance under the Securities and Exchange Board of India (SEBI) Act as it does not meet the eligibility criteria for public listing however SEBI is planning to come out with a framework for SPACs.

The International Financial Services Centres Authority (IFSCA), being the regulatory authority for development and regulation of financial services, financial products and financial institutions in the Gujarat International Finance Tec-City, has recently released a consultation paper defining critical parameters such as offer size to public, compulsory sponsor holding, minimum application size, minimum subscription of the offer size, etc.

SPAC approach offers several advantages over traditional IPO, such as providing companies access to capital, even when market volatility and other conditions limit liquidity. SPACs help to lower the transaction fees as well as expedite the timeline in becoming a public company. Raising money through a SPAC is easier as compared to traditional IPO since the SPAC has already raised money through an IPO. This implies the company in Question only has to negotiate with a single entity, as opposed to thousands of individual investors. This makes the process of fundraising a lot easier and quicker than through an IPO. The involvement of skilled professionals in identifying the target makes the investment a well thought and a well governed process.

However, the merger of a SPAC with a target company presents several challenges, such as complex accounting and financial reporting/registration requirements, to meet a public company readiness timeline and being ready to operate as a public company within a period of three to five months of signing a letter of intent.

It is typically more expensive for a company to raise money through a SPAC than an IPO. Investors' money invested in a SPAC trust to earn a suitable return for up to two years, could be put to better use elsewhere.

Question 14(RTP May'18, MTP Mar'19, May'19)
DESCRIBE the guidelines for SME listing and its benefits.

Solution

Guidelines for SME Listing

(i) **Capital**: The post issue face value capital should not exceed ₹ Twenty-five crores.

(ii) Trading lot size

- The minimum application and trading lot size shall not be less than ₹ 1,00,000/-.
- The minimum depth shall be ₹ 1,00,000/- and at any point of time it shall not be less than ` 1,00,000/-.
- The investors holding with less than ₹1,00,000/- shall be allowed to offer their holding to the Market Maker in one lot.
- However in functionality the market lot will be subject to revival after a stipulated time.

(iii)**Participants:** The existing Members of the Exchange shall be eligible to participate in SME Platform.

(iv)**Underwriting**: The issues shall be 100% underwritten and Merchant Bankers shall underwrite 15% in their own account.

Benefits of Listing in SME

i. **Easy access to Capital**: BSE SME provides an avenue to raise capital through equity infusion for growth oriented SME's.

ii. **Enhanced Visibility and Prestige**: The SME's benefit by greater credibility and enhanced financial status leading to demand in the company's shares and higher valuation of the company.

iii. **Encourages Growth of SMEs**: Equity financing provides growth opportunities like expansion, mergers and acquisitions thus being a cost effective and tax efficient mode.

iv. **Ensures Tax Benefits**: In case of listed securities Short Term Gains Tax is 15% and there is absolutely no Long Term Capital Gains Tax.

v. **Enables Liquidity for Shareholders**: Equity financing enables liquidity for shareholders provides growth opportunities like expansion, mergers and acquisitions, thus being a cost effective and tax efficient mode.

vi. **Equity financing through Venture Capital**: Provides an incentive for Venture Capital Funds by creating an Exit Route and thus reducing their lock in period.

vii. **Efficient Risk Distribution**: Capital Markets ensure that the capital flows to its best uses and those riskier activities with higher payoffs are funded.

viii. **Employee Incentives**: Employee Stock Options ensures stronger employee commitment, participation and recruitment incentive.

Question 15(RTP Nov'18, RTP May'19)
LIST the ways to arrange finance for Small and Medium Enterprises. OR
Describe the process for arrangement of finance in the case of MSME.

Solution

The need for finance can be classified into following types:

- Long and medium term loans
- Short term or working capital requirements
- Risk Capital
- Seed Capital/Marginal Money
- Bridge loans

Financial assistance in India for MSME units is available from a variety of institutions. The important ones are:

i. Commercial/Regional Rural/Co-operative Banks.
ii. SIDBI: Small Industries Development Bank of India (refinance and direct lending)
iii. SFCs/SIDCs: State Financial Corporations (e.g. Delhi Financial Corporation)/State Industrial Development Corporations.

Long- and medium-term loans are provided by SFCs, SIDBI and SIDCs. Banks also finance term loans. This type of financing is needed to fund purchase of land, construction of factory building/shed and for purchase of machinery and equipment. The short-term loans are required for working capital requirements, which fund the purchase of raw materials and consumables, payment of wages and other immediate manufacturing and administrative expenses. Such loans are generally available from commercial banks. The commercial banks also sanction composite loan comprising of working capital and term loan up to a loan limit of ₹ 1 crore.

For loans from financial institutions and commercial banks a formal application needs to be made. The details of documentation that need to be provided with the loan application are indicated below:

- Balance Sheet and Profit Loss Statement for last three consecutive years of firms owned by promoters
- Income Tax Assessment Certificates of Partners/Directors
- Proof of Possession of Land/Building
- Architect's estimate for construction cost
- Partnership deed/Memorandum and Articles of Associations of Company
- Project Report
- Budgetary Quotations of Plant and Machinery

A sanction or rejection letter is issued by bank after its assessment of the application. After receiving a sanction letter, applicants need to indicate in writing their acceptance of terms and conditions laid down by FI/Banks.

Subsequently, loan is disbursed according to the phased implementation of the project. In today's environment there are other choices apart from commercial banks and Government owned financial institutions. These options include venture capital funds and non-government finance companies.

Question 16(PP May'22)
Enlist the criteria for an entity to be classified as a Startup entity under the Startup India. Scheme initiated by the Government of India.

Solution
As per Government Notification, an entity shall be considered as a Startup:

(i) Upto a period of ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.

(ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.

(iii) Entity is working towards innovation, development or improvement of products or processes or services, or if it is a scalable business model with a high potential of employment generation or wealth creation. Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a 'Startup

Chapter 11

SECURITISATION

Space for your notings of Formulae or important points

INTRODUCTION

Some companies or firms who are involved in sending the money or making credit sale must have a huge balance of receivables in their Balance Sheet.

Though they have a huge receivable but still they may face liquidity crunch to run their business.

One way may to adopt borrowing route, but this results in changing the debt equity ratio of the company which may not only be acceptable to some stakeholders but also put companies to financial risk which affects the future borrowings by the company.

To overcome this problem the term 'securitization' was coined.

The process of securitization typically involves the

- creation of pool of assets
- from the illiquid financial assets, such as receivables or loans which are marketable.

In other words, it is the process of repackaging or rebundling of illiquid assets into marketable securities. These assets can be automobile loans, credit card receivables, residential mortgages or any other form of future receivables.

FEATURES OF SECURITISATION

1) Creation of Financial Instruments – The process of securities can be viewed as process of creation of additional financial product of securities in market backed by collaterals.

2) Bundling and Unbundling – When all the assets are combined in one pool it is bundling and when these are broken into instruments of fixed denomination it is unbundling.

3) Tool of Risk Management – In case of assets are securitized on non-recourse basis, then securitization process acts as risk management as the risk of default is shifted.

4) Structured Finance – In the process of securitization, financial instruments are tailor structured to meet the risk return trade of profile of investor, and hence, these securitized instruments are considered as best examples of structured finance.

5) Trenching – Portfolio of different receivable or loan or asset are split into several parts based on risk and return they carry called 'Tranche'. Each Trench carries a different level of risk and return.

6) Homogeneity – Under each tranche the securities issued are of homogenous nature and even meant for small investors who can afford to invest in small amounts.

BENEFITS OF SECURITIZATION

The benefits of securitization can be viewed from the angle of various parties involved as follows:

From the angle of originator

Originator (entity which sells assets collectively to Special Purpose Vehicle) achieves the following benefits from securitization.

(i) **Off – Balance Sheet Financing**: When loan/receivables are securitized it releases a portion of capital tied up in these assets resulting in off Balance Sheet financing leading to improved liquidity position which helps in expanding the business of the company.

(ii) **More specialization in main business**: By transferring the assets the entity could concentrate more on core business as servicing of loan is transferred to SPV. Further, in case of non-recourse arrangement even the burden of default is shifted.

(iii) **Helps to improve financial ratios:** Especially in case of Financial Institutions and Banks, it helps to manage Capital –To-Weighted Asset Ratio effectively.

(iv) **Reduced borrowing Cost**: Since securitized papers are rated due to credit enhancement even, they can also be issued at reduced rate as of debts and hence the originator earns a spread, resulting in reduced cost of borrowings.

From the angle of investor

Following benefits accrues to the investors of securitized securities.

(i) **Diversification of Risk**: Purchase of securities backed by different types of assets provides the diversification of portfolio resulting in reduction of risk.

(ii) **Regulatory requirement**: Acquisition of asset backed belonging to a particular industry say micro industry helps banks to meet regulatory requirement of investment of fund in industry specific.

(iii) **Protection against default**: In case of recourse arrangement if there is any default by any third party then originator shall make good the least amount.

Moreover, there can be insurance arrangement for compensation for any such default.

PARTICIPANTS IN SECURITIZATION

Broadly, the participants in the process of securitization can be divided into two categories; one is Primary Participant and the other is Secondary Participant.

Primary Participants: Primary Participants are main parties to this process.

The primary participants in the process of securitization are as follows:

a) **Originator**: It is the initiator of deal or can be termed as securitizer. It is an entity which sells the assets lying in its books and receives the funds generated through the sale of such assets. The originator transfers both legal as well as beneficial interest to the Special Purpose Vehicle.

b) **Special Purpose Vehicle**: Also, called SPV is created for the purpose of executing the deal. Since issuer originator transfers all rights in assets to SPV, it holds the legal title of these assets.
The main objective of creating SPV is to remove the asset from the Balance Sheet of Originator. Since, SPV makes an upfront payment to the originator, it holds the key position in the overall process of securitization.

Further, it also issues the securities to the investors.

c) **The Investors**: Investors are the buyers of securitized papers which may be an individual, an institutional investor such as mutual funds, provident funds, insurance companies, mutual funds, Financial Institutions etc.

Since, they acquire a participating in the total pool of assets/receivable, they receive their money back in the form of interest and principal as per the terms agreed.

Secondary Participants

Besides the primary participants other parties involved into the securitization process are as follows:

a) **Obligors**: Actually they are the main source of the whole securitization process. They are the parties who owe money to the firm and are assets in the Balance Sheet of Originator.

The amount due from the obligor is transferred to SPV and hence they form the basis of securitization process and their credit standing is of paramount importance in the whole process.

b) **Rating Agency**: Since the securitization is based on the pools of assets rather than the originators, the assets have to be assessed in terms of its credit quality and credit support available.

Rating agency assesses the following:

- Strength of the Cash Flow.
- Mechanism to ensure timely payment of interest and principle repayment.
- Credit quality of securities.
- Liquidity support.
- Strength of legal framework.

Although rating agency is secondary to the process of securitization but it plays a vital role.

c) **Receiving and Paying agent (RPA):** Also, called Servicer or Administrator, it collects the payment due from obligor(s) and passes it to SPV. It also follow up with defaulting borrower and if required initiate appropriate legal action against them.

Generally, an originator or its affiliates acts as servicer.

d) **Agent or Trustee**: Trustees are appointed to oversee that all parties to the deal perform in the true spirit of terms of agreement. Normally, it takes care of interest of investors who acquires the securities.

e) **Credit Enhancer**: Since investors in securitized instruments are directly exposed to performance of the underlying and sometime may have limited or no recourse to the originator, they seek additional comfort in the form of credit enhancement.

Originator itself or a third party say a bank may provide this additional context called Credit Enhancer. While originator provides his comfort in the form of over collateralization or cash collateral, the third party provides it in form of letter of credit or surety bonds.

f) **Structurer**: It brings together the originator, investors, credit enhancers and other parties to

the deal of securitization. Normally, these are investment bankers also called arranger of the deal.

MECHANISM OF SECURITIZATION

Let us discuss briefly the steps in securitization mechanism:

1) **Creation of Pool of Assets**
   The process of securitization begins with creation of pool of assets by segregation of assets backed by similar type of mortgages in terms of interest rate, risk, maturity and concentration units.

2) **Transfer to SPV**
   One assets have been pooled, they are transferred to Special Purpose Vehicle (SPV) especially created for this purpose.

3) **Sale of Securitized Papers**
   SPV designs the instruments based on nature of interest, risk, tenure etc. based on pool of assets. These instruments can be Pass Through Security or Pay Through Certificates.

4) **Administration of assets**
   The administration of assets in subcontracted back to originator which collects principal and interest from underlying assets and transfer it to SPV.

5) **Recourse to Originator**
   Performance of securitized papers depends on the performance of underlying assets and unless specified in case of default they go back to originator from SPV.

6) **Repayment of funds**
   SPV will repay the funds in form of interest and principal to the investor that arises from the assets pooled.

7) **Credit Rating to Instruments**
   Sometime before the sale of securitized instruments credit rating can be done to assess the risk of the issuer.

PROBLEMS IN SECURITIZATION

Following are main problems faced in growth of Securitization of instruments especially in Indian context:

a) **Stamp Duty**
   Stamp Duty is one of the obstacle in India. Under Transfer of Property Act, 1882, a mortgage debt stamp duty which even goes upto 12% in some states of India and this impeded the growth of securitization in India.

   It should be noted that since pass through certificate does not evidence any debt only able to receivable, they are exempted from stamp duty.

   Moreover, in India, recognizing the special nature of securitized instruments in some states has reduced the stamp duty on them.

b) **Taxation**

Taxation is another area of concern in India. In the absence of any specific provision relating to securitized instruments in Income Tax Act experts' opinion differ a lot.

Some are of opinion that SPV as a trustee is liable to be taxed in a representative capacity then others are of view that instead of SPV, investors will be taxed on their share of income.

Clarity is also required on the issues of capital gain implications on passing payments to the investors.

c) **Accounting**

Accounting and reporting of securitized assets in the books of originator is another area of concern.

Although securitization is slated to be an off-balance sheet instrument but in true sense receivables are removed from originator's balance sheet.

Problem arises especially when assets are transferred without recourse.

d) **Lack of standardization**

Every originator following his own format for documentation and administration having lack of standardization is another obstacle in the growth of securitization.

e) **Inadequate Debt Market**

Lack of existence of a well-developed debt market in India is another obstacle that hinders the growth of secondary market of securitized or asset backed securities.

f) **Ineffective Foreclosure laws**

For many years efforts are on for effective foreclosure but still foreclosure laws are not supportive to lending institutions and this makes securitized instruments especially mortgaged backed securities less attractive as lenders face difficulty in transfer of property in event of default by the borrower.

SECURITIZATION INSTRUMENTS

On the basis of different maturity characteristics, the securitized instruments can be divided into following three categories:

a) **Pass Through Certificates (PTCs)**

As the title suggests originator (seller of the assets) transfers the entire receipt of cash in the form of interest or principal repayment from the assets sold. Thus, these securities represent direct claim of the investors on all the assets that has been securitized through SPV.

Since all cash flows are transferred the investors carry proportional beneficial interest in the asset held in the trust by SPV.

It should be noted that since it is a direct route any prepayment of principal is also proportionately distributed among the securities holders.

Further, due to these characteristics on completion of securitization by the final payment of assets, all the securities are terminated simultaneously.

b) Pay Through Security (PTS)

In contrast to PTC in PTS, SPV debt securities are backed by the assets and hence it can restructure different tranches from varying maturities of receivables.

In other words, this structure permits desynchronization of servicing of securities issued from cash flow generating from the asset.

Further, this structure also permits the SPV to reinvest surplus funds for short term as per their requirement.

Since, in Pass Through, all cash flow passes immediately to investors but, in PTS in case of early retirement of receivables plus cash can be used for short term yield. This structure also provides the freedom to issue several debt tranches with varying maturities.

c) Stripped Securities

Stripped Securities are created by dividing the cash flows associated with underlying securities into two or more new securities.

Those two securities are as follows:

(i) Interest Only (IO) Securities
(ii) Principle Only (PO) Securities

As each investor receives a combination of principal and interest, it can be stripped into two portion of Interest and Principle.
Accordingly, the holder of IO securities receives only interest while PO security holder receives only principal.

Being highly volatile in nature these securities are less preferred by investors.

In case yield to maturity in market rises, PO price tends to fall as borrower prefers to postpone the payment on cheaper loans. Whereas if interest rate in market falls, the borrower tends to repay the loans as they prefer to borrow fresh at lower rate of interest.

In contrast, value of IO's securities increases when interest rate goes up in the market as more interest is calculated on borrowings.

However, when interest rate due to prepayments of principals, IO's tends to fall.

Thus, from the above, it is clear that it is mainly perception of investors that determines the prices of IOs and Pos.

PRICING OF THE SECURITIZED INSTRUMENTS

Pricing of securitized instruments is an important aspect of securitization. While pricing the instruments, it is important that it should be acceptable to both originators as well as to the investors. On the same basis pricing of securities can be divided into following two categories:

From Originator's Angle

From originator's point of view, the instruments can be priced at a rate at which originator has to incur an outflow and if that outflow can be amortized over a period of time by investing the amount raised through securitization.

From Investor's Angle

From an investor's angle security price can be determined by discounting best estimate of expected future cash flows using rate of yield to maturity of a security of comparable security with respect to credit quality and average life of the securities.

This yield can also be estimated by referring the yield curve available for marketable securities, though some adjustments is needed on account of spread points, because of credit quality of the securitized instruments.

SECURITIZATION IN INDIA

It is the Citi Bank who pioneered the concept of securitization in India by bundling of auto loans into securitized instruments.

Thereafter many organizations securitized their receivables.

In order to encourage securitization, the Government has come out with Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act, 2002, to tackle menace of Non-Performing Assets (NPAs) without approaching the Court.

As mentioned above, though, initially started with auto loan receivables, it has become an important source of funding for micro finance companies and NBFCs and even now a days commercial mortgage-backed securities are also emerging.

The important highlight of the scenario of securitization in Indian Market is that it is dominated by a few players e.g. ICICI Bank, HDFC Bank, NHB etc.

As per a report of CRISIL, securitization transactions in India scored to the highest level of approximately 70000 crores, in Financial Year 2016. (Business Line, 15th June, 2016)

In order to further enhance the investor base in securitized debts, SEBI has allowed FPIs to invest in securitized debt of unlisted companies upto a certain limit.

Question 1 (MTP Oct'19, MTP Nov'21, RTP Nov'20, MTP April'18, MTP May'20, MTP Oct'20, Nov'19, July'21)
What are the main problems faced in securitization especially in Indian context?

Solution
Following are main problems faced in growth of Securitization of instruments especially in Indian context:

1) **Stamp Duty**: Stamp Duty is one of the obstacle in India. Under Transfer of Property Act, 1882, a mortgage debt stamp duty which even goes upto 12% in some states of India and this impeded the growth of securitization in India. It should be noted that since pass through certificate does not evidence any debt only able to receivable, they are exempted from stamp duty. Moreover, in India, recognizing the special nature of securitized instruments in some states has reduced the stamp duty on them.

2) **Taxation:** Taxation is another area of concern in India. In the absence of any specific provision relating to securitized instruments in Income Tax Act experts' opinion differ a lot. Some are of opinion that SPV as a trustee is liable to be taxed in a representative capacity then others are of view that instead of SPV, investors will be taxed on their share of income. Clarity is also required on the issues of capital gain implications on passing payments to the investors.

3) **Accounting:** Accounting and reporting of securitized assets in the books of originator is another area of concern. Although securitization is slated to be an off-balance sheet instrument but in true sense receivables are removed from originator's balance sheet. Problem arises especially when assets are transferred without recourse.

4) **Lack of standardization**: Every originator following his own format for documentation and administration having lack of standardization is another obstacle in the growth of securitization.

5) **Inadequate Debt Market**: Lack of existence of a well-developed debt market in India is another obstacle that hinders the growth of secondary market of securitized or asset backed securities.

6) **Ineffective Foreclosure laws**: For many years efforts are on for effective foreclosure but still. foreclosure laws are not supportive to lending institutions and this makes securitized instruments especially mortgaged backed securities less attractive as lenders face difficulty in transfer of property in event of default by the borrower.

Question 2(MTP Oct'18, MTP April'21, Nov'20)
DIFFERENTIATE between PTS and PTC.

Solution
Difference between Pass Through Certificates (PTCs) and Pay Through Security (PTS) Pass Through Certificates (PTCs)

As the title suggests originator (seller of eh assets) transfers the entire receipt of cash in form of interest or principal repayment from the assets sold. Thus, these securities represent direct claim of

the investors on all the assets that has been securitized through SPV Since all cash flows are transferred the investors carry proportional beneficial interest in the asset held in the trust by SPV.

It should be noted that since it is a direct route any prepayment of principal is also proportionately distributed among the securities holders. Further, due to these characteristics on completion of securitization by the final payment of assets, all the securities are terminated simultaneously. Skewness of cash flows occurs in early stage if principals are repaid before the scheduled time.

Pay Through Security (PTS)

As mentioned earlier, since, in PTCs all cash flows are passed to the performance of the securitized assets. To overcome this limitation and limitation to single mature there is another structure i.e. PTS.

In contrast to PTC in PTS, SPV debt securities backed by the assets and hence it can restructure different tranches from varying maturities of receivables.

In other words, this structure permits desynchronization of servicing of securities issued from cash flow generating from the asset. Further, this structure also permits the SPV to reinvest surplus funds for short term as per their requirement.

Since, in Pass Through, all cash flow immediately in PTS in case of early retirement of receivables plus cash can be used for short term yield. This structure also provides the freedom to issue several debt trances with varying maturities.

Question 3(RTP May'20, MTP April'19, May'19)
Discuss briefly the steps involved in the Securitization mechanism.

Solution
The steps involved in securitization mechanism are as follows:

Creation of Pool of Assets: The process of securitization begins with creation of pool of assets by segregation of assets backed by similar type of mortgages in terms of interest rate, risk, maturity and concentration units.

Transfer to SPV: One assets have been pooled, they are transferred to Special Purpose Vehicle (SPV) especially created for this purpose.

Sale of Securitized Papers: SPV designs the instruments based on nature of interest, risk, tenure etc. based on pool of assets. These instruments can be Pass Through Security or Pay Through Certificates.

Administration of assets: The administration of assets in subcontracted back to originator which collects principal and interest from underlying assets and transfer it to SPV, which works as a conduct.

Recourse to Originator: Performance of securitized papers depends on the performance of underlying assets and unless specified in case of default they go back to originator from SPV.

Repayment of funds: SPV will repay the funds in form of interest and principal that arises from the assets pooled.

Credit Rating of Instruments: Sometime before the sale of securitized instruments credit rating can be done to assess the risk of the issuer.

Question 3(MTP April'19, May'18, Nov'19, RTP Nov'19, PP May'22)
Explain the benefits of Securitization from the perspective of both originator as well as the investor.

Solution

The benefits of securitization can be viewed from the angle of various parties involved as follows:

A. **From the angle of originator**: Originator (entity which sells assets collectively to Special Purpose Vehicle) achieves the following benefits from securitization.

(i) **Off – Balance Sheet Financing**: When loan/receivables are securitized it release a portion of capital tied up in these assets resulting in off Balance Sheet financing leading to improved liquidity position which helps expanding the business of the company.

(ii) **More specialization in main business**: By transferring the assets the entity could concentrate more on core business as servicing of loan is transferred to SPV. Further, in case of non-recourse arrangement even the burden of default is shifted.

(iii) **Helps to improve financial ratios**: Especially in case of Financial Institutions and Banks, it helps to manage Capital –To-Weighted Asset Ratio effectively.

(iv) **Reduced borrowing Cost**: Since securitized papers are rated due to credit enhancement even they can also be issued at reduced rate as of debts and hence the originator earns a spread, resulting in reduced cost of borrowings.

B. **From the angle of investor**: Following benefits accrues to the investors of securitized securities.

(i) **Diversification of Risk**: Purchase of securities backed by different types of assets provides the diversification of portfolio resulting in reduction of risk.

(ii) **Regulatory requirement**: Acquisition of asset backed belonging to a particular industry say micro industry helps banks to meet regulatory requirement of investment of fund in industry specific.

(iii) **Protection against default**: In case of recourse arrangement if there is any default by any third party then originator shall make good the least amount. Moreover, there can be insurance arrangement for compensation for any such default.

Question 5(Nov'18, MTP Aug'18, MTP March'21, Jan'21)
Discuss about the Primary Participants in the process of Securitization.

Solution

Primary Participants are main parties to the process of securitization. The primary participants in the process of securitization are as follows:

a) **Originator**: It is the initiator of deal or can be termed as securitizer. It is an entity which sells the assets lying in its books and receives the funds generated through the sale of such assets. The originator transfers both legal as well as beneficial interest to the Special Purpose Vehicle

b) **Special Purpose Vehicle**: Also, called SPV, it is created for the purpose of executing the deal. Since issuer originator transfers all rights in assets to SPV, it holds the legal title of these assets. It is created especially for the purpose of securitization only and normally could be in form of a company, a firm, a society or a trust. The main objective of creating SPV is to remove the asset from the Balance Sheet of Originator.

Since, SPV makes an upfront payment to the originator, it holds the key position in the overall process of securitization. Further, it also issues the securities (called Asset Based Securities or Mortgage Based Securities) to the investors.

c) **The Investors**: Investors are the buyers of securitized papers which may be an individual, an institutional investor such as mutual funds, provident funds, insurance companies, Financial Institutions etc. Since, they acquire a participating share in the total pool of assets/receivable, they receive their money back in the form of interest and principal as per the agreed terms.

Question 6(MTP March'18) (MTP April'19)(MTP Sep'22)
Describe various securitization instruments. OR

EXPLAIN briefly Securitization instruments

Solution
On the basis of different maturity characteristics, the securitized instruments can be divided into following three categories:

1) **Pass Through Certificates (PTCs):** As the title suggests originator (seller of the assets) transfers the entire receipt of cash in form of interest or principal repayment from the assets sold. Thus, these securities represent direct claim of the investors on all the assets that has been securitized through SPV. Since all cash flows are transferred the investors carry proportional beneficial interest in the asset held in the trust by SPV.

2) **Pay Through Security (PTS):** In PTCs all cash flows are passed to the performance of the securitized assets. To overcome this limitation and limitation to single mature there is another structure i.e. PTS. In contrast to PTC in PTS, SPV debt securities backed by the assets and hence it can restructure different tranches from varying maturities of receivables. In other words, this structure permits desynchronization of servicing of securities issued from cash flow generating from the asset. Further, this structure also permits the SPV to reinvest surplus funds for short term as per their requirement.

3) **Stripped Securities**: Stripped Securities are created by dividing the cash flows associated with underlying securities into two or more new securities. Those two securities are as follows:
   a) Interest Only (IO) Securities
   b) Principle Only (PO) Securities

Question 7(MTP Aug'18, MTP April'22, Jan'21, MTP Sep'22)
Explain the features of 'Securitization'. OR

"Securitisation is the process of repackaging or rebundling of illiquid assets into marketable securities". EXPLAIN.

Solution
The securitization has the following features:

i. **Creation of Financial Instruments** – The process of securities can be viewed as process of creation of additional financial product of securities in market backed by collaterals.

ii. **Bundling and Unbundling** – When all the assets are combined in one pool it is bundling and when these are broken into instruments of fixed denomination it is unbundling.

iii. **Tool of Risk Management** – In case of assets are securitized on non-recourse basis, then securitization process acts as risk management as the risk of default is shifted.

iv. **Structured Finance** – In the process of securitization, financial instruments are tailor structured to meet the risk return trade of profile of investor, and hence, these securitized instruments are considered as best examples of structured finance.

v. **Trenching** – Portfolio of different receivable or loan or asset are split into several parts based on risk and return they carry called 'Trenche'. Each Trench carries a different level of risk and return.

vi. **Homogeneity** – Under each trenche the securities are issued of homogenous nature and even meant for small investors who can afford to invest in small amounts.

Question 8(MTP Aug'18, MTP Oct'18)
EXPLAIN securitization in India.

Solution
It is the Citi Bank who pioneered the concept of securitization in India by bundling of auto loans in securitized instruments. Thereafter many organizations securitized their receivables. Although started with securitization of auto loans it moved to other types of receivables such as sales tax deferrals, aircraft receivable etc. In order to encourage securitization, the Government has come out with Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act, 2002, to tackle menace of Non-Performing Assets (NPAs) without approaching to Court. With growing sophistication of financial products in Indian Capital Market, securitization has occupied an important place.

As mentioned above, though, initially started with auto loan receivables, it has become an important source of funding for micro finance companies and NBFCs and even now a days commercial mortgage backed securities are also emerging. The important highlight of the scenario of securitization in Indian Market is that it is dominated by a few players e.g. ICICI Bank, HDFC Bank, NHB etc.

As per a report of CRISIL, securitization transactions in India scored to the highest level of approximately ₹ 70000 crores, in Financial Year 2016. (Business Line, 15th June, 2016) In order to further enhance the investor base in securitized.

Question 9(MTP March'19)
Describe the concept of 'Stripped Securities'.

Solution
Stripped Securities are created by dividing the cash flows associated with underlying securities into two or more new securities. Those two securities are as follows:

a) Interest Only (IO) Securities
b) Principle Only (PO) Securities

As each investor receives a combination of principal and interest, it can be stripped into two portion of Interest and Principle. Accordingly, the holder of IO securities receives only interest while PO security holder receives only principal. Being highly volatile in nature these securities are less preferred by investors.
In case yield to maturity in market rises, PO price tends to fall as borrower prefers to postpone the payment on cheaper loans. Whereas if interest rate in market falls, the borrower tends to repay the loans as they prefer to borrow fresh at lower rate of interest.

In contrast, value of IO's securities increases when interest rate goes up in the market as more interest is calculated on borrowings. However, when interest rate due to prepayments of principals, IO's tends to fall. Thus, from the above, it is clear that it is mainly perception of investors that determines the prices of IOs and POs.

Question 10(MTP Oct'21, MTP April'21)
Explain the term 'Business Model' with the help of an illustration.

Solution
The term business model is a wide term denoting core aspects of a business including purpose, business process, target customers, offerings, strategies, infrastructure, organizational structures, sourcing, trading practices, and operational processes and policies including culture.

Further, as per Investopedia, a business model is the way in which a company generates revenue and makes a profit from company operations. Analysts use the term gross profit as a way to compare the efficiency and effectiveness of a firm's business model. Gross profit is calculated by subtracting the cost of goods sold from revenues. A business model can be illustrated with the help of an example. There are two companies – company A and company B. Both the companies are engaged in the business of renting movies. Prior to the advent of internet both the companies rent movies physically. Both the companies made ₹5 crore as revenues. Cost of goods sold was ₹4 crore. So, the companies made ₹1 crore as gross profit. After the introduction of internet, company A started to offer movies online instead of renting or selling it physically. This change affected the business model of company A positively. Revenue is still ₹5 crore but the significant part is that cost of goods sold is now ₹2 crore only. This is because online sales lead to significant reduction of storage and distribution costs. So, the gross profit increases from 20% to 60%.

Therefore, Company A isn't making more in sales, but it figured out a way to revolutionize its business model, which greatly reduces costs. Managers at company A have an additional 40% more in margin to play with than managers at company A. Managers at company A have little room for error and they have to tread carefully.

Question 11(MTP March'19, MTP Nov'21, Dec'21)
"While pricing the securitized instruments, it is important that it should be acceptable to both originators as well as to the investors". Explain.

Solution
Pricing of securitized instruments is an important aspect of securitization. While pricing the instruments, it is important that it should be acceptable to both originators as well as to the investors. On the same basis pricing of securities can be divided into following two categories:

1) **From Originator's Angle**: From originator's point of view, the instruments can be priced at a rate at which originator has to incur an outflow and if that outflow can be amortized over a period of time by investing the amount raised through securitization.

2) **From Investor's Angle**: From an investor's angle security price can be determined by discounting best estimate of expected future cash flows using rate of yield to maturity of a security of comparable security with respect to credit quality and average life of the securities. This yield can also be estimated by referring the yield curve available for marketable securities, though some adjustments is needed on account of spread points, because of credit quality of the securitized instruments.

Question 12(MTP March'22, RTP May'21)
"Besides the primary participants other parties are also involved in the process of Securitisation". EXPLAIN.

Solution
Besides the primary participants other parties involved into the securitization process can be explained as follows:

1) **Obligors**: Actually they are the main source of the whole securitization process. They are the parties who owe money to the firm and are assets in the Balance Sheet of Originator. The amount due from the obligor is transferred to SPV and hence they form the basis of securitization process and their credit standing is of paramount importance in the whole process.

2) **Rating Agency**: Since the securitization is based on the pools of assets rather than the originators, the assets have to be assessed in terms of its credit quality and credit support available. Rating agency assesses the following:
   - Strength of the Cash Flow.
   - Mechanism to ensure timely payment of interest and principle repayment.
   - Credit quality of securities.
   - Liquidity support.
   - Strength of legal framework.

3) **Receiving and Paying agent (RPA):** Also, called Servicer or Administrator, it collects the payment due from obligor(s) and passes it to SPV. It also follow up with defaulting borrower and if required initiate appropriate legal action against them. Generally, an originator or its affiliates acts as servicer.

4) **Agent or Trustee**: Trustees are appointed to oversee that all parties to the deal perform in the true spirit of terms of agreement. Normally, it takes care of interest of investors who acquires the securities.

5) **Credit Enhancer**: Since investors in securitized instruments are directly exposed to performance of the underlying and sometime may have limited or no recourse to the originator, they seek additional comfort in the form of credit enhancement. In other words, they require credit rating of issued securities which also empowers marketability of the securities.

   Originator itself or a third party say a bank may provide this additional context called Credit Enhancer. While originator provides his comfort in the form of over collateralization or cash collateral, the third party provides it in form of letter of credit or surety bonds.

6) **Structurer:** It brings together the originator, investors, credit enhancers and other parties to the deal of securitization. Normally, these are investment bankers also called arranger of the deal. It ensures that deal meets all legal, regulatory, accounting and tax laws requirements.

Question 13(MTP April'18, MTP March'19)
Describe the characteristics of Financial Instruments.

Solution
The important characteristics of financial instruments are enumerated as below:

1) **Liquidity**: Financial instruments provide liquidity. These can be easily and quickly converted into cash.

2) **Marketing**: Financial instruments facilitate easy trading on the market. They have a ready market.

3) **Collateral value**: Financial instruments can be pledged for getting loans.

4) **Transferability**: Financial instruments can be transferred from one person to another.

5) **Maturity period**: The maturity period of financial instruments may be short term, medium term or long term.

6) **Transaction cost**: Financial instruments involve buying and selling cost. The buying and selling costs are called transaction costs.

7) **Risk:** Financial instruments carry risk. Equity based instruments are riskier in comparison to debt based instruments because the payment of dividend is uncertain. A company may not

declare dividend in a particular year. However, payment of principle or interest is more or less certain unless the company gets insolvent.

Question 14(MTP Oct'18)
EXPLAIN briefly the concept of credit rating.

Solution
Credit Rating means an assessment made from credit-risk evaluation, translated into a current opinion as on a specific date on the quality of a specific debt security issued or on obligation undertaken by an enterprise in terms of the ability and willingness of the obligator to meet principal and interest payments on the rated debt instrument in a timely manner.

Thus, Credit Rating is:

1) An expression of opinion of a rating agency.
2) The opinion is in regard to a debt instrument.
3) The opinion is as on a specific date.
4) The opinion is dependent on risk evaluation.
5) The opinion depends on the probability of interest and principal obligations being met timely.

Such opinions are relevant to investors due to the increase in the number of issues and in the presence of newer financial products viz. asset backed securities and credit derivatives.

Question 15(PP May'22)
What are the benefits of Securitization?

Chapter 12

RISK MANAGEMENT

Space for your notings of Formulae or important points

ORGANIZATION

A business organization faces many types of risks. Important among them are discussed as below:

1) Strategic Risk

A successful business always needs a comprehensive and detailed business plan.

But it's also a fact of life that, if things changes, even the best-laid plans can become outdated if it cannot keep pace with the latest trends. This is what is called as strategic risk.

So, strategic risk is a risk in which a company's strategy becomes less effective and it struggles to achieve its goal.

It could be due to technological changes, a new competitor entering the market, shifts in customer demand, increase in the costs of raw materials, or any number of other large-scale changes.

We can take the example of Kodak which was able to develop a digital camera by 1975. But it considers this innovation as a threat to its core business model, and failed to develop it. However, it paid the price because when digital camera was ultimately discovered by other companies, it failed to develop it and left behind. Similar example can be given in case of Nokia when it failed to upgrade its technology to develop touch screen mobile phones. That delay enables Samsung to become a market leader in touch screen mobile phones.

However, a positive example can be given in the case of Xerox which invented photocopy machine. When laser printing was developed, Xerox was quick to lap up this opportunity and changes its business model to develop laser printing. So, it survived the strategic risk and escalated its profits further.

2) Compliance Risk

Every business needs to comply with rules and regulations.

For example, with the advent of Companies Act, 2013, and continuous updating of SEBI guidelines, each business organization has to comply with plethora of rules, regulations and guidelines.

Non-compliance leads to penalties in the form of fine and imprisonment.

However, when a company ventures into a new business line or a new geographical area, the real problem then occurs.

For example, a company pursuing cement business likely to venture into sugar business in a different state. But laws applicable to the sugar mills in that state are different. So, that poses a compliance risk. If the company fails to comply with laws related to a new area or industry or sector, it will pose a serious threat to its survival.

3) Operational Risk

This type of risk relates to internal risk.

It also relates to failure on the part of the company to cope with day to day operational problems.

Operational risk relates to 'people' as well as 'process'.

For example, an employee paying out ₹ 1,00,000 from the account ofthe company instead of ₹ 10,000. This is a people as well as a process risk. An organization can employ another person to check the work of that person who has mistakenly paid ₹ 1,00,000 or it can install an electronic system that can flag off an unusual amount.

4) Financial Risk

Financial Risk is referred as the unexpected changes in financial conditions such as prices, exchange rate, Credit rating, and interest rate etc.

Financial Risk can be divided into following categories.

(i) Counter Party Risk

This risk occurs due to non-honoring of obligations by the counter party which can be failure to deliver the goods for the payment already made or vice-versa or repayment of borrowings and interest etc.

(ii) Political Risk

Generally, this type of risk is faced by an overseas investor, as the adverse action by the government of host country may lead to huge loses. This can be on any of the following form.

- Confiscation or destruction of overseas properties.
- Rationing of remittance to home country.
- Restriction on conversion of local currency of host country into foreign currency.
- Restriction as to borrowings.
- Invalidation of Patents
- Price control of products

(iii)Interest Rate Risk

This risk occurs due to change in interest rate resulting in change in asset and liabilities. This risk is more important for banking companies as their balance sheet's items are more interest sensitive and their base of earning is spread between borrowing and lending rates.

As we know that the interest rates are two types i.e. fixed and floating. The risk in both of these types is inherent. If any company has borrowed money at floating rate then with increase in floating the liability under fixed rate shall remain the same. This fixed rate, with falling floating rate the liability of company to pay interest under fixed rate shall comparatively be higher.

(iv)Currency Risk

This risk mainly affects the organization dealing with foreign exchange as their cash flows changes with the movement in the currency exchange rates. This risk can be affected by cash flow adversely or favorably.

For example, if rupee depreciates vis-à-vis US$ receivables will stand to gain vis-à-vis to the importer who has the liability to pay bill in US$. The best case we can quote Infosys (Exporter) and Indian Oil Corporation Ltd. (Importer).

(v) Liquidity Risk

Broadly liquidity risk can be defined as inability of organization to meet it liabilities whenever they become due.

This risk mainly arises when organization is unable to generate adequate cash or there may be some mismatch in period of cash flow generation.

This type of risk is more prevalent in banking business where there may be mismatch in maturities and receiving fresh deposits pattern.

EVALUATION OF FINANCIAL RISK

The financial risk can be evaluated from different point of views as follows:

1) **From stakeholder's point of view**: Major stakeholders of a business are equity shareholders and they view financial gearing i.e. ratio of debt in capital structure of company as risk since in event of winding up of a company they will be least prioritized.

   Even for a lender, existing gearing is also a risk since company having high gearing faces more risk in default of payment of interest and principal repayment.

2) **From Company's point of view**: From company's point of view if a company borrows excessively or lend to someone who defaults, then it can be forced to go into liquidation.

3) **From Government's point of view**: From Government's point of view, the financial risk can be viewed as failure of any bank or (like Lehman Brothers) down grading of any financial institution leading to spread of distrust among society at large. Even this risk also includes wilful defaulters. This can also be extended to sovereign debt crisis.

VALUE-AT-RISK (VAR)

As per Wikipedia, VAR is a measure of risk of investment. Given the normal market condition in a set of period, say, one day it estimates how much an investment might lose. This investment can be a portfolio, capital investment or foreign exchange etc.,

VAR answers two basic questions –

i. What is worst case scenario?
ii. What will be loss?

It was first applied in 1922 in New York Stock Exchange, entered the financial world in 1990s and become world's most widely used measure of financial risk.

Features of VAR

Following are main features of VAR

(i) **Components of Calculations**: VAR calculation is based on following three components:

   a) Time Period

b) Confidence Level – Generally 95% and 99%
c) Loss in percentage or in amount

(ii) **Statistical Method**: It is a type of statistical tool based on Standard Deviation.

(iii) **Time Horizon**: VAR can be applied for different time horizons say one day, one week, one month and so on

(iv) **Probability**: Assuming the values are normally attributed, probability of maximum loss can be predicted.

(v) **Control Risk**: Risk can be controlled by selling limits for maximum loss.

(vi) **Z Score**: Z Score indicates how many standard Deviations is away from Mean value of a population. When it is multiplied with Standard Deviation it provides VAR.

Application of VAR

VAR can be applied

a) to measure the maximum possible loss on any portfolio or a trading position.
b) as a benchmark for performance measurement of any operation or trading.
c) to fix limits for individuals dealing in front office of a treasury department.
d) to enable the management to decide the trading strategies.
e) as a tool for Asset and Liability Management especially inbanks.

Example:

The concept of VAR can be understood in a better manner with help of following example:

Suppose you hold worth ₹ 2 crore shares of X Ltd. whose market price standard deviation is 2% per day. Assuming 252 trading days a year, determine maximum loss level over the period of 1 trading day and 10 trading days with 99% confidence level.

Question on VAR

Consider a portfolio consisting of a ₹ 200,00,000 investment in share XYZ and a ₹ 200,00,000 investment in share ABC. The daily standard deviation of both shares is 1% and that the coefficient of correlation between them is 0.3. You are required to determine the 10-day 99% value at risk for the portfolio?

APPROPRIATE METHODS FOR IDENTIFICATION AND MANAGEMENT OF FINANCIAL RISK

As we have classified financial risk in 4 categories, we shall discuss identification and management of each risk separately under same category.

1) **Counter Party Risk**:

The various hints that may provide counter party risk are as follows:

a) Failure to obtain necessary resources to complete the project or transaction undertaken.
b) Any regulatory restrictions from the Government.
c) Hostile action of foreign government.

d) Let down by third party.
e) Have become insolvent.

The various techniques to manage this type of risk are as follows:

1. Carrying out Due Diligence before dealing with any third party.
2. Do not over commit to a single entity or group or connected entities.
3. Know your exposure limits.
4. Review the limits and procedure for credit approval regularly.
5. Rapid action in the event of any likelihood of default
6. Use of performance guarantee, insurance or other instruments.

2) Political risk:

From the following actions by the Governments of the host country this risk can be identified:

- Insistence on resident investors or labour.
- Restriction on conversion of currency.
- Expropriation of foreign assets by the local govt.
- Price fixation of the products.

Since this risk mainly relates to investments in foreign country, company should assess country risk:

1. By referring political ranking published by different business magazines.
2. By evaluating country's macro-economic conditions.
3. By analyzing the popularity of current government and assess their stability.
4. By taking advises from the embassies of the home countries in the host countries.

Further, following techniques can be used to mitigate the risk:

(i) Local sourcing of raw materials and labour.
(ii) Entering into joint ventures
(iii)Local financing
(iv)Prior negotiations

3) **Interest Rate Risk**:

Generally, interest rate Risk is mainly identified from the following:

- Monetary Policy of the Government.
- Any action by Government such as demonetization etc.
- Economic Growth
- Release of Industrial Data
- Investment by foreign investors
- Stock market changes

The management of Interest risk has been discussed in greater detail in separate chapter later on.

4) **Currency Risk**:

Just like interest rate risk the currency risk is dependent on the Government action and economic development. Some of the parameters to identity the currency risk are as follows:

(i) Government Action: The Government action of any country has visual impact in its currency. For example, the UK Govt. decision to divorce from European Union i.e. Brexit brought the pound to its lowest since 1980's.

(ii) Nominal Interest Rate: As per interest rate parity (IRP)the currency exchange rate depends on the nominal interest of that country.

(iii) Inflation Rate: Purchasing power parity theory discussed in later chapters impact the value of currency.

(iv) Natural Calamities: Any natural calamity can have negative impact.

(v) War, Coup, Rebellion etc.: All these actions can have far reaching impact on currency's exchange rates.

(vi) Change of Government: The change of government and its attitude towards foreign investment also helps to identify the currency risk. So far as the management of currency risk is concerned, it has been covered in a detailed manner in a separate chapter

Question 1 (PP May'19, RTP May'18)
DESCRIBE Value at Risk and its application. OR

Explain the significance of VAR.

Solution
VAR is a measure of risk of investment. Given the normal market condition in a set of period, say, one day it estimates how much an investment might lose. This investment can be a portfolio, capital investment or foreign exchange etc., VAR answers two basic questions -

(i) What is worst case scenario?
(ii) What will be loss?

It was first applied in 1922 in New York Stock Exchange, entered the financial world in 1990s and become world's most widely used measure of financial risk.

VAR can be applied
(i) to measure the maximum possible loss on any portfolio or a trading position.
(ii) as a benchmark for performance measurement of any operation or trading.
(iii) to fix limits for individuals dealing in front office of a treasury department.
(iv) to enable the management to decide the trading strategies.
(v) as a tool for Asset and Liability Management especially in banks.

Question 2(MTP March'18, MTP Oct'18, MTP Nov'21, RTP Nov'20, MTP May'20, MTP March'21, MTP Oct'21, PP Nov'18, MTP Sep'22)
The Financial Risk can be viewed from different perspective. Explain. OR

Explain Financial Risk from the point of view of Stakeholder, Company and the Government.

Solution
The financial risk can be evaluated from different point of views as follows:

a) **From stakeholder's point of view:** Major stakeholders of a business are equity shareholders and they view financial gearing i.e. ratio of debt in capital structure of company as risk since in event of winding up of a company they will be least prioritized. Even for a lender, existing gearing is also a risk since company having high gearing faces more risk in default of payment of interest and principal repayment.

b) **From Company's point of view:** From company's point of view if a company borrows excessively or lend to someone who defaults, then it can be forced to go into liquidation.

c) **From Government's point of view**: From Government's point of view, the financial risk can be viewed as failure of any bank or (like Lehman Brothers) down grading of any financial institution leading to spread of distrust among society at large. Even this risk also includes willful defaulters. This can also be extended to sovereign debt crisis.

Question 3

Consider a portfolio consisting of a ₹ 2,00,00,000 investment in share XYZ and a ₹ 2,00,00,000 investment in share ABC. The daily standard deviation of both shares is 1% and that the coefficient of correlation between them is 0.3. You are required to determine the 10-day 99% value at risk for the portfolio?

Solution

The standard deviation of the daily change in the investment in each asset is ₹ 2,00,000 i.e. 2 lakhs. The variance of the portfolio's daily change is

V = 22 + 22 + 2 x 0.3 x 2 x 2 = 10.4

σ (Standard Deviation) = √3.22 lakhs 10.4

Alternatively, it can also be computed as follows:

= (1)2(0.50)2 + (1)2(0.50)2 + 2(1)(1)(0.3)(0.50)(0.50)

= 0.25 + 0.25 + 0.15 = 0.65%

σ (Standard Deviation) = 0.80623% =√0.65

σ (Standard Deviation) in Amount = ₹ 400 lakhs x 0.80623% = ₹ 3.22 lakhs

Accordingly, the standard deviation of the 10-day change is

₹ 3.22 lakhs x = Rs.10.18 lakh

From the Normal Table we see that z score for 1% is 2.33. This means that 1% of a normal distribution lies more than 2.33 standard deviations below the mean. The 10-day 99 percent value at risk is therefore

2.33 × ₹ 10.18 lakh = Rs.23.72 lakh

Question 4(MTP April'18, MTP March'22, RTP May'20, PP May'19, PP July'21)

Explain features of Value at Risk (VAR).

Solution

Explanation of four features of VAR are as below:

(i) **Components of Calculations**: VAR calculation is based on following three components:
   a) Time Period
   b) Confidence Level – Generally 95% and 99%
   c) Loss in percentage or in amount

(ii) **Statistical Method**: It is a type of statistical tool based on Standard Deviation.

(iii) **Time Horizon**: VAR can be applied for different time horizons say one day, one week, one month and so on.

(iv) **Probability**: Assuming the values are normally attributed, probability of maximum loss can be predicted.

(v) **Control Risk**: Risk can be controlled by selling limits for maximum loss.

(vi) **Z score**: Z score indicates how many standard Deviations is away from Mean value of a population. When it is multiplied with Standard Deviation it provides VAR.

Question 5(MTP Oct'19, PP Dec'21)
Briefly explain Counter Party Risk and the various techniques to manage this risk.

Solution
The various hints that may provide counter party risk are as follows:

a) Failure to obtain necessary resources to complete the project or transaction undertaken.
b) Any regulatory restrictions from the Government.
c) Hostile action of foreign government.
d) Let down by third party.
e) Have become insolvent.

The various techniques to manage this type of risk are as follows:

1) Carrying out Due Diligence before dealing with any third party.
2) Do not over commit to a single entity or group or connected entities.
3) Know your exposure limits.
4) Review the limits and procedure for credit approval regularly.
5) Rapid action in the event of any likelihood of defaults.
6) Use of performance guarantee, insurance or other instruments.

Question 6(MTP Nov'19, RTP Nov'18, RTP Nov'19, MTP Oct'22)
Explain some of the parameters to identify the currency risk.

Solution
Some of the parameters to identity the currency risk are as follows:

1) **Government Action**: The Government action of any country has visual impact in its currency.

   For example, the UK Govt. decision to divorce from European Union i.e. Brexit brought the pound to its lowest since 1980's.

2) **Nominal Interest Rate**: As per interest rate parity (IRP) the currency exchange rate depends on the nominal interest of that country.

3) **Inflation Rate**: Purchasing power parity theory impact the value of currency.

4) **Natural Calamities**: Any natural calamity can have negative impact.

5) **War, Coup, Rebellion etc.**: All these actions can have far reaching impact on currency's exchange rates.

6) **Change of Government**: The change of government and its attitude towards foreign investment also helps to identify the currency risk.

Question 7(RTP July'21, RTP May'21)
How should company assess political risk and how this risk can be identified? OR Explain how an organization interested in making investments in foreign country can assess country risk and mitigate the risk.

Solution
Since this risk mainly relates to investments in foreign country, company should assess country

1) By referring political ranking published by different business magazines.
2) By evaluating country's macroeconomic conditions
3) By analyzing the popularity of current government and assess their stability.
4) By taking advises from the embassies of the home country in the host countries.

Further, following techniques can be used to mitigate (minimize) this risk.

(i) Local sourcing of raw materials and labour.
(ii) Entering into joint ventures
(iii)Local financing
(iv)Prior negotiations

From the following actions by the Governments of the host country this risk can be identified:

1) Insistence on resident investors or labour.
2) Restriction on conversion of currency.
3) Repatriation of foreign assets of the local govt.
4) Price fixation of the products.

Question 8(PP Jan'21)
Risks are inherent and integral part of market.

Solution
Yes, Risk is an integral part of market and this is a type of systematic risk that affects prices of any particular share move up or down consistently for some time periods in line with other shares in the market. A general rise in share prices is referred to as a bullish trend, whereas a general fall in share prices is referred to as a bearish trend. In other words, the share market moves between the bullish phase and the bearish phase. The market movements can be easily seen in the movement of share price indices such as the BSE Sensitive Index, BSE National Index, NSE Index etc.

Question 9(MTP April'22)
EXPLAIN the main risk that can be faced by an overseas investor.

Solution
Mainly Political Risk is faced by an overseas investors, as the adverse action by the government of host country may lead to huge loses. This can be on any of the following form.

- Confiscation or destruction of overseas properties.
- Rationing of remittance to home country.
- Restriction on conversion of local currency of host country into foreign currency.
- Restriction as to borrowings.
- Invalidation of Patents
- Price control of products

Question 10(PP May'22)
Explain Compliance Risk & Operational Risk

Solution

a) Compliance Risk: Every business needs to comply with rules and regulations. For example, with the advent of Companies Act, 2013, and continuous updating of SEBI guidelines, each business organization has to comply with plethora of rules, regulations and guidelines. Noncompliance leads to penalties in the form of fine and imprisonment. However, when a company ventures into a new business line or a new geographical area, the real problem then occurs. For example, a company pursuing cement business likely to venture into sugar business in a different state but laws applicable to the sugar mills in that state are different. So, that poses a compliance risk. If the company fails to comply with laws related to a new area or industry or sector, it will pose a serious threat to its survival.

b) Operational Risk: This type of risk relates to internal risk. It also relates to failure on the part of the company to cope with day-to-day operational problems. Operational risk relates to 'people' as well as 'process'. We will take an example to illustrate this.

   For example, an employee paying out ` 1,00,000 from the account of the company instead of ` 10,000. This is a people as well as a process risk. An organization can employ another person to check the work of that person who has mistakenly paid ` 1,00,000 or it can install an electronic system that can flag off an unusual amount.

Chapter 13

SECURITY ANALYSIS

Space for your notings of Formulae or important points

Question 1
Explain the Efficient Market Theory in and what are major misconceptions about this theory?

Solution
Efficient Market Theory was developed by University of Chicago professor Eugen Fama in the 1960s. As per this theory, at any given time, all available price sensitive information is fully reflected in securities' prices. Thus this theory implies that no investor can consistently outperform the market as every stock is appropriately priced based on available information. Stating otherwise theory states that no none can "beat the market" hence making it impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices as stocks are always traded at their fair value on stock exchanges. Hence it is impossible to outperform the overall market through expert stock selection or market timing and that the only way an investor can possibly obtain higher returns is by purchasing riskier investments.

Misconception about Efficient Market Theory:
Efficient Market Theory implies that market prices factor in all available information and as such it is not possible for any investor to earn consistent long term returns from market operations.

Although price tends to fluctuate they cannot reflect fair value. This is because the future is uncertain. The market springs surprises continually and as prices reflect the surprises they fluctuate.

Inability of institutional portfolio managers to achieve superior investment performance implies that they lack competence in an efficient market. It is not possible to achieve superior investment performance since market efficiency exists due to portfolio managers doing this job well in a competitive setting.

The random movement of stock prices suggests that stock market is irrational. Randomness and irrationality are two different things, if investors are rational and competitive, price changes are bound to be random.

Question 2(MTP March'18, MTP Oct'18)
Explain Dow Jones theory.

Solution
The Dow Theory is one of the oldest and most famous technical theories. It was originated by Charles Dow, the founder of Dow Jones Company in late nineteenth century. It is a helpful tool for determining the relative strength of the stock market. It can also be used as a barometer of business.

The Dow Theory is based upon the movements of two indices, constructed by Charles Dow, Dow Jones Industrial Average (DJIA) and Dow Jones Transportation Average (DJTA). These averages reflect the aggregate impact of all kinds of information on the market. The movements of the market are divided into three classifications, all going at the same time; the primary movement, the secondary movement, and the daily fluctuations. The primary movement is the main trend of the market, which lasts from one year to 36 months or longer. This trend is commonly called bear or bull market. The secondary movement of the market is shorter in duration than the primary movement, and is opposite in direction. It lasts from two weeks to a month or more. The daily fluctuations are the narrow movements from day-to-day. These fluctuations are not part of the Dow Theory interpretation of the

stock market. However, daily movements must be carefully studied, along with primary and secondary movements, as they go to make up the longer movement in the market.

Thus, the Dow Theory's purpose is to determine where the market is and where is it going, although not how far or high. The theory, in practice, states that if the cyclical swings of the stock market averages are successively higher and the successive lows are higher, then the market trend is up and a bullish market exists. Contrarily, if the successive highs and successive lows are lower, then the direction of the market is down and a bearish market exists.

Charles Dow proposed that the primary uptrend would have three moves up, the first one being caused by accumulation of shares by the far-sighted, knowledgeable investors, the second move would be caused by the arrival of the first reports of good earnings by corporations, and the last move up would be caused by widespread report of financial well-being of corporations. The third stage would also see rampant speculation in the market. Towards the end of the third stage, the farsighted investors, realizing that the high earnings levels may not be sustained, would start selling, starting the first move down of a downtrend, and as the non-sustainability of high earnings is confirmed, the second move down would be initiated and then the third move down would result from distress selling in the market.

Question 3
Explain the Elliot Theory of technical analysis.

Solution
Inspired by the Dow Theory and by observations found throughout nature, Ralph Elliot formulated Elliot Wave Theory in 1934. This theory was based on analysis of 75 years stock price movements and charts. From his studies, he defined price movements in terms of waves. Accordingly, this theory was named Elliot Wave Theory. Elliot found that the markets exhibited certain repeated patterns or waves. As per this theory wave is a movement of the market price from one change in the direction to the next change in the same direction. These waves are resulted from buying and selling impulses emerging from the demand and supply pressures on the market. Depending on the demand and supply pressures, waves are generated in the prices.

As per this theory, waves can be classified into two parts:-

a) **Impulsive Patterns-(Basic Waves)** - In this pattern there will be 3 or 5 waves in a given direction (going upward or downward). These waves shall move in the direction of the basic movement.
This movement can indicate bull phase or bear phase.

b) **Corrective Patterns- (Reaction Waves)** - These 3 waves are against the basic direction of the basic movement. Correction involves correcting the earlier rise in case of bull market and fall in case of bear market.

Question 4(MTP April'19, MTP Oct'19
Explain the various indicators that can be used to assess the performance of an economy. OR

Discuss the various techniques used in economic analysis.

Solution
Economic analysis is used to forecast national income with its various components that have a bearing on the concerned industry and the company in particular. Gross national product (GNP) is used to

measure national income as it reflects the growth rate in economic activities and has been regarded as a forecasting tool for analyzing the overall economy along with its various components during a particular period.

Some of the techniques used for economic analysis are:

a) **Anticipatory Surveys**: They help investors to form an opinion about the future state of the economy. It incorporates expert opinion on construction activities, expenditure on plant and machinery, levels of inventory – all having a definite bearing on economic activities. Also future spending habits of consumers are taken into account.

   In spite of valuable inputs available through this method, it has certain drawbacks:
   (i) Survey results do not guarantee that intentions surveyed would materialize.
   (ii) They are not regarded as forecasts per se, as there can be a consensus approach by the investor for exercising his opinion. Continuous monitoring of this practice is called for to make this technique popular.

b) **Barometer/Indicator Approach**: Various indicators are used to find out how the economy shall perform in the future.

   The indicators have been classified as under:
   (i) **Leading Indicators**: They lead the economic activity in terms of their outcome. They relate to the time series data of the variables that reach high/low points in advance of economic activity.

   (ii) **Roughly Coincidental Indicators**: They reach their peaks and troughs at approximately the same in the economy.

   (iii)**Lagging Indicators:** They are time series data of variables that lag behind in their consequences vis-a- vis the economy. They reach their turning points after the economy has reached its own already. All these approaches suggest direction of change in the aggregate economic activity but nothing about its magnitude. The various measures obtained from such indicators may give conflicting signals about the future direction of the economy. To avoid this limitation, use of diffusion/composite index is suggested whereby combining several indicators into one index to measure the strength/weaknesses in the movement of a particular set of indicators. Computation of diffusion indices is no doubt difficult notwithstanding the fact it does not eliminate irregular movements.

   Money supply in the economy also affects investment decisions. Rate of change in money supply in the economy affects GNP, corporate profits, interest rates and stock prices. Increase in money supply fuels inflation. As investment in stocks is considered as a hedge against inflation, stock prices go up during inflationary period.

c) **Economic Model Building Approach**: In this approach, a precise and clear relationship between dependent and independent variables is determined. GNP model building or sectoral analysis is used in practice through the use of national accounting framework.

   The steps used are as follows:

(i) Hypothesize total economic demand by measuring total income (GNP) based on political stability, rate of inflation, changes in economic levels.
(ii) Forecasting the GNP by estimating levels of various components viz. consumption expenditure, gross private domestic investment, government purchases of goods/services, net exports.
(iii) After forecasting individual components of GNP, add them up to obtain the forecasted GNP.
(iv) Comparison is made of total GNP thus arrived at with that from an independent agency for the forecast of GNP and then the overall forecast is tested for consistency. This is carried out for ensuring that both the total forecast and the component wise forecast fit together in a reasonable manner.

Question 5(MTP Mar'19)
Describe the concept of 'Evaluation of Technical Analysis'.

Solution

Evaluation of Technical Analysis

Technical Analysis has several supporters as well several critics. The advocates of technical analysis offer the following interrelated argument in their favour:

a) Under influence of crowd psychology trend persist for some time. Tools of technical analysis help in identifying these trends early and help in investment decision making.

b) Shift in demand and supply are gradual rather than instantaneous. Technical analysis helps in detecting this shift rather early and hence provides clues to future price movements.

c) Fundamental information about a company is observed and assimilated by the market over a period of time. Hence price movement tends to continue more or less in same direction till the information is fully assimilated in the stock price. Detractors of technical analysis believe that it is an useless exercise; their arguments are as follows:
   (i) Most technical analysts are not able to offer a convincing explanation for the tools employed by them.
   (ii) Empirical evidence in support of random walk hypothesis cast its shadow over the usefulness of technical analysis.
   (iii) By the time an uptrend and down trend may have been signaled by technical analysis it may already have taken place.
   (iv) Ultimately technical analysis must be self-defeating proposition. With more and more people employing it, the value of such analysis tends to decline.

In a nutshell, it may be concluded that in a rational, well ordered and efficient market, technical analysis may not work very well. However with imperfection, inefficiency and irrationalities that characterizes the real world market, technical analysis may be helpful. If technical analysis is used in conjunction with fundamental analysis, it might be useful in providing proper guidance to investment decision makers.

Question 6(MTP Oct'20, RTP Nov'20)
Explain various Market Indicators.

Solution

Following are major Market Indicators:

(i) **Breadth Index:** It is an index that covers all securities traded. It is computed by dividing the net advances or declines in the market by the number of issues traded. The breadth index either supports or contradicts the movement of the Dow Jones Averages. If it supports the movement of the Dow Jones Averages, this is considered sign of technical strength and if it does not support the averages, it is a sign of technical weakness i.e. a sign that the market will move in a direction opposite to the Dow Jones Averages. The breadth index is an addition to the Dow Theory and the movement of the Dow Jones Averages.

(ii) **Volume of Transactions**: The volume of shares traded in the market provides useful clues on how the market would behave in the near future. A rising index/price with increasing volume would signal buy behavior because the situation reflects an unsatisfied demand in the market. Similarly, a falling market with increasing volume signals a bear market and the prices would be expected to fall further. A rising market with decreasing volume indicates a bull market while a falling market with dwindling volume indicates a bear market. Thus, the volume concept is best used with another market indicator, such as the Dow Theory.

(iii) **Confidence Index**: It is supposed to reveal how willing the investors are to take a chance in the market. It is the ratio of high-grade bond yields to low-grade bond yields. It is used by market analysts as a method of trading or timing the purchase and sale of stock, and also, as a forecasting device to determine the turning points of the market. A rising confidence index is expected to precede a rising stock market, and a fall in the index is expected to precede a drop in stock prices. A fall in the confidence index represents the fact that low-grade bond yields are rising faster or falling more slowly than high grade yields. The confidence index is usually, but not always a leading indicator of the market. Therefore, it should be used in conjunction with other market indicators.

(iv) **Relative Strength Analysis**: The relative strength concept suggests that the prices of some securities rise relatively faster in a bull market or decline more slowly in a bear market than other securities i.e. some securities exhibit relative strength. Investors will earn higher returns by investing in securities which have demonstrated relative strength in the past because the relative strength of a security tends to remain undiminished over time. Relative strength can be measured in several ways. Calculating rates of return and classifying those securities with historically high average returns as securities with high relative strength is one of them. Even ratios like security relative to its industry and security relative to the entire market can also be used to detect relative strength in a security or an industry.

(v) **Odd - Lot Theory:** This theory is a contrary - opinion theory. It assumes that the average person is usually wrong and that a wise course of action is to pursue strategies contrary to popular opinion. The odd-lot theory is used primarily to predict tops in bull markets, but also to predict reversals in individual securities.

Question 7(PP Nov'20)

In an efficient market, technical analysis may not work perfectly. However, with imperfections, inefficiencies and irrationalities, which characterises the real world, technical analysis may be

helpful. Critically analyse the statement.

Solution

Yes, this statement is correct.

Arguments for technical analysis: Under influence of crowd psychology trend persists for some time. Technical analysis helps in identifying these trends early which is helping decision making.

Shift in demand and supply is gradual rather than instantaneous. Technical analysis helps in detecting this shift rather early.

Fundamental information about a company is observed and assimilated by the market over a period of time. Hence price movements tend to more or less in same direction till the information is fully assimilated in the price of the stock.

Arguments against technical analysis:

Technical are not able to offer a convincing explanation for tools employed by them. Empirical evidence in support of random walk hypothesis cast its shadow on it.

By the time trends are signaled by technical analysis, trends have already taken place.

Question 8

Differentiate between Technical analysis and Fundamental analysis.

Solution

S.No.	Basis	Fundamental Analysis	Technical Analysis
1	Method	Prospects are measured by analyzing economy's macro factors such as Country's GDP, Inflation rate, Interest Rate, Growth Rate etc. and company's micro factors like its Sales, Profitability, Solvency, Assets and Liabilities and Cash Position etc.	Predict future prices and their direction using purely historical market data and information such as their Price Movements, Volume, Open interest etc.
2	Rule	Prices of a share discounts everything.	Price captures everything
3	Usefulness	For Long-Term Investing	For Short-Term Investing

Question 9(RTP Nov'18, MTP May'20)

Explain the challenges to Efficient Market theory.

Solution

a) **Information inadequacy** – Information is neither freely available nor rapidly transmitted to all participants in the stock market. There is a calculated attempt by many companies to circulate misinformation.

b) **Limited information processing capabilities** – Human information processing capabilities are sharply limited. According to Herbert Simon every human organism lives in an environment which generates millions of new bits of information every second but the bottle necks of the perceptual apparatus does not admit more than thousand bits per seconds and possibly much less.

c) **Irrational Behaviour** – It is generally believed that investors' rationality will ensure a close correspondence between market prices and intrinsic values. But in practice this is not true. J. M. Keynes argued that all sorts of consideration enter into the market valuation which is in no way relevant to the prospective yield. This was confirmed by L. C. Gupta who found that the market evaluation processes work haphazardly almost like a blind man firing a gun. The market seems to function largely on hit or miss tactics rather than on the basis of informed beliefs about the long-term prospects of individual enterprises.

d) **Monopolistic Influence** – A market is regarded as highly competitive. No single buyer or seller is supposed to have undue influence over prices. In practice, powerful institutions and big operators wield grate influence over the market. The monopolistic power enjoyed by them diminishes the competitiveness of the market.

Question 10(RTP May'19)
DESCRIBE the factors affecting Industry Analysis.

Solution
The following factors may particularly be kept in mind while assessing the factors relating to an industry.

a) **Product Life-Cycle**: An industry usually exhibits high profitability in the initial and growth stages, medium but steady profitability in the maturity stage and a sharp decline in profitability in the last stage of growth.

b) **Demand Supply Gap**: Excess supply reduces the profitability of the industry because of the decline in the unit price realization, while insufficient supply tends to improve the profitability because of higher unit price realization.

c) **Barriers to Entry**: Any industry with high profitability would attract fresh investments. The potential entrants to the industry, however, face different types of barriers to entry. Some of these barriers are innate to the product and the technology of production, while other barriers are created by existing firms in the industry.

d) **Government Attitude**: The attitude of the government towards an industry is a crucial determinant of its prospects.

e) **State of Competition in the Industry**: Factors to be noted are- firms with leadership capability and the nature of competition amongst them in foreign and domestic market, type of products manufactured viz. homogeneous or highly differentiated, demand prospects through classification viz customer- wise/area-wise, changes in demand patterns in the long/immediate/ short run, type of industry the firm is placed viz. growth, cyclical, defensive or decline.

f) **Cost Conditions and Profitability**: The price of a share depends on its return, which in turn depends on profitability of the firm. Profitability depends on the state of competition in the industry, cost control measures adopted by its units and growth in demand for its products.

g) **Technology and Research**: They play a vital role in the growth and survival of a particular industry. Technology is subject to change very fast leading to obsolescence. Industries which update themselves have a competitive advantage over others in terms of quality, price etc.

Question 11(RTP May'20)
Explain the factors affecting economic analysis.

Solution
Some of the factors affecting economic analysis are discussed as under:

(i) **Growth Rates of National Income and Related Measures**: For most purposes, what is important is the difference between the nominal growth rate quoted by GDP and the 'real' growth after taking inflation into account. The estimated growth rate of the economy would be a pointer to the prospects for the industrial sector, and therefore to the returns investors can expect from investment in shares.

(ii) **Growth Rates of Industrial Sector:** This can be further broken down into growth rates of various industries or groups of industries if required. The growth rates in various industries are estimated based on the estimated demand for its products.

(iii) **Inflation:** Inflation is measured in terms of either wholesale prices (the Wholesale Price Index or WPI) or retail prices (Consumer Price Index or CPI). The demand in some industries, particularly the consumer products industries, is significantly influenced by the inflation rate. Therefore, firms in these industries make continuous assessment about inflation rates likely to prevail in the near future so as to fine-tune their pricing, distribution and promotion policies to the anticipated impact of inflation on demand for their products.

(iv) **Monsoon:** Because of the strong forward and backward linkages, monsoon is of great concern to investors in the stock market too.

Question 12(MTP April'18)
Explain Random Walk theory.

Solution
Random Walk Theory
Random Walk hypothesis states that the behaviour of stock market prices is unpredictable and that there is no relationship between the present prices of the shares and their future prices. Basic premises of the theory are as follows:

- Prices of shares in stock market can never be predicted. The reason is that the price trends are not the result of any underlying factors, but that they represent a statistical expression of past data.
- There may be periodical ups or downs in share prices, but no connection can be established between two successive peaks (high price of stocks) and troughs (low price of stocks).

Chapter 14

FINANCIAL POLICY & CORPORATE STRATEGY

Space for your notings of Formulae or important points

Question 1 (MAY 2018)
Explain the interface of Financial Policy and Strategic Management.

Solution
The interface of strategic management and financial policy will be clearly understood if we appreciate the fact that the starting point of an organization is money and the end point of that organization is also money. No organization can run an existing business and promote a new expansion project without a suitable internally mobilized financial base or both i.e. internally and externally mobilized financial base.

Sources of finance and capital structure are the most important dimensions of a strategic plan. The needfor fund mobilization to support the expansion activity of firm is very vital for any organization.

The generation of funds may arise out of ownership capital and or borrowed capital. A company may issue equity shares and/or preference shares for mobilizing ownership capital and debentures to raise borrowed capital. Public deposits, for a fixed time period, have also become a major source of short- and medium-term finance. Organizations may offer higher rates of interest than banking institutions to attract investors and raise fund. The overdraft, cash credits, bill discounting, bank loan and trade credit are the other sources of short-term finance.

Along with the mobilization of funds, policy makers should decide on the capital structure to indicate the desired mix of equity capital and debt capital. There are some norms for debt equity ratio which need to be followed for minimizing the risks of excessive loans. For instance, in case of public sector organizations, the norm is 1:1 ratio and for private sector firms, the norm is 2:1 ratio.

However, this ratio in its ideal form varies from industry to industry. It also depends on the planning mode of the organization. For capital intensive industries, the proportion of debt to equity is much higher. Similar is the case for high-cost projects in priority sectors and for projects in under developed regions.

Another important dimension of strategic management and financial policy interface is the investment and fund allocation decisions. A planner has to frame policies for regulating investments in fixed assets and for restraining of current assets. Investment proposals mooted by different business units may be divided into three groups. One type of proposal will be for addition of a new product by the firm.

Another type of proposal will be to increase the level of operation of an existing product through either an increase in capacity in the existing plant or setting up of another plant for meeting additional capacityrequirement. The last is for cost reduction and efficient utilization of resources through a new approach and/or closer monitoring of the different critical activities.

Now, given these three types of proposals a planner should evaluate each one of them by making within group comparison in the light of capital budgeting exercise. In fact, project evaluation and project selection are the two most important jobs under fund allocation. Planner's task is to make the best possible allocation under resource constraints.

Dividend policy is yet another area for making financial policy decisions affecting the strategic performance of the company. A close interface is needed to frame the policy to be beneficial for all. Dividend policy decision deals with the extent of earnings to be distributed as dividend and the extent ofearnings to be retained for future expansion scheme of the firm. From the point of view of long term

funding of business growth, dividend can be considered as that part of total earnings, which cannot be profitably utilized by the company. Stability of the dividend payment is a desirable consideration that can have a positive impact on share prices.

The alternative policy of paying a constant percentage of the net earnings may be preferable from the point of view of both flexibility of the firm and ability of the firm. It also gives a message of lesser risk forthe investors. Yet some other companies follow a different alternative. They pay a minimum dividend per share and additional dividend when earnings are higher than the normal earnings. In actual practice,investment opportunities and financial needs of the firm and the shareholders preference for dividend against capital gains resulting out of share are to be taken into consideration for arriving at the right dividend policy. Alternatives like cash dividend and stock dividend are also to be examined while working out an ideal dividend policy that supports and promotes the corporate strategy of the company.

Question 2(MTP Aug'18 , Nov'19, March'22, RTP May'20, MTP April'19, MTP Oct'20, MTP Sep'22)
Write a short note on Balancing Financial Goals vis-a-vis Sustainable Growth. OR

Often, a conflict can arise if growth objectives are not consistent with the value of the organization's sustainable growth. EXPLAIN.

Solution

The concept of sustainable growth can be helpful for planning healthy corporate growth. This concept forces managers to consider the financial consequences of sales increases and to set sales growth goals that are consistent with the operating and financial policies of the firm. Often, a conflict can arise if growth objectives are not consistent with the value of the organization's sustainable growth. Question concerning right distribution of resources may take a difficult shape if we take into consideration the rightness not for the current stakeholders but for the future stakeholders also. To take an illustration, let us refer to fuel industry where resources are limited in quantity and a judicial use of resources is needed to cater to the need of the future customers along with the need of the present customers. One may have noticed the save fuel campaign, a demarketing campaign that deviates from the usual approach of sales growth strategy and preaches for conservation of fuel for their use across generation. This is an example of stable growth strategy adopted by the oil industry as a whole under resource constraints and the long run objective of survival over years. Incremental growth strategy, profit strategy and pause strategy are other variants of stable growth strategy.

Sustainable growth is important to enterprise long-term development. Too fast or too slow growth will go against enterprise growth and development, so financial should play important role in enterprise development, adopt suitable financial policy initiative to make sure enterprise growth speed close to sustainable growth ratio and have sustainable healthy development.

The sustainable growth rate (SGR), concept by Robert C. Higgins, of a firm is the maximum rate of growth in sales that can be achieved, given the firm's profitability, asset utilization, and desired dividend payout and debt (financial leverage) ratios. The sustainable growth rate is a measure of how much a firm can grow without borrowing more money. After the firm has passed this rate, it must borrow funds from another source to facilitate growth. Variables typically include the net profit margin on new and existing retained in the business.

SGR = ROE x (1- Dividend payment ratio)

Sustainable growth models assume that the business wants to: 1) maintain a target capital structure without issuing new equity; 2) maintain a target dividend payment ratio; and 3) increase sales as rapidly as market conditions allow.

Since the asset to beginning of period equity ratio is constant and the firm's only source of new equity is retained earnings, sales and assets cannot grow any faster than the retained earnings plus the additional debt that the retained earnings can support. The sustainable growth rate is consistent with the observed evidence that most corporations are reluctant to issue new equity. If, however, the firm is willing to issue additional equity, there is in principle no financial constraint on its growth rate. Indeed, the sustainable growth rate formula is directly predicted on return on equity.

Question 3(July'21)
Explain the different levels of enterprise strategy? OR Enumerate 'Strategy' at different levels of hierarchy.

Solution

a) **Corporate Level Strategy**: Corporate level strategy fundamentally is concerned with selection of businesses in which a company should compete. Corporate level strategy should be able to answer three basic questions:
   - **Suitability**: Whether the strategy would work for the accomplishment of common objective of the company.
   - **Feasibility**: Determines the kind and number of resources required to formulate and implement the strategy.
   - **Acceptability**: It is concerned with the stakeholder's satisfaction.

b) **Business Unit Level Strategy**: At the business unit level, the strategic issues are about both practical coordination of operating units and about developing and sustaining a competitive advantage for the products and services that are produced.

c) **Functional Level Strategy**: The functional level is the level of the operating divisions and departments. The strategic issues at this level are related to functional business processes and value chain. Functional level strategies in R&D, operations, manufacturing, marketing, finance, and human resources involve the development and coordination of resources through which business unit level strategies can be executed effectively and efficiently.

Question 4
Explain the Functions of Strategic Financial Management OR

The investment and financial decisions functions involve many functions. Explain?

Solution

The investment and financial decisions functions involve the following functions:

a) Continual search for best investment opportunities
b) Selection of the best profitable opportunities
c) Determination of optimal mix of funds for the opportunities
d) Establishment of systems for internal controls and Analysis of results for future decision-making.

Question 5(MTP Oct'19, PP Jan'21, MTP April'21, RTP July'21, RTP Nov'20, PP Nov'19)
What are key decisions falling within the scope of financial strategy? OR

As a financial strategist you will depend on certain key financial decisions. Discuss.

Solution

- **Financing decisions**: These decisions deal with the mode of financing or mix of equity capital and debt capital.

- **Investment decisions**: These decisions involve the profitable utilization of firm's funds especially in long term projects (capital projects). The projects are evaluated in relation to their expected return and risk. Dividend decisions: These decisions determine the division of earnings between payments to shareholders and reinvestment in the company.

- **Portfolio decisions**: A portfolio decision refers to a collection of investment tools such as stocks, shares, mutual funds, bonds, cash and so on depending on the investor's income, budget and convenient time frame.

Question 6(MTP April'22, RTP May'21, MTP March'21)
EXPLAIN what makes an organization financially sustainable.

Solution
To be financially sustainable, an organization must:

- have more than one source of income;
- have more than one way of generating income;
- do strategic, action and financial planning regularly;
- have adequate financial systems;
- have a good public image;
- be clear about its values (value clarity); and have financial autonomy.

Question 7(RTP May'18)
DISTINGUISH between: Banking and Non-Banking financial institutions.

Solution
Distinction between Banking and Non-Banking financial institutions:

Basis for comparison	Banking Institutions	Non-Banking Institutions
Meaning	Bank is a financial intermediary which provides banking services to general people. And it requires a bank license for that.	Non-banking institutions are basically company form of organization that provides banking services to people without holding a banking license.
Transaction Services	Banks provide transaction services like providing overdraft facility, issue of cheque books, travelers cheque, demand draft, transfer of funds, etc.	The non-banking institutions do not provide any transaction services.

Money supply	Bank deposits constitute a major part of the national money supply.	The money supply of the Non-banking institutions is small.
Credit creation	Banks create credit.	Non-banking institutions do not create credit.
Compliance	Banks are required to comply with some of the legal requirements like Cash Reserve Ratio (CRR), Statutory Liquidity Ratio and Capital Adequacy Ratio (CAR).	Non-banking institutions are not required to comply with these legal requirements.
Demand Deposit	They are not accepted.	They are accepted.
Payment and settlement system	Contains an integral part of the system.	Not a part of the system.

Question 8(RTP Nov'18, MTP Aug'18)
EXPLAIN the key elements of a well-functioning financial system.

Solution
Key elements of a well-functioning financial system are explained as below:

i. **A strong legal and regulatory environment** – Capit_al market is regulated by SEBI which acts a watchdog of the securities market. This has been ensured through the passing of SEBI Act, Securities Contract Regulation Act and numerous SEBI rules, regulations and guidelines. Likewise money market and foreign exchange market is regulated by RBI and this has been ensured through various provisions of the RBI Act, Foreign Exchange Management Act etc. Thus, a strong legal system protects the rights and interests of investors and acts as a most important element of a sound financial system.

ii. **Stable money** – Money is an important part of an economy. Frequent fluctuations and depreciations in the value of money lead to financial crises and restrict the economic growth.

iii. **Sound public finances and public debt management** – Sound public finances means setting and controlling public expenditures and increase revenues to fund these expenditures efficiently. Public debt management is the process of establishing and executing a strategy for managing the government's debt in order to raise the required amount of funding. It also includes developing and maintaining an efficient market for government securities.

iv. **A central bank** – A central bank supervises and regulates the operations of the banking system. It acts as a banker to the banks and government, manager of money market and foreign exchange market and also lender of the last resort. The monetary policy of the Central Bank is used to keep the pace of economic growth on a higher path.

v. **Sound banking system** – A well-functioning financial system must have large variety of banks both in the private and public sector having both domestic and international operations with an ability to withstand adverse national and international events. They perform varied functions

such as operating the payment and clearing system, and foreign exchange market. Banks also undertake credit risk analysis and assess the expected risk and return of a project before giving any loan for a proposed project.

vi. **Information System** – All the participants in the financial system requires information at some stage or the other. Proper information disclosure practices form basis of a sound financial system for e.g. the corporates has to disclose their financial performance in the financial statements. Similarly, at the time of initial public offering, the companies have to disclose a host of information disclosing their financial health and efficiency.

vii. **Well-functioning securities market** – A securities market facilitates the issuance of both equity and debt. An efficient securities market helps in the deployment of funds raised through the capital market to the required sections of the economy, lowering the cost of capital for the firms, enhancing liquidity and attracting foreign investment.

Question 9(MTP Oct'21)
Are Sustainable Growth Rate and Internal Growth rate being same concepts? Explain.

Solution
Although both concepts appear to be same but there are some differences between them. The Internal Growth Rate can be defined as the maximum growth that a firm can achieve from using internal sources of fund i.e. without resorting to external funding. The Sustainable Growth Rate of a firm is the maximum rate of growth in sales that can be achieved, given the firm's profitability, asset utilization, and desired dividend payout and debt (financial leverage) ratios. The sustainable growth rate is a measure of how much a firm can grow without borrowing more money.

Question 10(MTP Nov'21, PP May'22)
Financial resources, Financial Tools and Financial Goals are outcomes of Financial Planning. Do you agree with this statement?

Solution
Financial planning is a systematic approach whereby the financial planner helps the customer to maximize his existing financial resources by utilizing financial tools to achieve his financial goals. Financial Resources, Financial Tools and Financial Goals are not the outcomes of Financial Planning rather these are components of Financial Planning.

Outcomes of the financial planning are as follows:

- **Financial objectives**: Financial objectives are to be decided at the very outset so that rest of the decisions can be taken accordingly. The objectives need to be consistent with the corporate mission and corporate objectives.

- **Financial decision making:** It helps in analyzing the financial problems that are being faced by the corporate and accordingly deciding the course of action to be taken by it.

- **Financial measures**: It includes ratio analysis, analysis of cash flow statement etc. to evaluate the performance of the Company. The selection of these measures again depends upon the corporate objectives.

Chapter 15

CAPITAL BUDGETING

Space for your notings of Formulae or important points

Illustration 1

Determine NPV of the project with the following information:

Initial Outlay of project	₹ 40,000
Annual revenues (Without inflation)	₹ 30,000
Annual costs excluding depreciation (Without inflation)	₹ 10,000
Useful life	4 years
Salvage value	Nil
Tax Rate	50 %
Cost of Capital(Including inflation premium of 10%)	12 %

Solution

Annual Cash Flow of project is

(₹ 30,000 – ₹ 10,000) (1 – 0.50) + ₹ 10,000 x 0.50 = ₹ 15,000

It would be inconsistent to discount these real cash flows at 12% (nominal rate of return). There are two alternatives:

(i). Either to restate the cash flow in nominal term and discount at 12% or

(ii). Restate the discount rate in real terms and use this to discount the real cash flows.

NPV using (i) approach

Since inflation rate is 10% a year, real cash flows may be stated in nominal cash flows as follows:

Nominal Cash Flow = (1 + Inflation Rate) Real Cash Flows

Year	Real Cash Flows	Nominal Cash flows
1	15000	15,000 × 1.10 = 16,500
2	15,000	15,000 × $(1.10)^2$ = 18,150
3	15,000	15,000 × $(1.10.)^3$ = 19,965
4	15,000	15,000 × $(1.10)^4$ = 21,962

NPV using nominal discounting rate 12%

$$= \frac{16,500}{(1.12)} + \frac{18,150}{(1.12)^2} + \frac{19,965}{(1.12)^3} + \frac{21,962}{(1.12)^4} - 40,000$$

= ₹ 14,732 + ₹ 14,469 + ₹ 14,211+ ₹ 13,957 – ₹40,000

= ₹ 17,369 (Approx)

NPV using (ii) approach

To compute NPV using (ii) approach, we shall need real discount rate, which shall be computed as follows:

Real Discount Rate = $\frac{1+Nominal\ Discount\ Rate}{1+Inflation\ Rate}$ - 1

Real Discount Rate = $\frac{1+0.12}{1+0.10}$ – 1 = 0.0182 i.e., 1.8%

NPV =

$$\sum_{t=1} cf_t - I_o$$

Where t = Time Period
cft = Annual Cash Flow
Io = Initial Outlay

Accordingly NPV of the project

$$= \frac{15,000}{(1.0182)} + \frac{15,000}{(1.0182)^2} + \frac{15,000}{(1.0182)^3} + \frac{15,000}{(1.0182)^4} - 40,000$$

= ₹ 14,732 + ₹ 14,469 + ₹ 14,210+ ₹ 13,956 – ₹ 40,000
= ₹ 57,367 – ₹ 40,000 = ₹17,367(Approx)

NPV based on consideration that inflation rate for revenue and cost are different shall be computed as follows:

$$N.P.V. = {}^{n}\Sigma_{t=1} [\{R_t (1+i_r) - C_t{}^{t}\Sigma_{r=1}(1+i_c)\} (1-T) + D_tT] / (1+k)^t - I_0$$

Rt = revenues for the year 't' with no inflation.
Ir = annual inflation rate in revenues for 'r th ' year.
Ct = costs for year 't' with no inflation.
Ic = annual inflation rate of costs for year 'r'.
T = tax rate.
Dt = depreciation charge for year 't'.
I0 = initial outlay.
k = cost of capital (with inflation premium).

Illustration 2

XYZ Ltd. requires ₹ 8,00,000 for an unit. Useful life of project - 4 years. Salvage value - Nil. Depreciation Charge ₹ 2,00,000 p.a. Expected revenues & costs (excluding depreciation) ignoring inflation.

Year	1	2	3	4
Revenues	6,00,000	7,00,000	8,00,000	8,00,000
Costs	3,00,000	4,00,000	4,00,000	4,00,000

Tax Rate 60% cost of capital 10% (including inflation premium).

Calculate NPV of the project if inflation rates for revenues & costs are as follows:

Year	Revenues	Costs
1	10%	12%
2	9%	10%
3	8%	9%
4	7%	8%

Solution

Computation of Annual Cash Flow

(i). Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	6,00,000	6,00,000(1.10) = 6,60,000
2	7,00,000	7,00,000(1.10)(1.09) = 8,39,300
3	8,00,000	8,00,000(1.10)(1.09)(1.08) = 10,35,936
4	8,00,000	8,00,000(1.10)(1.09)(1.08)(1.07) = 11,08,452

(ii). Inflation adjusted Costs

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	3,00,000	3,00,000(1.12) = 3,36,000
2	4,00,000	4,00,000(1.12)(1.10) = 4,92,800
3	4,00,000	4,00,000(1.12)(1.10)(1.09) = 5,37,172
4	4,00,000	4,00,000(1.12)(1.10)(1.09)(1.08) = 5,80,124

(iii). Tax Benefit on Depreciation = ₹ 2,00,000 x 0.60 = ₹ 1,20,000

(iv). Net Profit after Tax

Year	Revenues (Inflation Adjusted) (1)	Costs (Inflation Adjusted) (2)	Net Profit (3) = (1) - (2)	Tax (4) = 60% of (3)	Net after Profit (3) - (4)
1	6,60,000	3,36,000	3,24,000	1,94,400	1,29,600
2	8,39,300	4,92,800	3,46,500	2,07,900	1,38,600
3	10,35,936	5,37,172	4,98,764	2,99,258	1,99,506
4	11,08,452	5,80,124	5,28,328	3,16,997	2,11,331

(v). Present Value of Cash Inflows

Year	Net after tax Profit	Tax benefit on Depreciation	Cash Inflows	PVF @10%	PV
	₹	₹	₹	₹	₹
1	1,29,600	1,20,000	2,49,600	0.909	2,26,886
2	1,38,600	1,20,000	2,58,600	0.826	2,13,604
3	1,99,506	1,20,000	3,19,506	0.751	2,39,949
4	2,11,331	1,20,000	3,31,331	0.683	2,26,299
					9,06,738

NPV = ₹ 9,06,738 – ₹ 8,00,000 = ₹ 1,06,738

Illustration 3

Possible net cash flows of Projects A and B at the end of first year and their probabilities are given below. Discount rate is 10 per cent. For both the projects, initial investment is ₹ 10,000. Calculate the expected net present value for each project. State which project is preferable?

Possible Event	Project A		Project B	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
A	8,000	0.10	24,000	0.10
B	10,000	0.20	20,000	0.15
C	12,000	0.40	16,000	0.50
D	14,000	0.20	12,000	0.15
E	16,000	0.10	8,000	0.10

Solution

Calculation of Expected Value for Project A and Project B

Project A				Project B		
Possible Event	Cash Flow (₹)	Probability	Expected Value (₹)	Cash Flow (₹)	Probability	Expected Value (₹)
A	8,000	0.10	800	24,000	0.10	2,400
B	10,000	0.20	2,000	20,000	0.15	3,000
C	12,000	0.40	4,800	16,000	0.50	8,000
D	14,000	0.20	2,800	12,000	0.15	1,800
E	16,000	0.10	1,600	8,000	0.10	800
ENCF			12,000			16,000

The Net Present Value for Project A is (0.909 × ₹ 12,000 – ₹ 10,000) = ₹ 908

The Net Present Value for Project B is (0.909 × ₹ 16,000 – ₹ 10,000) = ₹ 4,544.

Illustration 4

Probabilities for net cash flows for 3 years of a project are as follows

Year 1		Year 2		Year 3	
Cash Flow (₹)	Probability	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
2,000	0.1	2,000	0.2	2,000	0.3
4,000	0.2	4,000	0.3	4,000	0.4
6,000	0.3	6,000	0.4	6,000	0.2
8,000	0.4	8,000	0.1	8,000	0.1

Calculate the expected net present value of the project using 10 per cent discount rate if the Initial Investment of the project is ₹ 10,000.

Solution

Calculation of Expected Value

Year 1			Year 2			Year 3		
Cash Flow	Prob.	Expected Value	Cash Flow	Prob.	Expected Value	Cash Flow	Prob.	Expected Value
2,000	0.1	200	2,000	0.2	400	2,000	0.3	600
4,000	0.2	800	4,000	0.3	1200	4,000	0.4	1,600
6,000	0.3	1,800	6,000	0.4	2400	6,000	0.2	1,200
8,000	0.4	3,200	8,000	0.1	800	8,000	0.1	800
ENCF		6,000			4,800			4,200

The present value of the expected value of cash flow at 10 per cent discount rate has been determined as follows:

Present value of Cash Flow $= \frac{ENCF}{(1+k)} + \frac{ENCF2}{(1+k)^2} + \frac{ENCF3}{(1+k)^3}$

$= \frac{6,000}{(1.1)} + \frac{4,800}{(1.1)^2} + \frac{4,200}{(1.1)^3}$

= (6,000 X 0.909) + (4,800 X 0.826) + (4,200 X .751)

= ₹ 12,573

Expected Net Present value = Present Value of cash flow - Initial Investment

= ₹ 12,573 – ₹ 10,000 = ₹ 2,573.

Illustration 5

Calculate Variance and Standard Deviation of Project A and Project B on the basis of following information:

Possible Event	Project A		Project B	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
A	8,000	0.10	24,000	0.10
B	10,000	0.20	20,000	0.15
C	12,000	0.40	16,000	0.50
D	14,000	0.20	12,000	0.15
E	16,000	0.10	8,000	0.10

Solution

Calculation of Expected Value for Project A and Project B

Project A				Project B		
Possible Event	Cash Flow (₹)	Probability	Expected Value (₹)	Cash Flow (₹)	Probability	Expected Value (₹)
A	8,000	0.10	800	24,000	0.10	2,400

B	10,000	0.20	2,000	20,000	0.15	3,000
C	12,000	0.40	4,800	16,000	0.50	8,000
D	14,000	0.20	2,800	12,000	0.15	1,800
E	16,000	0.10	1,600	8,000	0.10	800
ENCF			12,000			16,000

Project A

Variance (σ^2)

= (8,000 – 12,000)^2 × (0.1) + (10,000 – 12,000)^2 × (0.2) + (12,000 – 12000)^2 × (0.4) + (14,000 – 12,000)^2 × (0.2) + (16,000 – 12,000)^2 × (0.1)

= 16,00,000 + 8,00,000 + 0 + 8,00,000 + 16,00,000 = 48,00,000

Standard Deviation (σ) = $\sqrt{Variance}(\sigma^2)$ = $\sqrt{48,00,000}$ = 2,190.90

Project B:

Variance(σ^2)

= (24,000 – 16,000)^2 × (0.1) + (20,000 – 16,000)^2 × (0.15) + (16,000 – 16,000)^2 × (0.5) + (12,000 – 16,000)^2 × (0.15) + (8,000 – 16,000)^2 × (0.1)

= 64,00,000 + 24,00,000 + 0 + 24,00,000 + 64,00,000 = 1,76,00,000

Standard Deviation (σ) = = $\sqrt{Variance}$ (σ^2) = $\sqrt{1,76,00,000}$ = 4195.23

Illustration 6

Calculate Coefficient of Variation of Project A and Project B based on the following information

Possible Event	Project A		Project B	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
A	10,000	0.10	26,000	0.10
B	12,000	0.20	22,000	0.15
C	14,000	0.40	18,000	0.50
D	16,000	0.20	14,000	0.15
E	18,000	0.10	10,000	0.10

Solution

Calculation of Expected Value for Project A and Project B

Project A				Project B		
Possible Event	Cash Flow	Probability	Expected Value	Cash Flow	Probability	Expected Value
A	10,000	0.10	1,000	26,000	0.10	2,600

B	12,000	0.20	2,400	22,000	0.15	3,300
C	14,000	0.40	5,600	18,000	0.50	9,000
D	16,000	0.20	3,200	14,000	0.15	2,100
E	18,000	0.10	1,800	10,000	0.10	1,000
ENCF			14,000			18,000

Project A:

Variance (σ^2)

= (10,000 – 14,000)^2 × (0.1) + (12,000 – 14,000)^2 × (0.2) + (14,000 – 14000)^2 × (0.4) + (16,000 – 14,000)^2 × (0.2) + (18000 – 14,000)^2 × (0.1)

= 16,00,000 + 8,00,000 + 0 + 8,00,000 + 16,00,000 = 48,00,000

Standard Deviation (σ) = $\sqrt{Variance}$ (σ^2) = $\sqrt{48,00,000}$ = 2,190.90

Project B:

Variance(σ^2)

= (26,000 – 18,000)^2 × (0.1) + (22,000 – 18,000)^2 × (0.15) + (18,000 – 18,000)^2 × (0.5) + (14,000 – 18,000)^2 × (0.15) + (10,000 – 18,000)^2 × (0.1)

= 64,00,000 + 24,00,000 + 0 + 24,00,000 + 64,00,000 = 1,76,00,000

Standard Deviation (σ) = = $\sqrt{Variance}$ (σ^2) = $\sqrt{1,76,00,000}$ = 4195.23

Projects	Coefficient of variation	Risk	Expected Value
A	$\frac{2190.90}{14000}$ = 0.1565	Less	Less
B	$\frac{4195.23}{18000}$ = 0.2331	More	More

In project A, risk per rupee of cash flow is ₹ 0.16 while in project B, it is ₹ 0.23. Therefore, Project A is better than Project B.

Illustration 7

An enterprise is investing ₹ 100 lakhs in a project. The risk-free rate of return is 7%. Risk premium expected by the Management is 7%. The life of the project is 5 years. Following are the cash flows that are estimated over the life of the project:

Year	Cash flows (₹ in lakhs)
1	25
2	60
3	75
4	80

5	65

Calculate Net Present Value of the project based on Risk free rate and also on the basis of Risks adjusted discount rate.

Solution

The Present Value of the Cash Flows for all the years by discounting the cash flow at 7% is calculated as below:

Year	Cash flows (₹ in lakhs)	Discounting Factor @ 7%	Present value of Cash Flows (₹ In Lakhs)
1	25	0.935	23.38
2	60	0.873	52.38
3	75	0.816	61.20
4	80	0.763	61.04
5	65	0.713	46.35
Total of Present value of Cash flows			244.34
Less: Initial investment			100.00
Net Present Value (NPV)			144.34

Now, when the risk-free rate is 7% and the risk premium expected by the Management is 7%, then risk adjusted discount rate is 7% + 7% = 14%.

Discounting the above cash flows using the Risk Adjusted Discount Rate would be as follows:

Year	Cash flows (₹ in Lakhs)	Discounting Factor @ 14%	Present Value of Cash Flows (₹ in lakhs)
1	25	0.877	21.93
2	60	0.769	46.14
3	75	0.675	50.63
4	80	0.592	47.36
5	65	0.519	33.74
Total of Present value of Cash flows			199.79
Less: Initial investment			100.00
Net present value (NPV)			99.79

Illustration 8

If Investment proposal costs ₹ 45,00,000 and risk free rate is 5%, calculate net present value under certainty equivalent technique.

Year	Expected cash flow (₹)	Certainty Equivalent coefficient
1	10,00,000	0.90
2	15,00,000	0.85
3	20,00,000	0.82

4	25,00,000	0.78

Solution

NPV $= \frac{10,00,000(0.90)}{(1+0.05)} + \frac{15,00,000(0.85)}{(1+0.05)^2} + \frac{20,00,000(0.82)}{(1+0.05)^3} + \frac{25,00,000(0.78)}{(1+0.05)^4} - 45,00,000$

= 5,34,570

Illustration 9

X Ltd. is considering its new project with the following details:

Sr. No.	Particulars	Figures
1	Initial capital cost	400 Cr.
2	Annual unit sales	5 Cr.
3	Selling price per unit	₹ 100
4	Variable cost per unit	₹ 50
5	Fixed costs per year	₹ 50 Cr.
6	Discount Rate	6%

Required:

1) Calculate the NPV of the project.
2) Compute the impact on the project's NPV considering a 2.5 per cent adverse variance in each variable. Which variable is having maximum effect?

Consider Life of the project as 3 years.

Solution

Calculation of Net Cash Inflow per year

	Particulars	Amount (₹)
A	Selling price per unit	100
B	Variable cost per unit	50
C	Contribution per unit (A - B)	50
D	Number of units sold per year	5 Cr.
E	Total Contribution (C × D)	₹ 250 Cr.
F	Fixed cost per year	₹ 50 Cr.
G	Net cash inflow per year (E - F)	₹ 200 Cr.

1) Calculation of Net Present Value (NPV) of the Project

Year	Year Cash Flow (₹ in Cr.)	PV factor @ 6%	Present Value (PV) (₹ in Cr.)
0	(400.00)	1.000	(400.00)

1	200.00	0.943	188.60
2	200.00	0.890	178.00
3	200.00	0.840	168.00
Net Present Value			134.60

Here, NPV represent the most likely outcomes and not the actual outcomes. The actual outcome can be lower or higher than the expected outcome.

2) Sensitivity Analysis considering 2.5 % Adverse Variance in each variable

	Particulars	Base	Initial capital cost increased to ₹ 410 crore	Selling Price per Unit Reduced to ₹ 97.5	Variable Cost Per Unit increased to ₹ 51.25	Fixed Cost Per Unit increased to ₹ 51.25	Units sold per year reduced to 4.875 crore
		₹	₹	₹	₹	₹	₹
A	Selling price per unit	100	100	97.5	100	100	100
B	Variable cost per unit	50	50	50	51.25	50	50
C	Contribution per unit (A - B)	50	50	47.5	48.75	50	50
		(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)
D	Number of units sold per year (units in Crores)	5	5	5	5	5	4.875
E	Total Contribution (C × D)	250	250	237.5	243.75	250	243.75
F	Fixed cost per year	50	50	50	50	51.25	50
G	Net Cash Inflow per year (E - F)	200	200	187.5	193.75	198.75	193.75
H	PV of Net cash Inflow per year (G × 2.673)	534.60	534.60	501.19	517.89	531.26	517.89
I	Initial capital cost	400	410	400	400	400	400

J	NPV (H - I)	134.60	124.60	101.19	117.89	131.26	117.89
K	Percentage Change in NPV	-	-7.43%	-24.82%	-12.41%	-2.48%	-12.41%

The above table shows that by changing one variable at a time by 2.5% (adverse) while keeping the others constant, the impact in percentage terms on the NPV of the project can be calculated. Thus, the change in selling price has the maximum effect on the NPV by 24.82%.

Illustration 10

XYZ Ltd. is considering a project "A" with an initial outlay of ₹ 14,00,000 and the possible three cash inflow attached with the project as follows:

Particulars	Year 1	Year 2	Year 3
Worst case	450	400	700
Most likely	550	450	800
Best case	650	500	900

Assuming the cost of capital as 9%, determine NPV in each scenario. If XYZ Ltd is certain about the most likely result in first two years but uncertain about the third year's cash flow, analyze what will be the NPV expecting worst scenario in the third year.

Solution

The possible outcomes will be as follows:

Year	PVF @ 9%	Worst Case		Most likely		Best case	
		Cash Flow	PV	Cash Flow	PV	Cash Flow	PV
		('000)	('000)	('000)	('000)	('000)	('000)
0	1	(1,400)	(1,400)	(1,400)	(1,400)	(1,400)	(1,400)
1	0.917	450	412.65	550	504.35	650	596.05
2	0.842	400	336.80	450	378.90	500	421.00
3	0.772	700	540.40	800	617.60	900	694.80
NPV			-110.15		100.85		311.85

If XYZ Ltd. is certain about the most likely result in first two years but uncertain about the third year's cash flow, then, NPV expecting worst case scenario is expected in the third year will be as follows:

$$= -14,00,000 + \frac{5,50,000}{(1+0.09)} + \frac{4,50,000}{(1+0.09)^2} + \frac{7,00,000}{(1+0.09)^3}$$

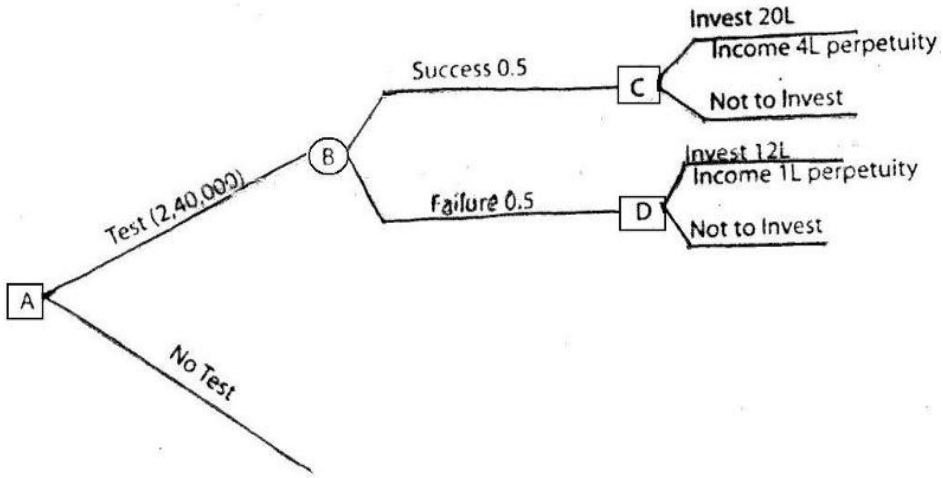
= - 14,00,000 + 5,04,587 + 3,78,756 + 5,40,528 = 23,871

Illustration 11

L & R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be ₹ 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale are rated at 50%. In case it does succeed. L&R can invest a sum of ₹ 20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of ₹ 4 lacs. Even if the commercial launch fails, they can make an investment of a smaller amount of ₹ 12 lacs with the hope of gaining perpetually a sum of ₹ 1 lac. Evaluate the proposal, adopting decision tree approach. The discount rate is 10%.

Solution

Decision tree diagram is given below:



Evaluation

At Decision Point C: The choice is between investing ₹ 20 lacs for a perpetual benefit of ₹ 4 lacs and not to invest. The preferred choice is to invest, since the capitalized value of benefit of ₹ 4 lacs (at 10%) adjusted for the investment of ₹ 20 lacs, yields a net benefit of ₹ 20 lacs.

At Decision Point D: The choice is between investing ₹ 12 lacs, for a similar perpetual benefit of ₹ 1 lac. and not to invest. Here the invested amount is greater than capitalized value of benefit at ₹ 10 lacs. There is a negative benefit of ₹ 2 lacs. Therefore, it would not be prudent to invest.

At Outcome Point B: Evaluation of EMV is as under (₹ in lacs).

Outcome	Amount (₹)	Probability	Result (₹)
Success	20.00	0.50	10.00
Failure	0.00	0.50	00.00
Net result			10.00

EMV at B is, therefore, ₹ 10 lacs.

At A: Decision is to be taken based on preferences between two alternatives. The first is to test, by investing ₹ 2,40,000 and reap a benefit of ₹ 10 lacs. The second is not to test, and thereby losing the opportunity of a possible gain.

The preferred choice is, therefore, investing a sum of ₹ 2,40,000 and undertaking the test.

Illustration 12

A Company named Roby's cube decided to replace the existing Computer system of their organisation. Original cost of old system was ₹ 25,000 and it was installed 5 years ago. Current market value of old system is ₹ 5,000. Depreciation of the old system was charged with life of 10 years with Estimated Salvage value as Nil. Depreciation of the new system will be charged with life over 5 years. Present cost of the new system is ₹ 50,000. Estimated Salvage value of the new system is ₹ 1,000. Estimated cost savings with new system is ₹ 5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of ₹ 10,00,00. Company follows straight line method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30%.

Solution

Step I. Net cash outflow (assumed at current time) [Present values of cost]:

a) (Book value of old system – market value of old system) × Tax Rate
   = Tax payable/savings from sale
   = [(₹ 25,000 – 5 × ₹ 2,500) – ₹ 5,000] × 0.30 = ₹ 7,500 × 0.30
   = ₹ 2,250

b) Cost of new system – [Tax payable/savings from sale + Market value of old system] = Net cash outflow
   Or, ₹ 50,000 – [₹ 2,250 + ₹ 5,000] = ₹ 42,750

Step II. Estimated change in cash flows per year if replacement decision is implemented.

Change in cash flow = [(Change in sales ± Change in operating costs)-Change in depreciation)] (1- tax rate) + Change in depreciation

= [₹ 1,00,000 × 0.1 + ₹ 5,000 – (₹ 49,000/5 – ₹ 25,000/10)] (1-0.30) + (₹ 49,000/5 – 25000/10)]
= ₹ 12,690

Step III. Present value of benefits = Present value of yearly cash flows + Present value of estimated salvage of new system
= ₹ 12,690 × PVIFA (10%, 5) + ₹ 1,000 × PVIF (10%, 5)
= ₹ 48,723

Step IV. Net present value = Present value of benefits - Present value of costs
= ₹ 48,723 – ₹ 42,750
= ₹ 5,973

Step V. Decision rule: Since NPV is positive we should accept the proposal to replace the machine.

Illustration 13

X Ltd. is a taxi operator. Each taxi cost to company ₹ 4,00,000 and has a useful life of 3 years. The taxi's operating cost for each of 3 years and salvage value at the end of year is as follows:

	Year 1	Year 2	Year 3
Operating Cost	₹ 1,80,000	₹ 2,10,000	₹ 2,38,000
Resale Value	₹ 2,80,000	₹ 2,30,000	₹ 1,68,000

You are required to determine the optimal replacement period of taxi if cost of capital of X Ltd. is 10%.

Solution

NPV if taxi is kept for 1 Year

= – ₹ 4,00,000 - ₹ 1,80,000 (0.909) + ₹ 2,80,000 (0.909)

= – ₹ 3,09,100

NPV if taxi is kept for 2 Year

= – ₹ 4,00,000 – ₹ 1,80,000 x 0.909 + ₹ 20,000 x 0.826

= – ₹ 5,47,100

NPV if taxi is kept for 3 Year

= – ₹ 4,00,000 – ₹ 1,80,000 x 0.909 – ₹ 2,10,000 x 0.826 – ₹ 70,000 x 0.751

= – ₹ 7,89,650

Since above NPV figures relate to different periods, there are not comparable to make them comparable we shall use concept of EAC as follows:

EAC of 1 year = 3,09,100/0.909 = 3,40,044

EAC of 2 years = 5,47,100/1.735 = 3,15,331

EAC of 3 years = 7,89,650/2.486 = 3,17,639

Since lowest EAC incur if taxi for 2 year; Hence the optimum replacement cycle to replace taxi in 2 years.

TEST YOUR KNOWLEDGE

Question 1

Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of ₹ 50,00,000. The expected cash flow after tax for the next three years is as follows:

Year 1		Year 2		Year 3	
CFAT	Probability	CFAT	Probability	CFAT	Probability
14,00,000	0.1	15,00,000	0.1	18,00,000	0.2
18,00,000	0.2	20,00,000	0.3	25,00,000	0.5
25,00,000	0.4	32,00,000	0.4	35,00,000	0.2
40,00,000	0.3	45,00,000	0.2	48,00,000	0.1

The Company wishes to take into consideration all possible risk factors relating to airline operations. The company wants to know:

i. The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.
ii. The possible deviation in the expected value.
iii. How would standard deviation of the present value distribution help in Capital Budgeting decisions?

Solution

(i). Expected NPV

Year I			Year II			Year III		
CFAT	P	CF×P	CFAT	P	CF×P	CFAT	P	CF×P
14	0.1	1.4	15	0.1	1.5	18	0.2	3.6
18	0.2	3.6	20	0.3	6.0	25	0.5	12.5
25	0.4	10.0	32	0.4	12.8	35	0.2	7.0
40	0.3	12.0	45	0.2	9	48	0.1	4.8
	x or CF	27.0		x or CF	29.3			x or CF 27.9

NPV	PV factor @ 6%	Total PV
27	0.943	25.461
29.3	0.890	26.077
27.9	0.840	23.436
	PV of cash inflow	74.974
	Less: Cash outflow	50.000
	NPV	24.974

(ii). Possible deviation in the expected value

Year I				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_1	$(X - \bar{X})^2 P^1$
14 – 27	-13	169	0.1	16.9
18 – 27	-9	81	0.2	16.2

25 – 27	-2	4	0.4	1.6
40 – 27	13	169	0.3	50.7
				85.4

σ_1 = = $\sqrt{85.4} = 9.241$

Year II				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_2	$(X - \bar{X})^2 \times P_2$
15-29.3	-14.3	204.49	0.1	20.449
20-29.3	-9.3	86.49	0.3	25.947
32-29.3	2.7	7.29	0.4	2.916
45-29.3	15.7	246.49	0.2	49.298
				98.61

σ_2 = = $\sqrt{98.61} = 9.930$

Year III				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_3	$(X - \bar{X})^2 \times P_3$
18-27.9	-9.9	98.01	0.2	19.602
25-27.9	-2.9	8.41	0.5	4.205
35-27.9	7.1	50.41	0.2	10.082
48-27.9	20.1	404.01	0.1	40.401
				74.29

$\sigma_3 = \sqrt{74.29} = 8.619$

Standard deviation about the expected value:

$$s = \sqrt{\frac{85.4}{(1.06)^2} + \frac{98.61}{(1.06)^4} + \frac{74.29}{(1.06)^6}} = 14.3696$$

(iii). Standard deviation is a statistical measure of dispersion; it measures the deviation from a central number i.e. the mean.

In the context of capital budgeting decisions especially where we take up two or more projects giving somewhat similar mean cash flows, by calculating standard deviation in such cases, we can measure in each case the extent of variation. It can then be used to identify which of the projects is least risky in terms of variability of cash flows.

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous.

Besides this, if we assume that probability distribution is approximately normal we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.

Question 2

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is ₹ 5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under:

		Cash Flows(in ₹)	
Situation	Probability	Project A	Project B
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000
Worse	0.3	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted? Explain with workings.

Solution

Project A

Expected Net Cash flow (ENCF)

0.3 (6,00,000) + 0.4 (4,00,000) + 0.3 (2,00,000) = 4,00,000

σ^2= 0.3 (6,00,000– 4,00,000)^2 + 0.4 (4,00,000 – 4,00,000)^2 + 0.3 (2,00,000 – 4,00,000)^2

$\sigma = \sqrt{24,00,00,00,000}$

σ = 1,54,919.33

Present Value of Expected Cash Inflows = 4,00,000 × 4.100 = 16,40,000

NPV = 16,40,000 – 5,00,000 = 11,40,000

Project B

ENCF = 0.3 (5,00,000) + 0.4 (4,00,000) + 0.3 (3,00,000) = 4,00,000

σ^2= 0.3 (5,00,000 – 4,00,000)^2 + 0.4 (4,00,000 – 4,00,000)^2 + 0.3 (3,00,000 – 4,00,000)^2

$\sigma = \sqrt{6,00,00,00,000}$

σ = 77,459.66

Present Value of Expected Cash Inflows = 4,00,000 × 4.100 = 16,40,000

NPV = 16,40,000 – 5,00,000 = 11,40,000

Recommendation: NPV in both projects being the same, the project should be decided on the basis of standard deviation and hence project 'B' should be accepted having lower standard deviation, means less risky.

Question 3

A company is considering Projects X and Y with following information:

Project	Expected NPV	Standard Deviation
X	1,22,000	90,000
Y	2,25,000	1,20,000

(i). Which project will you recommend based on the above data?

(ii). Explain whether your opinion will change, if you use coefficient of variation as a measure of risk.

(iii). Which measure is more appropriate in this situation and why?

Solution

(i). On the basis of standard deviation project X be chosen because it is less risky than Project Y having higher standard deviation.

(ii). $CV_x = \frac{SD}{ENPV} = \frac{90,000}{1,22,000} = 0.738$

$CV_y = \frac{1,20,000}{2,25,000} = 0.533$

On the basis of Co-efficient of Variation (C.V.) Project X appears to be riskier and hence Y should be accepted.

(iii). However, the NPV method in such conflicting situation is best because the NPV method is in compatibility of the objective of wealth maximisation in terms of time value.

Question 4

KLM Ltd., is considering taking up one of the two projects-Project-K and Project-So Both the projects having same life require equal investment of ` 80 lakhs each. Both are estimated to have almost the same yield. As the company is new to this type of business, the cash flow arising from the projects cannot be estimated with certainty. An attempt was therefore, made to use probability to analyse the pattern of cash flow from other projects during the first year of operations. This pattern is likely to continue during the life of these projects. The results of the analysis are as follows:

Project K		Project S	
Cash Flow in (₹)	Probability	Cash Flow in (₹)	Probability
11	0.10	9	0.10
13	0.20	13	0.25
15	0.40	17	0.30
17	0.20	21	0.25
19	0.10	25	0.10

Required:

(i). Calculate variance, standard deviation and co-efficient of variance for both the projects.

(ii). Which of the two projects is riskier?

Solution

Calculation of Variance and Standard Deviation

Project K

Expected Net Cash Flow

= (0.10 x 11) + (0.20 x13) + (0.40 x 15) + (0.20 x 17) + (0.10 x 19)

= 1.1 + 2.6 + 6 + 3.4 + 1.9 = 15

σ^2 = $0.10(11 - 15)^2 + 0.20(13 - 15)^2 + 0.40(15 - 15)^2 + 0.20(17 - 15)^2 + 0.10(19 - 15)^2$

= 1.6 + 0.8 + 0 + 0.8 + 1.6 = 4.8

σ = $\sqrt{4.8}$ = 2.19

Project S

Expected Net Cash Flow

= (0.10 X 9) + (0.25 X 13) + (0.30 X 17) + (0.25 X 21) + (0.10 X 25)

= 0.9 + 3.25 + 5.1 + 5.25 + 2.5 = 17

σ^2 = $0.1(9-17)^2 + 0.25(13-17)^2 + 0.30(17-17)^2 + 0.25(21-17)^2 + 0.10(25-17)^2$

= 6.4 + 4 + 0 + 4 + 6.4 = 20.8

σ = $\sqrt{20.8}$ = 4.56

Calculation of Coefficient of Variation

Coefficient of Variation = $\frac{Standard\ Deviation}{Mean}$

Project K = $\frac{2.19}{15}$ = 0.146

Project S = $\frac{4.56}{17}$ = 0.268

Project S is riskier as it has higher Coefficient of Variation.

Question 5

Project X and Project Y are under the evaluation of XY Co. The estimated cash flows and their probabilities are as below:

Project X : Investment (year 0) ₹ 70 lakhs

Probability Weights	0.30	0.40	0.30
Years	₹ lakhs	₹ lakhs	₹ lakhs
1	30	50	65
2	30	40	55
3	30	40	45

Project Y: Investment (year 0) ₹ 80 lakhs.

Probability Weighted	Annual Cash Flows through life
	₹ lakhs
0.20	40
0.50	45
0.30	50

a) Which project is better based on NPV, criterion with a discount rate of 10%?
b) Compute the standard deviation of the present value distribution and analyse the inherent risk of the projects.

Solution

a) Calculation of NPV of XY Co.:

Project X	Cash Flow	PVF	PV

Year				
1	(30 x 0.3) + (50 x 0.4) + (65 x 0.3)	48.5	0.909	44.09
2	(30 x 0.3) + (40 x 0.4) + (55 x 0.3)	41.5	0.826	34.28
3	(30 x 0.3) + (40 x 0.4) + (45 x 0.3)	38.5	0.751	28.91
				107.28
	NPV = (107.28 – 70) =			(+) 37.28

Project Y

Year				
1-3	(40 x 0.2) + (45 x 0.5) + (50 x 0.3)	45.5	2.487	113.16
	NPV = (113.16 – 80) =			(+) 33.16

b) Calculation of Standard deviation

As per Hiller's model

$$M = \sum_{i=0}^{n} (1 + r)^{-1} Mi$$

$$\sigma 2 = \sum_{i=0}^{n} (1 + r)^{-2i} \sigma 2$$

Hence

Project X

Year			
1	$\sqrt{(30-48.5)^2 0.30 + (50-48.5)^2 0.40 + (65-48.5)^2 0.30}$	= $\sqrt{185.25}$	= 13.61
2	$\sqrt{(30-41.5)^2 0.30 + (40-41.5)^2 0.40 + (55-41.5)^2 0.30}$	= $\sqrt{95.25}$	= 9.76
3	$\sqrt{(30-38.5)^2 0.30 + (40-38.5)^2 0.40 + (45-38.5)^2 0.30}$	= $\sqrt{35.25}$	= 5.94

Standard Deviation about the Expected Value

$$= \sqrt{\frac{185.25}{(1+0.10)^2} + \frac{95.25}{(1+0.10)^4} + \frac{35.25}{(1+0.10)^6}}$$

$$= \sqrt{\frac{185.25}{1.21} + \frac{95.25}{1.4641} + \frac{35.25}{1.7716}}$$

$= \sqrt{238.06}$ = 15.43

Project Y (For 1-3 Years)

$$= \sqrt{(40-45.5)^2 0.20 + (45-45.5)^2 0.50 + (50-45.5)^2 0.30}$$

$= \sqrt{12.25}$ = 3.50

Standard Deviation about the Expected Value

$$= \sqrt{\frac{12.25}{(1+0.10)^2} + \frac{12.25}{(1+0.10)^4} + \frac{12.25}{(1+0.10)^6}}$$

$$= \sqrt{\frac{12.25}{1.21} + \frac{12.25}{1.4641} + \frac{12.25}{1.7716}}$$

$= \sqrt{10.12 + 8.37 + 6.91}$

$= \sqrt{25.4}$

= 5.03

Analysis: Project Y is less risky as its Standard Deviation is less than Project X.

Question 6

Shivam Ltd. is considering two mutually exclusive projects A and B. Project A costs ₹ 36,000 and project B ₹ 30,000. You have been given below the net present value probability distribution for each project.

Project A		Project B	
NPV Estimates ₹	Probability	NPV Estimates ₹	Probability
15,000	0.20	15,000	0.10
12,000	0.30	12,000	0.40
6,000	0.30	6,000	0.40
3,000	0.20	3,000	0.10

(i). Compute the expected net present values of projects A and B.

(ii). Compute the risk attached to each project i.e. standard deviation of each probability distribution.

(iii). Compute the profitability index of each project.

(iv). Which project do you recommend? State with reasons.

Solution

(i). Statement showing computation of expected net present value of Projects A and B:

Project A			Project B		
NPV Estimate (₹)	Probability	Expected Value	NPV Estimate	Probability	Expected Value
15,000	0.2	3,000	15,000	0.1	1,500
12,000	0.3	3,600	12,000	0.4	4,800
6,000	0.3	1,800	6,000	0.4	2,400
3,000	0.2	600	3,000	0.1	300
	1.0	EV = 9,000		1.0	EV = 9,000

(ii). Computation of Standard deviation of each project

Project A

P	X	(X – EV)	P (X - EV)²
0.2	15,000	6,000	72,00,000
0.3	12,000	3,000	27,00,000
0.3	6,000	- 3,000	27,00,000
0.2	3,000	- 6,000	72,00,000
			Variance = 1,98,00,000

Standard Deviation of Project A = $\sqrt{1,98,00,000}$ = 4,450

Project B

P	X	(X – EV)	P (X - EV)²
0.1	15,000	6,000	36,00,000
0.4	12,000	3,000	36,00,000
0.4	6,000	- 3,000	36,00,000
0.1	3,000	- 6,000	36,00,000
			Variance = 1,44,00,000

Standard Deviation of Project A = $\sqrt{1,44,00,000}$ = 3,795

(iii). Computation of profitability of each project

Profitability index = Discount cash inflow / Initial outlay

In case of Project A : PI = $\frac{9,000+36,000}{36,000} = \frac{45,000}{36,000} = 1.25$

In case of Project B : PI = $\frac{9,000+30,000}{30,000} = \frac{39,000}{30,000} = 1.30$

(iv). Measurement of risk is made by the possible variation of outcomes around the expected value and the decision will be taken in view of the variation in the expected value where two projects have the same expected value, the decision will be the project which has smaller variation in expected value. In the selection of one of the two projects A and B, Project B is preferable because the possible profit which may occur is subject to less variation (or dispersion). Much higher risk is lying with project A.

Question 7

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.:

	Year	P = 0.30	P = 0.50	P = 0.20
Initial Investment	0	4,00,000	4,00,000	4,00,000
Estimated net after tax cash inflows per year	1 to 5	1,00,000	1,10,000	1,20,000
Estimated Salvage Value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

(i). The expected NPV of the project.

(ii). The best case and the worst case NPVs.

(iii). The probability of occurrence of the worst case if the cash flows are perfectly dependent overtime and independent overtime.

(iv). Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.

(v). Coefficient of variation of X Ltd. on its average project which is in the range of 0.95 to 1.0. If the coefficient of variation of the project is found to be less risky than average, 100

basis points are deducted from the Company's cost of Capital.

Should the project be accepted by X Ltd?

Solution

(i). Expected cash flows:-

Year			Net cash flows	P.V.	PV. @ 10%
0	(4,00,000 x 1)	=	(-)4,00,000	1.000	(-)4,00,000
1 to 4	(1,00,000x 0.3+1,10,000x 0.5	=	1,09,000	3.170	3,45,530
	+ 1,20,000 x 0.2)				
5	[1,09,000 + (20,000 x 0.3 +	=	1,52,000	0.621	94,392
	50,000 x 0.5 + 60,000 x 0.2)]				
			NPV=		39,922

(ii). **ENPV of the worst case**

1,00,000 x 3.790 = 3,79,000 (Students may have 3.791 also the values will change accordingly)

20,000 x 0.621 = Rs 12,420/-

ENPV = (-) 4,00,000 + 3,79,000 + 12,420 = (-) Rs 8,580/-

ENPV of the best case

ENPV = (-) 4,00,000 + 1,20,000 x 3.790 + 60,000 x 0.621 = Rs 92,060/-.

(iii). (a) Required probability = 0.3

(b) Required probability = $(0.3)^5$ = 0.00243

(iv). The base case NPV = (-) 4,00,000 + (1,10,000 x 3.79) + (50,000 x 0.621) = ₹ 47,950/-

ENPV = 0.30 x (-) 8580 + 0.5 x 47950 + 92060 x 0.20 = ₹ 39,813/-

Therefore,

$$\sigma_{ENPV} \sqrt{(0.30)(-8580-39813)^2 + (0.50)(47950-39813)^2 + (0.20)(92060-39813)^2}$$

= ₹ 35,800/-

Therefore, CV = 35,800/39,813 = 0.90

(v). Risk adjusted out of cost of capital of X Ltd. = 10% - 1% = 9%.

NPV

Year	Expected net cash flow	PV @ 9%	
0	(-) 4,00,000	1.000	(-) 4,00,000
1 to 4	1,09,000	3.240	3,53,160
5	1,52,000	0.650	98,800
		ENPV =	51,960

Therefore, the project should be accepted.

Question 8

XY Ltd. has under its consideration a project with an initial investment of ₹ 1,00,000. Three probable cash inflow scenarios with their probabilities of occurrence have been estimated as below:

Annual cash inflow (₹)	20,000	30,000	40,000
Probability	0.1	0.7	0.2

The project life is 5 years and the desired rate of return is 20%. The estimated terminal values for the project assets under the three probability alternatives, respectively, are ₹ 0, 20,000 and 30,000.

You are required to:

(i). Find the probable NPV;

(ii). Find the worst-case NPV and the best-case NPV; and

(iii). State the probability occurrence of the worst case, if the cash flows are perfectly positively correlated over time.

Solution

The expected cash flows of the project are as follows:

Year	Pr = 0.1	Pr = 0.7	Pr = 0.2	Total
	₹	₹	₹	₹
0	-10,000	-70,000	-20,000	-1,00,000
1	2,000	21,000	8,000	31,000
2	2,000	21,000	8,000	31,000
3	2,000	21,000	8,000	31,000
4	2,000	21,000	8,000	31,000
5	2,000	21,000	8,000	31,000
5	0	14,000	6,000	20,000

(i). NPV based on expected cash flows would be as follows:

$$= -1,00,000 + \frac{31,000}{(1+0.20)^1} + \frac{31,000}{(1+0.20)^2} + \frac{31,000}{(1+0.20)^3} + \frac{31,000}{(1+0.20)^4} + \frac{31,000}{(1+0.20)^5} + \frac{20,000}{(1+0.20)^5}$$

= -1,00,000 + 25,833.33 + 21,527.78 + 17,939.81 + 14,949.85 + 12,458.20 + 8,037.55

NPV = ₹ 746.52

(ii). For the worst case, the cash flows from the cash flow column farthest on the left are used to calculate NPV

$$= -1,00,000 + \frac{20,000}{(1+0.20)^1} + \frac{20,000}{(1+0.20)^2} + \frac{20,000}{(1+0.20)^3} + \frac{20,000}{(1+0.20)^4} + \frac{20,000}{(1+0.20)^5}$$

= -1,00,000 + 16,666.67+ 13,888.89 + 11,574.07 + 9,645.06+ 8037.76

NPV = ₹ 40,187.76

For the best case, the cash flows from the cash flow column farthest on the right are used to calculated NPV

$$= -1,00,000 + \frac{40,000}{(1+0.20)^1} + \frac{40,000}{(1+0.20)^2} + \frac{40,000}{(1+0.20)^3} + \frac{40,000}{(1+0.20)^4} + \frac{40,000}{(1+0.20)^5} + \frac{30,000}{(1+0.20)^5}$$

= - 1,00,000 + 33,333.33+ 27,777.78 + 23,148.15+ 19,290.12 + 16,075.10 + 12,056.33

NPV = ₹ 31,680.81

(iii). If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the possibility of the worst case occurring is the probability of getting ₹ 20,000 net cash flow in year 1 is 10%.

Question 9

XYZ Ltd. is considering a project for which the following estimates are available:

Initial Cost of the project	10,00,000
Sales price/unit	60
Cost/unit	40
Sales Volumes	
Year 1	20,000 units
Year 2	30,000 units
Year 3	30,000 units

Discount rate is 10% p.a.

You are required to measure the sensitivity of the project in relation to each of the following parameters:

a) Sales Price/unit
b) Unit cost
c) Sales volume
d) Initial outlay and
e) Project lifetime

Taxation may be ignored.

Solution

Calculation of NPV

NPV = $-10{,}00{,}000 + \frac{20{,}000\ x\ 20}{1.1} + \frac{30{,}000\ x\ 20}{(1.21)} + \frac{30{,}000\ x\ 20}{1.331}$

= -10,00,000 + 3,63,636 + 4,95,868 + 4,50,789

= 13,10,293 – 10,00,000

= ₹ 3,10,293/-

Measurement of sensitivity is as follows:

a) Sales Price:-

Let the sale price/Unit be S so that the project would break even with 0 NPV.

Therefore, 10,00,000 = $\frac{20{,}000(S-40)}{1.1} + \frac{30{,}000(S-40)}{(1.21)} + \frac{30{,}000(S-40)}{1.33}$

S – 40 = 10,00,000/65,514

S – 40 = 15.26

S = ₹ 55.26 which represents a fall of (60-55.26)/60 Or 0.079 or 7.9%

Alternative Method

$\frac{10,00,000\ x\ 20}{13,10,293}$ = ₹ 15.26

S = ₹ 40 + ₹ 15.26

S = ₹ 55.26

Alternative Method

If sale Price decreased by say 10%, then NPV (at Sale Price of ₹ 60 – ₹ 6 = ₹ 54)

NPV = $-10,00,000 + \frac{20,000x\ 14}{(1.1)} + \frac{30,000\ x\ 14}{(1.21)} + \frac{30,000\ x\ 14}{1.331}$

= -10,00,000 +2,54,545 + 3,47,107 + 3,15,552

= -82,796

NPV decrease (%) = $\frac{3,10,293-(-82,796)}{3,10,293}\ X\ 100 = 126.68\%$

b) **Unit Cost**:

If sales price = ₹ 60 the cost price required to give a margin of ₹ 15.26 is (₹ 60 – ₹ 15.26) or ₹ 44.74 which would represent a rise of 11.85% i.e., $\left(\frac{44.74-40}{40}\right)\ X\ 100$

Alternative Solution

If unit cost increased by say 10%. The new NPV will be as follows:

NPV = -10,00,000 + $\frac{20,000\ x\ 16}{(1.1)^1} + \frac{30,000\ x\ 16}{(1.1)^2} + \frac{30,000\ x\ 16}{(1.1)^3}$

= -10,00,000 + 2,90,909 + 3,96,694 + 3,60,631

= 48,234

NPV decrease (%) = $\frac{3,10,293-48,234}{3,10,293}\ X\ 100 = 84.46\%$

c) **Sales volume**:-

The requisite percentage fall is:-

3,10,293/13,10,293 x 100 = 23.68%

Alternative Solution

If sale volume decreased by say 10%. The new NPV will be as follows:

NPV = -10,00,000 + $\frac{18,000\ x\ 20}{(1.1)^1} + \frac{27,000\ x\ 20}{(1.1)^2} + \frac{27,000\ x\ 20}{(1.1)^3}$

= -10,00,000 + 3,27,272 + 4,46,281 + 4,05,710

= 1,79,263

NPV decrease (%) = $\frac{3,10,293-1,79,263}{3,10,293}\ X\ 100 = 42.22\%$

d) **Since PV of inflows remains at ₹ 13,10,293 the initial outlay must also be the same**.
Percentage rise = 3,10,293/10,00,000 100 = 31.03%.

Alternative Solution
If initial outlay increased by say 10%. The new NPV will be as follows:
NPV = $-11{,}00{,}000 + \frac{20{,}000x\ 20}{(1.1)1} + \frac{30{,}000\ x\ 20}{(1.1)2} + \frac{30{,}000\ x\ 20}{(1.1)3}$

= -11,00,000 + 3,63,636 + 4,95,868 + 4,50,789 = 2,10,293

NPV decrease (%) = $\frac{3{,}10{,}293-2{,}10{,}293}{3{,}10{,}293}\ X\ 100 = 32.22\%$

e) **Present value for 1st two years**.
= - 10,00,000 + 4,00,000 x 0.909 + 6,00,000 x 0.826
= - 10,00,000 + 3,63,600 + 4,95,600
= - 10,00,000 + 8,59,200
= - 1,40,800

Therefore,
The project needs to run for some part of the third year so that the present value of return is ₹ 1,40,800. It can be computed as follows:

i. 30,000 units x ₹ 20 x 0.751 = ₹ 4,50,600
ii. Per day Production in (₹) assuming a year of 360 days = $\frac{4{,}50{,}600}{360}$ = ₹ 1,252
iii. Days needed to recover ₹ 1,40,800 = $\frac{1{,}40{,}800}{1.252}$ = ₹ 112

Thus, if the project runs for 2 years and 112 days then breakeven would be achieved representing a fall of $\frac{(3-2.311)}{3}$ X 100 = 22.97%

Question 10
From the following details relating to a project, analyse the sensitivity of the project to changes in initial project cost, annual cash inflow and cost of capital:

Initial Project Cost (₹)	1,20,000
Annual Cash Inflow (₹)	45,000
Project Life (Years)	4
Cost of Capital	10%

To which of the three factors, the project is most sensitive?
(Use annuity factors: for 10%, 3.169 and 11%, 3.103).

Solution

PV of cash inflows (₹ 45,000 x 3.169)	1,42,605
Initial Project Cost	1,20,000
NPV	22,605

If initial project cost is varied adversely by 10%*

NPV (Revised) (₹ 1,42,605 - ₹ 1,32,000)	₹ 10,605
Change in NPV (₹ 22,605 – ₹ 10,605)/ ₹ 22,605 i.e.	53.08 %

If annual cash inflow is varied adversely by 10%*

Revised annual inflow	₹ 40,500
NPV (Revised) (₹ 40,500 x 3.169) – (₹ 1,20,000)	(+) ₹ 8,345
Change in NPV (₹ 22,605 – ₹ 8,345) / ₹ 22,605	63.08 %

If cost of capital is varied adversely by 10%*

NPV (Revised) (₹ 45,000 x 3.103) – ₹ 1,20,000	(+) ₹ 19,635
Change in NPV (₹ 22,605 – ₹ 19,635) / ₹ 22,605	13.14 %

Conclusion: Project is most sensitive to 'annual cash inflow'.

*Note: Students may please note that they may assume any other percentage rate other than 10 % say 15%, 20 % 25 % etc.

Question 11

Red Ltd. is considering a project with the following Cash flows:

Years	Cost of Plant	Recurring Cost	Savings
0	10,000		
1		4,000	12,000
2		5,000	14,000

The cost of capital is 9%. Measure the sensitivity of the project to changes in the levels of plant value, running cost and savings (considering each factor at a time) such that the NPV becomes zero. The P.V. factor at 9% are as under:

Year	Factor
0	1
1	0.917
2	0.842

Which factor is the most sensitive to affect the acceptability of the project?

Solution

P.V. of Cash Flows

Year 1	Running Cost	₹ 4,000 x 0.917	= (₹ 3,668)
	Savings	₹ 12,000 x 0.917	= ₹ 11,004
Year 2	Running Cost	₹ 5,000 x 0.842	= (₹ 4,210)
	Savings	₹ 14,000 x 0.842	= ₹ 11,788
			₹ 14,914
Year 0	Less: P.V. of Cash Outflow	₹ 10,000 x 1	₹ 10,000

		NPV	₹ 4,914

Sensitivity Analysis

(i). Increase of Plant Value by ₹ 4,914

$\frac{4,914}{10,000}$ x 100 = 49.14%

(ii). Increase of Running Cost by ₹ 4,914

$\frac{4,914}{3,668+4,210} = \frac{4,914}{7,878}$ x 100 = 62.38%

(iii). Fall in Saving by ₹ 4,914

$\frac{4,914}{11,004+11,788} = \frac{4,914}{22,792}$ x 100 = 21.56%

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

Alternative Solution

P.V. of Cash Flows

Year 1	Running Cost	₹ 4,000 x 0.917	= (₹ 3,668)
	Savings	₹ 12,000 x 0.917	= ₹ 11,004
Year 2	Running Cost	₹ 5,000 x 0.842	= (₹ 4,210)
	Savings	₹ 14,000 x 0.842	= ₹ 11,788
			₹ 14,914
Year 0	Less: P.V. of Cash Outflow	₹ 10,000 x 1	₹ 10,000
		NPV	₹ 4,914

Sensitivity Analysis

(i). If the initial project cost is varied adversely by say 10%*.
NPV Revised = (₹ 4,914 - ₹1000) = ₹ 3,914

Change in NPV = $\frac{4,914-3914}{4,914}$ x 100 = 20.35%

(ii). If Annual Running Cost is varied by say 10%*.
NPV (Revised) = (₹ 4,914 - ₹ 400 X 0.917 - ₹ 500 X 0.843)
= ₹ 4,914 - ₹ 367 - ₹ 421= ₹ 4,126

Change in NPV = $\frac{4,914-4,126}{4,914}$ x 100 = 16.04%

(iii). If Saving is varied by say 10%*.

NPV (Revised) = (₹ 4,914 - ₹ 1,200 X 0.917 - ₹ 1,400 X 0.843)
= ₹ 4,914 - ₹ 1,100 - ₹ 1,180 = ₹ 2,634

Change in NPV = $\frac{4,914- \ ,634}{4,914}$ x 100 = 46.40%

Hence, savings factor is the most sensitive to affect the acceptability of the project.

* Any percentage of variation other than 10% can also be assumed.

Question 12

The Easygoing Company Limited is considering a new project with initial investment, for a product "Survival". It is estimated that IRR of the project is 16% having an estimated life of 5 years.

Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.
Other information available are:
Profit Volume Ratio (P/V) is 70%,
Variable cost ₹ 60/- per unit
Annual Cash Flow ₹ 57,500/-

Ignore Depreciation on initial investment and impact of taxation.

Calculate
(i). Initial Investment of the Project
(ii) Net Present Value of the Project
(iii) Annual Fixed Cost
(iv) Estimated annual unit of sales
(v) Break Even Units

Cumulative Discounting Factor for 5 years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%
3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199

Solution

(i). Initial Investment

IRR = 16% (Given)
At IRR, NPV shall be zero, therefore

Initial Cost of Investment = PVAF (16%,5) x Cash Flow (Annual)

= 3.274 x ₹ 57,500
= ₹ 1,88,255

(ii). Net Present Value (NPV)

Let Cost of Capital be X, then $\frac{16-}{X}$ x 100 = 60% ; X = 10%

Thus NPV of the project

= Annual Cash Flow x PVAF (10%, 5) – Initial Investment

= ₹ 57,500 x 3.791 – ₹ 1,88,255

= ₹ 2,17,982.50 – ₹ 1,88,255 = ₹ 29,727.50

(iii). Annual Fixed Cost

Let change in the Fixed Cost which makes NPV zero is X. Then,

₹ 29,727.50 – 3.791X = 0. Thus X = ₹ 7,841.60

Let original Fixed Cost be Y then, Y × 7.8416% = ₹ 7,841.60

Y = ₹ 1,00,000

Thus Fixed Cost is equal to ₹ 1,00,000

(iv). Estimated Annual Units of Sales

Selling price per unit = $\frac{60\%}{100\,\%-70\,\%}$ = ₹ 200

$\frac{Actual\ Cash\ Flow+Fixe\ \ Cost}{PV\ Ratio}$ = Sales Value

$\frac{57,500+1,00,000}{0.70}$ = 2,25,000

Sales in Units = $\frac{2,25,000}{200}$ = 1,125 units

(v). Break Even Units

$\frac{Fixed\ Cost}{Contribution\ Per\ Unit}$ = 1,00,000/140 = 714.285 units

Question 13

Unnat Ltd. is considering investing ₹ 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and fixed costs to be ₹ 10,00,000 per year.

The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.

You are required to measure the sensitivity of the project's net present value to a change in the following project variables:

a) sale price;
b) sales volume;
c) variable cost;
d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Prob.
Poor	1,75000	0·30
Normal	2,00,000	0·60
Good	2,25,000	0·10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

Solution

Calculation of NPV

= - ₹ 50,00,000 + [2,00,000 (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)

= - ₹ 50,00,000 + [2,00,000 (₹ 13.50) – ₹ 10,00,000] 3.605

= - ₹ 50,00,000 + [₹ 27,00,000 – ₹ 10,00,000] 3.605

= - ₹ 50,00,000 + ₹ 61,28,500 = ₹ 11,28,500

Measurement of Sensitivity Analysis

a) **Sales Price**:-

Let the sale price/Unit be S so that the project would break even with 0 NPV.

₹ 50,00,000 = [2,00,000 (S – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)

₹ 50,00,000 = [2,00,000 S – ₹ 33,00,000 – ₹ 10,00,000] 3.605

₹ 50,00,000 = [2,00,000 S – ₹ 43,00,000] 3.605

₹ 13,86,963 = 2,00,000 S – ₹ 43,00,000

₹ 56,86,963 = 2,00,000 S

S = ₹ 28.43 which represents a fall of (30 - 28.43)/30 or 0.0523 or 5.23%

b) **Sales volume**:-

Let V be the sale volume so that the project would break even with 0 NPV.

₹ 50,00,000 = [V (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)

₹ 50,00,000 = [V (₹ 13.50) – ₹ 10,00,000] PVIAF (12%,5)

₹ 50,00,000 = [₹ 13.50 V – ₹ 10,00,000] 3.605

₹ 13,86,963 = ₹ 13.50V – ₹ 10,00,000

₹ 23,86,963 = ₹ 13.50V

V = 1,76,812 which represents a fall of (2,00,000 - 1,76,812)/2,00,000 or 0.1159 or 11.59%

c) **Variable Cost**:

Let the variable cost be V so that the project would break even with 0 NPV.

₹ 50,00,000 = [2,00,000(₹ 30 – V) – ₹ 10,00,000] PVIAF(12%,5)

₹ 50,00,000 = [₹ 60,00,000 – 2,00,000 V – ₹ 10,00,000] 3.605

₹ 50,00,000 = [₹ 50,00,000 – 2,00,000 V] 3.605

₹ 13,86,963 = ₹ 50,00,000 – 2,00,000 V

₹ 36,13,037 = 2,00,000V

V = ₹ 18.07 which represents a fall of (18.07 – 16.50)/16.50 or 0.0951 or 9.51%

d) Expected Net Present Value

(1,75,000 X 0.30) + (2,00,000 X 0.60) + (2,25,000 X 0.10) =1,95,000

NPV = [1,95,000 X ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = ₹ 8,85,163

Further NPV in worst and best cases will be as follows:

Worst Case:

[1,75,000 X ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = - ₹ 88,188

Best Case:

[2,25,000 X ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = ₹ 23,45,188

Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

Question 14

The Textile Manufacturing Company Ltd., is considering one of two mutually exclusive proposals, Projects M and N, which require cash outlays of ₹ 8,50,000 and ₹ 8,25,000 respectively. The certainty-equivalent (C.E) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bonds is 6% and this is used as the risk-free rate. The expected net cash flows and their certainty equivalents are as follows:

Project M			Project N	
Year-end	Cash Flow ₹	C.E.	Cash Flow ₹	C.E.
1	4,50,000	0.8	4,50,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,00,000	0.5	5,00,000	0.7

Present value factors of ₹ 1 discounted at 6% at the end of year 1, 2 and 3 are 0.943, 0.890 and 0.840 respectively. Required:

(i). Which project should be accepted?

(ii). If risk adjusted discount rate method is used, which project would be appraised with a higher rate and why?

Solution

(i). Statement Showing the Net Present Value of Project M

Year end	Cash Flow	C.E.	Adjusted Cash flow	Present value factor at 6%	Total Present value
	(a)	(b)	('c) = (a) x (b)	(d)	(e) = (c) x (d)
1	4,50,000	0.8	3,60,000	0.943	3,39,480
2	5,00,000	0.7	3,50,000	0.890	3,11,500
3	5,00,000	0.5	2,50,000	0.840	2,10,000
					8,60,980
Less: Initial Investment					(8,50,000)
NPV					10,980

Statement Showing the Net Present Value of Project N

Year end	Cash Flow	C.E.	Adjusted Cash flow	Present value factor at 6%	Total Present value
	(a)	(b)	('c) = (a) x (b)	(d)	(e) = (c) x (d)
1	4,50,000	0.9	4,05,000	0.943	3,81,915
2	4,50,000	0.8	3,60,000	0.890	3,20,400
3	5,00,000	0.7	3,50,000	0.840	2,94,000
					9,96,315
Less: Initial Investment					(8,25,000)
NPV					1,71,315

Decision: Since the net present value of Project N is higher, so the project N should be accepted.

(ii). Certainty - Equivalent (C.E.) Co-efficient of Project M (2.0) is lower than Project N (2.4). This means Project M is riskier than Project N as "higher the riskiness of a cash f low, the lower will be the CE factor". If risk adjusted discount rate (RADR) method is used, Project M would be analysed with a higher rate.

RADR is based on the premise that riskiness of a proposal may be taken care of, by adjusting the discount rate. The cash flows from a more risky proposal should be discounted at a relatively higher discount rate as compared to other proposals whose cash flows are less risky. Any investor is basically risk averse. However, he may be ready to take risk provided he is rewarded for undertaking risk by higher returns. So, more risky the investment is, the greater would be the expected return. The expected return is expressed in terms of discount rate which is also the minimum required rate of return generated by a proposal if it is to be accepted. Therefore, there is a positive correlation between risk of a proposal and the discount rate.

Question 15

Determine the risk adjusted net present value of the following projects:

	X	Y	Z
Net cash outlays (₹)	2,10,000	1,20,000	1,00,000
Project life	5 years	5 years	5 years
Annual Cash inflow (₹)	70,000	42,000	30,000
Coefficient of variation	1.2	0.8	0.4

The Company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

Coefficient of Variation	Risk-Adjusted Rate of Return	P.V. Factor 1 to 5 years At risk adjusted rate of discount
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

Solution

Statement showing the determination of the risk adjusted net present value

Projects	Net cash outlays	Coefficient of variation	Risk adjusted discount rate	Annual cash inflow	PV factor 1-5 years	Discounted cash inflow	Net present value
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii) = (v) x (vi)	(viii) =(vii) x (ii)
X	2,10,000	1.20	16 %	70,000	3.274	2,29,180	19,180
Y	1,20,000	0.80	14 %	42,000	3.433	1,44,186	24,186
Z	1,00,000	0.40	12 %	30,000	3.605	1,08,150	8,150

Question 16

New Projects Ltd. is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

	P-I	P-II	P-III
Cost	₹ 15,00,000	₹ 11,00,000	₹ 19,00,000
Inflows-Year 1	6,00,000	6,00,000	4,00,000
Year 2	6,00,000	4,00,000	6,00,000
Year 3	6,00,000	5,00,000	8,00,000
Year 4	6,00,000	2,00,000	12,00,000
Risk Index	1.80	1.00	0.60

Minimum required rate of return of the firm is 15% and applicable tax rate is 40%. The risk free interest rate is 10%.

Required:
(i). Find out the risk-adjusted discount rate (RADR) for these projects.
(ii). Which project is the best?

Solution

(i). The risk free rate of interest and risk factor for each of the projects are given. The risk adjusted discount rate (RADR) for different projects can be found on the basis of CAPM as follows:

Required Rate of Return = I_{Rf} + (k_o - I_{RF}) Risk Factor

For P-I : RADR = 0.10 + (0.15 – 0.10) 1.80 = 19%

For P-II : RADR = 0.10 + (0.15 – 0.10) 1.00 = 15 %

For P-III : RADR = 0.10 + (0.15 – 0.10) 0.60 = 13 %

(ii). The three projects can now be evaluated at 19%, 15% and 13% discount rate as follows:

Project P-I

Annual Inflows	₹ 6,00,000
PVAF (19 %, 4)	2.639
PV of Inflows (6,00,000 x 2.639)	₹ 15,83,400
Less: Cost of Investment	₹ 15,00,000
Net Present Value	₹ 83,400

Project P-II

Year	Cash Inflow (₹)	PVF (15%,n)	PV (₹)
1	6,00,000	0.870	5,22,000
2	4,00,000	0.756	3,02,400
3	5,00,000	0.658	3,29,000
4	2,00,000	0.572	1,14,400
Total Present Value			12,67,800
Less: Cost of Investment			11,00,000
Net Present Value			1,67,800

Project P-III

Year	Cash Inflow (₹)	PVF (15%,n)	PV (₹)
1	4,00,000	0.885	3,54,000
2	6,00,000	0.783	4,69,800
3	8,00,000	0.693	5,54,400
4	12,00,000	0.613	7,35,600
Total Present Value			21,13,800
Less: Cost of Investment			19,00,000
Net Present Value			2,13,800

Project P-III has highest NPV. So, it should be accepted by the firm

Question 17

A firm has projected the following cash flows from a project under evaluation:

Year	₹ lakhs
0	(70)
1	30
2	40
3	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%.

Show how the viability of the project is to be evaluated.

Solution

It is stated that the cash flows have been adjusted for inflation; hence they are "nominal". The cost of capital or discount rate is "real". In order to be compatible, the cash flows should be converted into "real flow". This is done as below:

Year	Nominal cash flows	Adjusted Inflation* factor	Real cash flows	PVF @ 10%	PV of cash flows
0	(70)	-	(70)	1.000	(70)
1	30	0.952	28.56	0.909	25.96
2	40	0.907	36.28	0.826	29.97
3	30	0.864	25.92	0.751	19.47
				Total	75.40
Less: Cash out flow					70.00
NPV (+)					5.40

* 1/1.05; 1/(1.05)2 ; 1/(1.05)3;

Advise: With positive NPV, the project is financially viable.

Alternatively, instead of converting cash flows into real terms, the discount rate can be converted into nominal rate. Result will be the same.

An alternative solution is presented herewith

Alternative solution:

Year	Nominal cash flows	PVF @ 15.50% adjusted by the inflation factor i.e. 5%*	PV of cash flows
1	30	0.866	25.98
2	40	0.749	29.96
3	30	0.649	19.47
Cash Inflow			75.41
Less: Cash Outflow			70.00
Net Present Value			5.41

*0.909/1.05 = 0.866 ; 0.826/1.1025 = 0.749 ; 0.751/1.1576 = 0.649

Advise: With positive NPV, the project is financially viable.

Question 18

Shashi Co. Ltd has projected the following cash flows from a project under evaluation:

Year	0	1	2	3
₹ (in lakhs)	(72)	30	40	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%. Show how the viability of the project is to be evaluated. PVF at 10% for 1 -3 years are 0.909, 0.826 and 0.751.

Solution

Here the given cash flows have to be adjusted for inflation. Alternatively, the discount rate can be converted into nominal rate, as follows:-

Year 1 = 0.909/1.05 = 0.866 ; Year 2 = 0.826/(1.05)2 or 0.826/1.1025 = 0.749

Year 3 = 0.751/(1.05)3 or 0.751/1.1576 = 0.649

Year	Nominal Cash Flows (₹ in lakhs)	Adjusted PVF as above	PV of Cash Flows (₹ in lakhs)
1	30	0.866	25.98
2	40	0.749	29.96
3	30	0.649	19.47
Cash Inflows			75.41
Less: Cash Outflow			(72.00)
NPV			3.41

With positive NPV, the project is financially viable.

Alternative Solution

Assumption: The cost of capital given in the question is "Real'.

Nominal cost of capital = (1.10) (1.05) -1 = 0.155 =15.50%

DCF Analysis of the project

(₹ in lakhs)

	Period	PVF @ 15.50%	CF	PV
Investment	0	1	-72	-72
Operation	1	0.866	30	+ 25.98
-do-	2	0.750	40	+ 30.00
-do-	3	0.649	30	+ 19.47
NPV				+ 3.45

The proposal may be accepted as the NPV is positive.

Question 19

KLM Ltd. requires ₹ 15,00,000 for a new project.
Useful life of project is 3 years.
Salvage value - NIL.
Depreciation is ₹ 5,00,000 p.a.

Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year	1	2	3
Revenues in ₹	10,00,000	13,00,000	14,00,000
Costs in ₹	5,00,000	6,00,000	6,50,000

Applicable tax rate is 35%. Assume cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenue %	Cost %
1	9	10
2	8	9
3	6	7

PVF at 14%, for 3 years =0.877, 0.769 and 0.675

Show amount to the nearest rupee in calculations.

You are required to calculate net present value of the project.

Solution

(i). Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	10,00,000	10,00,000(1.09) = 10,90,000
2	13,00,000	13,00,000(1.09) (1.08) = 15,30,360
3	14,00,000	14,00,000(1.09) (1.08)(1.06) = 17,46,965

(ii). Inflation adjusted Costs

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	5,00,000	5,00,000(1.10) = 5,50,000
2	6,00,000	6,00,000(1.10)(1.09) = 7,19,400
3	6,50,000	6,50,000(1.10)(1.09)(1.07) = 8,33,905

(iii). Tax Benefit on Depreciation = ₹ 5,00,000 x 0.35 = ₹ 1,75,000

(iv). Net Profit after Tax

Year	Revenues (Inflation Adjusted)	Costs (Inflation Adjusted)	Net Profit	Tax	Profit after Tax
	(1)	(2)	(3) = (1) – (2)	(4) = 35% of (3)	(3) – (4)
1	10,90,000	5,50,000	5,40,000	1,89,000	3,51,000
2	15,30,360	7,19,400	8,10,960	2,83,836	5,27,124
3	17,46,965	8,33,905	9,13,060	3,19,571	5,93,489

(v). Present Value of Cash Inflows

Year	Net Profit after tax	Tax Benefit on Depreciation	Cash Inflow	PVF@ 14%	PV
1	3,51,000	1,75,000	5,26,000	0.877	4,61,302
2	5,27,124	1,75,000	7,02,124	0.769	5,39,933
3	5,93,489	1,75,000	7,68,489	0.675	5,18,730
					15,19,965

NPV = ₹ 15,19,965 – ₹ 15,00,000 = ₹ 19,965

Question 20

A firm has an investment proposal, requiring an outlay of ₹ 80,000. The investment proposal is expected to have two years economic life with no salvage value. In year 1, there is a 0.4 probability that cash inflow after tax will be ₹ 50,000 and 0.6 probability that cash inflow after tax will be ₹ 60,000. The probability assigned to cash inflow after tax for the year 2 is as follows:

The cash inflow year 1	₹ 50,000		₹ 60,000	
The cash inflow year 2	Probability		Probability	
	₹ 24,000	0.2	₹ 40,000	0.4
	₹ 32,000	0.3	₹ 50,000	0.5
	₹ 44,000	0.5	₹ 60,000	0.1

The firm uses a 10% discount rate for this type of investment. Required:

(i). Construct a decision tree for the proposed investment project and calculate the expected net present value (NPV).

(ii). What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?

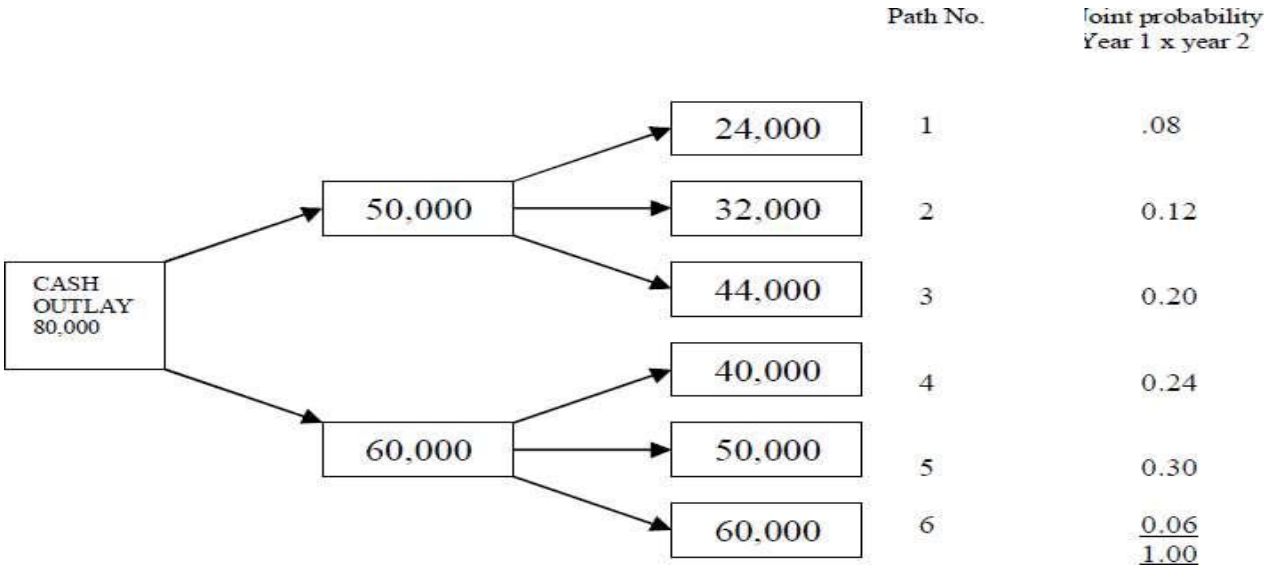
(iii). What will be the best outcome and the probability of that occurrence?

(iv). Will the project be accepted?

(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

Solution

(i). The decision tree diagram is presented in the chart, identifying various paths and outcomes, and the computation of various paths/outcomes and NPV of each path are presented in the following tables:



The Net Present Value (NPV) of each path at 10% discount rate is given below:

Path	Year 1 Cash Flows	Year 2 Cash Flows	Total Cash Inflows (PV)	Cash Inflows NPV	
		₹	₹	₹	
1	50,000 x .909 = 45,450	24,000 x.826 = 19,824	65,274	80,000	(—) 14,726
2	45,450	32,000 x .826 = 26,432	71,882	80,000	(—) 8,118
3	45,450	44,000x .826 = 36,344	81,794	80,000	1,794
4	60,000 x.909 = 54,540	40,000x .826 = 33,040	87,580	80,000	7,580
5	54,540	50,000x .826 = 41,300	95,840	80,000	15,840
6	54,540	60,000x .826 = 49,560	1,04,100	80,000	24,100

Statement showing Expected Net Present Value

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z	NPV (₹)	Joint Probability	Expected NPV
1	—14,726	0.08	—1,178.08
2	—8,118	0.12	—974.16
3	1,794	0.20	358.80
4	7,580	0.24	1,819.20
5	15,840	0.30	4,752.00
6	24,100	0.06	1,446.00
			6223.76

(ii). If the worst outcome is realized the project will yield NPV of - ₹ 14,726. The probability of occurrence of this NPV is 8% and a loss of ₹ 1,178 (path 1).

(iii). The best outcome will be path 6 when the NPV is at ₹ 24,100. The probability of occurrence of this NPV is 6% and a expected profit of ₹ 1,446.

(iv). The project should be accepted because the expected NPV is positive at ₹ 6,223.76 based on joint probability.

Question 21

Jumble Consultancy Group has determined relative utilities of cash flows of two forthcoming projects of its client company as follows:

Cash Flow in ₹	-15000	-10000	-4000	0	15000	10000	5000	1000
Utilities	-100	-60	-3	0	40	30	20	10

The distribution of cash flows of project A and Project B are as follows:

Project A					
Cash Flow (₹)	-15000	- 10000	15000	10000	5000
Probability	0.10	0.20	0.40	0.20	0.10
Project B					
Cash Flow (₹)	- 10000	-4000	15000	5000	10000
Probability	0.10	0.15	0.40	0.25	0.10

Which project should be selected and why ?

Solution

Evaluation of project utilizes of Project A and Project B

	Project A		
Cash Flow (in ₹)	Probability	Utility	Utility Value
-15,000	0.10	-100	-10
-10,000	0.20	-60	-12
15,000	0.40	40	16
10,000	0.20	30	6
5,000	0.10	20	2
			2

	Project B		
Cash Flow (in ₹)	Probability	Utility	Utility Value
-10,000	0.10	-60	-6
-4,000	0.15	-3	-0.45
15,000	0.40	40	16
5,000	0.25	20	5
10,000	0.10	30	3
			17.55

Project B should be selected as its expected utility is more.

Question 22

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%. Required:

When should the company replace the machine?

(Notes: Present value of an annuity of Re. 1 per period for 8 years at interest rate of 15% : 4.4873; present value of Re. 1 to be received after 8 years at interest rate of 15% : 0.3269).

Solution

A & Co.

Equivalent cost of (EAC) of new machine

		₹
(i)	Cost of new machine now	90,000
	Add: PV of annual repairs @ ₹ 10,000 per annum for 8 years (₹ 10,000 x 4.4873)	44873
		1,34,873
	Less: PV of salvage value at the end of 8 years ((₹ 20,000 x 0.3269)	6,578
		128335
	Equivalent annual cost (EAC) (` 1,28,335/4.4873)	28600

PV of cost of replacing the old machine in each of 4 years with new machine

Scenario	Year	Cash Flow	PV @ 15%	PV
Replace Immediately	0	(28,600)	1.00	(28,600)
		40,000	1.00	40,000
				11,400
Replace in one year	1	(28,600)	0.870	(24,882)
	1	(10,000)	0.870	(8,700)
	1	25,000	0.870	21,750
				(11,832)
Replace in two years	1	(10,000)	0.870	(8,700)
	2	(28,600)	0.756	(21,622)
	2	(20,000)	0.756	(15,120)
	2	15,000	0.756	11,340

				(34,102)
Replace in three years	1	(10,000)	0.870	(8,700)
	2	(20,000)	0.756	(15,120)
	3	(28,600)	0.658	(18,819)
	3	(30,000)	0.658	(19,740)
	3	10,000	0.658	6,580
				(55,799)
Replace in four years	1	(10,000)	0.870	(8,700)
	2	(20,000)	0.756	(15,120)
	3	(30,000)	0.658	(19,740)
	4	(28,600)	0.572	(16,359)
	4	(40,000)	0.572	(22,880)
				(82,799)

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.

Alternatively, optimal replacement period can also be computed using the following table:

Scenario	Year	Cashflow	PV at 15%	PV
Replace immediately	0	(40,000)	1	(40,000)
	1 to 4	28,600	2.855	81,652
				41,652
Replace after 1 year	1	10,000	0.870	8,696
	1	(25,000)	0.870	(21,739)
	2 to 4	28,600	1.985	56,783
				43,739
Replace after 2 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	2	(15,000)	0.756	(11,342)
	3 and 4	28,600	1.229	35,157
				47,633
Replace after 3 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	3	(10,000)	0.658	(6,575)
	4	28,600	0.572	16,352
				53,321
Replace after 4 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725

	4	40,000	0.572	22,870
				66,414

Question 23

A company has an old machine having book value zero – which can be sold for ₹ 50,000. The company is thinking to choose one from following two alternatives:

(i). To incur additional cost of ₹ 10,00,000 to upgrade the old existing machine.

(ii). To replace old machine with a new machine costing ₹ 20,00,000 plus installation cost 50,000.

Both above proposals envisage useful life to be five years with salvage value to be nil.

The expected after tax profits for the above three alternatives are as under :

Year	Old existing Machine (₹)	Upgraded Machine (₹)	New Machine (₹)
1	5,00,000	5,50,000	6,00,000
2	5,40,000	5,90,000	6,40,000
3	5,80,000	6,10,000	6,90,000
4	6,20,000	6,50,000	7,40,000
5	6,60,000	7,00,000	8,00,000

The tax rate is 40 per cent.

The company follows straight line method of depreciation. Assume cost of capital to be 15 per cent. P.V.F. of 15%, 5 = 0.870, 0.756, 0.658, 0.572 and 0.497.

You are required to advise the company as to which alternative is to be adopted.

Solution

(A)	Cash Outflow		₹
	(i)	In case machine is upgraded:	
		Upgradation Cost	10,00,000
	(ii)	In case new machine installed:	
		Cost	20,00,000
		Add: Installation cost	50,000
		Total Cost	20,50,000
		Less: Disposal of old machine	
		₹ 50,000 – 40% tax	30,000
		Total Cash Outflow	20,20,000

Working Note:

(i). Depreciation – in case machine is upgraded
₹ 10,00,000 ÷ 5 = ₹ 2,00,000

(ii). Depreciation – in case new machine is installed
₹ 20,50,000 ÷ 5 = ₹ 4,10,000

(iii). Old existing machine – Book Value is zero. So, no depreciation.

B. Cash Inflows after Taxes (CFAT)

Year	Old Existing Machine	Upgraded Machine			
	(i) EAT/CFAT	(ii) EAT	(iii) DEP	(iv) CFAT	= (iv)-(i) Incremental CFAT
	₹	₹	₹	₹	₹
1	5,00,000	5,50,000	2,00,000	7,50,000	2,50,000
2	5,40,000	5,90,000	2,00,000	7,90,000	2,50,000
3	5,80,000	6,10,000	2,00,000	8,10,000	2,30,000
4	6,20,000	6,50,000	2,00,000	8,50,000	2,30,000
5	6,60,000	7,00,000	2,00,000	9,00,000	2,40,000

Cash Inflow after Taxes (CFAT)

Year		New Machine		
	(vi) EAT	(vii) DEP	(viii) CFAT	(ix) = (viii) – (i) Incremental CFAT
1	6,00,000	4,10,000	10,10,000	5,10,000
2	6,40,000	4,10,000	10,50,000	5,10,000
3	6,90,000	4,10,000	11,00,000	5,20,000
4	7,40,000	4,10,000	11,50,000	5,30,000
5	8,00,000	4,10,000	12,10,000	5,50,000

P.V. AT 15% - 5 Years – on Incremental CFAT

Year	Upgraded Machine			New Machine		
	Incremental CFAT	PVF	Total P.V.	Incremental CFAT	PVF	Total PV
1	2,50,000	0.870	2,17,500	5,10,000	0.870	4,43,700
2	2,50,000	0.756	1,89,000	5,10,000	0.756	3,85,560
3	2,30,000	0.658	1,51,340	5,20,000	0.658	3,42,160
4	2,30,000	0.572	1,31,560	5,30,000	0.572	3,03,160
5.	2,40,000	0.497	1,19,280	5,50,000	0.497	2,73,350
Total P.V. of CFAT			8,08,680			17,47,930
Less: Cash Outflows			10,00,000			20,20,000*
N.P.V. =			-1,91,320			- 2,72,070

*Acquisition Cost (including installation cost)	20,50,000
Less: Salvage Value of existing machine net of Tax	30,000
	20,20,000

As the NPV in both the new (alternative) proposals is negative, the company should continue with the existing old Machine.

Question 24

Company X is forced to choose between two machines A and B. The two machines are designed differently but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

Solution

Statement showing the evaluation of two machines

Machines	A	B
Purchase cost (₹): (i)	1,50,000	1,00,000
Life of machines (years)	3	2
Running cost of machine per year (₹): (ii)	40,000	60,000
Cumulative present value factor for 1-3 years @ 10% (iii)	2.486	-
Cumulative present value factor for 1-2 years @ 10% (iv)	-	1.735
Present value of running cost of machines (₹): (v)	99,440	1,04,100
	[(ii) x (iii)]	[(ii) x (iv)]
Cash outflow of machines (₹): (vi) = (i) + (v)	2,49,440	2,04,100
Equivalent present value of annual cash outflow	1,00,338	1,17,637
	[(vi) x (iii)]	[(vi) x (iv)]

Decision: Company X should buy machine A since its equivalent cash outflow is less than machine B.

Question 25

Company Y is operating an elderly machine that is expected to produce a net cash inflow of ₹ 40,000 in the coming year and ₹ 40,000 next year. Current salvage value is ₹ 80,000 and next year's value is ₹ 70,000. The machine can be replaced now with a new machine, which costs ₹ 1,50,000, but is much more efficient and will provide a cash inflow of ₹ 80,000 a year for 3 years. Company Y wants to know whether it should replace the equipment now or wait a year with the clear understanding that the new machine is the best of the available alternatives and that it in turn be replaced at the optimal point. Ignore tax. Take opportunity cost of capital as 10 per cent. Advise with reasons.

Solution

Statement showing present value of cash inflow of new machine when it replaces elderly machine now

NPV of New Machine

PV of Cash Inflow (80000 x 2.486)	₹ 1,98,880
Less: Purchase Cost of New Machine	₹ 1,50,000
	₹ 48,880

Since NPV of New Machine is positive, it should be purchased.

Timing Decision

Replace Now

Current Realizable Value	80,000
NPV of New Machine	48,880
Total NPV	1,28,880

Replace after 1 Year

Cash Inflow for Year 1	40000
Realisable Value of Old Machine	70000
NPV of New Machine	48,880
Total NPV after 1 Year	1,58,880
PV of Total NPV (158880/1.1)	1,44,436

Advise: Since Total NPV is higher in case of Replacement after one year Machine should be replaced after 1 year.

Question 26

A machine used on a production line must be replaced at least every four years. Costs incurred to run the machine according to its age are:

Age of the Machine (years)					
	0	1	2	3	4
Purchase price (in ₹)	60,000				
Maintenance (in ₹)		16,000	18,000	20,000	20,000
Repair (in ₹)		0	4,000	8,000	16,000
Scrap Value (in ₹)		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

Solution

Working Notes

First of all, we shall calculate cash flows for each replacement cycle as follows:

One Year Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	32,000	16,000

Two Year Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	24,000	2,000

Three Year Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	16,000	(12,000)

Four Year Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	-	(28,000)
4	-	(36,000)	8,000	(28,000)

Now we shall calculate NPV for each replacement cycles

		1 Year		2 Years		3 Years		4 Years	
Year	PVF@ 15%	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV
0	1	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000
1	0.8696	16,000	13,914	-16,000	-13,914	-16,000	-13,914	-16,000	-13,914
2	0.7561	-	-	2,000	1,512	-22,000	-16,634	-22,000	-16,634
3	0.6575	-	-	-	0	-12,000	-7,890	-28,000	-18,410
4	0.5718	-	-	-	0		0	-28,000	-16,010
			-46,086		**-72,402**		**-98,438**		**-1,24,968**

Replacement Cycles		EAC (₹)
1 Year	46,086 /0.8696	52,997
2 Years	72,402/1.6257	44,536
3 Years	98,438/ 2.2832	43,114
4 Years	1,24,968 /2.855	43,772

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.

Note: Alternatively, Answer can also be computed by excluding initial outflow as there will be no change in final decision.

Question 27

Trouble Free Solutions (TFS) is an authorized service center of a reputed domestic air conditioner manufacturing company. All complaints/service related matters of Air conditioner are attended by this service center. The service center employs a large number of mechanics, each of whom is provided with a motor bike to attend the complaints. Each mechanic travels approximately 40000 kms per annuam. TFS decides to continue its present policy of always buying a new bike for its mechanics but wonders whether the present policy of replacing the bike every three year is optimal or not. It is of believe that as new models are entering into market on yearly basis, it wishes to consider whether a replacement of either one year or two years would be better option than present three year period. The fleet of bike is due for replacement shortly in near future.

The purchase price of latest model bike is ₹ 55,000. Resale value of used bike at current prices in market is as follows:

Period	₹
1 Year old	35,000
2 Year old	21,000
3 Year old	9,000

Running and Maintenance expenses (excluding depreciation) are as follows

Year	Road Taxes Insurance etc. (₹)	Petrol Repair Maintenance etc. (₹)
1	3,000	30,000
2	3,000	35,000
3	3,000	43,000

Using opportunity cost of capital as 10% you are required to determine optimal replacement period of bike.

Solution

In this question the effect of increasing running cost and decreasing resale value have to be weighted upto against the purchase cost of bike. For this purpose, we shall compute Equivalent Annual Cost (EAC) of replacement in different years shall be computed and compared.

Year	Road Taxes	Petrol etc.	Total	PVF @10%	PV	Cumulative PV	PV of Resale Price	Net Outflow
	₹	₹	₹	₹	₹	₹	₹	₹
1	3,000	30,000	33,000	0.909	29,997	29,997	31,815	(1,818)
2	3,000	35,000	38,000	0.826	31,388	61,385	17,346	44,039
3	3,000	43,000	46,000	0.751	34,546	95,931	6,759	89,172

Computation of EACs

Year*	Purchase Price of Bike (₹)	Net Outflow (₹)	Total Outflow (₹)	PVAF @ 10%	EAC (₹)**
1	55,000	(1,818)	53,182	0.909	58,506
2	55,000	44,039	99,039	1.735	57,083
3	55,000	89,172	1,44,172	2.486	57,993

Thus, from above table it is clear that EAC is least in case of 2 years, hence bike should be replaced every two years.

* Assume these periods are the periods from which bike shall be kept in use.

**EAC is used to bring Cash Flows occurring for different periods at one point of Time.

OTHER QUESTIONS FROM PAST

Question 1

A manufacturing unit engaged in the production of automobile parts is considering a proposal of purchasing one of the two plants, details of which are given below:

Particulars	Plant A	Plant B
Cost	₹ 20,00,000	₹ 38,00,000
Installation charges	₹ 4,00,000	₹ 2,00,000
Life	20 years	15 years
Scrap value after full life	₹ 4,00,000	₹ 4,00,000
Output per minute (units)	200	400

The annual costs of the two plants are as follows:

Particulars	Plant A	Plant B
Running hours per annum	2,500	2,500
Costs:	(In ₹)	(In ₹)
Wages	1,00,000	1,40,000
Indirect materials	4,80,000	6,00,000
Repairs	80,000	1,00,000
Power	2,40,000	2,80,000
Fixed Costs	60,000	80,000

Will it be advantageous to buy Plant A or Plant B? Substantiate your answer with the help of comparative unit cost of the plants. Assume interest on capital at 10 percent. Make other relevant assumptions:

Note: 10 percent interest tables

	20 Years	15 Years
Present value of ₹ 1	0.1486	0.2394
Annuity of ₹ 1 (capital recovery factor with 10% interest)	0.1175	0.1315

Solution

Working Notes:

Calculation of Equivalent Annual Cost

	Machine A	Machine B
Cash Outlay	₹ 24,00,000	₹ 40,00,000
Less: PV of Salvage Value		
4,00,000 x 0.1486	₹ 59,440	
4,00,000 x 0.2394		₹ 95,760
Annuity Factor	0.1175	0.1315
	₹ 2,75,016	₹ 5,13,408

Computation of Cost Per Unit

	Machine A	Machine B
Annual Output (a)	2500 x 60 x 200	2500 x 60 x 400
	= 3,00,00,000	= 6,00,00,000
Annual Cost (b)	₹	₹
Wages	1,00,000	1,40,000
Indirect Material	4,80,000	6,00,000
Repairs	80,000	1,00,000
Powers	2,40,000	2,80,000
Fixed Cost	60,000	80,000
Equivalent Annual Cost	2,75,016	5,13,408
Total	12,35,016	17,13,408
Cost Per Unit (b)/(a)	0.041167	0.02860

Decision: As the unit cost is less in proposed Plant B, it may be recommended that it is advantageous to acquire Plant B.

Question 2

XYZ Ltd., an infrastructure company is evaluating a proposal to build, operate and transfer a section of 35 kms. of road at a project cost of ₹ 200 crores to be financed as follows:

Equity Shares Capital ₹ 50 crores, loans at the rate of interest of 15% p.a. from financial institutions ₹ 150 crores. The Project after completion will be opened to traffic and a toll will be collected for a period of 15 years from the vehicles using the road. The company is also required to maintain the road during the above 15 years and after the completion of that period, it will be handed over to the Highway authorities at zero value. It is estimated that the toll revenue will be ₹ 50 crores per annum and the annual toll collection expenses including maintenance of the roads will amount to 5% of the project cost. The company considers to write off the total cost of the project in 15 years on a straight line basis. For Corporate Income- tax purposes the company is allowed to take depreciation @ 10% on WDV basis. The financial institutions are agreeable for the repayment of the loan in 15 equal annual instalments – consisting of principal and interest.

Calculate Project IRR and Equity IRR. Ignore Corporate taxation.

Explain the difference in Project IRR and Equity IRR.

Solution

Computation of Project IRR

Project IRR is computed by using the following equation:

Where,

CO_0 = Cash outflow at time zero

CF_i = Net cash inflow at different points of time

N = Life of the project and

R = Rate of discount (IRR)

Now,

CO_0 = ₹ 200 crores

CF_i = ₹ 40 crores p.a. for 15 years (Refer to working note (i))

Therefore,

200 Crore = $\frac{40 \text{ Crores}}{(1+r)15}$

The value of IRR of the project:

1) An approximation of IRR is made on the basis of cash flow data. A rough approximation may be made with reference to the payback period. The payback period in the given case is 5 years i.e., (200 Crores/40 Crores). From the PVAF table the closest figures are given in rate 18% (5.092) and the rate 19% (4.876). This means the IRR of the project is expected to be between 18% and 19%.

2) The estimate of IRR cash inflow of the project for both these rates is as follows:

At 18% = ₹ 40 crores x PVAF (18%, 15 years)
= ₹ 40 crores x 5.092
= ₹ 203.68 crores

At 19% = ₹ 40 crores x PVAF (19%, 15 years)
= ₹ 40 crores x 4.876
= ₹ 195.04 crores

3) The exact IRR by interpolating between 18% and 19% is worked out as follows:

IRR = 18% + $\frac{203.68 \text{ Crores} - 200 \text{ Crores}}{203.68 \text{ Crores} - 195.04 \text{ Crores}}$ X 1%

= 18% + $\frac{3.68 \text{ Crores}}{8.64 \text{ Crores}}$ X 1%

= 18 % + 0.426%
= 18.43%

Therefore, the IRR of the project is 18.43%.

Working Notes:

(i). Net cash inflow of the project

Cash inflow	
Toll revenue	50 crores p.a. for 15 years
Cash outflow	
Toll collection expenses including maintenance of the roads (5% of ` 200 crores)	10 crores p.a. for 15 years
Net cash inflow	40 crores p.a. for 15 years

Note: Since corporate taxes is not payable. The impact of depreciation need not be considered.

Computation of Equity IRR

Equity IRR is computed by using the following equation:

$$\text{Cash inflow at zero date from equity shareholders} = \frac{\text{Cash Inflow available for equity shareholders}}{(1+r)n}$$

Where,

r = Equity IRR

n = Life of the project

Here, Cash inflow at zero date from equity shareholders = ₹ 50 crores

Cash inflow for equity shareholders = ₹ 14.35 crores p.a.

(Refer to working note)

Therefore:

$$50 \text{ Crores} = \frac{14.35 \text{ Crores}}{(1+r)15}$$

The value of equity IRR of the project is calculated as follows:

1) An approximation of IRR is made on the basis of cash flow data. A rough approximation may be made with reference to the payable period. The payback period in the given case is 3.484(50 Crores/14.35 Crores). From the PVAF table the closest figure may be about 25% and 30%. This means the equity IRR of project must be between 25% and 30%.

2) The estimated NPV of the project at 25% = ₹ 14.35 crores X 3.859 = ₹ 55.3766 crores. The estimated NPV of the project at 30% = ₹ 14.35 crores X 3.268 =₹ 46.896 crores

3) IRR by using Interpolation Formula will be

$$= 25\% + \frac{55.377-}{55.3766-46.896} \text{ X } 5\%$$

$$= 25\% + \frac{5.377}{8.4806} \text{ X } 5\%$$

= 25 % + 3.17 %

= 28.17%

(ii). Equated annual instalment (i.e. principal + interest) of loan from financial institution:

Amount of loan from financial institution	₹ 150 crores
Rate of interest	15% p.a.
No. of years	15
Cumulative discount factor for 1-15 years	5.847

Hence, equated yearly instalment will be ₹ 150 crores/5.847 i.e. ₹ 25.65 crores.

(iii). Cash inflow available for equity shareholders

Net cash inflow of the project	₹ 40.00 crores
[Refer to working note (i)]	
Equated yearly instalment of the project	₹ 25.65 crores
[Refer to working note (ii)]	
Cash inflow available for equity shareholders	₹ 14.35 crores

Difference in Project IRR and Equity IRR:

The project IRR is 18.4% whereas Equity IRR is 28%. This is attributed to the fact that XYZ Ltd. is earning 18.4% on the loan from financial institution but paying only 15%. The difference between the return and cost of funds from financial institution has enhanced equity IRR. The 3.4% (18.4% - 15%) earnings on ₹ 150 crores goes to equity shareholders who have invested ₹ 50 crore i.e.

$3.4\% + \frac{150\ \text{Crores}}{50\ \text{Crores}} = 10.2\%$ is added to the project IRR which gives equity IRR of 28%.

Question 3

ABC Chemicals is evaluating two alternative systems for waste disposal, System A and System B, which have lives of 6 years and 4 years respectively. The initial investment outlay and annual operating costs for the two systems are expected to be as follows:

	System A	System B
Initial Investment Outlay	₹ 5 million	₹ 4 million
Annual Operating Costs	₹ 1.5 million	₹ 1.6 million
Salvage value	₹ 1 million	₹ 0.5 million

If the hurdle rate is 15%, which system should ABC Chemicals choose?

The PVIF @ 15% for the six years are as below:

Year	1	2	3	4	5	6
PVIF	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323

Solution

PV of Total Cash Outflow under System A

	₹
Initial Outlay	50,00,000
PV of Annual Operating Cost (1-6 years) 15,00,000 x 3.7845	56,76,750
Less: PV of Salvage Value ` 10,00,000 x 0.4323	(4,32,300)
	1,02,44,450
PVAF (15%, 6)	3.7845
Equivalent Annual Cost (1,02,44,450/3.7845)	27,06,949

PV of Total Cash Outflow under System B

Initial Outlay	40,00,000
PV of Annual Operating Cost (1-4 years) 16,00,000 x 2.855	45,68,000

Less: PV of Salvage Value ` 5,00,000 x 0.5718	(2,85,900)
	82,82,100
PVAF (15%, 4)	2.855
Equivalent Annual Cost (82,82,100/2.855)	29,00,911

Since Equivalent Annual Cost (EAC) is least in case of system A hence same should be opted.

Question 4

You own an unused Gold mine that will cost ₹ 10,00,000 to reopen. If you open the mine, you expect to be able to extract 1,000 ounces of Gold a year for each of three years. After that the deposit will be exhausted. The Gold price is currently ₹ 5,000 an ounce, and each year the price is equally likely to rise or fall by ₹ 500 from its level at the start of year. The extraction cost is ₹ 4,600 an ounce and the discount rate is 10 per cent.

Required:

a) Should you open the mine now or delay one year in the hope of a rise in the Gold price?
b) What difference would it make to your decision if you could costlessly (but irreversibly) shut down the mine at any stage? Show the value of abandonment option.

Solution

a)

1) Assume we open the mine now at t = 0. Taking into account the distribution of possible future price of gold over the next three years, we have

$$NPV = -10,00,000 + \frac{1000 \times \{(0.5 \times 5,500 + 0.5 \times 4,500) - 4,600\}}{1.10} + \frac{1000 \times \{(0.5)2 \times (6,000 + 5,000 + 5,000 + 4,000) - 4,600\}}{(1.10)2}$$

$$+ \frac{1000 \times \{(0.5)3 \times (6,500 + 5,500 + ,500 + 4,500 \quad ,500 + 5,500 + 4,500 \quad ,500) - 4,600\}}{(1.10)3}$$

$$= -5,260$$

Because the NPV is negative, we should not open the mine at t = 0. It does not make sense to open the mine at any price less than or equal to ₹ 5,000 per ounce.

2) Assume that we delay one year until t = 1, and open the mine if the price is ₹ 5,500.

At that point:

$$NPV = -10,00,000 + \frac{1000 \times \{(0.5 \times 6,000 + 0.5 \times 5,000) - 4,600\}}{1.10} + \frac{1000 \times \{(0.5)2 \times (6,500 + 5,500 + 5,500 + 4,500) - 4,600\}}{(1.10)2}$$

$$+ \frac{1000 \times \{(0.5)3 \times (7,000 + 6,000 + 6,000 + 5,000 + 5,000 + 6,000 + 5,000 + \quad ,000) - 4,600\}}{(1.10)3}$$

$$= -12,38,167$$

If the price at t1 reaches ₹ 5,500, then expected price for all future periods is 5,500.

NPV at t_0 = ₹ 12,38,167/1.10 = ₹ 11,25,606

If the price rises to ₹ 5,500 at t = 1, we should open the mine at that time. The expected NPV of this strategy is:

(0.50 x ₹ 11,25,606) + (0.50 x 0) = ₹ 5,62,803

As already stated mine should not be opened if the price is less than or equal to 5,000 per ounce.

If the price at t1 reaches ₹ 4,500, then expected price for all future periods is 4,500. In that situation we should not open the mine.

b) Suppose we open the mine at t = 0, when the price is ₹ 5,000. At t = 2, there is a 0.25 probability that the price will be ₹ 4,000. Then since the price at t = 3 cannot rise above the extraction cost, the mine should be closed. If we open the mine at t = 0, when the price was ` 5,000 with the closing option the NPV will be:

$$\text{NPV} = \text{- Rs.10,00,000} + \sum_{\tau-1} + \frac{(5000-4,600)x\ 1,000}{(1.10)\text{t}} + \frac{0.125\text{x}\ (1,900+900+900+900-100-10\ )x1,000\}}{(1.10)3}$$

= ₹ 1,07,438

Therefore, the NPV with the abandonment option (i.e. savings) is ₹ 1,07,438. The value of the abandonment option is:
0.125 x 1,000 x (100+1100) / (1.10)3 = Rs 1,12,697

The NPV of strategy (2), that to open the mine at t = 1, when price rises to ₹ 5,500 per ounce, even without abandonment option, is higher than option 1. Therefore, the strategy (2) is preferable.

Under strategy 2, the mine should be closed if the price reaches ₹ 4,500 at t = 3, because the expected profit is (₹ 4,500 – 4,600) x 1,000 = – ₹ 1,00,000.

The value of the abandonment option is:

0.125 x(1,00,000) / (1.10)4 = ₹ 8,538

Note: Students may also assume that the price of the gold remains at ₹ 5,000 to solve the question.

Question 5

DEF Ltd has been regularly paying a dividend of ₹ 19,20,000 per annum for several years and it is expected that same dividend would continue at this level in near future. There are 12,00,000 equity shares of ₹ 10 each and the share is traded at par.

The company has an opportunity to invest ₹ 8,00,000 in one year's time as well as further 8,00,000 in two years' time in a project as it is estimated that the project will generate cash inflow of ₹ 3,60,000 per annum in three years' time which will continue forever. This investment is possible if dividend is reduced for next two years.

Whether the company should accept the project? Also analyze the effect on the market price of the share, if the company decides to accept the project.

Solution

First we calculate cost of Equity (Ke)/PE Ratio

D1 = $\frac{19,20,000}{12,00,000}$ = 1.6

P_0 = 10

Ke = $\frac{D}{P}$ = 1.6/10 = 16%

P/E = 10/1.6 = 6.25

Now we shall compute NPV of the project

NPV = $\frac{-8,00,000}{(1+0.16)} + \frac{-8,00,000}{(1+0.16)2} + \{\frac{3,60,000}{0.16} \times \frac{1}{(1+0.16)3}\}$

= -6,89,655 – 5,94,530 + 16,72,117
= 3,87,932

As NPV of the project is positive, the value of the firm will increase by ₹ 3,87,932 and spread over the number of shares e.g. 12,00,000, the market price per share will increase by 32 paisa.

Question 6

Ramesh owns a plot of land on which he intends to construct apartment units for sale. No. of apartment units to be constructed may be either 10 or 15. Total construction costs for these alternatives are estimated to be ` 600 lakhs or ` 1025 lakhs respectively. Current market price for each apartment unit is ` 80 lakhs. The market price after a year for apartment units will depend upon the conditions of market. If the market is buoyant, each apartment unit will be sold for ` 91 lakhs, if it is sluggish, the sale price for the same will be ` 75 lakhs. Determine the value of vacant plot of land. Assuming that the construction cost will remain same in year 1 should Ramesh start construction now or keep the land vacant? The yearly rental per apartment unit is ` 7 lakhs and the risk free interest rate is 10% p.a.

Assume that the construction cost will remain unchanged.

Solution

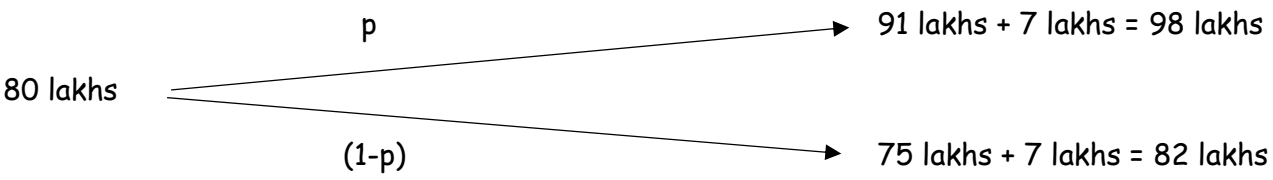
Presently 10 units apartments shall yield a profit of ₹ 200 lakh (₹ 800 lakhs – ₹ 600 lakhs) and 15 unit apartment will yield a profit of ₹ 175 lakh (₹ 1200 lakhs – ₹ 1025 lakhs). Thus 10 units apartment is the best alternative if Ramesh has to construct now.

However, Ramesh waits for 1 year his pay-off will be as follows:

	Market Conditions	
	Buoyant Market	Sluggish Market
10 units apartments	₹ 91 lakhs X 10 – ₹ 600 lakhs = ₹ 310 lakhs	₹ 75 lakhs X 10 – ₹ 600 lakhs = ₹ 150 lakhs
15 units apartments	₹ 91 lakhs X 15 – ₹ 1025 lakhs = ₹ 340 lakhs	₹ 75 lakhs X 15 – ₹ 1025 lakhs = ₹ 100 lakhs

Thus if market conditions turnout to be buoyant the best alternative is 15 units apartments and net pay-off will be ` 340 lakhs and if market turnout to be sluggish the best alternative is the 10 units apartments and net pay-off shall be ` 150 lakhs.

To determine the value of vacant plot we shall use Binomial Model (Risk Neutral Method) of option valuation as follows:



Alternatively student can calculate these values as follows (Sale Value + Rent):

If market is buoyant then possible outcome = ₹ 91 lakh + ₹ 7 lakh = ₹ 98 lakhs

If market is sluggish then possible outcome = ₹ 75 lakh + ₹ 7 lakh = ₹ 82 lakhs

Let p be the probability of buoyant condition then with the given risk-free rate of interest of 10% the following condition should be satisfied:

80 lakhs = $\frac{(\text{p x 98 lakhs})+((1-p)x8 \quad lakhs)}{1.10}$

p= 3/8 i.e., 0.375

Thus 1-p = 0.625

Expected cash flow next year

0.375 × ₹ 340 lakhs + 0.625 X ₹ 150 lakhs = ₹ 221.25 lakhs

Present Value of expected cash flow:

₹ 221.25 lakhs (0.909) = ₹ 201.12 lakhs. Thus, the value of vacant plot is ₹ 201.12 lakhs

Since the current value of vacant land is more than profit from 10 units apartments now (₹ 200 lakh) the land should be kept vacant.

Question 7

Ram Chemical is in production Line of Chemicals and considering a proposal of building new plant to produce pesticides. The Present Value (PV) of new proposal is ` 150 crores (After considering scrap value at the end of life of project). Since this is a new product market, survey indicates following variation in Present Value (PV):

Condition Favourable in first year	PV will increase 30% from original estimate
Condition sluggish in first year	PV will decrease by 40% from original Figures.

In addition Rama Chemical has a option to abandon the project at the end of Year and dispose it at ₹ 100 crores. If risk free rate of interest is 8%, what will be present value of put option?

Solution

Decision Tree showing pay off

Year 0	Year 1	Pay Off
150	195	0
	90	100 – 90 = 10

First of all we shall calculate probability of high demand (P) using risk neutral method as follows:

8% = p x 30% + (1-p) x (-40%)

0.08 = 0.30 p - 0.40 + 0.40p

p = 0.48/0.70 = 0.6857 say 0.686

The value of abandonment option will be as follows:

Expected Payoff at Year 1

= p x 0 + [(1-p) x 10] = 0.686 x 0 + [0.314 x 10] = ₹ 3.14 crore

Since expected pay off at year 1 is 3.14 crore, present value of expected pay off will be:

= 3.14/1.08 = 2.907 Crore

This is the value of abandonment option (Put Option).

Question 8

The municipal corporation of a city with mass population is planning to construct a flyover that will replace the intersection of two busy highways X and Y. Average traffic per day is 10,000 vehicles on highway X and 8,000 vehicles on highway Y. 70% of the vehicles are private and rest are commercial vehicles. The flow of traffic across and between aforesaid highways is controlled by traffic lights. Due to heavy flow, 50% of traffic on each of the highways is delayed. Average loss of time due to delay is 1.3 minute in highway X and 1.2 minute in highway Y. The cost of time delayed is estimated to be ₹ 80 per hour for commercial vehicle and ₹ 30 for private vehicle.

The cost of stop and start is estimated to be ₹ 1.20 for commercial vehicle and ₹ 0.80 for private vehicle. The cost of operating the traffic lights is ₹ 80,000 a year. One policeman is required to be posted for 3 hours a day at the crossing which costs ₹ 150 per hour.
Due to failure to obey traffic signals, eight fatal accidents and sixty non-fatal accidents occurred in last 4 years. On an average, insurance settlements per fatal and non-fatal accidents are ₹ 5,00,000 and ₹ 15,000 respectively.

To eliminate the delay of traffic and the accidents caused due to traffic light violations, the flyover has been designed. It will add a quarter of kilometer to the distance of 20% of total traffic. No posting of policeman will be required at the flyover. The flyover will require investment of ₹ 3 Cr. Extra maintenance cost would be ₹ 70,000 a year.

The incremental operating cost for commercial vehicle will be ₹ 5 per km and ₹ 2 for non- commercial vehicle. Expected economic life of the flyover is 30 years having no salvage value. The cost of capital for the project is 8%. (corresponding capital recovery rate is 0.0888).

You are required to calculate:

(i). total net benefits to users,

(ii). annual cost to the state; and

(iii). benefit cost ratio

Solution

Benefit to the Users (when 365 days taken in a year)

(i)	Annual Savings in Cost of Delays:	
	Highway X $(10000 \times 365 \times 0.50 \times \frac{1.3}{60})(0.70 \times 30 + 0.30 \times 80)$	₹ 17,79,375
	Highway Y $(8000 \times 365 \times 0.50 \times \frac{1.2}{60})(0.70 \times 30 + 0.30 \times 80)$	₹ 13,14,000
	(a)	₹ 30,93,375
(ii)	Annual Savings in Cost of Stops and Starts	
	Highway X $(10000 \times 365 \times 0.50)(0.70 \times 0.80 + 0.30 \times 1.20)$	₹ 16,79,000
	Highway Y $(8000 \times 365 \times 0.50)(0.70 \times 0.80 + 0.30 \times 1.20)$	₹ 13,43,200
	(b)	₹ 30,22,200
(iii)	Annual Saving in Accidents Claims (c)	
	$\frac{8}{4} \times 500000 + \frac{60}{4} \times 15000$ (c)	₹ 12,25,000
	Total Benefits (d) = (a) + (b) + (c)	₹ 73,40,575
	Less: Incremental Expenditures due to added distance	
	Highway X $(10000 \times 365 \times 0.20 \times 0.25)(0.70 \times 2 + 0.30 \times 5)$	₹ 5,29,250
	Highway Y $(8000 \times 365 \times 0.20 \times 0.25)(0.70 \times 2 + 0.30 \times 5)$	₹ 4,23,400
	(e)	₹ 9,52,650
	Total Net Benefits (d) – (e)	₹ 63,87,925

Annual Cost to State

Investment Cost (₹ 3,00,00,000 × 0.0888)	₹ 26,64,000
Extra Annual Maintenance	₹ 70,000
	₹ 27,34,000
Less: Saving in Cost of operating traffic lights (₹ 80,000 + 3 × 365 × ₹ 150)	₹ 2,44,250
	₹ 24,89,750

Cost Benefit Ratio = $\frac{\text{P.V of Benefits}}{\text{P.V of Costs}} = \frac{63,87,925 \text{ PVAF}(\frac{1}{0.0888})}{24,89,750 \text{ PVAF}(\frac{1}{0.0888})} = \frac{7,19,36,092}{2,80,37,725} = 2.57$

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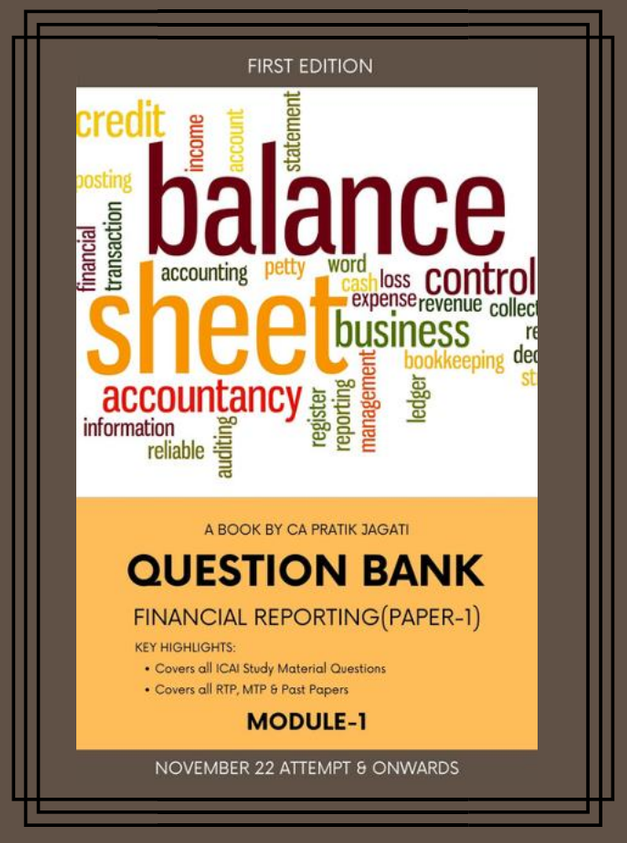

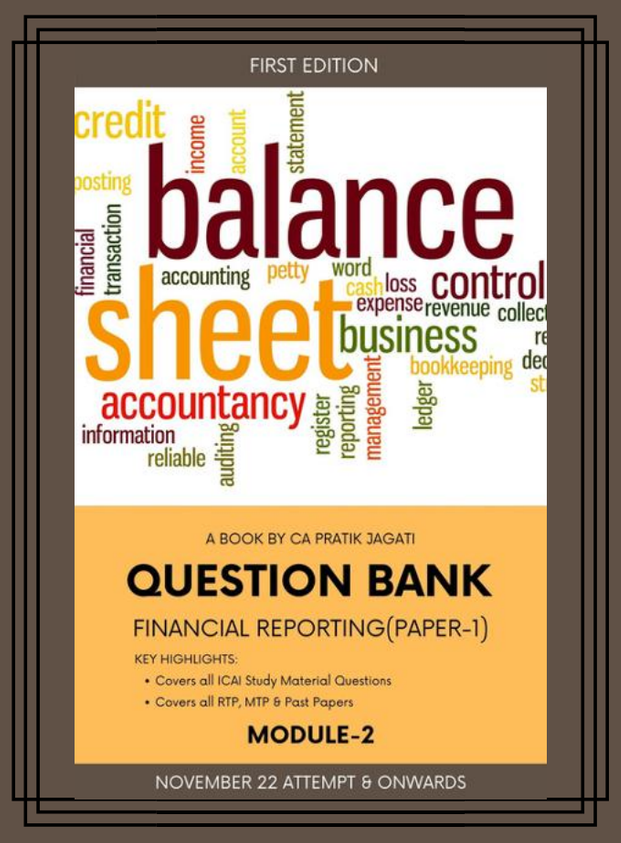

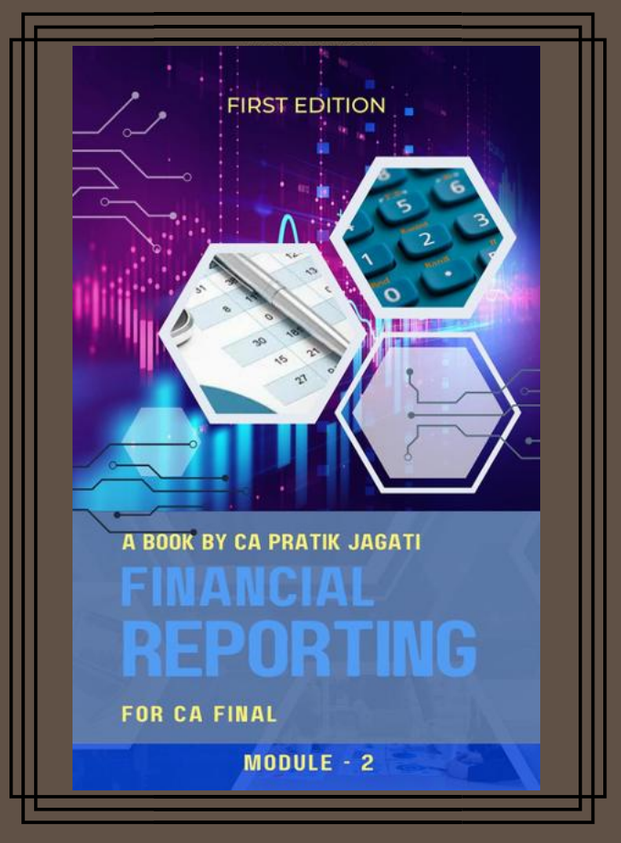

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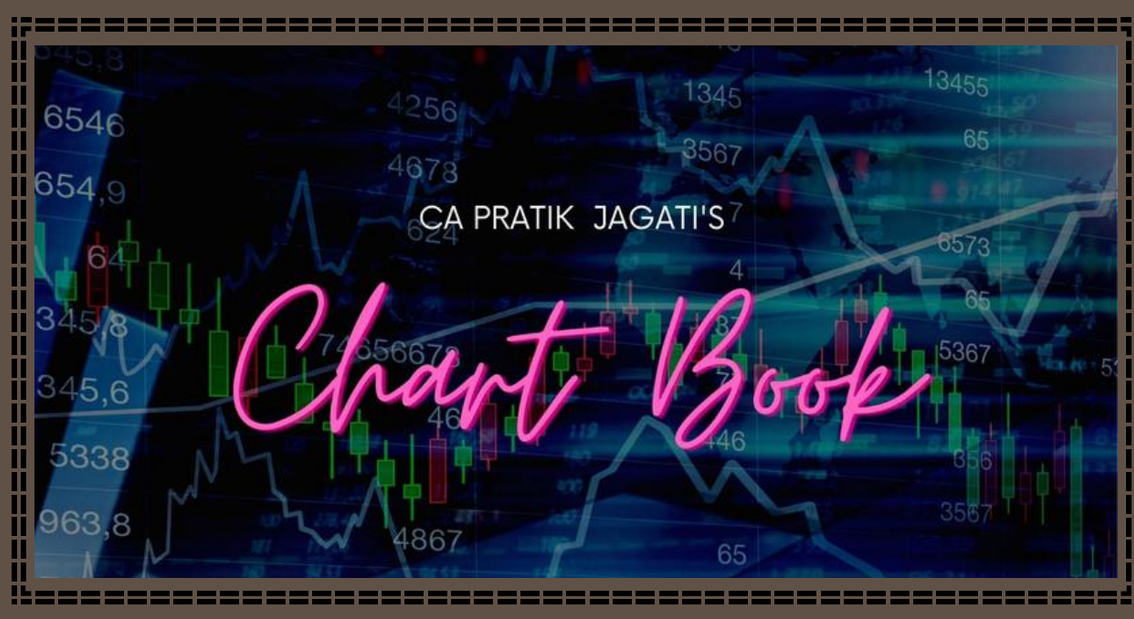

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