

CA FINAL

SFM

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**MISSION 100
SERIES**

FOREX

Question 1:

A German subsidiary of an US based MNC has to mobilize 100000 Euro's working capital for the next 12 months. It has the following options:

Loan from German Bank : @ 5% p.a.

Loan from US Parent Bank : @ 4% p.a.

Loan from Swiss Bank : @ 3% p.a.

Banks in Germany charge an additional 0.25% p.a. towards loan servicing. Loans from outside Germany attract withholding tax of 8% on interest payments. If the interest rates given above are market determined, examine which loan is the most attractive using interest rate differential.

ANSWER:

Net Cost under each of the Options is as follows:

i. Loan from German Bank

$$\text{Cost} = 5\% + 0.25\% = 5.25\%$$

ii. Loan from US Parent Bank

Effective Rate of Interest $\left(\frac{4\%}{1 - 0.08} \right)$	4.35%
Premium on US\$ $\left(\frac{1.05}{1.04} - 1 \right)$	0.96%
Net Cost	5.31%

iii. Loan from Swiss Bank

Effective Rate of Interest $\left(\frac{3\%}{1 - 0.08} \right)$	3.26%
Premium on US\$ $\left(\frac{1.05}{1.03} - 1 \right)$	1.94%
Net Cost	5.20%

Question 2:

KGF Bank's Sydney branch has surplus funds of USD \$ 7,00,000 for a period of 2 months. Cost of funds to the bank is 6% p.a. They propose to invest these funds in Sydney, New York or Tokyo 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 for a period of 2 Months.

Sydney	7.5% p.a.
New York	8% p.a.
Tokyo	4% p.a.

The market rates in Australia for US Dollars and Yen are as under:

Sydney on New York:

Spot	0.7100/0.7300
1 Months	10/20
2 Months	25/30

Sydney on Tokyo:

Spot	79.0900/79.2000
1 Months	40/30
2 Months	55/50

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

ANSWER:**i. If investment is made at Sydney**

Convert US\$ 7,00,000 at Spot Rate (7,00,000/0.7300)	= A\$ 9,58,904
Add: A\$ Interest for 2 months on A\$ 9,58,904 @ 7.5%	= A\$ 11,986
	= A\$ 9,70,890

Less: Amount Invested	\$ 7,00,000
Interest accrued thereon	\$ 7,000
	= \$ 7,07,000

Equivalent amount of £ required to pay the above sum ($\$ 7,07,000 / 0.7125^*$) = A\$ 9,92,281

Arbitrage Loss = A\$ 21,391

Or Equivalent Amount in US\$ (21391×0.7125) = \$ 15,241

ii. If investment is made at New York

Gain \$ 7,00,000 (8% - 6%) $\times 2/12$ = \$ 2,333.33

Or Equivalent amount in £ 3 months ($\$ 2,333 / 0.7330$) = A\$ 3,183

iii. If investment is made at Tokyo

Convert US\$ 700,000 at Spot Rate (Cross Rate) $79.0900/0.7300$	= ¥ 108.34
Yen equivalent US\$ 700,000	= ¥ 7,58,38,000
Add: Interest for 2 months @ 4%	= ¥ 5,05,587
	<u>= ¥ 7,63,43,587</u>
3 month Forward Rate of selling ¥ (1/79.1950)	= A\$ 0.0126
Sell ¥ in Forward Market ¥ 7,63,43,587 x A\$ 0.0126	= A\$ 9,61,929
Less: Amount invested and interest thereon	= A\$ 9,92,281
Arbitrage Loss	= A\$ 30,352
Or Equivalent Loss in \$(30352×0.7125)	= \$ 21,626
Out of three options the profit is in case of investment is made in New York. Hence it should be opted.	
* Due to conservative outlook.	

Question 3:

Humata Ltd., a Japanese Corporation, has sold goods today to Peacock Ltd., an Indian company for an amount of JPY 74 Lakhs. The payment will be due in three months from the date of invoice. At today's spot rate, it is equivalent to INR 50 Lakhs. It is anticipated that the INR will decline by 10% over the 3-months period and in order to protect the Yen payments, Peacock decides to take appropriate action in the foreign exchange market. The 3-months forward rate is presently quoted at JPY/INR 1.44

You are required to calculate:

- The expected loss to the importer and
- Impact of hedging by a forward contract

ANSWER:

Spot rate of ₹ 1 against yen = JPY 74 lakh / ₹ 50 lakh = JPY 1.48

3 months forward rate of Re. 1 against JPY = JPY 1.44

Anticipated decline in Exchange rate = 10%.

Expected spot rate after 3 months = JPY 1.48 – 10% of 1.48 = JPY 1.48 – JPY 0.15
= JPY 1.33 per rupee

₹ (in Lakhs)

Present cost of JPY 74 Lakhs 50.00

Cost after 3 months: JPY 74Lakhs / JPY 1.33 55.64

Expected exchange loss 5.64

If the expected exchange rate risk is hedged by a Forward contract:

Present cost 50.00

Cost after 3 months if forward contract

is taken JPY 74 lakh / JPY 1.44 51.39

Expected loss 1.39

Suggestion: If the exchange rate risk is not covered with forward contract, the expected exchange loss is ₹ 5.64 Lakhs. This could be reduced to ₹ 1.39 Lakhs if it is covered with Forward contract. Hence, taking forward contract is suggested.

Question 4:

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.

Find 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 differs if Mr. Mammen invests in the bond just before the interest payable.

ANSWER:**i. If USD is flat**

$$\begin{aligned}
 \text{Return} &= \frac{(\text{Price at end} - \text{Price at beginning}) + \text{Interest}}{\text{Price at beginning}} \\
 &= \frac{(103 - 100) + 3}{100} \\
 &= \frac{3 + 3}{100} = 0.06 \text{ say } 6\%
 \end{aligned}$$

ii. If USD appreciates by 3%

$$(1+0.06)(1+0.03) - 1 = 1.06 \times 1.03 - 1 = 0.0918 \text{ i.e. } 9.18\%$$

iii. If USD depreciates by 3%

$$(1+0.06)(1-0.03) - 1 = 1.06 \times 0.97 - 1 = 0.0282 \text{ i.e. } 2.82\%$$

iv. If Indian Rupee is appreciated by 5%

$$(1+0.06)(1-0.05) - 1 = 1.06 \times 0.95 - 1 = 0.007 \text{ i.e. } 0.7\%.$$

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

Question 5:

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
Senex now	3,765
Inflation in US	5%
Inflation in India	9%

- Compute the nominal rate of return to the US investor.
- Compute the real depreciation /appreciation of Rupee.
- What should be the exchange rate if relevant purchasing power parity holds good?
- What will be the real return to an Indian investor in Sensex?

ANSWER:**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 T_0	3,256
No. of units of Sensex that can be purchased at T_0 (₹ 8,50,00,000/3,256)	26,105
Sensex at T_1	3,765
Sale of Sensex (26,105 x 3,765)	9,82,85,325
US\$ at T_1	₹ 43.90
Equivalent Amount in US\$	22,38,846
Gain in US\$	2,38,846
Nominal rate to US investor	11.94%

ii. Real Appreciation/Depreciation of Rupee

$$\text{Real Exchange Rate (Buying)} = 43.85 \frac{(1+0.05)}{(1+0.09)} = 42.24$$

$$\text{Real Appreciation of ₹} = \frac{42.50 - 42.24}{42.50} \times 100 = 0.61\%$$

iii. Exchange rate if relevant purchasing power parity holds

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

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

$$\text{Exchange rate} = 44.12/44.22$$

iv. Real return to Indian Investor in Sensex

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

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

Question 6:

i. Interest rates for 3 months in USA and Canada are as follows:

Currency	Borrow	Interest
US \$	4%	2.5%
Canadian \$	4.5%	3.5 %

ii. Can \$/ US \$ spot 1.235 ---- 1.240
 3 months forward 1.255---- 1.260

Advice, the currency in which borrowing and lending for 3 months needs to be done for the US company. Take 3 months = 90/360 days.

ANSWER:

Suppose we have to borrow \$ 1,000. The outflow under the two options shall be as follows:

If borrowing is made in US

	\$
Principal amount	1,000
Interest $\left(\$1,000 \times \frac{90}{360} \times 4\% \right)$	10
Outflow	1010

If borrowing is made in Can \$

	Can \$
Equivalent Can \$	1,240
Interest $\left(\text{Can } \$ 1,240 \times \frac{90}{360} \times 4.5\% \right)$	13.95
Outflow	1,253.95

$$\text{Conversion @ forward rates} = \frac{\text{Can\$ } 1,253.95}{1.255} = \$ 999.16$$

Since US\$ outflow is least in Can \$, the borrowings should be made in Can \$.

Question 7:

M/s. A Ltd. is planning to import an equipment from Japan at a cost of 3,400 lakh yens. The company may avail loans at 18% p.a. interest with quarterly rests with which it can import the said equipment. The company has also an offer from Osaka branch of an Indian bank extending credit of 180 days at 2% p.a. against opening of an irrevocable letter of credit (L/C).

Additional information:

Present Exchange Rate ₹ 100 = 340 yen

180 days forward rate ₹ 100 = 345 yen

Commission charges for L/C at 2% per 12 months.

Advice whether the company should accept the offer.

ANSWER:

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	₹1092.03

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 8:

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.

ANSWER:**i. 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)

ii. 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 9:

XYZ Ltd. has imported goods to the extent of US\$ 8 Million. The payment terms are as under:

- 1% discount if full amount is paid immediately; or
- 60 days interest free credit. However, in case of a further delay up to 30 days, interest at the rate of 8% p.a. will be charged for additional days after 60 days. M/s XYZ Ltd. has ₹ 25 Lakh available and for remaining it has an offer from bank for a loan up to 90 days @ 9.0% p.a.

The quotes for foreign exchange are as follows:

Spot Rate INR/ US\$ (buying)	₹ 66.98
60 days Forward Rate INR/ US\$ (buying)	₹ 67.16
90 days Forward Rate INR/ US\$ (buying)	₹ 68.03

Advise which one of the following options would be better for XYZ Ltd.

- Pay immediately after utilizing cash available and for balance amount take 90 days loan from bank.
- Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.
- Avail supplier offer of 90 days credit and utilize cash available.

Further presume that the cash available with XYZ Ltd. will fetch a return of 4% p.a. in India till it is utilized.

Assume year has 360 days. Ignore Taxation.

Compute your working upto four decimals and cash flows in Crore.

ANSWER:

To evaluate which option would be better we shall compute the outflow under each option as follows:

i. Pay Immediately availing discount

Particulars		
Spot Rate		₹ 66.98
Amount required in US\$	[US\$ 8 Million (1 – 0.01)]	US\$ 7.92 Million
Amount required in ₹	[₹ 66.98 x US\$ 7.92 Million]	₹ 53.0482 Crore
Cash Available		₹ 0.2500 Crore
Loan required		₹ 52.7982 Crore
Interest for 90 days @ 9%		₹ 1.1880 Crore
Total Outflow		₹ 53.9862 Crore

ii. Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.

Particulars	
Applicable Forward Rate	₹ 67.16
Amount required in [₹ 67.16 x US\$ 8 Million]	₹ 53.7280 Crore
Loan required [₹ 53.7280 Crore – ₹ 0.25 Crore]	₹ 53.4780 Crore
Interest for 30 days @ 9%	₹ 0.4011 Crore
	₹ 53.8791 Crore
Interest earned on Cash for 60 days @ 4%	₹ 0.0017 Crore
Total Outflow	₹ 53.8774 Crore

iii. Avail supplier offer of 90 credit and utilize cash available

Particulars	
Amount Payable	US\$ 8 Million
Interest for 30 days @ 8%	US\$ 0.0533 Million
Amount required in ₹	US\$ 8.0533 Million
Applicable Forward Rate	₹ 68.03
Amount required in ₹ [₹ 68.03 x US\$ 8.0533 Million]	₹ 54.7866 Crore
Cash Available	₹ 0.2500 Crore
Interest earned on Cash for 90 days @ 4%	₹ 0.0025 Crore
Total Outflow	₹ 54.5341 Crore

Decision: Cash outflow is least in case of Option (ii) same should be opted for.

Question 10:

An MNC company in USA has surplus funds to the tune of \$ 10 million for six months. The Finance Director of the company is interested in investing in DM for higher returns. There is a Double Tax Avoidance Agreement (DTAA) in force between USA and Germany. The company received the following information from London:

€/ \$ Spot	0.4040/41
6 months forward	67/65
Rate of interest for 6 months (p.a.)	5.95% – 6.15%
Withholding tax applicable for interest income	22%
Tax as per DTAA	10%

If the company invests in £, what is the gain for the company?

(Source: ICAI)

ANSWER:

\$ 10 million converted @ € 0.4040/\$ = \$10,000,000 × 0.4040 = € 4,040,000 and invested @ 5.95% for 6 months in Luxemburg will fetch :

€ 4,040,000 (1 + 0.0595/2) = € 4,160,190

Interest earned = € (4,160,190 – 4,040,000) = €120,190

Withholding Tax @ 10% (in view of DTAA) = €12,019

Net interest eligible for repatriation = €108,171

Amount repatriated after 6 months = €108,171 + €4,040,000 = €4,148,171

Amount received at the forward rate of € 0.3976/\$ = €4,148,171/0.3976 = \$10,433,026

Additional amount fetched = \$10,433,026 - \$10,000,000 = \$ 433,026.

Question 11:

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:

- Do Nothing.
- 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.

ANSWER:**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
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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
	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 12:

Somu Electronics imported goods from Japan on July 1st 2009, of JP ¥ 1 million, to be paid on 31st, December 2009. The treasury manager collected the following exchange rates on July 01, 2009 from the bank.

Delhi Rs./US\$ Spot	45.86 /88
6 months forward	46.00/03
Tokyo JP ¥/ US\$ Spot	108/108.50
6 months forward	110/110.60

In spite of fact that the forward quotation for JP ¥ was available through cross currency rates, Mr. X, the treasury manager purchased spot US\$ and converted US\$ into JP ¥ in Tokyo using 6 months forward rate.

However, on 31st December, 2009 Rs./US\$ spot rate turned out to be 46.24 /26.

You are required to calculate the loss or gain in the strategy adopted by Mr. X by comparing the notional cash flow involved in the forward cover for Yen with the actual cash flow of the transaction.

ANSWER:

Here we have to compare the notional cash outflow for the forward rate of JP ¥ and the actual cash outflow involved in rupees against forward purchase of JP ¥ for dollars in Tokyo and spot purchase of dollars in Delhi for Rs.

A. Cash flow of forward purchasing the JP ¥

Rs. /JP ¥ 6 month forward rate

Bid rate = Bid rate of US\$ / Ask Rate of JP ¥ = Rs. 46/ JP ¥ 110.60 = Rs. 0.415913

Ask rate = Ask rate of US\$ / Bid Rate of JP ¥ = Rs. 46.03/ JP ¥ 110 = Rs. 0. 418454

Hence, Rs./JP ¥ 6 month forward rate = 0.415913/0.418454

Accordingly, if the company had purchased JP ¥ forward against rupees it would have paid = Rs.418454.50

B. Cash flow of forward purchasing US\$ in spot market and converting into JP ¥

Amount of US dollars to be paid on due date by purchase of JP¥ 1 million in forward market
 = JP¥ 1,000,000/ JP¥ 110 = US\$ 9090.91

Cash outflows in rupees against purchase of dollars in on Dec. 31, 2009 = US\$ 9090.91×
 Rs. 46.26 = Rs. 420,545.50

C. Loss or gain due to strategy adopted by Mr. X.

(A) – (B) = Rs.4,18,454.50 – 4,20,545.50 = Rs. 2091.00

Thus, the company paid more Rs. 2,091.00 in the strategy adopted by Mr. X.

Question 13:

Poomphar Electronic Ltd in Chennai exports refrigerators to Belgium by importing all the components from south Korea. Imports are invoiced in Hong Kong dollars and exports in Euro. The company is exporting 6000 unit at a price of Euro 165 per unit. The cost of imported components is HK\$ 75. The fixed cost and other variable costs per unit per unit are ₹1200 and ₹2500 respectively. The cash flows in foreign currencies are due in six months. The current exchange rates are as follows :

₹/Euro : 59.60/62

₹/HK\$: 5.96/5.98

After six months the exchange rates (at the time of receipts and payments of foreign currency) turn out as follows :

₹/Euro : 60.30/32

₹/HK\$: 6.23/25

You are required to :

- Calculate the loss/gain due to the transaction exposure.
- Based on the following additional information, calculate the loss/gain due to transaction and operating exposure if the life contracted price of washing machine is ₹9500.
 - The current exchange rates change to

₹/Euro : 59.85/87

₹/HK\$: 6.00/02
 - Price elasticity of demand of the product in Germany is estimated as 2.5.
 - Payment and receipts are to be settled/received at the end of six months.

ANSWER:

- Profit based on current exchange rate

Revenue – Import Cost – FC - VC

$$= (6000 \times 165 \times 59.60) - (6000 \times 75 \times 5.98) - 6000(1,200 + 2,500)$$

$$= ₹98,94,000$$

Project based on exchange rate after 6 month

Revenue - Import Cost - FC -VC

$$= (6000 \times 165 \times 60.30) - (6000 \times 75 \times 6.25) - 6000(1,200 + 2,500)$$

$$= 93,72,000$$

$$\therefore \text{Loss due to transaction exposure} = 98,94,000 - 93,72,000 = ₹5,22,000$$

ii. Step 1 :

Since the firm is now invoicing exports at ₹9,500, there is no transaction exposure relating to € receivable.

Of course, we still have HK\$ payable. Using the revised current rate and the rate after 6 months, loss due to transaction exposure = $6,000 \times 750 \times (6.25 - 6.02) = ₹10,35,000$

* Why 6,000?units to change hone wala hai

Answer : Change in units Economic exposure € and that's why Transaction exposure calculate karte time units change nahi karenge, 6,000 he rakhenge

Step 2 :

$$S_0 = ₹/€ 59.60$$

(Old Current Rate)

$$S_T = ₹/€$$

$$= 60.3$$



(New Current Rate)

$$€ \text{ Equivalent price based on old current rate} = \frac{9,500}{59.60} = €159.40$$

$$€ \text{ Equivalent price based on revised current rate} = \frac{9,500}{59.85} = 158.73$$

$$\therefore \text{Fall in price} = \frac{159.4 - 158.73}{159.4} \times 100 = 0.42\%$$

Given, elasticity, $ed = 2.5\%$

So, increase in demand = $2.5\% \times 0.42\% = 1.05\%$

$\therefore$ New Demand = 6000 units + 1.05% of 6,000 = 6063 units (approx)

Self Note : Dono current exchange rate kuy use kiye, 6 months baad wala bhi toh use kar sakte the?

Answer : No, because if we use rate after 6m i.e. ₹60.3/Euro, the change in demand will occur after 6m which will affect future project and not current 6m profit

Step 3 :

Project based on old units, ₹ invoicing and revised current rate

$$= (6000 \times 9,500) - (6000 \times 750 \times 6.02) - 6000(1,200 + 2,500) = 77,10,000$$

Project based on new units, ₹ invoicing and exchange rate after 6m

$$= (6063 \times 9,500) - (6063 \times 750 \times 6.25) - 6063 \times 2500 - 6000 \times 1200$$

$$= ₹68,20,687.5$$

$$\therefore \text{Loss due to economic exposure} = 77,10,000 - 68,20,687.5 = ₹8,89,312.5$$

Question 14:

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.

ANSWER:

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:

	High Risk		
Low Reward	Strategy 1	Strategy 3	High Reward
	Strategy 4	Strategy 2	
	Low Risk		

Question 15:

Z has to remit USD \$1,00,000 for her daughter's education on 4th April 2021. Accordingly, she has booked a forward contract with his bank on 4th January 2021 @ ₹ 73.8775. The Bank has covered its position in the market @ ₹ 73.7575.

The exchange rates for USD \$ in the interbank market on 4th, 7th and 14th April 2021 were:

	4th April ₹	7th April ₹	14th April ₹
Spot USD 1	73.2775/73.2975	73.1575/73.1975	73.1375/73.1775
Spot/March	73.3975/73.4275	73.2775/73.3275	73.2575/73.3075
April	73.5275/73.5675	73.4075/73.4650	73.3875/73.4475
May	73.7775/73.8250	73.6575/73.7275	73.6375/73.7050
June	74.0700/74.1325	73.9575/74.0675	73.9500/74.0525

Exchange margin of 0.10 percent and interest outlay of funds @ 12 percent are applicable. The remitter, due to rescheduling of the semester, has requested on 14th April 2021 for extension of contract with due date on 14th June 2021.

Calculate:

- Cancellation Rate;
- Amount Payable on \$ 100,000;
- Swap loss;
- Interest on outlay of funds, if any;
- New Contract Rate; and
- Total Cost

Note: Rates must be rounded to 4 decimal places in multiples of 0.0025 and assume 365 days in a year.

ANSWER:**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	₹ 73.1575
Less: Exchange Margin @ 0.10%	₹ 0.0732
	₹ 73.0843
Rounded off to	₹ 73.0850

ii. Amount payable on \$ 1,00,000

Bank sells \$1,00,000 @ ₹ 73.8775	₹ 73,87,750
Bank buys \$1,00,000 @ ₹ 73.0850	₹ 73,08,500
Amount payable by customer	₹ 79,250

iii. Swap Loss

On 4th April, the bank does a swap sale of \$ at market buying rate of ₹ 73.4275 and forward purchase for April at market selling rate of ₹ 73.2775.

Bank buys at	₹ 73.4275
Bank sells at	₹ 73.2775
Amount payable by customer	₹ 0.1500
Swap Loss for \$ 1,00,000 in ₹	₹ 15,000

iv. Interest on Outlay of Funds

On 4th April, the bank receives delivery under cover contract at ₹ 73.7575 and sell spot at ₹ 73.2775.

Bank buys at	₹ 73.7575
Bank sells at	₹ 73.2775
Amount payable by customer	₹ 0.4800

Outlay for \$ 1,00,000 in ₹ 48,000

Interest on ₹ 48,000 @ 12% for 3 days ₹ 47

v. New Contract Rate

The contract will be extended at current rate

\$/ ₹ Market forward selling Rate for June	₹ 74.0525
Add: Exchange Margin @ 0.10%	₹ 0.0741
	₹ 74.1266
Rounded off to	₹ 74.1275

vi. Total Cost

Cancellation Charges	₹ 79,250.00
Swap Loss	₹ 15,000.00
Interest	₹ 47.00
	₹ 94,297.00

Question 16:

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:

- Exchange rate quoted to the company
- Cash inflow to the company
- Interest amount to be paid to bank by the company.

ANSWER:

- 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

- Cash Inflow ₹ 1,83,69,825
- Interest for 80 days @ 8% ₹ 3,22,101

Question 17:

The risk free rate of interest rate in USA is 8% p.a. and in UK is 5% p.a. The spot exchange rate between US \$ and UK £ is 1\$ = £ 0.75.

Assuming that interest is compounded on daily basis then at which forward rate of 2 year there will be no opportunity for arbitrage.

Further, show how an investor could make risk-less profit, if two year forward price is 1 \$ = 0.85 £.

Given $e^{0.06} = 0.9413$ & $e^{-0.16} = 0.852$, $e^{0.16} = 1.1735$, $e^{-0.1} = 0.9051$

ANSWER:**WEIRD ANSWER BY ICAI**

2 year Forward Rate will be calculated as follows:

$$F = S e^{(r_{UK} - r_{US})t}$$

Where F = Forward Rate

S = Spot Rate

rUK = Risk Free Rate in UK

rUS = Risk Free Rate in US

t = Time

Accordingly,

$$\begin{aligned} F &= 0.75 e^{(0.05 - 0.08)2} \\ &= 0.75 \times 0.9413 \\ &= 0.706 \end{aligned}$$

Thus,

$$1 \text{ US \$} = \text{£ } 0.706$$

If forward rate is 1 UK \$ = 0.85\$ then an arbitrage opportunity exists. Take following steps.

- (a) Should borrow UK £
- (b) Buy US \$
- (c) Enter into a short forward contract on US \$

Accordingly,

The riskless profit would be

- (a) Say borrow £ $0.706 e^{-(0.05)(2)} = \text{£ } 0.639$ and invest in UK for 2 years.
- (b) Now buy US \$ at US \$ $1 e^{-(0.08)2} = \text{US \$ } 0.852$, so that after two year it can be used to close out the position.

- (c) After two year the investment in US \$ will become US \$ $0.852 e^{(0.08)(2)} = \text{US \$ } 0.852 \times 1.1735 = 1 \text{ US \$}$
- (d) Sell this US \$ for £ 0.85 and repay loan of £ 0.639 along with interest i.e £ 0.706. Thus arbitrage profit will be
 $\text{US\$ } 0.85 - \text{US\$ } 0.706 = 0.144 \text{ \$}.$

ALTERNATE METHOD OF ANSWER BY SANJAY SARAF SIR

ALTERNATE METHOD TO FIND ARBITRAGE PROFIT

Let us assume that the amount borrowed be 1,00,000 pounds

- STEP 1:** Borrow 1,00,000 pounds @ 5% p.a. for 2 years
 Outflow after 2 years = $1,00,000 \times e^{(0.05 \times 2)} = 1,10,485.03 \text{ pounds}$
- STEP 2:** Sell 1,00,000 pounds spot @ 0.75 GBP/USD getting $1,00,000/0.75 = \$ 1,33,333.33$
- STEP 3:** invest \$ @ 8% p.a. for 2 years
 We will get $1,33,333.33 \times e^{(0.08 \times 2)} = \$1,56,466.67$
- STEP 4:** Sell 2 year forward @ 0.85 getting $1,56,466.67 \times 0.85 = 1,32,996.67 \text{ GBP}$

Arbitrage profit = $1,32,996.67 - 1,10,485.03 = 22,511.64 \text{ GBP approx}$

Question 18:

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.

ANSWER:

Investment in JPY			(in billions)
Particulars	Currency INR	ER	Currency JPY
Available amount	200	1.58	<u>316</u>
Dividend Income			25
Stock Lending Income			11.9276
Investment value at the end after discount @ 2%			<u>309.68</u>
Amount available at the end			<u>346.6076</u>
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.			<u>0.07</u>
Amount available at the end			<u>2.87</u>
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 19:

Drilldip Inc. a US based company has 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 to exchange rate volatility.

You are required to:

- Construct a swap that will help the Drilldip to reduce the exchange rate risk.
- Assuming that Indian Government offers a swap at spot rate which is $1\text{US\$} = ₹ 50$ 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 $1\text{US\$} = ₹ 54$. Further you may also assume that the Drilldip can also take a US\$ loan at 8% p.a.

(Source: ICAI)

ANSWER:**i. The following swap arrangement can be entered by Drilldip.**

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

ii. With the swap

	Year 0 (Million US\$)	Year 1 (Million US\$)
Buy ₹ 500 crore at spot rate of $1\text{US\$} = ₹ 50$	(100.00)	----
Swap ₹ 500 crore back at agreed rate of ₹ 50	----	100.00
Sell ₹ 240 crore at $1\text{US\$} = ₹ 54$	----	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 $1\text{US\$} = ₹ 50$	(100.00)	----
Sell ₹ 740 crore at $1\text{US\$} = ₹ 54$	----	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 20:

K Ltd. currently operates from 4 different buildings and wants to consolidate its operations into one building which is expected to cost ₹ 90 crores. The Board of K Ltd. had approved the above plan and to fund the above cost, agreed to avail an External Commercial Borrowing (ECB) of GBP 10 m from G Bank Ltd. on the following conditions:

- The Loan will be availed on 1st April, 2019 with interest payable on half yearly rest.
- Average Loan Maturity life will be 3.4 years with an overall tenure of 5 years.
- Upfront Fee of 1.20%.
- Interest Cost is GBP 6 months LIBOR + Margin of 2.50%.
- The 6 month LIBOR is expected to be 1.05%.

K Ltd. also entered into a GBP-INR hedge at 1 GBP = INR 90 to cover the exposure on account of the above ECB Loan and the cost of the hedge is coming to 4.00% p.a.

As a Finance Manager, given the above information and taking the 1 GBP = INR 90:

- Calculate the overall cost both in percentage and rupee terms on an annual basis.
- What is the cost of hedging in rupee terms?
- If K Ltd. wants to pursue an aggressive approach, what would be the net gain/loss for K Ltd. if the INR depreciates/appreciates against GBP by 10% at the end of the 5 years assuming that the loan is repaid in GBP at the end of 5 years?

Ignore time value and taxes and calculate to two decimals.

ANSWER:**i. Calculation of Overall Cost**

Upfront Fee (GBP 10 M @ 1.20%)	₹ 1,20,000
Interest Payment (GBP 10 M x 3.55% x 3.4)	₹ 12,07,000
Hedging Cost (GBP 10 M x 4% x 3.4)	₹ 13,60,000
Total	₹ 26,87,000
Or	₹ 2.687 million

$$\text{Overall cost in \% terms on Annual Basis} = \frac{2.687 \text{ million}}{(1,00,00,000 - 1,20,000)} \times \frac{1}{3.4}$$

$$= \frac{2.687}{9.88} \times \frac{1}{3.4} \times 100 = 8\%$$

$$\text{Overall Cost in Rupee terms @ GBP 1} = ₹ 90 \times \frac{2.687}{3.4} \times 100 = ₹ 711.26 \text{ lakhs}$$

OR

$$\begin{aligned}
 \text{Overall cost in \% terms on Annual Basis} &= \frac{2.687 \text{ million}}{(1,00,00,000)} \times \frac{1}{3.4} \\
 &= \frac{2.687}{1.00} \times \frac{1}{3.4} \times 100 = 7.9\% \\
 \text{Overall Cost in Rupee terms@ GBP 1} &= 10,000,000 \times 7.90\% \times 90 \\
 &= ₹ 71,100,000
 \end{aligned}$$

OR

Calculation of overall cost

Interest & Margin (A)	3.55%
Hedging cost (B)	4%
	7.55%
Onetime fee	1.20%
Average loan maturity	3.4 years
Per annum cost 1.2/3.4 (C)	0.35%
Annual overall cost in % terms (A+B+C)	7.9%
Overall Cost in Rupee terms@ GBP 1 = 10,000,000 X 7.90% X 90	₹ 71,100,000

ii. Cost of Hedging in terms of Rupees

$$₹ 13,60,000 \times 90 = ₹ 12,24,00,000 = ₹ 12.24 \text{ crores in Total}$$

OR

$$\text{GBP } 10,000,000 \times 90 \times 4\% = ₹ 3,60,00,000 \text{ on Annual Basis}$$

iii. If K Ltd. pursues an aggressive approach then Gain/Loss in INR Depreciation/ Appreciation shall be computed as follows:**a. If INR depreciates by 10%**

Re. loss per GBP = 90 x 10%	₹ 9
Total Losses GBP10M	₹ 90 Million
Less: Cost of Hedging	₹ 36 Million
Net Loss	₹ 54 million

b. If INR appreciates by 10%

₹ Gains per GBP = ₹ 90 x 10%	₹ 9
Total Gain on Repayment of loan	90 Million
Add: Saving in Cost of Hedging	36 Million
Net Gain	126 Million

PORTFOLIO MANAGEMENT & **MUTUAL FUND**

Question 1:

During the year 2017 an investor invested in a mutual fund. The capital gain and dividend for the year was ₹ 3.00 per unit, which were re-invested at the year end NAV of ₹ 23.75. The investor had total units of 26,750 as at the end of the year. The NAV had appreciated by 18.75% during the year and there was an entry load of ₹ 0.05 at the time when the investment was made.

The investor lost his records and wants to find out the amount of investment made and the entry load in the mutual fund.

ANSWER:

$$\text{NAV in the Beginning of year} = \frac{\text{₹ } 23.75}{118.75} \times 100 = \text{₹ } 20$$

$$\text{No. of Units after Bonus issue} = 26,750$$

Let x be the No. of Units acquired then

$$26,750 = x + \frac{x \times 3}{23.75}$$

$$x = 23,750 \text{ units}$$

$$\text{Investment Amount} = 23,750 \text{ units } (\text{₹ } 20 + \text{₹ } 0.05) = \text{₹ } 4,76,187.50$$

$$\text{Entry load} = \text{₹ } 1,187.50 \text{ i.e. } (23750 \times \text{₹ } 0.05)$$

Question 2:

The following particulars relating to Vishnu Fund Schemes:

Particulars	Value ₹ in Crores
1. Investment in Shares (at cost)	
a. Pharmaceuticals companies	79
b. Construction Industries	31
c. Service Sector Companies	56
d. IT Companies	34
E. Real Estate Companies	10
2. Investment in Bonds (Fixed Income)	
a. Listed Bonds (8000, 14% Bonds of ₹ 15,000 each)	12
b. Unlisted Bonds	7
3. No. of Units outstanding (crores)	4.2
4. Expenses Payable	3.5
5. Cash and Cash equivalents	1.5
6. Market expectations on listed bonds	8.842%

Particulars relating to each sector are as follows:

Sector	Index on Purchase date	Index on Valuation date
Pharmaceutical companies	260	465
Construction Industries	210	450
Service Sector Companies	275	480
IT Companies	240	495
Real Estate Companies	255	410

The fund has incurred the following expenses:

Consultancy and Management fees ₹ 480 Lakhs

Office Expenses ₹ 150 Lakhs

Advertisement Expenses ₹ 38 Lakhs

You are required to calculate the following:

- Net Asset Value of the fund
- Net Asset Value per unit
- If the period of consideration is 2 years, and the fund has distributed ₹ 3 per unit per year as cash dividend, ascertain the Net return (Annualized).
- Ascertain the Expenses ratio.

ANSWER:

i. Calculation of NAV of the Fund

			Crore ₹
1.	Value of Shares		
	a. Pharmaceutical Companies	$79 \times \frac{465}{260}$	141.288
	b. Construction Companies	$31 \times \frac{450}{210}$	66.429
	c. Service Sector Companies	$56 \times \frac{480}{275}$	97.745
	d. IT Companies	$34 \times \frac{495}{240}$	70.125
	e. Pharmaceutical Companies	$10 \times \frac{410}{255}$	16.078
2.	Investment in Bonds		
	a. Listed Bonds	$\frac{14}{8.842} \times 12$	19.00
	b. Unlisted Bonds		7.000
3.	Cash and Cash Equivalents		1.50
			419.165
	Less: Expense Payable		3.500
	NAV of the Fund		415.665

ii. NAV of the Fund Per Unit

NAV of the Fund	₹ 415.665 crore
Number of Units	4.20 crore
NAV Per Unit (₹ 415.665 crore / 4.20 crore)	₹ 98.97

iii. Net Return

Initial Cost Per Unit		
Investment in Shares	₹ 210 crore	
Bonds	₹ 19 crore	₹ 229 crore
Number of Units		4.20 crore
Cost Per Unit		₹ 54.52
Return		
Capital Gain	(₹ 98.97 – ₹ 54.52)	₹ 44.45
Dividend	₹ 3 x 2	₹ 6.00
		₹ 50.45
Annualised Return	$\frac{50.45}{54.52} \times \frac{1}{2}$	46.27%

Question 3:

M/S Enterprise, an Asset management Company (AMC) on 1.04.2016 has floated a scheme "Dividend Plan". Mr. X, an investor, has invested in the scheme. Dividend is given in the form of units. The details (except the issue price) are as follows:

Date	Dividend (%)	NAV
1.04.2016		?
31.03.2018	20	48
31.03.2019	25	50
31.03.2020	30	45
31.03.2021*	-	49
Initial Investment (₹)	₹ 18,40,000	
Average Profit (₹) over 5 years	₹ 54,576	

* In the Question Paper printed as 31.0.2021

You are required to calculate the issue price of the scheme as on 01.04.2016 to ascertain the capital appreciation. Assume face value of units as ₹ 10/-

ANSWER:

Particulars	₹
(a) Amount invested by Mr. X	18,40,000
(b) Gains during 5 year [₹54,576 × 5]	2,72,880
(c) Value of investment as on 31/3/21 (a) + (b)	21,12,880
(d) NAV as on 31.03.21	₹ 49 per unit
(e) Total Number of units as on 31.03.21	₹ 43,120 units

Let us assume N_1 be the no. of units on 31.03.2020 then

$$= \frac{₹ 10 \times N_1 \times 0.30}{45} + N_1 = 43,120$$

$$\frac{N_1}{15} + N_1 = 43,120$$

$$N_1 = 40,425$$

Now let us assume N_2 be number of units on 31.03.19, then

$$\frac{₹ 10 \times N_2 \times 0.25}{50} + N_2 = 40,425$$

$$\frac{N_2}{20} + N_2 = 40,425$$

$$N_2 = 38,500$$

Now let us assume N_3 be number of units on 31.03.18, then

$$\frac{₹ 10 \times N_3 \times 0.20}{48} + N_3 = 38,500$$

$$\frac{N_3}{24} + N_3 = 38,500$$

$$N_3 = 36,960$$

$$\text{NAV as on 1.04.16} = \frac{18,40,000}{36,960} = ₹ 49.78$$

Thus, issue price of unit is ₹ 49.78

Question 4:

There are two Mutual Funds viz., A and B each having close ended equity schemes.

Net Asset Value (NAV) per unit as on 31st December 2020 of equity schemes of A is ₹ 80.10 (consisting 98% equity and remaining cash balance) and that of B is ₹ 64.60 (consisting 97% equity and balance in cash).

Other information is as follows:

Particulars of Equity Schemes	A	B
Sharpe Ratio	2.50	3.20
Treynor Ratio	15	15
Standard Deviation	8.50	5.00

There is no change in portfolios during the next month and annual average cost is ₹ 3.00 per unit for the schemes of both the Mutual Funds.

Assume 30 days in a month, and compute up to two decimal points only.

You are required to calculate the expected NAV per unit after a month for the schemes of both the Mutual Funds, if the share market goes down by 4% within a month.

ANSWER:**Working Notes:****(i) Decomposition of Funds in Equity and Cash Components**

	A Mutual Fund	B Mutual Fund
NAV on 31.12.21	₹ 80.10	₹ 64.60
% of Equity	98%	97%
Equity element in NAV	₹ 78.50	₹ 62.66
Cash element in NAV	₹ 1.60	₹ 1.94

(ii) Calculation of Beta**(a) A Mutual Fund**

$$\text{Sharpe Ratio} = 2.50 = \frac{E(R) - R_f}{\sigma_A} = \frac{E(R) - R_f}{8.50}$$

$$E(R) - R_f = 21.25$$

$$\text{Treynor Ratio} = 15 = \frac{E(R) - R_f}{\beta_A} = \frac{21.25}{\beta_A}$$

$$\beta_{AJ} = 21.25/15 = 1.42$$

(b) B Mutual Fund

$$\text{Sharpe Ratio} = 3.20 = \frac{E(R) - R_f}{\sigma_B} = \frac{E(R) - R_f}{5}$$

$$E(R) - R_f = 16$$

$$\text{Treynor Ratio} = 15 = \frac{E(R) - R_f}{\beta_B} = \frac{16}{\beta_B}$$

$$\beta_K = 16/15 = 1.07$$

(iii) Increase in the Value of Equity

	A Mutual Fund	B Mutual Fund
Market down by	4.00%	4.00%
Beta	1.42	1.07
Equity component goes down	5.68%	4.28%

(iv) Balance of Cash after 1 month

	A Mutual Fund	B Mutual Fund
Cash in Hand on 31.12.20	₹ 1.60	₹ 1.94
Less: Exp. Per month (₹ 3/12)	₹ 0.25	₹ 0.25
Balance after 1 month	₹ 1.35	₹ 1.69

NAV after 1 month

	A Mutual Fund	B Mutual Fund
Value of Equity after 1 month		
78.50 x (1 - 0.0568)	₹ 74.04	-
62.66 x (1 - 0.0428)	-	₹ 59.98
Cash Balance	₹ 1.35	₹ 1.69
	₹ 75.39	₹ 61.67

Question 5:

Mr. X is having 1 lakh shares of M/s. Kannyaka Ltd. The beta of the company is 1.40.

Mr. Y a financial advisor has suggested having the following portfolio:

Security	Beta	% holding
S	1.20	10
K	0.75	10
P	0.40	30
D	1.40	50
		100

Market Return is 12%

Risk free rate is 8%

You are required to calculate the following for the present investment and suggested portfolio:

- i. What is the expected return based on CAPM and also
 - (1) If the market goes up by 2.5%.
 - (2) If the market goes down by 2.5%
 - (3) If the market gives Negative Returns of 2.5%
- ii. If the probability of market giving negative return is more, please advise Mr. X whether to continue the holdings of M/s. Kannyaka Ltd. or to buy the portfolio as per the suggestion of Mr. Y. If so why?

ANSWER:

Working Notes -

Calculation of Portfolio Beta suggested by Mr. Y

Security	Beta	Wt. of Holding	Beta x Wt. of Holding
S	1.20	0.1	0.120
K	0.75	0.1	0.075
P	0.40	0.3	0.120
D	1.40	0.5	0.700
Total		1.0	1.015

Portfolio Beta is 1.015

Calculation of Expected Return based on CAPM at present situation-

Particulars	Risk Free Rate (R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c x e	g = b + f
Kannyaka 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 (R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$g = b + f$
Kannyaka Ltd.	8	1.400	14.5	6.5	9.100	17.10
Portfolio	8	1.015	14.5	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(R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$g = b + f$
Kannyaka Ltd.	8	1.400	9.5	1.5	2.100	10.10
Portfolio	8	1.015	9.5	1.5	1.523	9.52

- (3) Calculation of Expected Return based on CAPM if market gives negative returns of 2.5%-

Particulars	Risk Free Rate(R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$G = b + f$
Kannyaka Ltd.	8	1.400	-2.5	-10.5	-14.700	-6.70
Portfolio	8	1.015	-2.5	-10.5	-10.658	-2.66

- (ii) If the probability of market giving negative return is more, It is advisable to Mr. X to buy the portfolio suggested by Mr. Y because Beta of the portfolio is less than of Kannyaka Ltd.

Question 6:

Following are the details of a portfolio consisting of three shares:

Share	Portfolio weight	Beta	Expected return in %	Total Variance
DGS	0.35	0.30	12%	0.010
DV	0.25	1.20	18%	0.030
BP	0.40	0.50	10%	0.015

Standard Deviation of Market Portfolio Returns = 14%

Covariance (DGS, DV) = 0.020,

Covariance (DV, BP) = 0.050,

Covariance (BP, DGS) = 0.030

You are required to calculate:

- The Portfolio Beta
- Residual Variance of each of the three Shares,
- Portfolio Variance using Sharpe Index Model,
- Portfolio Variance (on the basis of Modern Portfolio Theory given by Markowitz).

ANSWER:

- (i) Portfolio Beta

$$0.35 \times 0.30 + 0.25 \times 1.20 + 0.40 \times 0.50 = 0.605$$

- (ii) Residual Variance

To determine Residual Variance first of all we shall compute the Systematic Risk as follows:

$$\beta_A^2 \times \sigma_M^2 = (0.30)^2 (0.14)^2 = 0.001764$$

$$\beta_B^2 \times \sigma_M^2 = (1.20)^2 (0.14)^2 = 0.028224$$

$$\beta_C^2 \times \sigma_M^2 = (0.50)^2 (0.14)^2 = 0.0049$$

Residual Variance

$$\text{DGS} \quad 0.010 - 0.001764 = 0.008236$$

$$\text{DV} \quad 0.030 - 0.028224 = 0.001776$$

$$\text{BP} \quad 0.015 - 0.0049 = 0.0101$$

- (iii) Portfolio variance using Sharpe Index Model

$$\text{Systematic Variance of Portfolio} = (0.14)^2 \times (0.605)^2 = 0.007174 \text{ or } 0.0072$$

$$\text{Unsystematic Variance of Portfolio} = 0.008236 \times (0.35)^2 + 0.001776 \times (0.25)^2 + 0.0101 \times (0.40)^2 = 0.002736 \text{ or } 0.0027$$

$$\text{Total Variance} = 0.007174 + 0.002736 = 0.00991 \text{ or } 0.0099$$

(iv) Portfolio variance on the basis of Markowitz Theory

$$\begin{aligned}
 &= (w_A \times w_A \times \sigma_A^2) + (w_A \times w_B \times \text{Cov}_{AB}) + (w_A \times w_C \times \text{Cov}_{AC}) + (w_B \times w_A \times \text{Cov}_{AB}) \\
 &+ (w_B \times w_B \times \sigma_B^2) + (w_B \times w_C \times \text{Cov}_{BC}) + (w_C \times w_A \times \text{Cov}_{CA}) + (w_C \times w_B \times \text{Cov}_{CB}) \\
 &+ (w_C \times w_C \times \sigma_C^2) \\
 &= (0.35 \times 0.35 \times 0.010) + (0.35 \times 0.25 \times 0.020) + (0.25 \times 0.40 \times 0.050) + (0.40 \times 0.35 \\
 &\times 0.030) + (0.25 \times 0.35 \times 0.020) + (0.40 \times 0.25 \times 0.050) + (0.35 \times 0.40 \times 0.030) + \\
 &(0.25 \times 0.25 \times 0.030) + (0.40 \times 0.40 \times 0.015) \\
 &= 0.001225 + 0.00175 + 0.005 + 0.0042 + 0.00175 + 0.005 + 0.0042 + 0.001875 + \\
 &0.0024 \\
 &= 0.0274
 \end{aligned}$$

Question 7:

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.

- 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?
- 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?

ANSWER:

- Investment committed to each security would be:-

	<u>A</u> (₹)	<u>B</u> (₹)	<u>C</u> (₹)	<u>Total</u> (₹)
Portfolio X	1,500	2,000	1,500	5,000
Portfolio Y	<u>600</u>	<u>1,500</u>	<u>900</u>	<u>3,000</u>
Combined Portfolio	<u>2,100</u>	<u>3,500</u>	<u>2,400</u>	<u>8,000</u>
∴ Stock weights	0.26	0.44	0.30	

- The equation of critical line takes the following form:-

$$WB = a + bWA$$

Substituting the values of WA & WB from portfolio X and Y in above equation, we get

$$0.40 = a + 0.30b, \text{ and}$$

$$0.50 = a + 0.20b$$

Solving above equation we obtain the slope and intercept, $a = 0.70$ and $b = -1$ and thus, the critical line is

$$WB = 0.70 - WA$$

If half of the funds is invested in security A then,

$$WB = 0.70 - 0.50 = 0.20$$

$$\text{Since } WA + WB + WC = 1$$

$$WC = 1 - 0.50 - 0.20 = 0.30$$

$$\therefore \text{ Allocation of funds to security B} = 0.20 \times 8,000 = ₹ 1,600, \text{ and}$$

$$\text{Security C} = 0.30 \times 8,000 = ₹ 2,400$$

Question 8:

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.

ANSWER:

$$\text{Maximum decline in one month} = \frac{5326 - 4793.40}{5326} \times 100 = 10\%$$

- (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

$$\text{Value of equity} = 60,000 \times 5122.96/5326 = ₹ 57,713$$

$$\text{Value of risk free investment} = ₹ 2,40,000$$

$$\text{Total value of portfolio} = ₹ 2,97,713$$

Investment in equity = Multiplier x (Portfolio value – Floor value)

$$= 2 (2,97,713 - 2,70,000) = ₹ 55,426$$

Revised Portfolio:

$$\text{Equity} = ₹ 55,426$$

$$\text{Risk free Securities} = ₹ 2,97,713 - ₹ 55,426 = ₹ 2,42,287$$

- (3) After another 10 days

$$\text{Value of equity} = 55,426 \times 5539.04/5122.96 = ₹ 59,928$$

$$\text{Value of risk free investment} = ₹ 2,42,287$$

$$\text{Total value of portfolio} = ₹ 3,02,215$$

Investment in equity = Multiplier x (Portfolio value – Floor value)

$$= 2 (3,02,215 - 2,70,000) = ₹ 64,430$$

Revised Portfolio:

$$\text{Equity} = ₹ 64,430$$

$$\text{Risk Free Securities} = ₹ 3,02,215 - ₹ 64,430 = ₹ 2,37,785$$

The investor should off-load ₹ 4502 of risk free securities and divert to Equity.

Question 9:

Data for finding out the optimal portfolio are given below:

Security Number	Mean Return	Excess Return	Beta	Unsystematic Risk	Excess Return to Beta
	R_i	$R_i - R_f$	β	σ_{ei}^2	$\frac{R_i - R_f}{\beta_i}$
1	19	14	1.0	20	14
2	23	18	1.5	30	12
3	11	6	0.5	10	12
4	25	20	2.0	40	10
5	13	8	1.0	20	8
6	9	4	0.5	50	8
7	14	9	1.5	30	6

The riskless rate of interest is 5 per cent and the market variance is 10. Determine the cut-off point.

ANSWER:

Security	$\frac{R_i - R_f}{\beta_i}$	$\frac{(R_i - R_f) \times \beta_i}{\sigma_{ei}^2}$	$\sum_{i=1}^N \frac{(R_i - R_f) \times \beta_i}{\sigma_{ei}^2}$	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$\sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}$	C_i
1	14	0.7	0.7	0.05	0.05	4.67
2	12	0.9	1.6	0.075	0.125	7.11
3	12	0.3	1.9	0.025	0.15	7.60
4	10	1.0	2.9	0.1	0.25	8.29
5	8	0.4	3.3	0.05	0.3	8.25
6	8	0.04	3.34	0.005	0.305	8.25
7	6	0.45	3.79	0.075	0.38	7.90

' C_i ' calculations are given below:

For Security 1

$$C_1 = \frac{10 \times .7}{1 + 10(.05)} = 4.67$$

Here 0.7 is got from column 4 and 0.05 from column 6. Since the preliminary calculations are over, it is easy to calculate the C_i .

$$C_2 = \frac{10 \times 1.6}{1 + 10(.125)} = 7.11$$

$$C_3 = \frac{10 \times 1.9}{1 + 10(0.15)} = 7.6$$

$$C_4 = \frac{10 \times 2.9}{1 + 10(0.25)} = 8.29$$

$$C_5 = \frac{10 \times 3.3}{1 + 10(0.3)} = 8.25$$

$$C_6 = \frac{10 \times 3.34}{1 + 10(0.305)} = 8.25$$

$$C_7 = \frac{10 \times 3.79}{1 + 10(0.38)} = 7.90$$

The highest C_i value is taken as the cut-off point i.e. C^* . The stocks ranked above C^* have high excess returns to beta than the cut-off C and all the stocks ranked below C^* have low excess returns to beta. Here, the cut-off point is 8.29. Hence, the first four securities i.e. 1 – 4 are selected and remaining 3 are rejected.

Now we shall compute how much to be invested in each security by calculating Z_i for these four securities as follows:

$$Z_i = \frac{B_i}{\sigma_i^2} \left(\frac{R_i - R_o}{1 B_i} - C^* \right)$$

Thus,

$$Z_1 = \frac{1.00}{20} \left(\frac{14}{1.0} - 8.29 \right) = 0.05(5.71) = 0.2855$$

$$Z_2 = \frac{1.5}{30} \left(\frac{18}{1.5} - 8.29 \right) = 0.05(3.71) = 0.1855$$

$$Z_3 = \frac{0.5}{10} \left(\frac{6}{0.5} - 8.29 \right) = 0.05(3.71) = 0.1855$$

$$Z_4 = \frac{2}{40} \left(\frac{20}{2} - 8.29 \right) = 0.05(1.71) = 0.0855$$

The proportion of investment in each stock will be computed as follows:

$$X_i = \frac{Z_i}{\sum_{j=1}^n Z_j}$$

$$\text{Thus } \sum_{j=1}^n Z_j = 0.2855 + 0.1855 + 0.1855 + 0.0855 = 0.742$$

Accordingly, proportion of investments in

$$\text{Security 1} = \frac{0.2855}{0.742} = 0.3848 \text{ i.e. } 38.48\%$$

$$\text{Security 2} = \frac{0.1855}{0.742} = 0.25 \text{ i.e. } 25\%$$

$$\text{Security 3} = \frac{0.1855}{0.742} = 0.25 \text{ i.e. } 25\%$$

$$\text{Security 4} = \frac{0.0855}{0.742} = 0.1152 \text{ i.e. } 11.52\%$$

Thus investment as per following proportion will be the optimal portfolio.

Security 1 → 38.48%

Security 2 → 25%

Security 3 → 25%

Security 4 → 11.52%

Question 10:

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

The risk-free rate of interest be 9.25%,

Calculate the return of the share as per Arbitrage Pricing Theory.

ANSWER:**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	<u>0.50</u>
					8.16
Risk free rate in %					<u>9.25</u>
Return as per APT					<u>17.41</u>

Question 11:

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.

- 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?
- 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?
- What is the expected return premium of factor 2?

ANSWER:

- 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:

$$\text{b prop. 1} = 1.50 \times 0.80 + (-0.50 \times 1.50) = 0.45$$

$$\text{b prop. 2} = 1.50 \times 0.60 + (-0.50 \times 1.20) = 0.30$$

- Mr. X's current position:**

$$\text{Security A } ₹ 3,00,000 / ₹ 1,00,000 = 3$$

$$\text{Security B } -₹ 1,00,000 / ₹ 1,00,000 = -1$$

$$\text{Risk free asset } -₹ 100,000 / ₹ 100,000 = -1$$

$$\text{b prop. 1} = 3.0 \times 0.80 + (-1 \times 1.50) + (-1 \times 0) = 0.90$$

$$\text{b prop. 2} = 3.0 \times 0.60 + (-1 \times 1.20) + (-1 \times 0) = 0.60$$

- 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 Securities A & B shall be as follows:

Security A

$$\text{Total Return} = 15\%$$

$$\text{Risk Free Return} = 10\%$$

$$\text{Risk Premium} = 5\%$$

Security B

$$\text{Total Return} = 20\%$$

$$\text{Risk Free Return} = 10\%$$

$$\text{Risk Premium} = 10\%$$

Question 12:

Mr. Sunil Mukharjee has estimated probable returns under different macroeconomic conditions for the following three stocks:

Stock	Current Price (₹)	Rates of return (%) during different Macroeconomic scenarios		
		Recession	Moderate Growth	Boom
Him Ice Ltd	12	-12	15	35
Kalahari Biotech	18	20	12	-5
Puma Softech	60	18	20	15

Mr. Sunil Mukherjee is exploring if it is possible to make any arbitrage profits from the above information.

Required :

Using the above information construct an arbitrage portfolio and show the payoffs under different economic scenarios.

ANSWER:

We find that only Puma has positive return under all economic scenarios. Hence, Arbitrage involves going long on Puma by short selling H & K. Given their current prices, one possible arbitrage portfolio could be -

Short Sell 2 shares of H

Short Sell 2 Shares of K

By 1 share of Puma

Therefore inflow = $2 \times 12 + 2 \times 18 = 60$

Outflow = 60

∴ Net Investment = 0

Recession

Profit from short position in H

$12\% \times 12 \times 2 = 2.88$

Loss from short position in K

$20\% \times 18 \times 2 = -7.2$

Profit on long position in PUMA

$18\% \times 60 \times 1 = 10.8$

Overall profit = 6.48

Moderate Growth

loss from short position in H

$= 15\% \times 12 \times 2 = 3.6$

loss from short position in K

$$= 18 \times 12\% \times 2 = - 4.32$$

Profit from long position in PUMA

$$= 60 \times 20\% \times 1 = 12$$

$$\text{Overall profit} = 4.08$$

Boom

Loss from short position in H

$$= 12 \times 35\% \times 2 = - 8.4$$

Profit from short position in K

$$= 18 \times 5\% \times 2 = 1.8$$

Profit from long position in PUMA

$$= 60 \times 15\% \times 1 = 9$$

$$\text{Overall Profit} = 2.4$$

Question 13:

Mr. Nirmal Kumar has categorized all the available stock in the market into the following types:

- i. Small cap growth stocks
- ii. Small cap value stocks
- iii. Large cap growth stocks
- iv. 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:

- i. Calculate the expected return on the market index using Arbitrage Pricing Theory.
- ii. Calculate the expected return on the market index using Capital Asset Pricing Model (CAPM).
- iii. Advise the composition of a portfolio if Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks and if the target beta for the desired portfolio is 1.

ANSWER:**a. Method I**

Stock's return

$$\text{Small cap growth} = 4.5 + 0.80 \times 6.85 + 1.39 \times (-3.5) + 1.35 \times 0.65 = 5.9925\%$$

$$\text{Small cap value} = 4.5 + 0.90 \times 6.85 + 0.75 \times (-3.5) + 1.25 \times 0.65 = 8.8525\%$$

$$\text{Large cap growth} = 4.5 + 1.165 \times 6.85 + 2.75 \times (-3.5) + 8.65 \times 0.65 = 8.478\%$$

$$\text{Large cap value} = 4.5 + 0.85 \times 6.85 + 2.05 \times (-3.5) + 6.75 \times 0.65 = 7.535\%$$

Expected return on market index

$$0.25 \times 5.9925 + 0.10 \times 8.8525 + 0.50 \times 8.478 + 0.15 \times 7.535 = 7.7526\%$$

Method II

Expected return on the market index

$$\begin{aligned}
 &= 4.5\% + [0.1 \times 0.9 + 0.25 \times 0.8 + 0.15 \times 0.85 + 0.50 \times 1.165] \times 6.85 + [(0.75 \times 0.10 + 1.39 \times 0.25 + 2.05 \times 0.15 + 2.75 \times 0.5)] \times (-3.5) + [(1.25 \times 0.10 + 1.35 \times 0.25 + 6.75 \times 0.15 + 8.65 \times 0.50)] \times 0.65 \\
 &= 4.5 + 6.85 + (-7.3675) + 3.77 = 7.7525\%.
 \end{aligned}$$

b. Using CAPM,

$$\text{Small cap growth} = 4.5 + 6.85 \times 0.80 = 9.98\%$$

$$\text{Small cap value} = 4.5 + 6.85 \times 0.90 = 10.665\%$$

$$\text{Large cap growth} = 4.5 + 6.85 \times 1.165 = 12.48\%$$

$$\text{Large cap value} = 4.5 + 6.85 \times 0.85 = 10.3225\%$$

Expected return on market index

$$= 0.25 \times 9.98 + 0.10 \times 10.665 + 0.50 \times 12.45 + 0.15 \times 10.3225 = 11.33\%$$

c. Let us assume that Mr. Nirmal will invest $X_1\%$ in small cap value stock and $X_2\%$ 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 14:

ABC Ltd. manufactures Car Air Conditioners (ACs), Window ACs and Split ACs constituting 60%, 25% and 15% of total market value. The stand-alone Standard Deviation and Coefficient of Correlation with market return of Car AC and Window AC is as follows:

	S.D.	Coefficient of Correlation
Car AC	0.30	0.6
Window AC	0.35	0.7

No data for stand-alone SD and Coefficient of Correlation of Split AC is not available. However, a company who derives its half value from Split AC and half from Window AC has a SD of 0.50 and Coefficient of correlation with market return is 0.85. Index has a return of 10% and has SD of 0.20. Further, the risk-free rate of return is 4%.

You are required to determine:

- Beta of ABC Ltd.
- Cost of Equity of ABC Ltd.
- Assuming that ABC Ltd. wants to raise debt of an amount equal to half of its Market Value then determine equity beta, if yield of debt is 5%.

ANSWER:**i. Determination of Beta of Car AC and Window AC**

$$\frac{\sigma_{sm}\sigma_s}{\sigma_m}$$

Car AC

$$\frac{0.6 \times 0.3}{0.2} = 0.90$$

Window AC

$$\frac{0.7 \times 0.35}{0.2} = 1.225$$

Beta of Split AC/ Window AC is

$$\frac{0.85 \times 0.50}{0.2} = 2.125$$

The Beta of Split AC alone is

$$\begin{aligned} 2.125 &= 0.50\beta_s + 0.50\beta_c \\ &= 0.50\beta_s + 0.50 \times 1.225 \end{aligned}$$

$$\beta_s = 3.025$$

ABC Ltd.'s Beta shall be:

$$0.6 \times 0.9 + 0.25 \times 1.225 + 0.15 \times 3.025 = 1.30$$

ii. Cost of Equity of ABC Ltd.

$$K_e = 4\% + 1.30(10\% - 4\%) = 11.80\%$$

iii. Calculation of Debt Beta

$$\frac{5\% - 4\%}{10\% - 4\%} = 0.167$$

Accordingly, Beta of Equity shall be

$$\begin{aligned} 1.30 &= 0.50 \times 0.167 + 0.50 \times \beta_e \\ &= 2.433 \end{aligned}$$

Question 15:

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(ρ)	0.30	

Assuming the risk-free interest rate to be 3%, you are required to determine:

- 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%?
- What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?
- Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio?

ANSWER:

- i. Let the weight of stocks of Economy A is expressed as w , then

$$(1 - w) \times 10.0 + w \times 15.0 = 10.5$$

i.e. $w = 0.1$ or 10%.

- ii. 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 $(0.02423)^{1/2} = 0.15565$ or 15.6%.

- iii. The Sharpe ratio will improve by approximately 0.04, as shown below:

$$\text{Sharpe Ratio} = \frac{\text{Expected Return} - \text{Risk Free Rate of Return}}{\text{Standard Deviation}}$$

$$\text{Investment only in developed countries: } \frac{10 - 3}{16} = 0.437$$

$$\text{With inclusion of stocks of Economy A: } \frac{10.5 - 3}{15.6} = 0.481$$

Question 16:

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 (β_p) 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 (β_D) is 0.28.

You are required to calculate:

- Equity Beta (β_E),
- Ascertain Equity Beta (β_E), 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 (β_{D1}) is 0.45 and any further funds raised by way of Debt will have a Beta (β_{D2}) of 0.50.

- Whether the new Equity Beta (β_E) justifies increase in the value of equity on account of leverage?

ANSWER:**i. Equity Beta**

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta as follows:

$$= 1.55 \times 0.64 + 1.40 \times 0.36$$

$$= 0.992 + 0.504 = 1.496$$

Now we shall compute Equity Beta using the following formula:

$$\beta_{\text{Asset}} = \beta_{\text{Equity}} \left[\frac{E}{E + D(1 - t)} \right] + \beta_{\text{Debt}} \left[\frac{D(1 - t)}{E + D(1 - t)} \right]$$

Accordingly,

$$1.496 = \beta_{\text{Equity}} \left[\frac{500}{500 + 290} \right] + \beta_{\text{Debt}} \left[\frac{290}{500 + 290} \right]$$

$$1.496 = \beta_{\text{Equity}} \left[\frac{500}{790} \right] + 0.28 \left[\frac{290}{790} \right]$$

$$\beta_{\text{Equity}} = 2.20$$

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 = $\frac{\text{Total Value} \times \text{Debt Ratio}}{\text{Debt Ratio} + \text{Equity Ratio}}$	474
Less: Value of Existing Debt	(290)
Value of Debt to be Raised	184

$$\begin{aligned}
 \text{Equity after Repurchase} &= \text{Total value of Firm} - \text{Desired Debt Value} \\
 &= ₹ 790 \text{ Crore} - ₹ 474 \text{ Crore} \\
 &= ₹ 316 \text{ Crore}
 \end{aligned}$$

Weighted Average Beta of ABCL:

Source of Finance	Investment (in ₹ Crore)	Weight	Beta of the Division	Weighted Beta
Equity	316	0.4	$\beta_{(E=X)}$	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 17:

Ramesh has identified stocks of two companies A and B having good investment potential:

Following data is available for these stocks:

Year	A (Market Price per Share in ₹)	B (Market Price per Share in ₹)
2013	19.60	8.70
2014	18.75	12.80
2015	33.42	16.20
2016	42.64	18.25
2017	43.25	15.60
2018	44.60	13.25
2019	34.75	18.60

You are required to calculate:

- The Risk and Return by investing in Stock A and B
- The Risk and Return by investing in a portfolio of these Stocks if he invests in Stock A and B in proportion of 6 : 4.
- The better opportunity for investment

(Source: ICAI)

ANSWER:

Year	A				B				(Return - $\bar{A}$) x (Return - $\bar{B}$)
	Market Price Per Share in ₹	Return (%)	Return - $\bar{A}$	Squared	Market Price Per Share in ₹	Return (%)	Return - $\bar{B}$	Squared	
2013	19.60				8.70				
2014	18.75	-4.34	-18.33	335.9889	12.80	47.13	30.94	957.2836	-567.1302
2015	33.42	78.24	64.25	4128.0625	16.20	26.56	10.37	107.5369	666.2725
2016	42.64	27.59	13.60	184.9600	18.25	12.65	-3.54	12.5316	-48.1440
2017	43.25	1.43	-12.56	157.7536	15.60	-14.52	-30.71	943.1041	385.7176
2018	44.60	3.12	-10.87	118.1569	13.25	-15.06	-31.25	976.5625	339.6875
2019	34.75	-22.09	-36.08	1301.7664	18.60	40.38	24.19	585.1561	-872.7752
		83.95		6226.6883			97.14	3582.1748	-96.3718
Mean ($\bar{A}$)		13.99	Variance	1037.7814	Mean ($\bar{B}$)		16.19	Variance	597.0291
									Cov. = -16.0620

- Return A = 13.99% and Risk (SD) = $\sqrt{1037.7814} = 32.2146$ and Return B = 16.19% and Risk (SD) = $\sqrt{597.0291} = 24.4342$
- Return of Portfolio = $0.60 \times 13.99\% + 0.40 \times 16.19\% = 14.87\%$
 Risk (Standard Deviation) of Portfolio = $[0.60^2 \times 1037.7814 + 0.40^2 \times 597.0291 + 2 \times 0.60 \times 0.40 \times (-16.0620)]^{1/2}$
 $= [373.6013 + 95.5247 - 7.7098]^{1/2} = 21.4806$
- On the basis of Return 'B' is preferable and on the basis of Risk 'Portfolio Investment' is preferable over the individual stocks.

Question 18:

An Indian investor invests in American and British securities in the proportion of 75% and 25%. The expected return is 15% from the former and 12% from the latter. The risk manifesting in variance is 15% in US securities and 18% in UK securities. Correlation is 0.6. Determine the Portfolio Return and Portfolio risk.

ANSWER:**Portfolio Return**

$$0.75 \times 0.15 + 0.25 \times 0.12 = 0.1425 = 14.25\%$$

Portfolio Risk

$$\begin{aligned} & (0.75)^2 (0.15)^2 + (0.25)^2 (0.18)^2 + 2(0.75)(0.25)(0.15)(0.18)(0.6) \\ &= \sqrt{0.020756} \\ &= 0.1441 = 14.41\% \end{aligned}$$

Question 19:

A Portfolio Manager (PM) has the following four stocks in his portfolio:

Security	No. of Shares	Market Price per share (₹)	β
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:

- Portfolio beta.
- If the PM seeks to reduce the beta to 0.8, how much risk free investment should he bring in?
- If the PM seeks to increase the beta to 1.2, how much risk free investment should he bring in?

ANSWER:

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	β (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	1.0000		1.108

Portfolio beta**1.108**

- 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)	β (x)	βWx
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	1.0000		0.800

- ii. 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
 $1200000 \times 100 / 108.30$ 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)	β (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	1.0000		1.20

Portfolio beta 1.20

Question 20:

Suppose that in the universe of available risky securities contains a large number of shares two stocks, identically distributed with $E(r) = 15\%$, or $\sigma = 60\%$, and with a common correlation coefficient of $\rho = 0.5$.

- What is the expected return and standard deviation of an equally weighted risky portfolio of 25 stocks?
- What is the smallest number of stocks necessary to generate an efficient portfolio with a standard deviation equal to or smaller than 43%?
- What is the systematic risk in this security universe?
- If T-bills are available and yield 10%, what is the slope of the CAL?

ANSWER:

The parameters are $E(R) = 15$, $\sigma = 60$, and the correlation between any pair of stocks is $\rho = .5$.

- The portfolio expected return is invariant to the size of the portfolio because all stocks have identical expected returns. The standard deviation of a portfolio with $n = 25$ stock is

$$\begin{aligned}\sigma_p &= \left[\sigma^2/n + \rho \times \sigma^2(n-1)/n \right]^{1/2} \\ &= \left[60^2/25 + 0.5 \times 60^2 \times 24/25 \right]^{1/2} = 43.27\end{aligned}$$

- Because the stocks are identical, efficient portfolios are equally weighted. To obtain a standard deviation of 43%, we need to solve for n :

$$43^2 = \frac{60^2}{n} + 0.5 \times \frac{60^2(n-1)}{n}$$

$$1,849n = 3,600 + 1,800n - 1,800$$

$$n = 1,800/49 = 36.73$$

Thus we need 37 stock and will come in with volatility slightly under the target.

- As n gets very large, the variance of an efficient (equally weighted) portfolio diminishes, leaving only the variance that comes from the covariances among stocks, that is

$$\sigma_p = \sqrt{\rho \times \sigma^2} = \sqrt{0.5 \times 60^2} = 42.43$$

- If the risk-free is 10%, then the risk premium on any size portfolio is $15\% - 10\% = 5\%$. The standard deviation of a well-diversified portfolio is (practically) 42.43%; hence the slope of the Capital Allocation Line (CAL) is

$$S = 5/42.43 = 0.1178$$

EQUITY VALUATION, MERGERS
AND ACQUISITIONS &
FINANCIAL ANALYSIS

Question 1:

R Ltd. and S Ltd. operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. R Ltd.'s management is interested in acquisition of S. Ltd. due to its excess plant capacity. Share of S Ltd. is trading in market at ₹ 3.20 each. Other data relating to S Ltd. is as follows:

Balance Sheet of S Ltd.

Liabilities	Amount (₹)	Assets	Amount (₹)
Current Liabilities	1,59,80,000	Current Assets	2,48,75,000
Long Term Liabilities	1,28,00,000	Other Assets	94,00,000
Reserve & Surplus	2,79,95,000	Property Plants & Equipment	3,45,00,000
Share Capital (80 Lakhs shares of ₹ 1.5 each)	1,20,00,000		
Total	6,87,75,000	Total	6,87,75,000

Particulars	R Ltd. (₹)	S Ltd. (₹)	Combined Entity (₹)
Profit after Tax	86,50,000	49,72,000	1,21,85,000
Residual Net Cash Flows per year	90,10,000	54,87,000	1,85,00,000
Required return on equity	13.75%	13.05%	12.5%

You are required to compute the following:

- Minimum price per share S Ltd. should accept from R Ltd.
- Maximum price per share R Ltd. shall be willing to offer to S Ltd.
- Floor Value of per share of S Ltd., whether it shall play any role in decision for its acquisition by R Ltd.

ANSWER:**i. Calculation of Minimum price per share S Ltd. should accept from R Ltd.**

$$\text{Value of S Ltd.} = \frac{\text{Residual Cash Flow}}{K_e - g} = \frac{54,87,000}{0.1305 - 0} = ₹ 4,20,45,977$$

$$\text{Value per share of S Ltd.} = \frac{4,20,45,977}{80,00,000} = ₹ 5.26$$

$$\text{Book Value of per share of S Ltd.} = \frac{3,99,95,000}{80,00,000} = ₹ 4.99 \text{ or } ₹ 5$$

Therefore, the minimum price per share S Ltd. should accept from R Ltd. is ₹ 5 (current book value)

ii. Calculation of Maximum price per share R Ltd. shall be willing to offer to S Ltd.

$$\text{Value of R Ltd.} = \frac{\text{Residual Cash Flow}}{K_e - g} = \frac{90,10,000}{0.1375 - 0} = ₹ 6,55,27,273$$

$$\text{Value of Combined entity} = \frac{1,85,00,000}{0.125 - 0} = ₹ 14,80,00,000$$

$$\begin{aligned} \text{Value of synergy} &= \text{Value of Combined entity} - \text{Individual values of R Ltd. and S Ltd.} \\ &= ₹ 14,80,00,000 - (₹ 4,20,45,977 + ₹ 6,55,27,273) \\ &= ₹ 4,04,26,750 \end{aligned}$$

Maximum price per share R Ltd. shall be willing to offer to S Ltd. shall be computed as follows:

$$\begin{aligned} &= \frac{\text{Value of S Ltd. as per Residual cash flows} + \text{Synergy benefits}}{\text{No. of Shares}} \\ &= \frac{4,20,45,977 + 4,04,26,750}{80,00,000} = ₹ 10.31 \end{aligned}$$

iii. Floor value of per share of S Ltd shall be ₹ 3.20 (current market price) and it shall not play any role in decision for the acquisition of S Ltd. as it is lower than its current book value.

Question 2:

X Limited proposes to acquire Y Limited. The relevant financial details of the two firms prior to the merger announcement are as follows:

Particulars	X Ltd	Y Ltd.
Market price per share	₹ 80	₹ 40
No. of outstanding shares	10 Lakhs	5 lakhs

The merger is expected to generate gains with a present value of ₹ 120 Lakhs. The X Ltd. will issue 1 share of it for 2 shares of Y Ltd.

You are required to find out the true cost of merger for X Ltd.

ANSWER:

Shareholders of Y Ltd. will get 2.50 lakh shares of X Ltd, so they will get:

$$= \frac{2.50 \text{ lakh}}{10 \text{ lakh} + 2.50 \text{ lakh}} = 20\% \text{ of Shares X Ltd.}$$

The value of X Ltd. after merger will be

$$= ₹ 80 \times 10 \text{ lakh} + ₹ 40 \times 5 \text{ lakh} + ₹ 120 \text{ Lakh}$$

$$= ₹ 800 \text{ Lakh} + 200 \text{ Lakh} + ₹ 120 \text{ Lakh} = ₹ 1120 \text{ lakh.}$$

True Cost of Merger will be:

$$(₹ 1120 \times 20\%) ₹ 224 \text{ lakh} - ₹ 200 \text{ lakh} = ₹ 24 \text{ lakh}$$

Question 3:

Fragrance Ltd. has reported a Net Operating Profit after Tax (NOPAT) to Capital Employed as 2.5% plus Weighted Average Cost of Capital (WACC) for the year 31st March 2021. Economic Value added is ₹ 4 crore as on 31st March 2021.

You are required to calculate

- i. The amount of Capital Employed
- ii. NOPAT, if WACC is 10%

ANSWER:

- (i) $EVA = NOPAT - WACC \times \text{Capital Employed}$
 $\text{₹ 4 Crore} = NOPAT - WACC \times \text{Capital Employed}$
 $\text{₹ 4 Crore} = [WACC + 0.025] \text{Capital Employed} - WACC \times \text{Capital Employed}$
 $\text{₹ 4 Crore} = \text{Capital Employed} [0.025]$
 $\text{Capital Employed} = \text{Rs } 160 \text{ Crore}$
- (ii) NOPAT if WACC is 10%
 $\text{₹ 4 Crore} = NOPAT - 0.10 \times \text{₹ } 160 \text{ crore}$
 $NOPAT = \text{₹ } 20 \text{ crore}$

Question 4:

Strong Ltd., (SL), an all equity financed, conglomerate is in need to borrow ₹ 2,000 crore to finance expansion of its crore current operations. However, SL is susceptible to raise the amount from the market. The CFO has suggested for divesting one of the two non- prime units to reduce the overall borrowings from the market. The following data, after internal due diligence, has been placed for consideration of the Board:

(₹ in cores)

Particulars	Unit	Unit 2
Reported Profit After Tax	147	140
Extra Ordinary Gains	16	8
Extra Ordinary Losses	20	12
Expected Profit from the launch of the new product	56	12
Price Earnings Ratio	10	12.5
Corporate Tax Rate (%)	30	30

You are required to advise the Borad on the following:

- The price at which the units can be divested,
- The unit which can be divested so as to minimise the borrowings from the market and
- The amount of borrowing.

ANSWER:**i. Price at which units can be Divested**

(₹ Crore)

Particulars	Unit I	Unit II
Reported Profit after Tax (a)	147	140
Reported profit before Tax [(a) /0.70]	210	200
Less: Extra Ordinary Gains	16	8
Add: Extra Ordinary Losses	20	12
	214	204
Profit from New Product	56	12
Profit before Tax	270	216
Less : Tax @ 30%	81	64.80
Future Maintainable Profit after Tax (b)	189	151.20
PE Ratio	10	12.5
Relevant Capitalization Factor (1/PE Ratio) (c)	10%	8%
Price of Unit [(b) / (c)]	1890	1890

- The unit I can be divested as it has lower PE Ratio.
- The amount of borrowing ₹ 2000 crore – ₹ 1890 crore = ₹ 110 crore

Question 5:

SM Limited has a market capitalization of ₹ 3,000 crore and the current earnings per share (EPS) is ₹ 200 with a price earnings ratio (PER) of 15. The Board of directors is considering a proposal to buy back 20% of the shares at a premium which can be supported by the financials of the company. The Board expects post buy back market price per share (MPS) of ₹ 3057. Post buy back PER will remain same. The company proposes to fund the buy back by availing 8% bank loan since available resources are committed for expansion plans.

Applicable income tax rate is 30%.

You are required to calculate :

- The interest amount which can be paid for availing the bank loan,
- The loan amount to be raised and
- The premium per share and percentage premium paid over the current MPS.

ANSWER:

Current Market Price of Share = ₹ 200 × 15 = ₹ 3,000

$$\begin{aligned} \text{No. of Shares} &= \frac{\text{Market capitalisation}}{\text{Market price of share}} \\ &= \frac{\text{₹ 3,000 crore}}{\text{₹ 3,000}} = 1 \text{ crore} \end{aligned}$$

No. of Shares proposed to Buyback = 20% of 1 crore = 20 Lakh

Post Buy back per share (₹) = ₹ 3,057

PE Ratio = 15

$$\text{Post Buy back EPS} = \frac{3057}{15} = ₹ 203.80$$

EAT = ₹ 203.80 × 80 Lakh = ₹ 16,304 Lakh

$$\text{Pre Tax Earning after Buyback} = \frac{16,304}{(1-0.30)} = ₹ 23,291.429 \text{ Lakh}$$

Earning Before Buyback = ₹ 200 × 100 = 20,000 Lakh

$$\text{Pre Tax Earning before Buyback} = \frac{20,000}{(1-0.30)} = ₹ 28,571.429 \text{ Lakh}$$

Particulars	
Pre Tax Earning before Buyback	₹ 28571.429 Lakhs
Pre Tax Earning after Buyback	₹ 23291.429 Lakhs
Interest which can be paid for availing bank loan	₹ 5,280.00 Lakhs
Loan Amount raised = $\frac{5280 \text{ lakh}}{0.08}$	₹ 66,000 Lakhs
Amount paid for Buy back of Share	₹ 66,000 Lakhs
No. of Shares Bought back	20 Lakhs
Share Buyback price per share = 66,000/20 Lakhs	₹ 3,300
Current Market Price per share (₹ 200 × 15)	₹ 3,000
Premium	₹ 300

$$\% \text{ Premium over current market price} = \frac{300}{3000} \times 100 = 10\%$$

Question 6:

The directors of Denter Inc wish to make an equity issue to finance an \$8m expansion scheme, which has an expected net present value of \$1.1m, and to re-finance an existing \$5m 15% Bond that is due for maturity in 5 years' time. For early redemption of these bonds there is a \$350,000 penalty charge. The company has obtained approval from its shareholders to suspend their pre-emptive rights and for the entity to make a \$15m placement of shares which will be at the price of 185¢ per share.

It is estimated that the floatation cost of the issue to be 4% of gross proceeds. Any surplus funds from the issue will be invested in IDRs, which is currently yielding 9% per year.

As on date the capital structure of Denter Inc is as follows:

	\$'000
Ordinary shares (25¢ per share)	8,000
Share premium	11,200
Free reserves	23,100
	42,300
15% term Bonds	5,000
11% debenture 2009-2012	9,000
	56,300

The entity's current share price is 190¢, and debenture price \$102. Denter can raise debenture or medium-term bank finance at 10% per year.

Assuming stock market to be semi-strong form efficient and no information about the proposed uses of funds from the issue has been made available to the public, you are required to estimate Denter's expected share price once full details of the placement, and the uses to which the finance is to be put, are announced.

ANSWER:

It is well known that in a semi-strong market the share price should accurately reflect new relevant information when it becomes publicly available. This would include the effect on Denter of the expansion scheme and the redemption of the term Bonds.

	\$m	\$m	\$m
The existing market value is 190¢ X 32m shares			60.8
The new investment has an expected NPV of \$1.1m, which will add to market value		1.1	
The proceeds of the issue will add to market value		<u>15.0</u>	16.1
Issue costs of 4% would reduce market value			(0.6)

Expected present value of outflows before redemption is announced

Interest £750,000 per year ($\$5m \times 15\%$) $\times 3.791$	2.843	
PV of repayment in year 5 $\$5m \times 0.621$	<u>3.105</u>	5.948
Redemption cost now	(5.000)	
Penalty charge	<u>(0.350)</u>	(5.350)
Present value benefit from early redemption		<u>0.598</u>
Expected total market value		<u>76.898</u>

Question 7:

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

- The value of exponent for 15 days EMA.
- The exponential moving average (EMA) of NIFTY during the above period. (Calculations to be done up to 2 decimals only)
- Analyse the buy & sell signal on the basis of your calculations

ANSWER:

- (i) Value of Exponent for 15 days EMA

$$= \frac{2}{n+1} = 0.125$$

- (ii) $EMA_t = a \times P_t + (1 - a) (EMA_{(t-1)})$ Where, a = exponent, P_t = Price of today

Date	1 Sensex	2 EMA for Previous day ($EMA_{(t-1)}$)	3 1-2	4 3×0.125	5 EMA $2 + 4$
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 8:

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.

Demonstrate how the market value of the share is affected by the decision of the Board. Also demonstrate 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%.

ANSWER:

$$\begin{aligned}
 \text{Value of share at present} &= \frac{D_1}{k_e - g} \\
 &= \frac{2(1.06)}{0.08 - 0.06} = ₹ 106
 \end{aligned}$$

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	$= \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^2}$	= ₹ 214.33

In order to maintain his receipt at least ₹ 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 9:

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:

- The amount of External Fund Requirement (EFR)
- The amount to be raised from Short Term, Long Term and Equity funds.

ANSWER:**(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 10:

Following information is available of M/s. TS Ltd.

PBIT	5.00
Less : Interest on Debt (10%)	1.00
PBT	4.00
Less: Tax @ 25%	1.00
PAT	3.00
No. of outstanding shares of ₹ 10 each	40 lakh
EPS (₹)	7.5
Market price of share (₹)	75
P/E ratio	10 Times

TS Ltd. has an undistributed reserves of ₹ 8 crores. The company requires ₹ 3 crores for the purpose of expansion which is expected to earn the same rate of return on capital employed as present. However, if the debt to capital employed ratio is higher than 35%, then P/E ratio is expected to decline to 8 Times and rise in the cost of additional debt to 14%. Given this data which of the following options the company would prefer, and why?

Option (i) : If the required amount is raised through debt, and

Option (ii) : If the required amount is raised through equity and the new shares will be issued at a price of ₹ 25 each.

ANSWER:**Working Notes**

(1) Calculation of Return on Capital Employed (ROCE)

	(₹ in crores)
Capital Employed:	
Share Capital (₹ 10 x 40 lakhs)	4
Reserves	8
Debt (₹ 1 cr. x 100/10)	10
	22
PBIT	5
ROCE	22.73%

(2) Revised PBIT

Existing Capital Employed	22
Additional	3
ROI	22.73%
Revised PBIT	5.6825

(3) New Debt/Equity

Existing Debt	10
Additional Under Option (i)	3
Total Debt	13
Total Equity	12

$$\text{New Debt to Capital Employed Ratio} = \frac{13}{25} = 0.52$$

So, P/E Ratio to be reduced to 8 times

(4) Debt to Capital Employed Ratio in Option (ii)

$$= \frac{10}{25} = 0.40$$

So, P/E Ratio to be reduced to 8 times in this case also

Question 11:

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:

- Market to book value
- Market to replacement cost
- Market to sales
- 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

ANSWER:**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	$250 \times 1.2290 = 307.25$
(ii)	Replacement Cost	500	0.7385	$500 \times 0.7385 = 369.25$
(iii)	Sales	500	0.8535	$500 \times 0.8535 = 426.75$
(iv)	Net Income	14	25	$14 \times 25 = 350.00$
Average				₹ 363.31

Value of XY Ltd. according to the comparable method is ₹ 363.31.

Question 11:

STR Ltd.'s current financial year's income statement reported its net income after tax as ₹ 50 Crore.

Following is the capital structure of STR Ltd. at the end of current financial year:

	₹
Debt (Coupon rate = 11%)	80 Crore
Equity (Share Capital + Reserves & Surplus)	250 Crore
Invested Capital	330 Crore

Following data is given to estimate cost of equity capital:

Asset Beta of TSR Ltd.	1.11
Risk free Rate of Return	8.5%
Average market risk premium	9%

The applicable corporate income tax rate is 30%.

Estimate Economic Value Added (EVA) of RST Ltd. in ₹ lakh.

ANSWER:

First of all, to calculate Cost of Equity we shall compute the Equity Beta of STR Ltd. as follows:

$$\beta_a = \beta_e \left[\frac{E}{E + D(1-t)} \right]$$

$$1.11 = \beta_e \left[\frac{250}{250 + 80(1-0.30)} \right]$$

$$\beta_e = 1.36$$

then we shall compute the Cost of Equity as per CAPM as follows:

$$\begin{aligned} k_e &= R_f + \beta \times \text{Market Risk Premium} \\ &= 8.5\% + 1.36 \times 9\% \\ &= 8.5\% + 12.24\% = 20.74\% \end{aligned}$$

$$\text{Cost of Debt } (k_d) = 11\%(1 - 0.30) = 7.70\%$$

$$\begin{aligned} \text{WACC } (k_0) &= k_e \times \frac{E}{E + D} + k_d \times \frac{D}{E + D} \\ &= 20.74\% \times \frac{250}{330} + 7.70\% \times \frac{80}{330} \\ &= 15.71 + 1.87 = 17.58\% \end{aligned}$$

$$\begin{aligned} \text{Taxable Income} &= ₹ 50 \text{ Crore} / (1 - 0.30) \\ &= ₹ 7142.86 \text{ lakhs} \end{aligned}$$

$$\begin{aligned} \text{Operating Income} &= \text{Taxable Income} + \text{Interest} \\ &= ₹ 7142.86 \text{ lakhs} + ₹ 880 \text{ lakhs} \\ &= ₹ 8022.86 \text{ lakhs} \end{aligned}$$

EVA

$$\begin{aligned} &= \text{EBIT} (1 - \text{Tax Rate}) - \text{WACC} \times \text{Invested Capital} \\ &= ₹ 8022.86 \text{ lakhs} (1 - 0.30) - 17.58\% \times ₹ 330 \text{ Crore} \\ &= ₹ 5616.00 \text{ lakhs} - ₹ 5801.40 \text{ lakhs} = - ₹ 185.40 \text{ lakhs} \end{aligned}$$

Question 12:

XYZ Ltd. is a paints manufacturer. The analyst's forecast of free cash flow is shown below:

Free cash flow forecast for XYZ Ltd.**(₹in crore)**

	Years							
	2013	2014	2015	2016	2017	2018	2019	2020
Sales	178.13	204.85	235.58	270.92	311.56	358.29	412.03	473.83
EBIT	16.33	17.25	17.19	19.58	22.17	24.95	27.89	30.95
NOPAT	10.61	11.21	11.17	12.73	14.41	16.22	18.13	20.12
+ Depreciation	3.14	2.13	2.68	2.82	2.96	3.11	3.26	3.42
Less:								
Capital exp.	0	0.63	2.36	1.79	1.88	1.97	2.07	2.17
Increase in working capital	0	6.44	4.12	6.10	9.45	11.67	12.97	14.32
Free cash flow	13.75	6.27	7.37	7.66	6.04	5.69	6.35	7.05

The cost of capital of the company is 15 per cent and value of debt is ₹4.92 crore. Assuming that the company acquiring XYZ Ltd. will not make any operating improvements or change the capital structure and analyst expects the cash flows to grow at 10 per cent forever after 2020, determine the value of Firm and Equity.

ANSWER:**Present Value of Free Cash Flows**

	Years							
	2013	2014	2015	2016	2017	2018	2019	2020
Free Cash Flow	13.75	6.27	7.37	7.66	6.04	5.69	6.35	7.05
PVF@15%	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.329
Present Value	11.96	4.74	4.85	4.38	3.00	2.46	2.39	2.31
Total								36.09

Approach I: Terminal Value is a Growing Perpetuity

$$\text{Terminal value} = \frac{\text{FCFF}(1+g)}{k_e - g} = \frac{7.05(1.10)}{0.15 - 0.10} = \frac{7.755}{0.05} = ₹ 155.1 \text{ crore}$$

$$\text{Present value of terminal value} = 155.1 \times \text{PVIF}(15\%, 7)$$

$$= 155.1 \times 0.376 = 58.32 \text{ crore}$$

$$\text{Total value} = ₹ (36.09 + 58.32) = ₹ 94.41 \text{ crore}$$

$$\text{Value of Equity} = ₹ 94.41 \text{ crore} - ₹ 7.92 \text{ crore} = ₹ 86.64 \text{ crore}$$

Approach 2: Terminal Value is a Stable Perpetuity

$$\begin{aligned}\text{Terminal value} &= \left[\frac{\text{Free cash flow}}{\text{Discount rate}} \right] = \text{FCF} / k \\ &= \left[\frac{7.05}{0.15} \right] = ₹ 47 \text{ crores}\end{aligned}$$

Value of the firm = ₹ 36.09 crore + ₹ 47.00 crore = ₹ 83.09 crore

Question 13:

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

ANSWER:

$$\text{No. of Shares} = \frac{\text{₹ 1,900 crores}}{\text{₹ 50}} = 38 \text{ crores}$$

$$\text{EPS} = \frac{\text{PAT}}{\text{No. of shares}}$$

$$\text{EPS} = \frac{\text{₹ 560 crores}}{38 \text{ crores}} = \text{₹ 14.737}$$

$$\begin{aligned} \text{Cost of Equity} &= R_f + \beta (R_m - R_f) \\ &= 9.5 + 0.1 (12.6 - 9.5) = 9.81\% \end{aligned}$$

$$\text{FCFE} = \text{Net income} - [(1-b) (\text{capex} - \text{dep}) + (1-b) (\Delta \text{WC})]$$

$$\begin{aligned} \text{FCFE} &= 14.737 - [(1-0.43) (53-45) + (1-0.43) (4.62)] \\ &= 14.737 - [4.56 + 2.6334] = 7.5436 \end{aligned}$$

$$P_0 = \frac{\text{FCFE}(1+g)}{K_e - g} = \frac{7.5436(1.07)}{0.0981 - 0.07} = \frac{8.0716}{0.0281} = \text{₹ 287.25}$$

Question 14:

The Digital Electronics System Corporation (DESC) pays no cash dividends currently and is not expected to for the next five years. Its latest (current) EPS was €10, all of which was reinvested in the company. The firm's expected ROE for the next five years is expected to be 20% per year and during this time it is also expected to continue to reinvest all of its earnings. It is expected that starting six years from now the DESC's ROE on new investments is expected to fall to 15% and it is expected that the corporation shall start paying out 40% of its earnings in form of cash dividends, which it will continue to do forever after. DESC's market capitalization rate is 15% per year.

- i. Using DDM model, what is the value of DESC's share today?
- ii. Now suppose that the current market price of share is equal to as computed in (a) above, then what do you expect to happen to its price over the next year? The year after?
- iii. If you are expecting that DESC to out only 20% of earning then what is the price per share at the end of year 5.

ANSWER:

- i. Expected EPS for next years

EPS 1	= €10 (1 + 0.20) = € 12
EPS 2	= € 12 (1 + 0.20) = €14.40
EPS 3	= € 14.40 (1 + 0.20) = € 17.28
EPS 4	= € 17.28 (1 + 0.20) = €20.736
EPS 5	= € 20,736 (1 + 0.20) = € 24.88
EPS 6	= €24.88(1 + 0.15) = € 28.61
Thus D 6	= 0.40(€ 28.61) = € 11.44

Hence, value of DESC's share 5 years from now =

$$P_5 = \frac{D_6}{K_e - g} = \frac{11.44}{15\% - 9\%} = € 191 \quad [\text{Note: } g = 0.60 \times 0.15 = 9\%]$$

So the value of DESC's share today is $\frac{191}{(1 + 0.15)^5} = € 94.96$

Note : There is no dividend payment from year 1 to year 5 as given in question

Note : Growth rate from year 1 to year 5 : $g = b \times r = 100\% \times 0.20 = 20\%$

- ii. The price should rise by 15% per year until year 6.
- iii. The value of DESC's shares 5 years from now.

[**Note :** $g = 0.80 \times 0.15 = 12\%$]

Note : $g = b \times r = 0.80 \times 0.15 = 0.12$ and $D_6 = 28.61 \times 20\% = 5.722$

Question 15:

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	t_1	t_2	t_3
PVIF	0.8696	0.7561	0.6575

ANSWER:**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 :

$$₹ 3676.44 \text{ Crores} + ₹ 25174.08 \text{ Crores} = ₹ 28,850.52 \text{ Crores}$$

Question 15:

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:

- Whether you will be in purchasing RK Ltd. equity at this time based on your one year forecast?
- 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

ANSWER:

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 = $\frac{15.02(1.15)}{0.18 - 0.15} = \text{Rs. } 575.77$

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 16:

BA Ltd. and DA Ltd. both the companies operate in the same industry. Both companies are in the process of negotiating a merger through exchange of equity shares. The Financial statements of both the companies for the current financial year are as follows:

Balance Sheet

Particulars	BA Ltd. (Rs.)	DA Ltd. (Rs.)
Current Assets	14,00,000	10,00,000
Fixed Assets (Net)	10,00,000	5,00,000
Total (Rs.)	24,00,000	15,00,000
Equity capital (Rs.10 each)	10,00,000	8,00,000
Retained earnings	2,00,000	-
14% long-term debt	5,00,000	3,00,000
Current liabilities	7,00,000	4,00,000
Total (Rs.)	24,00,000	15,00,000

Income Statement

	BA Ltd. (Rs.)	DA Ltd. (Rs.)
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	1,98,000
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	Rs.40	Rs.15

- Calculate the EPS, P/E Ratio, ROE and Book value/ Intrinsic Value Per Share of both companies.
- Calculate future EPS growth rates for each company.
- Evaluate the justifiable equity share exchange ratios that can be offered by BA Ltd. to the shareholders of DA Ltd.
- 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.

ANSWER:

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

Intrinsic value based	= ₹20 / ₹40	= 0.5:1 (upper limit)
Market price based	= ₹15 / ₹	= 0.375:1
= MPS _{DA} /MPS _{BA}	40	(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) /	2.1	1.2375	2.341
EPS Accretion (Dilution)	(Re.)	(ii)	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) /	40	15	44.6
MPS Accretion	(Re.)	(ii)	4.6	2.84***	

* Shares outstanding (combined) = 100000 shares + (.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 17:

AB Ltd. is a firm of recruitment and selection consultants. It has been providing consultancy for 10 years and obtained a stock market listing 4 years ago. It has pursued a policy of aggressive growth and specializes in providing services to companies in high- technology and high growth sectors. It is all-equity financed by ordinary share capital of Rs. 500 lakh in shares of Rs. 20 nominal (or par) value.

The company's results to the end of March 2009 have just been announced. Profits before tax were Rs.1,266 lakh. The Chairman's statement included a forecast that earnings might be expected to rise by 4%, which is a lower annual rate than in recent years. This is blamed on economic factors that have had a particularly adverse effect on information technology companies. YZ Ltd. is in the same business but has been established much longer. It serves more traditional service sectors and its earnings record has been erratic. Press comment has frequently blamed this on poor management and the company's shares have been out of favour with the stock market for some time. Its current earnings growth forecast is also 4% for the foreseeable future. YZ Ltd. has an issued ordinary share capital of Rs.1800 lakh in Rs.100 shares. Pre-tax profits for the year to 31 March 2009 were Rs.1,125 lakh.

AB Ltd. has recently approached the shareholders of YZ Ltd. with a bid of 5 new shares in AB Ltd. for every 6 YZ Ltd. shares. There is a cash alternative of Rs. 345 per share. Following the announcement of the bid, the market price of AB Ltd. shares fell 10% while the price of YZ Ltd. shares rose 14%. The P/E ratio and dividend yield for AB Ltd. and YZ Ltd. immediately prior to the bid announcement are shown below.

2009				
High	Low	Company	P/E	Dividend yield %
425	325	AB Ltd.	11	2.4
350	285	YZ Ltd.	7	3.1

Both AB Ltd. and YZ Ltd. pay tax at 30%.

AB Ltd.'s post-tax cost of equity capital is estimated at 13% per annum and YZ Ltd.'s at 11% per annum.

Assuming that you are a shareholder in YZ Ltd. You have a large, but not controlling interest.

You bought the shares some years ago and have been very disappointed with their performance. Based on the information and merger terms available, plus appropriate assumptions, to forecast post-merger values, evaluate whether the proposed share-for-share offer is likely to be beneficial to shareholders in both AB Ltd. and YZ Ltd. Also identify why the price of share of AB Ltd. fell following the announcement of bid.

Note: As a benchmark, you should then value the two companies AB Ltd. and YZ Ltd. using the constant growth form of the dividend valuation model.

ANSWER:

Assumption: Though in the question it is assumed that there is no operating synergy and so no increase on the combined earnings; it is unlikely a bid would be launched if substantial synergy was not estimated.

Share for share offer

	AB Ltd.	YZ Ltd.	Combined
Profit before tax (Rs. lakh)	1,266.00	1,125.00	2,391.00
Less: Tax @ 30%	379.80	337.50	717.30
Profit after Tax	886.20	787.50	1,673.70
Number of shares (lakh)	25.00	18.00	40.00
Earnings Per Share (Rs.)	35.45	43.75	41.84
P/E ratio	11	7	
Share price (pre bid) (Rs.)	389.95	306.25	381.53*
Market Value of company (Rs. lakh)	9,748.75	5,512.50	15,261.25
* $\frac{\text{Rs. } 15,261.25 \text{ lakh}}{40 \text{ lakh}} = \text{Rs. } 381.53$			

Post Bid Price (Combined Entity)

Rs. 41.84 X 11 = Rs. 460 per share

Share for Cash offer

Rs. 460 per share

Thus cash offer is more beneficial for AB Ltd.

Reasons (partially) for the fall in the market price of the shares in the market

Wealth of a shareholder of YZ Ltd. holding 6 shares in YZ Ltd. (Rs. 306.25 X 6)
Rs. 1,837.50

Wealth of a shareholder of YZ Ltd. holding 5 shares in combined entity (Rs. 381.53 X 5)
Rs. 1,907.65

Thus there seems to be transfer of wealth from the AB Ltd. to YZ Ltd.

Value of shares using the Dividend Growth Model

$$AB = \frac{(35.45 \times 1.04)}{(0.13 - 0.04)} = \text{Rs. } 409.64$$

$$YZ = \frac{(43.75 \times 1.04)}{(0.11 - 0.04)} = \text{Rs. } 650.00$$

This would suggest that AB is slightly undervalued, but that YZ is hugely undervalued in the marketplace. It is possible that the market does not believe YZ's growth estimates, given its poor performance to date.

Question 18:

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	1,050	1,300	660	785
Borrowing		655		105
Capital Employed		1,955		890

Market Price 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

ANSWER:

- (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 ($D_1/MP + g$) = [(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 X 100	27.60%

Alternatively, if given figure of dividend is considered as D_1 then Premium over Current Market Price shall be computed as follows:

Cost of Equity ($\frac{D_1}{P} + g$)	$\left[\frac{10}{75} + 0.15 \right]$	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 18:

Hanky Ltd. and Shanky Ltd. operate in the same field, manufacturing newly born babies's clothes. Although Shanky Ltd. also has interests in communication equipments, Hanky Ltd. is planning to take over Shanky Ltd. and the shareholders of Shanky Ltd. do not regard it as a hostile bid.

The following information is available about the two companies.

	Hanky Ltd.	Shanky Ltd.
Current earnings	₹ 6,50,00,000	₹ 2,40,00,000
Number of shares	50,00,000	15,00,000
Percentage of retained earnings	20%	80%
Return on new investment	15%	15%
Return required by equity shareholders	21%	24%

Dividends have just been paid and the retained earnings have already been reinvested in new projects. Hanky Ltd. plans to adopt a policy of retaining 35% of earnings after the takeover and expects to achieve a 17% return on new investment.

Saving due to economies of scale are expected to be ₹ 85,00,000 per annum.

Required return to equity shareholders will fall to 20% due to portfolio effects.

Requirements:

- Calculate the existing share prices of Hanky Ltd. and Shanky Ltd.
- Find the value of Hanky Ltd. after the takeover
- Advise Hanky Ltd. on the maximum amount it should pay for Shanky Ltd.

ANSWER:

(a) Existing share price of Hanky Ltd.

$$g = r \times b$$

$$r = 15\%$$

$$b = 20\%$$

$$g = 0.15 \times 0.2$$

$$= 0.03$$

$$\text{Ex dividend market value} = \frac{\text{Next year's dividend}}{k_e - g}$$

$$= \frac{6,50,00,000 \times 0.8 \times 1.03}{0.21 - 0.03} = ₹ 29,75,55,556$$

$$\text{Value of one share} = \frac{₹ 29,75,55,556}{50,00,000} = ₹ 59.51 \text{ per share}$$

Existing share price Shanky Ltd.

$$g = r \times b$$

$$= 0.15 \times 0.8 = 0.12$$

$$\begin{aligned} \text{Ex dividend market value} &= \frac{\text{Next year's dividend}}{k_e - g} \\ &= \frac{2,40,00,000 \times 0.2 \times 1.12}{0.24 - 0.12} = ₹ 4,48,00,000 \end{aligned}$$

$$\text{Value of one share} = \frac{₹ 4,48,00,000}{15,00,000} = ₹ 29.87 \text{ per share}$$

(b) Value of Hanky Ltd. after the takeover

Care must be taken in calculating next year's dividend and the subsequent growth rate. Next year's earnings are already determined, because both companies have already reinvested their retained earnings at the current rate of return. In addition, they will get cost savings of ₹ 85,00,000.

The dividend actually paid out at the end of next year will be determined by the new 35% retention and the future growth rate will take into account the increased return on new investment.

$$\text{Growth rate for combined firm, } g = 0.17 \times 0.35 = 0.06$$

$$\text{New cost of equity} = 20\%$$

$$\begin{aligned} \text{Next year's earnings} &= ₹ 6,50,00,000 \times 1.03 + ₹ 2,40,00,000 \times 1.12 + ₹ 85,00,000 \\ &= ₹ 10,23,30,000 \end{aligned}$$

$$\begin{aligned} \text{Next year's dividend} &= ₹ 10,23,30,000 \times 0.65 \\ &= ₹ 6,65,14,500 \end{aligned}$$

$$\text{Market value} = \frac{₹ 6,65,14,500}{0.20 - 0.06} = ₹ 47,51,03,571$$

(c) Maximum Hanky Ltd. should pay for Shanky Ltd.

$$\text{Combined value} = ₹ 47,51,03,571$$

$$\text{Present Value of Hanky Ltd.} = ₹ 29,75,55,556$$

$$= ₹ 17,75,48,015$$

Question 19:

The total value (equity + debt) of two companies, A Ltd. and B Ltd. are expected to fluctuate according to the state of the economy

State of the economy	Probability	Value of A Ltd. Rs. in lakh	Value of B Ltd. Rs. in lakh
Rapid growth	0.30	720	1150
Slow growth	0.50	520	750
Recession	0.20	380	600

A Ltd. and B Ltd. currently have a debt of Rs. 420 lakhs and Rs. 80 lakhs, respectively.

The two companies are deciding for merger. Assuming that no operational synergy is expected as a result of the merger, you are required to calculate the expected value of debt and equity of the merged company.

Also explain the reasons for any difference that exists from the expected values of debt and equity, if they do not change.

ANSWER:

To find the value of A Ltd. equity shares, subtract the debt of Rs.420 lakh from the total value.

	Recession	Slow growth	Rapid growth
Value of Equity	(40)	100	300
Debt	420	420	420
Total	380	520	720

It should be noted that in above table there is a negative value of equity in recession, which is not possible because the shares have limited liability. Therefore, we will assume that the shares are zero value and the debt has declined to Rs.380 lakhs because of bankruptcy risk. Therefore the expected value of equity and debt can be calculated as follows:

	Recession Rs. Lakh	Prob.	Slow growth Rs. Lakh	Prob.	Rapid growth Rs. Lakh	Prob.	Expected Value Rs. Lakh
Value of Equity	0	0.20	100	0.50	300	0.30	140
Value of Debt	380	0.20	420	0.50	420	0.30	412
Total	380		520		720		552

To find the value of B Ltd's equity shares subtract debt of Rs.80 lakhs from the total value.

	Recession Rs. Lakh	Prob.	Slow growth Rs. Lakh	Prob.	Rapid growth Rs. Lakh	Prob.	Expected Value Rs. Lakh
Value of Equity	520	0.20	670	0.50	1070	0.30	760
Value of Debt	80	0.20	80	0.50	80	0.30	80
Total	600	0.20	750		1150		840

When the two companies merge we have to add the economic values of equity and debt together. Since the bankruptcy risk is disappeared by combining with a low geared company the negative Rs.40 lakhs also has to be used while calculating the combined firm's expected value.

	Recession (0.20) Rs. Lakh	Slow growth (0.50) Rs. Lakh	Rapid growth (0.30) Rs. Lakh	Expected Value Rs. Lakh
Value of Equity	480	770	1370	892
Value of Debt	500	500	500	500
Total	980	1270	1870	1392

Expected Value of Equity		Expected Value of Debt	
	Rs. Lakh		Rs. Lakh
A Ltd.	140	A Ltd.	412
B Ltd.	760	B Ltd.	80
Total	900	Total	492
Combined firm loss in equity capital	8	Increase in debt	8

After the combination, in the absence of synergy, the total economic value of the business remains at Rs.1392 lakhs but the expected value of debt has increased by Rs. 8 lakhs at the expense of equity. Because, under the recession there is no longer a bankruptcy risk for the debt holders of A Ltd.

The cash flows of the combined company may reduce in volatility because of the portfolio effect and this may further reduce the cost of debt, increasing its value.

Question 20:

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 buyout on 1 April 2013. However, to make this buy-out successful there is an urgent need to attract substantial funds from venture capitalists.

VenCap, 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
VenCap 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 VenCap, Mr. Smith stated that book value of equity shall increase by 20% during above 4 years. Although, VenCap has shown their interest in investment but are doubtful about the projections of growth in the value as per projections of Mr. Smith. Further VenCap 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 VenCap of 18 shares instead of 10 or not.

ANSWER:**Working Notes**Calculation of Interest Payment on 9% Debentures

$$PVAF(9\%, 6) = 4.486$$

$$\text{Annual Installment} = \frac{22.50 \text{ crore}}{4.486} = 5.0156 \text{ crore}$$

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:

$$(194.7795/82.5000)^{1/4} - 1 = 23.96\%$$

This growth rate is slightly higher than 20% as projected by Mr. Smith.

If the condition of VenCap for 18 shares is accepted the expected share holding after 4 years shall be as follows:

No. of shares held by Management	6.00 crore
No. of shares held by VenCap at the starting stage	2.25 crore
No. of shares held by VenCap after 4 years	4.05 crore
Total holding	6.30 crore

Thus, it is likely that Mr. Smith may not accept this condition of VenCap as this may result in losing their majority ownership and control to VenCap. Mr. Smith may accept their condition if management has further opportunity to increase their ownership through other forms.

BOND VALUATION AND

MONEY MARKET

Question 1:

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

ANSWER:

$$\text{Nominal Interest or Bond Equivalent Yield} = \left[\frac{F - P}{P} \right] \times \frac{12}{M} \times 100$$

Where

F= Face Value

P= Issue Price

$$= \frac{5,00,000 - 4,87,750}{4,87,750} \times \frac{12}{3} \times 100 = 0.025115 \times 4 \times 100 = 10.046 = 10.05\% \text{ p.a.}$$

$$\text{Effective interest rate} = \left[1 + \frac{0.1005}{4} \right]^4 - 1 = 10.435\% \text{ p.a.}$$

Cost of Funds to the Company

Effective Interest	10.435%
Brokerage (0.150 × 4)	0.60%
Rating Charge	0.55%
Stamp duty (0.20 × 4)	<u>0.80%</u>
	<u>12.385%</u>

Question 2:

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

Calculate:

- Conversion value of Debenture;
- Market Conversion Price;
- Conversion Premium per share;
- Ratio of Conversion Premium;
- Premium over straight Value of Debenture;
- Favourable Income Differential per share; and
- Premium pay back period

ANSWER:

- Conversion Value of Debenture

$$= \text{Market Price of one Equity Share} \times \text{Conversion Ratio}$$

$$= ₹ 30 \times 25 = ₹ 750$$
- Market Conversion Price

$$= \frac{\text{Market Price of Convertible Debenture}}{\text{Conversion Ratio}}$$

$$\frac{1000}{25} = ₹ 40$$
- Conversion Premium per share

$$\text{Market Conversion Price} - \text{Market Price of Equity Share}$$

$$= ₹ 40 - ₹ 30 = ₹ 10$$
- Ratio of Conversion Premium

$$\frac{\text{Conversion premium per share}}{\text{Market Price of Equity Share}} = \frac{10}{30} \times 100 = 33.33\%$$
- Premium over Straight Value of Debenture

$$\frac{\text{Market Price of Convertible Bond}}{\text{Straight Value of Bond}} - 1 = \frac{1000}{800} - 1 = 25\%$$

- (f) Favourable income differential per share

$$\frac{\text{Coupon Interest from Debenture} - \text{Conversion Ratio} \times \text{Dividend Per Share}}{\text{Conversion Ratio}}$$

$$\frac{90 - 25 \times 1}{25} = ₹ 2.6$$

- (g) Premium pay back period

$$\frac{\text{Conversion premium per share}}{\text{Favourable Income Differential Per Share}} = \frac{10}{2.6} = 3.85 \text{ years}$$

Question 3:

B International Ltd. (BIL) has purchased 5 years 15.28% convertible debentures on 1.04.2021. The convertible debentures will mature on 31.03.2026. Each debenture can be converted into 20 equity shares of face value of ₹ 1 at any point of time but before maturity. Debentures will be redeemed at ₹ 100 on maturity.

The required rate of return of BIL is 10% per annum on a 5 -year security.

The Reputed, a consultant has projected the following price behaviour of the shares:

Period		Price Range (₹)		
From	To	Passive	Most likely	Optimistic
1.04.2021	31.12.2022	4	4.5	5
1.01.2023	30.06.2025	4.5	6.5	7
1.07.2025	31.03.2026	3.5	5	5.5

BIL, as a matter of policy, rounds up the amount.

You are required to calculate.

- The break-even price at which the debentures can be converted
- The ideal period in which BIL shall convert and dispose of the shares

Given:

PVIF (10%, 5) 0.6209

PVIFA (10%, 5) 3.7908

ANSWER:

- (i) The Break-even price at which Debenture can be converted shall be equivalent to Present Value of stream of cash flows from holding debenture till maturity and it shall be computed as follows:

$$PV = ₹ 15.28 \times PVIFA (10\%, 5) + ₹ 100 \times PVIF (10\%, 5)$$

$$= ₹ 15.28 \times 3.7908 + ₹ 100 \times 0.6209$$

$$= ₹ 57.92 + ₹ 62.09 = ₹ 120.01 \text{ say } ₹ 120$$

$$\text{Thus, Break Even price} = \frac{₹ 120}{₹ 20} = ₹ 6/- \text{ per share}$$

- (ii) The ideal period in which BIL should convert and dispose of share will be 01.01.23 to 30.06.25 as during this period the market price of share is most likely to exceed its Break-even price.

Question 4:

XL Ltd. has issued callable 10% bonds with 30 years maturity. The issue size is ₹ 1 crore with a face value of ₹ 1,000 per bond. The bonds have been issued at a discount of 1.2% on the face value of the bonds in the year 2011. The call option is available to XL Ltd. at the end of 10 years and 20 years from the time of the issue of the bond. the floatation cost was ₹ 1,50,000.

In the year 2021 XL Ltd, has an opportunity to issue 8% bonds at par with 20 years maturity worth ₹ 1 crore with a face value of ₹ 1,000 per bond. The old bonds will be retired with the proceeds of the proposed issue. The floatation cost of the present issue will be ₹ 3,00,000

There will be an overlapping interest for a period of three months during the course of the present issue.

Post tax cost of debt for XL Ltd. is 7% p.a.

The applicable tax bracket is 30%

You are required to advise XL Ltd., whether it can proceed with the proposal.

Given: PVIFA (7%,20) = 10.594

ANSWER:**NPV for bond refunding**

Particulars	₹
PV of annual cash flow savings (W.N. 2) (1,41,800 × PVIFA 20%,) i.e. 10.594	15,02,229
Less: Initial investment (W.N. 1)	4,21,000
NPV	10,81,229

Recommendation: Refunding of bonds is recommended as NPV is positive.

Working Notes:**(1) Initial investment:**

(a) Floatation cost		3,00,000
(b) Overlapping interest		
Before tax ($0.10 \times \frac{3}{12} \times 1 \text{ crore}$)	2,50,000	
Less tax @ 30%	<u>75,000</u>	1,75,000
(c) Tax saving on unamortised discount on old bond		
$\frac{20}{30} \times 1,20,000 \times 0.30$		(24,000)
(d) Tax savings from unamortised floatation		
Cost of old bond $\frac{20}{30} \times 1,50,000 \times 0.30$		<u>(30,000)</u>
		<u>4,21,000</u>

(2) Annual cash flow savings:

<i>(a) Old bond</i>			
(i)	Interest cost (0.10×1 crore)	10,00,000	
	Less tax @ 30%	<u>3,00,000</u>	7,00,000
(ii)	Tax savings from amortisation of discount		
	$1,20,000/30 \times 0.30$		(1200)
(iii)	Tax savings from amortisation of floatation cost		
	$1,50,000/30 \times 0.30$		<u>(1500)</u>
Annual after tax cost payment under old Bond (a)			<u>6,97,300</u>
<i>(b) New bond</i>			
(i)	Interest cost before tax (0.08×1 crore)	8,00,000	
	Less tax @ 30%	<u>2,40,000</u>	
	After tax interest		5,60,000
(ii)	Tax savings from amortisation of floatation cost		
	$(0.30 \times 3,00,000/20)$		<u>(4,500)</u>
Annual after tax payment under new Bond (b)			<u>5,55,500</u>
Annual Cash Flow Saving (a) – (b)			1,41,800

Question 5:

Bank A enters into a Repo for 21 days with Bank B in 8% Government of India Bonds 2020 @ 6.10% for ₹ 5 crore. Assuming that clean price is ₹ 97.30 and initial margin is 1.50% and days of accrued interest are 240 days (assume 360 days in a year).

Compute:

- i. the dirty price.
- ii. The repayment at maturity.

ANSWER:

(i) Dirty Price

= Clean Price + Interest Accrued

$$= 97.30 + 100 \times \frac{8}{100} \times \frac{240}{360} = 102.63$$

(ii) First Leg (Start Proceed)

$$= \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Initial Margin}}{100}$$

$$= ₹ 5,00,00,000 \times \frac{102.63}{100} \times \frac{100 - 1.50}{100} = ₹ 5,05,45,275$$

$$\text{Second Leg (Repayment at Maturity)} = \text{Start Proceed} \times \left(1 + \text{Repo rate} \times \frac{\text{No. of days}}{360}\right)$$

$$= ₹ 5,05,45,275 \times \left(1 + 0.0610 \times \frac{21}{360}\right) = ₹ 5,07,25,132$$

Question 6:

M/s Agfa Industries is planning to issue a debenture series on the following terms:

Face value	₹ 100
Term of maturity	10 years
Yearly coupon rate	
Years	
1 – 4	9%
5 – 8	10%
9 – 10	14%

The current market rate on similar debentures is 15 per cent per annum. The Company proposes to price the issue in such a manner that it can yield 16 per cent compounded rate of return to the investors. The Company also proposes to redeem the debentures at 5 per cent premium on maturity. Determine the issue price of the debentures.

ANSWER

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.

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

Thus the debentures should be priced at ₹ 71.327

Question 7:

On 31st March, 2013, the following information about Bonds is available:

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

Calculate:

- If 10 years yield is 7.5% p.a. what price the Zero Coupon Bond would fetch on 31st March, 2013?
- What will be the annualized yield if the T-Bill is traded @ 98500?
- 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)?

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)?

ANSWER

- Rate used for discounting shall be yield. Accordingly ZCB shall fetch:

$$= \frac{10000}{(1 + 0.075)^{10}} = ₹ 4,852$$

- 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 be computed on 360 days a year.

- Price GOI 2023 would fetch

$$\begin{aligned}
 &= ₹ 10.71 \text{ PVA}(8\%, 10) + ₹ 100 \text{ PVF}(8\%, 10) \\
 &= ₹ 10.71 \times 6.71 + ₹ 100 \times 0.4632 \\
 &= ₹ 71.86 + ₹ 46.32 = ₹ 118.18
 \end{aligned}$$

iv. Price GOI 2018 Bond would fetch:

$$\begin{aligned} &= ₹ 5 \text{ PVAF } (4\%, 10) + ₹ 100 \text{ PVF } (4\%, 10) \\ &= ₹ 5 \times 8.11 + ₹ 100 \times 0.6756 \\ &= 40.55 + 67.56 = 108.11 \end{aligned}$$

Question 8:

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

ANSWER:

$$(1) \text{ Second Leg} = \text{Start Proceed} \times \left(1 + \text{Repo Rate} \times \frac{\text{No. of days}}{360} \right)$$

$$₹ 2,00,31,759 = ₹ 2,00,06,750 \times \left(1 + \text{Repo Rate} \times \frac{9}{360} \right)$$

$$1.00125 = \left(1 + \text{Repo Rate} \times \frac{9}{360} \right)$$

$$\text{Repo Rate} = 0.05 = 5\%$$

$$(2) \text{ First Leg (Start Proceed)} = \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Initial Margin}}{100}$$

$$₹ 2,00,06,750 = ₹ 2,00,00,000 \times \frac{\text{Dirty Price}}{100} \times \frac{100 - 1.25}{100}$$

$$10003.375 = 98.75 \times \text{Dirty Price}$$

$$\text{Dirty Price} = ₹ 101.30$$

$$(3) \text{ Dirty Price} = \text{Clean Price} + \text{Interest Accrued}$$

$$101.30 = \text{Clean Price} + 100 \times \frac{240}{360} \times 6\%$$

$$\text{Clean Price} = ₹ 97.30$$

Question 9:

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 semiannually 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:

- What was the YTM of MP Ltd. bonds as on January 1, 2010?
- 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.

ANSWER:

- Since the bonds were sold at par, the original YTM was 10%.

$$\text{YTM} = \frac{\text{Interest}}{\text{Principal}} = \frac{\text{₹ } 100}{\text{₹ } 1,000} = 10\%$$

- Price of the bond as on 1st July, 2018 = ₹ 50 × 9.712 + ₹ 1,000 × 0.417
= ₹ 485.60 + ₹ 417
= ₹ 902.60

Total value of the bond on the next = ₹ 902.60 + ₹ 50 interest date = ₹ 952.60

$$\begin{aligned} \therefore \text{Value of bond at purchase date} &= \text{₹ } 952.60 \times \frac{1}{(1 + 0.06)^{2/3}} \\ &= \text{₹ } 952.60 \times 0.9620 \text{ (by using excel)} \\ &= \text{₹ } 916.40^{\dagger} \end{aligned}$$

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:

$$\begin{aligned} &= \text{₹ } 952.60 \times \frac{1}{\left(1 + 0.06 \times \frac{2}{3}\right)} \\ &= \text{₹ } 952.60 \times \frac{1}{(1 + 0.04)} \\ &= \text{₹ } 915.96 \end{aligned}$$

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:

$$\text{Accrued Interest on Bonds} = 1,000 \times \frac{10}{100} \times \frac{2}{12} = 16.67$$

Question 10:

- i. 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?
- ii. 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?
- iii. If the YTM of the bond in (ii) above increases to 10%, how it affects the bond's duration? And why?

ANSWER:

- i. 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

$$₹ 1,000 \text{ (PVIF 6\%, 20)} - ₹ 1,000 \text{ (PVIF 8\%, 20)}$$

$$₹ 1,000 (0.312) - ₹ 1,000 (0.214)$$

$$₹ 312.00 - ₹ 214.00 = ₹ 98.00$$

& change in price due to change in PV of Principal

$$(₹ 98 / ₹ 229.60) \times 100 = 42.68\%$$

PRICE CHANGE DUE TO CHANGE IN PV OF INTEREST**5 yrs. Bond**

$$₹ 80 \text{ (PVIFA 6\%, 5)} - ₹ 80 \text{ (PVIFA 8\%, 5)}$$

$$₹ 80 (4.212) - ₹ 80 (3.993)$$

$$₹ 336.96 - ₹ 319.44 = ₹ 17.52$$

$$\% \text{ change in price} = \frac{₹ 17.52}{₹ 83.96} \times 100 = 20.86\%$$

20 yrs. Bond

$$₹ 80 \text{ (PVIFA 6\%, 20)} - ₹ 80 \text{ (PVIFA 8\%, 20)}$$

$$₹ 80 (11.47) - ₹ 80 (9.82)$$

$$₹ 917.60 - ₹ 785.60 = ₹ 132$$

$$\& \text{ change in price} = \frac{₹ 132}{₹ 229.60} \times 100 = 57.49\%$$

ii. Duration in the average time taken to recollect back the investment

Years (A)	Coupon Payments (₹)	Redemption (₹)	Total (₹) (B)	PVIF @ 7% (₹) (C)	(A) x (B) x (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
				$\Sigma \text{ ABC}$	5,097.94

$$\text{Duration} = \frac{\Sigma \text{ ABC}}{\text{Purchase Price}} = \frac{5097.94}{₹ 1000} = 5.098 \text{ years}$$

iii. If YTM goes up to 10%, current price of the bond will decrease to

$$₹ 70 \times PVIFA (10\%, 6) + ₹ 1000 PVIF (10\%, 6)$$

$$₹ 304.85 + ₹ 564.00 = ₹ 868.85$$

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

$$\text{New Duration } ₹ 4,366.45 / ₹ 868.85 = 5.025 \text{ years}$$

The duration of bond decreases, reason being the receipt of slightly higher portion of one's investment on the same intervals.

Question 11:

GHI Ltd., AAA rated company has issued, fully convertible bonds on the following terms, a year ago:

Face value of bond	Rs. 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	Rs. 45
Market price of convertible bond	Rs. 1175

AAA rated company can issue plain vanilla bonds without conversion option at an interest rate of 9.5%.

Required:

Calculate as of today:

- Straight Value of bond.
- Conversion Value of the bond.
- Conversion Premium.
- Percentage of downside risk.
- Conversion Parity Price.

t	1	2	3
PVIF _{0.095,t}	0.9132	0.8340	0.7617

ANSWER:

- Straight Value of Bond

$$= ₹ 85 \times 0.9132 + ₹ 85 \times 0.8340 + ₹ 1085 \times 0.7617 = ₹ 974.96$$
- Conversion Value

$$= \text{Conversion Ratio} \times \text{Market Price of Equity Share}$$

$$= ₹ 45 \times 25 = ₹ 1,125$$
- Conversion Premium

$$\text{Conversion Premium} = \text{Market Conversion Price} - \text{Market Price of Equity Share}$$

$$= \frac{₹ 1,175}{25} - ₹ 45 = ₹ 2$$
- Percentage of Downside Risk

$$= \frac{₹ 1,175 - ₹ 974.96}{₹ 974.96} \times 100 = 20.52\%$$
- Conversion Parity Price

$$= \frac{\text{Bond Price}}{\text{No. of Share on Conversion}} = \frac{₹ 1,175}{25} = ₹ 47$$

Question 12:

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:

- Calculate the current yield and YTM of the bond.
- Calculate the duration of the NCD.
- Calculate the realized yield on the NCD assuming that intermediate coupon payments are, not available for reinvestment calculate.

ANSWER:

$$(i) \text{ Current yield} = \frac{\text{₹ } 7}{\text{₹ } 90} \times \frac{12}{6} = 0.1555 \text{ or } 15.55\%$$

YTM can be determined from the following equation

$$7 \times \text{PVIFA}(\text{YTM}, 10) + 100 \times \text{PVIF}(\text{YTM}, 10) = 90$$

Let us discount the cash flows using two discount rates 7.50% 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

Now we use interpolation formula

$$7.50\% + \frac{6.560}{6.560 - (-2.888)} \times 1.50\%$$

$$7.50\% + \frac{6.560}{9.448} \times 1.50\% = 7.50\% + 1.041\%$$

$$\text{YTM} = 8.541\% \text{ say } 8.54\%$$

Note: Students can also compute the YTM using rates other than 15% and 18%.

(ii) 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.

(iii) Realized Yield can be calculated as follows:

$$\frac{(7 \times 10) + 100}{(1+R)^{10}} = 90$$

$$(1+R)^{10} = \frac{170}{90}$$

$$R = \left(\frac{170}{90} \right)^{1/10} - 1 = 0.06380 \text{ or } 6.380\% \text{ for half yearly and } 12.76\% \text{ annually.}$$

Question 13:

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%.

- i. If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.
- ii. 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 extends the life of Bond for another 6 years.

ANSWER:

- i. If the current interest rate is 8%, the company will not extend the duration of Bond and the maximum amount the investor would ready to pay will be:

$$\begin{aligned}
 &= £1,000 \text{ PVIAF } (8\%, 6) + £10,000 \text{ PVIF } (8\%, 6) \\
 &= £1,000 \times 4.623 + £10,000 \times 0.630 \\
 &= £4,623 + £ 6,300 \\
 &= £ 10,923
 \end{aligned}$$

- ii. If the current interest rate is 12%, the company will extend the duration of Bond. After six years the value of Bond will be

$$\begin{aligned}
 &= £1,000 \text{ PVIAF } (12\%, 6) + £10,000 \text{ PVIF } (12\%, 6) \\
 &= £1,000 \times 4.111 + £10,000 \times 0.507 \\
 &= £4,111 + £5,070 \\
 &= £9,181
 \end{aligned}$$

Thus, potential loss will be £9,181-£10,923=£1,742

Question 14:

ABC Ltd. has the following outstanding Bonds.

Bond	Coupon	Maturity
Series X	8%	10 Years
Series Y	Variable changes annually comparable to prevailing rate	10 Years

Initially these bonds were issued at face value of Rs. 10,000 with yield to maturity of 8%.

Assuming that:

- After 2 years from the date of issue, interest on comparable bonds is 10%, then what should be the price of each bond?
- If after two additional years, the interest rate on comparable bond is 7%, then what should be the price of each bond?
- What conclusions you can draw from the prices of Bonds, computed above.

ANSWER:

Here we shall compare two bonds, one with fixed coupon rate and another as per with prevailing interest rate.

- (i) After 2 Years passed (8 years remaining) Value of Bond Series – X

$$\begin{aligned}
 &= \text{Rs. } 800 \text{ PVIAF } (10\%, 8) + \text{Rs. } 10,000 \text{ PVIF } (10\%, 8) \\
 &= \text{Rs. } 800 \times 5.335 + \text{Rs. } 10,000 \times 0.467 \\
 &= \text{Rs. } 4,268 + \text{Rs. } 4,670 = \text{Rs. } 8,938
 \end{aligned}$$

Since Bond-Series Y has a variable interest rates, so the interest amount will increase and decrease with the movement of interest rates. As given presently rate of interest is 10%, the value of Bond will be:

$$\begin{aligned}
 &= \text{Rs. } 1,000 \text{ PVIAF } (10\%, 8) + \text{Rs. } 10,000 \text{ PVIF } (10\%, 8) \\
 &= \text{Rs. } 1,000 \times 5.335 + \text{Rs. } 10,000 \times 0.467 \\
 &= \text{Rs. } 5,335 + \text{Rs. } 4,670 = \text{Rs. } 10,005
 \end{aligned}$$

- (ii) After 2 additional years at the yield rate of 7%, the value of Bond shall be as follows:

Bond-Series X

$$\begin{aligned}
 &= \text{Rs. } 800 \text{ PVIAF } (7\%, 6) + \text{Rs. } 10,000 \text{ PVIF } (7\%, 6) \\
 &= \text{Rs. } 800 \times 4.767 + \text{Rs. } 10,000 \times 0.666 \\
 &= \text{Rs. } 3,814 + \text{Rs. } 6,660 = \text{Rs. } 10,474
 \end{aligned}$$

Bond-Series Y

$$\begin{aligned}
 &= \text{Rs. } 700 \text{ PVIF } (7\%, 6) + \text{Rs. } 10,000 \text{ PVIF } (7\%, 6) \\
 &= \text{Rs. } 700 \times 4.767 + \text{Rs. } 10,000 \times 0.666 \\
 &= \text{Rs. } 3,337 + \text{Rs. } 6,660 = \text{Rs. } 9,997
 \end{aligned}$$

- (iii) From above prices it can be concluded that price of Bond-Series X moves inversely with change in interest rate. Whereas, the price of Bond Series Y does not fluctuate, reason being its interest (coupon) adjusted according to change in interest rates.

Question 15:

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

- Calculate the implied one year forward rates
- Expected Yield to Maturity and prices of one year and two year Zero Coupon Bonds at the end of the first year.

ANSWER:**(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	$\frac{1,000}{(1+0.1201)} = 892.78$	0.1201 i.e. 12.01%
3	0.1403	1,000	$\frac{1,000}{(1+0.1201)(1+0.1403)} = 782.93$	0.1302* i.e. 13.02%

$$* \sqrt{\left(\frac{1,000}{782.93}\right)} - 1 = 0.1302$$

Question 16:

The Investment portfolio of a bank is as follows:

Government Bond	Coupon Rate	Purchase rate (F.V. ₹ 100 per Bond)	Duration (Years)
G.O.I. 2006	11.68	106.50	3.50
G.O.I. 2010	7.55	105.00	6.50
G.O.I. 2015	7.38	105.00	7.50
G.O.I. 2022	8.35	110.00	8.75
G.O.I. 2032	7.95	101.00	13.00

Face value of total Investment is ₹ 5 crores in each Government Bond.

Calculate actual Investment in portfolio.

What is a suitable action to churn out investment portfolio in the following scenario?

- Interest rates are expected to lower by 25 basis points.
- Interest rates are expected to raise by 75 basis points.
- Also calculate the revised duration of investment portfolio in each scenario.

ANSWER:**Calculation of Actual investment of Portfolio**

Security	Purchase price	Investment (₹ in lakhs)
GOI 2006	106.50	532.50*
GOI 2010	105.00	525.00
GOI 2015	105.00	525.00
GOI 2022	110.00	550.00
GOI 2032	101.00	505.00
Total		2,637.50

$$* \frac{\text{₹ 5 Crores}}{\text{₹ 100} \times 1,00,000} \times \text{₹ 106.50}$$

$$\text{Average Duration} = \frac{3.5 + 6.5 + 7.5 + 8.75 + 13.00}{5} = \frac{39.25}{5} = 7.85$$

Suitable action to churn out investment portfolio in following scenario is to reduce risk and to maximize profit or minimize losses.

- Interest rates are expected to be lower by 25 basis points in such case increase the average duration by purchasing GOI 2032 and Disposing of GOI 2006.

$$\text{Revised average duration shall be} = \frac{39.25 - 3.5 + 13}{5} = \frac{48.75}{5} = 9.75 \text{ years}$$

- ii. Interest rates are expected to rise by 75 basis points in such case reduce the average duration by (*) Purchasing GOI 2010 and disposing of GOI 2032.

$$\text{Revised average duration shall be} = \frac{39.25 - 13 + 6.5}{5} = \frac{32.75}{5} = 6.55 \text{ years}$$

(*) Purchasing of GOI 2006 is not beneficial as maturity period is very short and 75 basis points is comparatively higher change.

Question 17:

Sonic Ltd. issued 8% 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 next year. 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.

ANSWER:**(i) Intrinsic value of Bond**

PV of Interest + PV of Maturity Value of Bond

Forward rate of interests

1 st Year	12%
2 nd Year	11.25%
3 rd Year	10.75%

$$\text{PV of interest} = \frac{₹ 80}{(1+0.12)} + \frac{₹ 80}{(1+0.12)(1+0.1125)} + \frac{₹ 80}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹ 193.61$$

$$\text{PV of Maturity Value of Bond} = \frac{₹ 1000}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹ 724.67$$

$$\text{Intrinsic value of Bond} = ₹ 193.61 + ₹ 724.67 = ₹ 918.28$$

- (ii) Expected Price = Intrinsic Value x Beta Value**
 $= ₹ 918.28 \times 1.02 = ₹ 936.65$

Question 18:

The following is the Yield structure of AAA rated debenture:

Period	Yield (%)
3 months	8.5%
6 months	9.25
1 year	10.50
2 years	11.25
3 years and above	12.00

- Based on the expectation theory calculate the implicit one-year forward rates in year 2 and year 3.
- If the interest rate increases by 50 basis points, what will be the percentage change in the price of the bond having a maturity of 5 years? Assume that the bond is fairly priced at the moment at ₹ 1,000.

ANSWER:**i. Implicit rates for year 2 and year 3**

$$\text{For year 2 } f_2 = \frac{(1+r_2)^2}{1+r_1} - 1 = \frac{(1.1125)^2}{(1.1050)} - 1 = 12\%$$

$$\begin{aligned} \text{For year 3 } f_3 &= \frac{(1+r_3)^3}{(1+r_1)(1+f_2)} - 1 \\ &= \frac{(1.12)^3}{(1.1050)(1.12)} - 1 = \frac{1.404928}{1.2376} - 1 = 13.52\% \end{aligned}$$

- If fairly priced at ₹ 1000 and rate of interest increases to 12.5% the percentage charge will be as follows:

$$\text{Price} = \frac{1000(1.12)^5}{(1.125)^5} = \frac{1762.34168}{1.8020} = 977.99 \text{ or } ₹ 987$$

$$\% \text{ charge} = \frac{1000 - 978}{1000} \times 100 = \frac{22}{1000} \times 100 = 2.2\%$$

Question 19:

A bond is held for a period of 45 days. The current discount yield is 6 per cent per annum. It is expected that current yield will increase by 200 basis points and current market price will come down by ₹ 2.50.

Calculate:

- Face value of the Bond and
- Bond Equivalent Yield

ANSWER:**i. Face Value of the Bond**

a.	Current Market Price*	45 days	6	0.9925
b.	Current Market Price*	45 days	8	0.9900
c.	Difference in Price Per Unit (a) – (b)			0.0025
d.	Difference in Price			₹ 2.50
e.	Face Value of Bond (d)/ (c)			₹ 1,000
f.	Current Market Price (a) x (e)		6	₹ 992.50
g.	Current Market Price (b) x (e)		8	₹ 990.00

$$* 1 - [(Discount Rate / 100) \times (45/360)]$$

ii. Bond Equivalent Yield

At the rate of 6%	$\frac{1,000 - 992.50}{992.50} \times \frac{360}{45} \times 100^\dagger$	6.05
At the rate of 8%	$\frac{1,000 - 990.00}{990.00} \times \frac{360}{45} \times 100^\dagger$	8.08

Alternative Solution if 365 days a year are assumed**i. Face Value of the Bond**

			%	
a.	Current Market Price*	45 days	6	0.9926
b.	Current Market Price*	45 days	8	0.9901
c.	Difference in Price Per Unit (a) – (b)			0.0025
d.	Difference in Price			₹ 2.50
e.	Face Value of Bond (d)/ (c)			₹ 1,000
f.	Current Market Price (a) x (e)		6	₹ 992.60
g.	Current Market Price (b) x (e)		8	₹ 990.10

$$* 1 - [(Discount Rate / 100) \times (45/365)]$$

ii. Bond Equivalent Yield

At the rate of 6%	$\frac{1,000 - 992.60}{992.60} \times \frac{360}{45} \times 100$	6.05
At the rate of 8%	$\frac{1,000 - 990.10}{990.10} \times \frac{365}{45} \times 100$	8.11

$$+ \frac{FV - CV}{CV} \times \frac{365}{45} \times 100$$

Question 20:

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?

ANSWER:**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 x_1 be the investment in Bond X and therefore investment in Bond Y shall be $(1 - x_1)$. Since the required duration is 2 year the proportion of investment in each of these two securities shall be computed as follows:

$$2 = x_1 + (1 - x_1) 3.563$$

$$x_1 = 0.61$$

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%	PV of ₹ 1,00,000 for 2 years @ 10% x 39%
= ₹ 1,00,000 (0.826) x 61%	= ₹ 1,00,000 (0.826) x 39%
= ₹ 50,386	= ₹ 32,214
No. of Bonds to be purchased	No. of Bonds to be purchased
= ₹ 50,386/₹ 972.73 = 51.79	= ₹ 32,214/₹ 936.52 = 34.40
i.e. approx. 52 bonds	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.

Note: In the above computation, Modified Duration can also be used instead of Duration.

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Question 1:

A future contract on BSE Index with 4 months maturity is used to hedge the value of the portfolio over the next 3 months. One future contract for delivery is 50 times of the index.

The following information is available:

Value of the portfolio	₹ 1,16,00,000
BSE Sensex on 1st January 2022	58580
(Anticipated on 1st September 2021)	
BSE Sensex on 1st January 2022	56641.25
(Anticipated on 1st December 2021)	
Dividend Yield of Index 6% p.a.	
181 days' treasury bills offers a rate of interest	9% p.a.
Beta of the portfolio	1.5

You are required to calculate

- The present value of the Sensex as on 1st September 2021
- Turned out value of the Sensex as on 1st December 2021
- The number of contracts to hedge the portfolio.

ANSWER:

- (i) Let X be the present value of the Sensex as the 1st September, 2021

$$58,580 = X + X [9\% - 6\%] \times \frac{4}{12}$$

$$58,580 = X + \frac{X}{100}$$

$$X = 58,000$$

Thus, the present value of Sensex as on 1st September 2021 is 58,000

- (ii) Let turned out value of Sensex on 1st Dec. 2021 is Y, then

$$56,641.25 = Y + Y [9\% - 6\%] \times \frac{1}{12}$$

$$56,641.25 = Y + \frac{Y}{400}$$

$$Y = 56,500$$

Thus, turned out value of Sensex on 1st December 2021 is 56,500

- (iii) No. of Contract to the Hedge Portfolio = $\frac{₹1,16,00,000 \times 1.50}{58,580 \times 50} = 5.95$ Say 6 Contracts

Question 2:

The following information is available about standard gold.

Spot Price (SP)	Rs. 15,600 per 10 gms.
Future Price (FP)	Rs. 17,100 for one year future contract
Risk free interest Rate (R_f)	8.5%
Present Value of Storage Cost	Rs. 900 per year

From the above information you are requested to calculate the Present Value of Convenience yield (PVC) of the standard gold.

ANSWER:

$$\frac{FP}{(1+r_f)^t} = SP + PVS - PVC$$

$$PVC = SP + PVS - \frac{FP}{(1+r_f)^t}$$

Accordingly,

$$= Rs. 15600 + Rs. 900 - \frac{Rs. 17100}{(1+0.085)^1}$$

$$= Rs. 15600 + Rs. 900 - Rs. 15760$$

$$= Rs. 16500 - Rs. 15760 = Rs. 740$$

Question 3:

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:

- Dispose off a part of his existing portfolio to acquire risk free securities, or
- Take appropriate position on Nifty Futures, currently trading at 8250 and each Nifty points multiplier is ₹ 210.

You are required to:

- Interpret the opinion of CEO, whether it is correct or not.
- Calculate the existing systematic risk of the portfolio,
- Advise the value of risk-free securities to be acquired,
- Advise the number of shares of each company to be disposed off,
- Advise the position to be taken in Nifty Futures and determine the number of Nifty contracts to be bought/sold; and
- 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.

ANSWER:

- (a) Yes, the apprehension of CEO is correct as the current portfolio is more 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)	β (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	<u>2000.00</u>	<u>0.10</u>	1.70	<u>0.17</u>
			<u>20000.00</u>	1.00		<u>1.40</u>

- (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

$$0.95 = 0 \times p + 1.40 (1 - p)$$

$$p = 0.32 \text{ i.e. } 32\%$$

Shares to be disposed off to reduce beta ($20000 \times 32\%$) ₹ 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% ($2\% \times 1.40$) rise for portfolio of shares

	₹ Lakh
Current Value of Portfolio of Shares	20000
Value of Portfolio after rise	20560
Mark-to-Market Margin paid ($8250 \times 0.020 \times ₹ 210 \times 519$)	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 4:

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,

- Please advise Mr. P how to hedge his market exposure using the available data.
- Calculate the profit or loss of Mr. P during the expiry of September 2021 futures in following situation:
 - Nifty Future rise by 10%
 - ML Ltd. falls by 5%
- Is it possible stock as well as nifty to raise or fall at the same percentage? Please state the reason.

ANSWER

- (i) To hedge his market exposure Mr. P should take short position in the Nifty Futures.

$$\text{No. of Contract of Nifty Future to be Short} = \frac{1.25 \times \text{Rs. } 700 \times 1,000}{17,500 \times 50} = 1$$

- (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 5:

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.

ANSWER:

(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

$$= (\text{₹ } 59 - \text{₹ } 58) \times 22,000 \text{ kg.} = \text{₹ } 22,000$$

Revenue from the sale of Rice

$$= 22,000 \times \text{₹ } 57 = \text{₹ } 12,54,000$$

$$\text{Total Cash Flow} = \text{₹ } 12,54,000 + \text{₹ } 22,000 = \text{₹ } 12,76,000$$

$$\text{Cash Flow per kg. of Rice} = \frac{\text{₹ } 12,76,000}{22,000} = \text{₹ } 58$$

Question 6:

LMN Ltd. is an export oriented business house based in Mumbai. The Company invoices in customer's currency. The receipt of US \$ 6,00,000 is due on 1st September, 2016.

Market information as at 1st June 2016 is :

Exchange Rates	US\$/₹	Exchange Rates US \$ / ₹	Contract Size
Spot	0.01471	Currency Futures	
1 Month Forward	0.01464	June 0.01456	₹ 30,00,000
3 Months Forward	0.01458	September 0.01449	

	Initial Margin (₹)	Interest Rates in India %
June	12,000	8.00 p.a.
September	16,000	8.50 p.a.

On 1st September, 2016, the spot rate US \$/₹ is 0.01461 and currency futures rate is US\$/₹ 0.01462.

It may be assumed that variation in Margin would be settled on the maturity of the futures contract.

Which of the following methods would be most advantageous for LMN Ltd.:

- using Forward Contract,
- using Currency Futures; and
- not hedging Currency Risks

Show the calculations and comment.

ANSWER:

Receipts using a forward contract (6,00,000/0.01458)	= ₹4,11,52,263
Receipts using currency futures	
The number of contracts needed is	
(6,00,000/0.01449)/30,00,000 = 13.80 say 14 contracts	
Initial margin payable is 14 x ₹ 16,000 = ₹ 2,24,000	
On September 1 Close at 0.01462	
Receipts = US\$6,00,000/0.01461	= 4,10,67,762
Variation Margin = [(0.01462 – 0.01449) x 14 x 30,00,000/-]/0.01461	
OR (0.00013x14x3000000)/.01461 = 5,460/0.01461	3,73,717
	4,14,41,479
Less: Interest Cost – 2,24,000 x 0.085 x 3/12	₹4,760

Net Receipts	<u>₹ 4,14,36,719</u>
Receipts under different methods of hedging	
Forward contract	₹4,11,52,263
Futures	₹4,14,36,719
No hedge	
US\$ 6,00,000/0.01461	₹ 4,10,67,762
The most advantageous option would have been to hedge with futures.	

Question 7:

X Inc. an American firm is under obligation to pay interests of Can\$ 20,20,000 and Can\$ 14,10,000 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 (US\$/Can\$)	Calls		Puts	
	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?

ANSWER:**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
<u>Option Costs:</u>				
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 8:

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.

ANSWER:**(i) Forward Cover**

$$\text{3-month Forward Rate} = \frac{1}{1.9726} = ₹ 0.5070/\text{JY}$$

Accordingly, INR required for JY 5,00,000 (5,00,000 X ₹ 0.5070) ₹ 2,53,500

(ii) Option Cover

To purchase JY 5,00,000, XYZ shall enter into a Put Option @ JY 2.125/INR

$$\text{Accordingly, outflow in INR} \left(\frac{\text{JY } 5,00,000}{2.125} \right) \quad ₹ 2,35,294$$

$$\text{Premium} \left(\frac{\text{INR } 2,35,294 \times 0.098}{1.9516} \right) \quad ₹ 11,815$$

$$\quad \quad \quad ₹ 2,47,109$$

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.

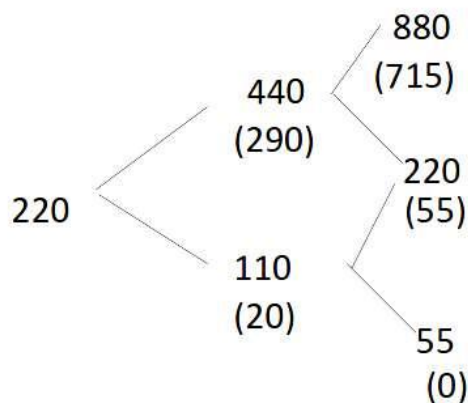
Question 9:

X Ltd.'s share is currently trading at Rs. 220. It is expected that in six months some it could double or halved (equivalent to a $\sigma=98\%$). One year call option on X Ltd.'s share has an exercise price of Rs. 165. Assuming risk free rate of interest to be 20%, calculate.

- Value of call option on X Ltd's share.
- Option Delta for the second six month, in case stock price rises to Rs. 440 or falls to Rs. 110.
- Now suppose in 6 months the share price is Rs. 110. How at this point we can replicate portfolio of call options and risk-free lending.

ANSWER:

The possible prices of X Ltd.'s share and the associated call option values shown below:



- a. Let p is the probability of a rise in the stock price. Then, if investors are risk-neutral:

$$p(1.00) + (1 - p)(-0.50) = 0.10$$

$$p = 0.4$$

If the stock price in month 6 is Rs.110, then the option will not be exercised. So expected value of call option is:

$$[(0.4 \times \text{Rs.}55) + (0.6 \times \text{Rs.}0)]$$

And its worth to be

$$[(0.4 \times \text{Rs.}55) + (0.6 \times \text{Rs.}0)]/1.10 = \text{Rs.}20$$

Similarly, if the stock price is Rs.440 in month 6, then, if it is exercised. The expected value of call option is

$$[(0.4 \times \text{Rs.}715) + (0.6 \times \text{Rs.}55)]$$

And it will be worth

$$[(0.4 \times \text{Rs.}715) + (0.6 \times \text{Rs.}55)]/1.10 = \text{Rs.}290$$

Value of call today is:

$$[(0.4 \times \text{Rs.}290) + (0.6 \times \text{Rs.}20)]/1.10 = \text{Rs.}116.36$$

- b. (i) If the price rises to Rs.440:

$$\text{Delta} = \frac{\text{Rs.}715 - \text{Rs.}55}{\text{Rs.}880 - \text{Rs.}220} = 1.0$$

- (ii) If the price falls to Rs.110:

$$\text{Delta} = \frac{\text{Rs.}55 - 0}{\text{Rs.}220 - \text{Rs.}55} = 0.33$$

- c. If the stock price is Rs.110 at 6 months, the option delta is 0.33. Therefore, in order to replicate the stock, we buy three calls and lend, as follows:

	Initial Outlay	Stock Price = 55	Stock Price = 220
Buy 3 calls	-60	0	165
Lend PV(55)	<u>-50</u>	+55	+55
	-110	+55	+220
This strategy is equivalent to:			
Buy stock	-110	+55	+220

Question 10:

You are trying to value a long term call option on the Standard and Poor's 500, expiring in 2 months, with a strike price of \$900. The index is currently at \$930, and the annualized standard deviation in stock prices is 20% per annum. The average dividend yield on the index is 0.3% per month, and is expected to remain unchanged over the next month. The treasury bond rate is 8%.

- Estimate the value of the long term call option.
- Estimate the value of a put option, with the same parameters.
- What are the implicit assumptions you are making when you use the Black-Scholes model to value this option?

Which of these assumptions are likely to be violated? What are the consequences for your valuation?

ANSWER:

(a) $S_0 = 930$

$K = 900$

$t = 2/12$

$r_f = 8\%$

$r = 3\%$

$\sigma^2 = (0.20)^2$

$c = S_0 e^{-r_f T} N(d_1) - X e^{-r T} N(d_2)$

where $d_1 = \frac{\ln(S_0 / X) + (-r_f + \sigma^2 / 2) T}{\sigma \sqrt{T}}$

$d_2 = \frac{\ln(S_0 / X) + (-r_f + \sigma^2 / 2) T}{\sigma \sqrt{T}}$

$d_1 = \frac{\ln(930/900) + (0.08 - 0.3 + 0.2^2) / 12}{0.2 \sqrt{2/12}} = 0.544$

$d_2 = \frac{\ln(930/900) + (0.08 - 0.3 + 0.2^2) / 12}{0.2 \sqrt{2/12}} = 0.4628$

$N(d_1) = 0.7069$

$N(d_2) = 0.6782$

$$C = \$930 \times 0.7069 \times e^{-0.03 \times 2/12} - \$900 \times 0.6782 \times e^{-0.08 \times 2/12}$$

$$C = \$930 \times 0.7069 \times 0.9950 - \$900 \times 0.6782 \times 0.9867$$

$$C = \$654.13 - \$602.26$$

$$C = \$51.87$$

(b) Value of put with same parameters

$$p = Xe^{-rT} N(-d_2) - S_0 e^{-r_f T} N(-d_1)$$

$$N(-d_1) = 0.2932$$

$$N(-d_2) = 0.3217$$

$$P = \$900 \times 0.3217 \times 0.9867 - \$930 \times 0.2932 \times 0.9950$$

$$P = \$285.68 - \$271.31$$

$$P = \$14.37$$

- (c)**
- (1) The variance will be unchanged for the life of the option. This is likely to be violated because stock price variances do change substantially over time.
 - (2) There will be no early exercise. This is reasonable and is unlikely to be violated.
 - (3) Any deviations from the option value will be arbitrated away.

While there are plenty of arbitrageurs eager to exploit deviations from true value, arbitraging an index is clearly more difficult to do than arbitraging an individual stock.

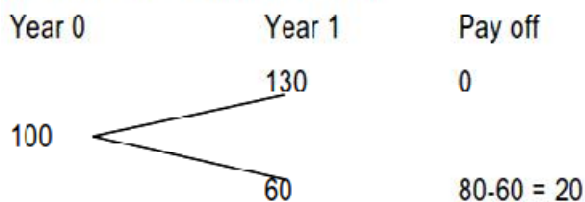
Question 11:

IPL already in production of Fertilizer is considering a proposal of building a new plant to produce pesticides. Suppose, the PV of proposal is Rs. 100 crore without the abandonment option. However, if market conditions for pesticide turns out to be favourable the PV of proposal shall increase by 30%. On the other hand if market conditions remain sluggish the PV of the proposal shall be reduced by 40%. In case company is not interested in continuation of the project it can be disposed off for Rs. 80 crore.

If the risk free rate of interest is 8% than what will be value of abandonment option.

ANSWER:

Decision Tree showing pay off



First of all we shall calculate probability of high demand (p) using risk neutral method as follows:

$$8\% = p \times 30\% + (1-p) \times (-40\%)$$

$$0.08 = 0.30p - 0.40 + 0.40p$$

$$p = \frac{0.48}{0.70} = 0.686$$

The value of abandonment option will be as follows:

Expected Payoff at Year 1

$$= p \times 0 + [(1-p) \times 20]$$

$$= 0.686 \times 0 + [0.314 \times 20]$$

$$= \text{Rs. } 6.28 \text{ crore}$$

Since expected pay off at year 1 is 6.28 crore. Present value of expected pay off will be:

$$\frac{6.28}{1.08} = 5.81 \text{ crore.}$$

This, the value of abandonment option (Put Option).

Question 12:

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

ANSWER:

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):

$$\begin{aligned}
 Z &= \frac{x - \mu}{\sigma} \\
 &= \frac{-1.00 \text{ crore} - 2.00 \text{ crore}}{1.60 \text{ crore}} \\
 &= -1.875 \text{ say } 1.875
 \end{aligned}$$

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 13:

Mr. Careless was employed with ABC Portfolio Consultants. The work profile of Mr. Careless involves advising the clients about taking position in Future Market to obtain hedge in the position they are holding. Mr. ZZZ, their regular client purchased 100,000 shares of X Inc. at a price of \$22 and sold 50,000 shares of A plc for \$40 each having beta 2. Mr. Careless advised Mr. ZZZ to take short position in Index Future trading at \$1,000 each contract.

Though Mr. Careless noted the name of A plc along with its beta value during discussion with Mr. ZZZ but forgot to record the beta value of X Inc.

On next day Mr. ZZZ closed out his position when:

- Share price of X Inc. dropped by 2%
- Share price of A plc appreciated by 3%
- Index Future dropped by 1.5%

Mr. ZZZ, informed Mr. Careless that he has made a loss of \$114,500 due to the position taken. Since record of Mr. Careless was incomplete he approached you to help him to find the number of contract of Future contract he advised Mr. ZZZ to be short to obtain a complete hedge and beta value of X Inc.

You are required to find these value.

ANSWER:

Let the number of contract in Index future be y and Beta of X Inc. be x. Then,

$$\frac{100,000 \times 22 \times x - 50,000 \times 40 \times 2}{1,000} = -y^*$$

* Negative (-) sign indicates the sale (short) position

$$2,200,000x - 4,000,000 = -1,000y$$

Cash Outlay (Outflow)

Purchase of 100,000 shares of X Inc. at a price of \$22 (100,000 × 22)	2,200,000
Sale of 50,000 shares of A plc for \$40 (50,000 × 40)	– 2,000,000
Short Position in Index Futures (1,000 × y)	-1,000y*
Net	200,000 – 1,000y

* Negative (-) sign indicates the indicates inflow due to sale (short) position

Cash Inflow

Sale of 100,000 shares of X Inc. $(100,000 \times 22 \times 0.98)$	2,156,000
Purchase of 50,000 shares of A plc $(50,000 \times 40 \times 1.03)$	– 2,060,000
Long Position in Index Futures $(1,000 \times y \times 0.985)$	-985y
Net	96,000 – 985y

* Negative (-) sign indicates the indicates outflow due to purchase (long) position

Position on Close Out

$$(200,000 - 1,000 y) - (96,000 - 985y) = 114,500$$

$$y = -700$$

Thus number of future contract short is 700

Beta of X Inc. can be calculated as follows:

$$2,200,000x - 4,000,000 = -1000 \times 700$$

$$2,200,000x = 3,300,000$$

$$x = 1.5$$

Thus Beta of X Inc. shall be 1.5

Question 14:

Espaceplc 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 deposits 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 £25 million for the entire period of slack season in about 3 months.

The banker of the firm has given the following quotations for Forward Rate Agreement (FRA):

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.

You are required to:

- Advise the position to be taken in Future Market by the firm to hedge its interest rate risk and demonstrate how 3 months Future contract shall be useful for the firm, if later interest rate turns out to be (i) 4.5% and (ii) 6.5%
- Evaluate whether the interest cost to Espaceplc shall be less had it adopted the route of FRA instead of Future Contract.

Note:- Ignore the time value of money in settlement amount for future contract.

ANSWER:

- (a) (i) 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.

$$\begin{aligned}
 \text{No. of Contracts} &= \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Duration of Loan}}{3 \text{ months}} \\
 &= \frac{\text{£ } 25,000,000}{\text{£ } 50,000} \times \frac{6}{3} = 1000 \text{ Contracts}
 \end{aligned}$$

(ii) 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%
<i>Future Course Action :</i>		
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	$\text{£ } 50,000 \times 1000 \times 1.35\% \times 3/12$ = £1,68,750	$\text{£ } 50,000 \times 1000 \times 0.65\% \times 3/12$ = (£81,250)
Interest for 6 months on £50 million at actual rates	$\text{£ } 25 \text{ million} \times 4.5\% \times \frac{1}{2}$ = £ 5,62,500	$\text{£ } 25 \text{ million} \times 6.5\% \times \frac{1}{2}$ = £ 8,12,500
	£ 7,31,250	£ 7,31,250

Thus, the firm locked itself in interest rate $\frac{\text{£ } 7,31,250}{\text{£ } 25,000,000} \times 100 \times \frac{12}{6} = 5.85\%$

- (b) No, the interest cost shall not be less for Espace plc had it taken the route of FRA, as the 3 x 9 FRA contract are available at 5.64% – 5.94% i.e. borrowing rate of 5.94%. Hence, the interest cost under this option shall be nearby by 5.94% which is more than interest rate under Future contract rate of 5.85%.

Question 15:

TMC Corporation entered into €3.5 million notional principal interest rate swap agreement. As per the agreement TMC is to pay a fixed rate and to receive a floating rate of LIBOR.

The Payment will be made at the interval of 90 days for one year and it will be based on the adjustment factor 90/360. The term structure of LIBOR on the date of agreement is as follows:

Days	Rate (%)
90	7.00
180	7.25
270	7.45
360	7.55

You are required to calculate fixed rate on the swap and first net payment on the swap.

ANSWER:

- (i) The discount bond prices are as follows:

Term	Rate%	Discount Bond Price
90 days	7.00	$B_0(90) = 1/(1 + 0.07(90/360)) = 0.9828$
180 days	7.25	$B_0(180) = 1/(1 + 0.0725(180/360)) = 0.9650$
270 days	7.45	$B_0(270) = 1/(1 + 0.0745(270/360)) = 0.9471$
360 days	7.55	$B_0(360) = 1/(1 + 0.0755(360/360)) = 0.9298$

The fixed rate is

$$\left(\frac{1 - 0.9298}{0.9828 + 0.9650 + 0.9471 + 0.9298} \right) \times \left(\frac{360}{90} \right) = 0.0734$$

- (ii) The first net payment is based on a fixed rate of 7.34 percent and a floating rate of 7 percent:

Fixed payment: €35,00,000(0.0734)(90/360) = €64,225

Floating payment: €35,00,000(0.07)(90/360) = €61,250

The net is that the party paying fixed makes a payment of €2,975

Question 16:

ABC Bank is seeking fixed rate funding. It is able to finance at a cost of six months LIBOR + 1/4% for ₹ 200 million for 5 years. The bank is able to swap into a fixed rate at 7.5% versus six month LIBOR treating six months as exactly half a year.

- What will be the "all in cost" funds to ABC Bank?
- Another possibility being considered is the issue of a hybrid instrument which pays 7.5% for first three years and LIBOR – ¼% for remaining two years.

Given a three year swap rate of 8%, suggest the method by which the bank should achieve fixed rate funding.

ANSWER:

- ABC Bank pays LIBOR + 0.25% p.a. for 5 years. The swap involves payment of 7.5% p.a. and receipt of LIBOR.

In flow	Out flow
LIBOR	LIBOR + 0.25% + 7.5%
Net interest payment	7.75%

Cash flows per six month period

In flow	Out flow
(LIBOR/2) x ₹200 million	(LIBOR/2) x ₹200 million + ₹2,50,000 + ₹ 75,00,000

Therefore All in cost of funds = ₹ 77,50,000.

Alternatively it can also be calculated as follows:

$$₹ 200 \text{ million} \times 7.75\% \times \frac{6}{12} = ₹ 7.75 \text{ million or } ₹ 77,50,000$$

- ABC Bank issues hybrid and enters both the five year and three year swaps.

First three years:

Bank pays on hybrid	7.5% p.a.
Bank pays on five year swap	7.5% p.a.
Bank receives on three year swap	8% p.a.
Bank receives on five year swap	LIBOR
Bank pays on three year swap	LIBOR
Net interest payment	7% p.a.

Final two years:

Bank pays on hybrid	LIBOR – 0.25%
Bank received on five year swap	LIBOR
Bank pays on five year swap	7.5% p.a.
Net interest payment	7.25% p.a.

Therefore the arrangement in (b) compared to (a) saves 0.75 p.a. over the first three years and 0.5% p.a. over final two years.

Question 17:

MPD Ltd. issues a ₹50 Million Floating Rate Loan on July 1, 2018 with resetting of coupon rate every 6 Months equal to LIBOR + 50 bps.

MPD is interested in an Interest rate Collar Strategy of 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
Strike Rate	5% for Floor & 8% for Cap
Reference Rate	6 months LIBOR
Premium	NIL, since premium paid for cap = premium received for Floor

The Reset dates & Interest rates p.a., on that dates are:

Reset Date	31/12/2018	30/06/2019	31/12/2019	30/06/2020	31/12/2020	30/06/2021
LIBOR (%)	7.00	8.00	6.00	4.75	4.25	5.25

Using the above data, you are required to determine:

- Effective Interest paid out at each six reset dates, (Round off to the nearest rupee)
- Average overall effective rate of interest p.a. (round off to 2 decimals)

ANSWER:

- (i) The pay-off of each leg shall be computed as follows:

Cap Receipt

Max {0, [Notional principal x (LIBOR on Reset date – Cap Strike Rate) x (No. of days in settlement period/ 365)}

Floor Pay-off

Max {0, [Notional principal x (Floor Strike Rate – LIBOR on Reset date) x (No. of days in settlement period/ 365)}

Statement showing effective interest on each payment 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	182	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

(ii) 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 18:

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.

ANSWER:

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 19:

TRC Cables Ltd. (an Indian Company) is in the business of manufacturing Electrical Cables and Data Cables including Fiber Optics cables. While mainly it exports the manufactured cables to other countries it has also established its production facilities at some African countries' due availability of raw material and cheap labour there. Some of the major raw material such as copper, aluminum and other non-ferrous metals are also imported from foreign countries. Hence overall TRC has frequent receipts and expenditure items denominated in Non-INR currencies.

Though TRC make use of Long-Term Debts and Equity to meet its long term fund requirements but to finance its operations it make use of short-term financial instruments such as Commercial Papers, Bank Credit and Term Loans from the banks etc. If any surplus cash is left with TRC it is invested in interest yielding securities. Recently due to stiff competition from its competitors TRC has relaxed its policy for granting credit and to manage receivables it has formed a separate credit division.

Further to hedge itself against the various risk it has entered into various OTC Derivatives Contracts settled outside the Exchange.

Required:

Evaluate the major risks to which TRC Ltd. is exposed to.

ANSWER:

Following are main categories of risks to which TRC Cables is exposed to:

- (i) Financial Risks: TRC is exposed to following financial risks:
 - (1) Currency Risk: Since most of the Receipts and Payments of TRC are denominated in Non-INR currencies it is exposed to Currency Risk.
 - (2) Commodity Risk: As major constituents of production of TRC are commodities such copper, aluminum etc. it is subject to Commodity Risk.
 - (3) Interest Rate Risk: As TRC borrows and invest money in short-term instruments it is exposed to Interest Rate Risk.
 - (4) Counter Party Risk: Due to relaxation of norms for granting credits certainly the receivable amount must have increased resulting in increased in Credit Risk.
 - (5) Liquidity Risk: Since for short-term funding requirements TRC is using Commercial Papers etc. they are exposed to Liquidity Risk as in time of need if funds are not available from these sources then securities shall be sold at discounted price.
 - (6) Political Risk: As TRC is operating in various other countries it is also exposed to Political Risks such as Restriction on Conversion of local earnings into foreign currency, restrictions on remittance etc.
- (ii) Settlement Risk: The use of OTC Derivatives by TRC also expose it to the settlement risk as the parties with whom it has entered into the contract may not honor the same.

Question 19:

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.

ANSWER:

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 / $\sqrt{\text{No. of days}} = 699000 / \sqrt{4}$	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 20:

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).

ANSWER:

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 -

$$V = 2^2 + 2^2 + 2 \times 0.3 \times 2 \times 2 = 10.4 \text{ lakh}$$

Standard Deviation of the portfolio's daily change = $\sqrt{10.4} = ₹ 3.2249 \text{ lakhs}$

The standard deviation of the 10-day change

$$= ₹ 3.2249 \text{ lakhs} \times \sqrt{10} = ₹ 10.1981 \text{ lakhs}$$

Therefore, the 10-days 99% VAR = $2.33 \times ₹ 10.1981 \text{ lakhs} = ₹ 23.7616 \text{ lakhs}$