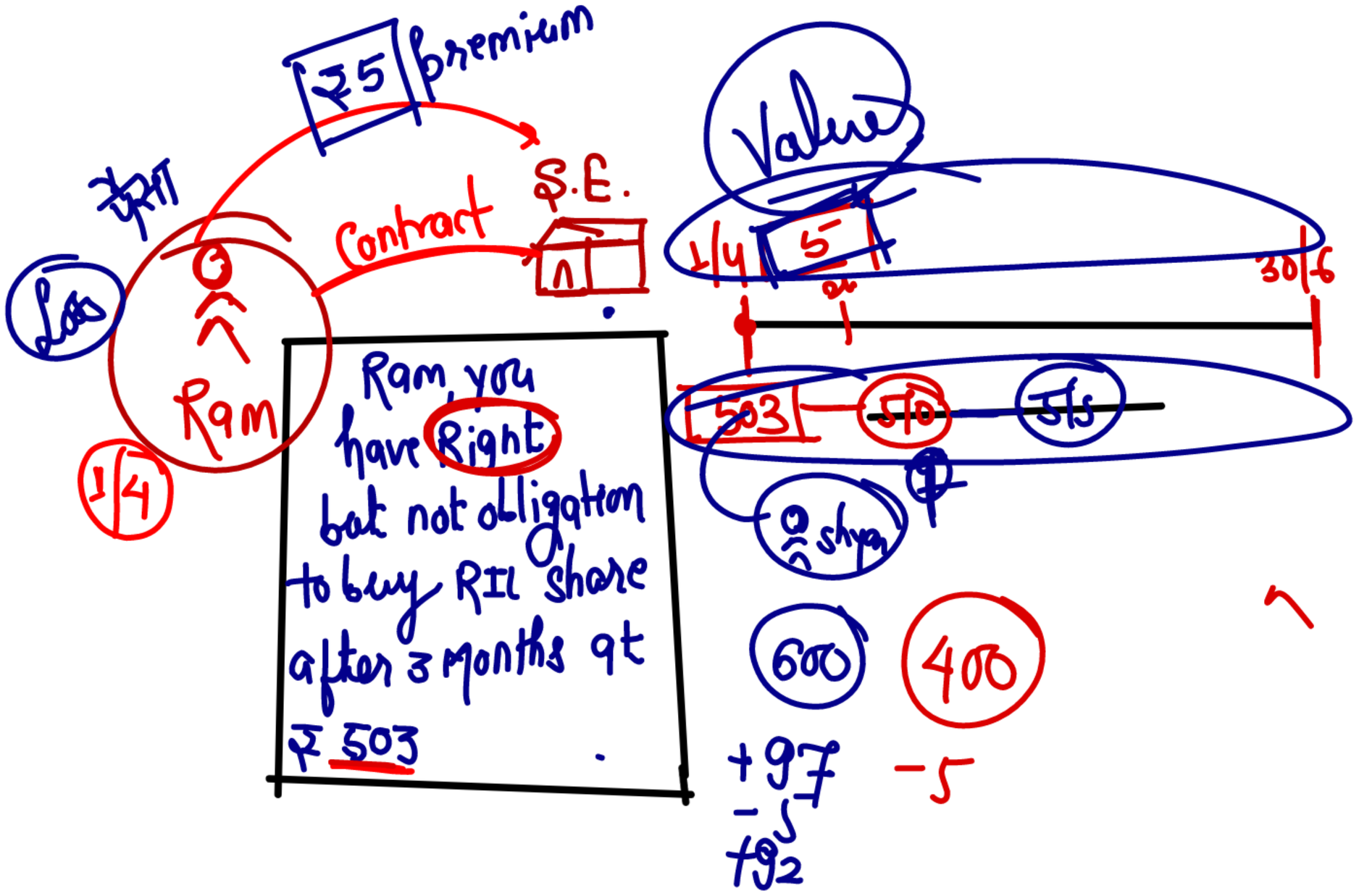
DERIVATIVES [8 to 16 Marks]

Derivative is a financial intruments & it derives its value from an underlying asset.

Underlying asset means share, Bonds, Commodity, Exchange Rates, Interest Rates etc.

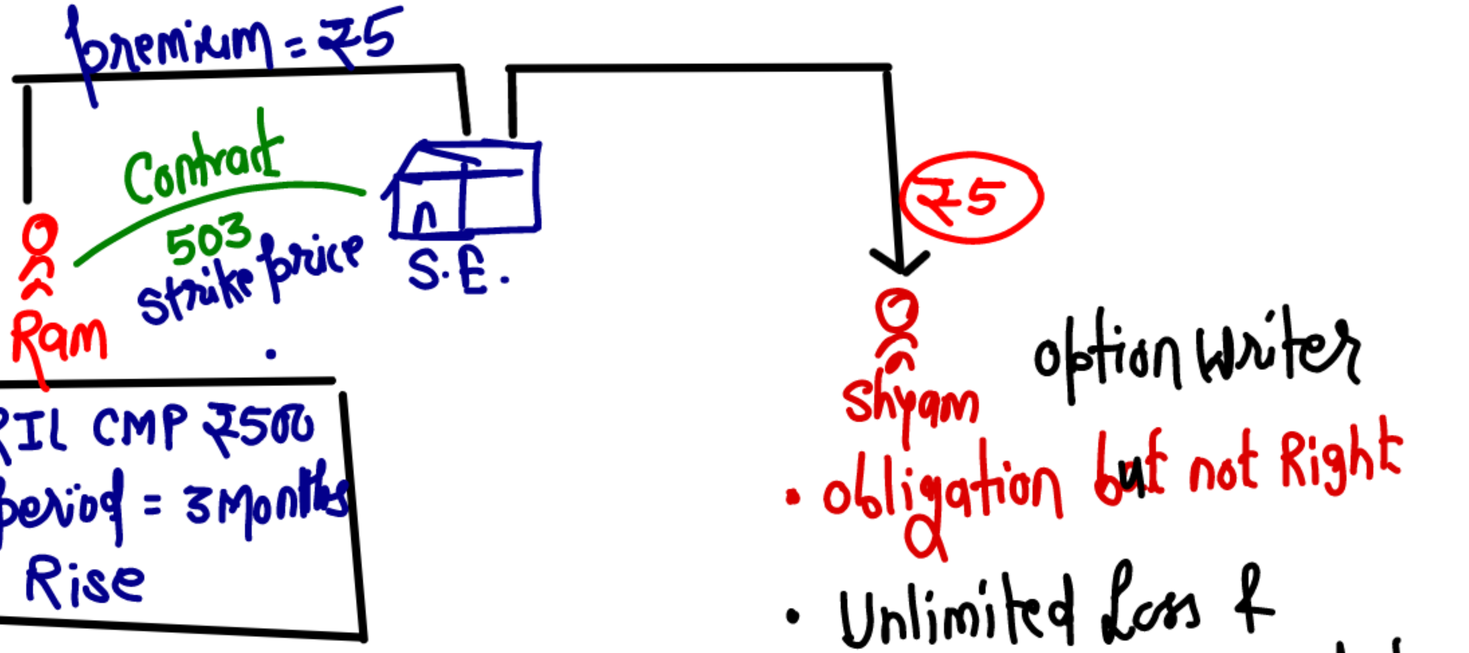
We will discuss this chapter in following parts

PART I option
PART II forward
PATR III future


₹5 premium
S.E.
Contract
Ram
Ram, you have Right but not obligation to buy RIL share after 3 months at ₹ 503
Value
1/4
5
30/6
503
510
515
Q
Q shyam
600
400
+97
-5
-3
+92

PART I option

1. option is a right but not obligation to buy or sell an underlying asset at predetermine price [Exercise price or Strike price). An option premium is to be paid in Advance.
2. There are two parties in option contracts
   - option Buyer or option Holder
   - option Seller or option Writer



option Holder

- Right but not obligation
- Unlimited profit & Loss upto premium
- premium is to be paid in Advance
- Loves Volatility

option Writer

- obligation but not Right
- Unlimited Loss & profit upto premium Amt
- Margin money is required to be deposited at SE
- Hates Volatility

③ There are two options

1. Call option
2. Put option

1. Call option

- Expected to price Rise
- Right to buy

EXAMPLE – 01

Mr. E is interested in buying a share of I.T.C. He is however afraid that the price of the share may move down. Hence, he does not purchase a share but buys a call option on 1 share of I.T.C. at a strike price of ₹ 300 by paying an option premium of ₹ 35.

Required:-

(i) Determine the breakeven point price of Mr. E.

(ii) Determine the Profit/Loss if the price on maturity is: - 250, 270, 290, 300, 320, 340, 350.

(iii) Draw pay off for call option holder.

(iv) Draw pay off for call option writer.

(Page No. 01)

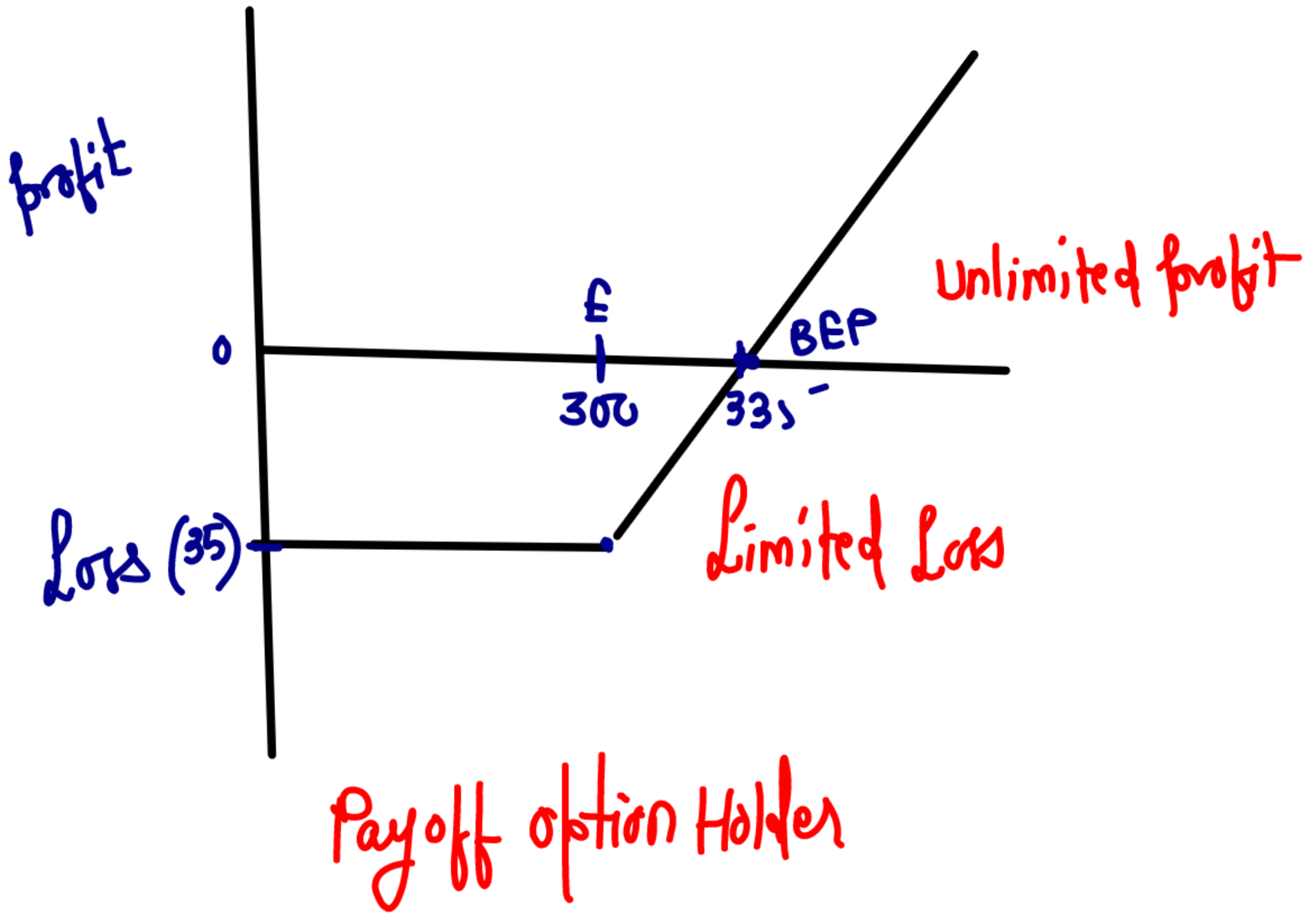
① BEP = EP + premium

= ₹300 + ₹35 = ₹335

② Profit/Loss 300↑

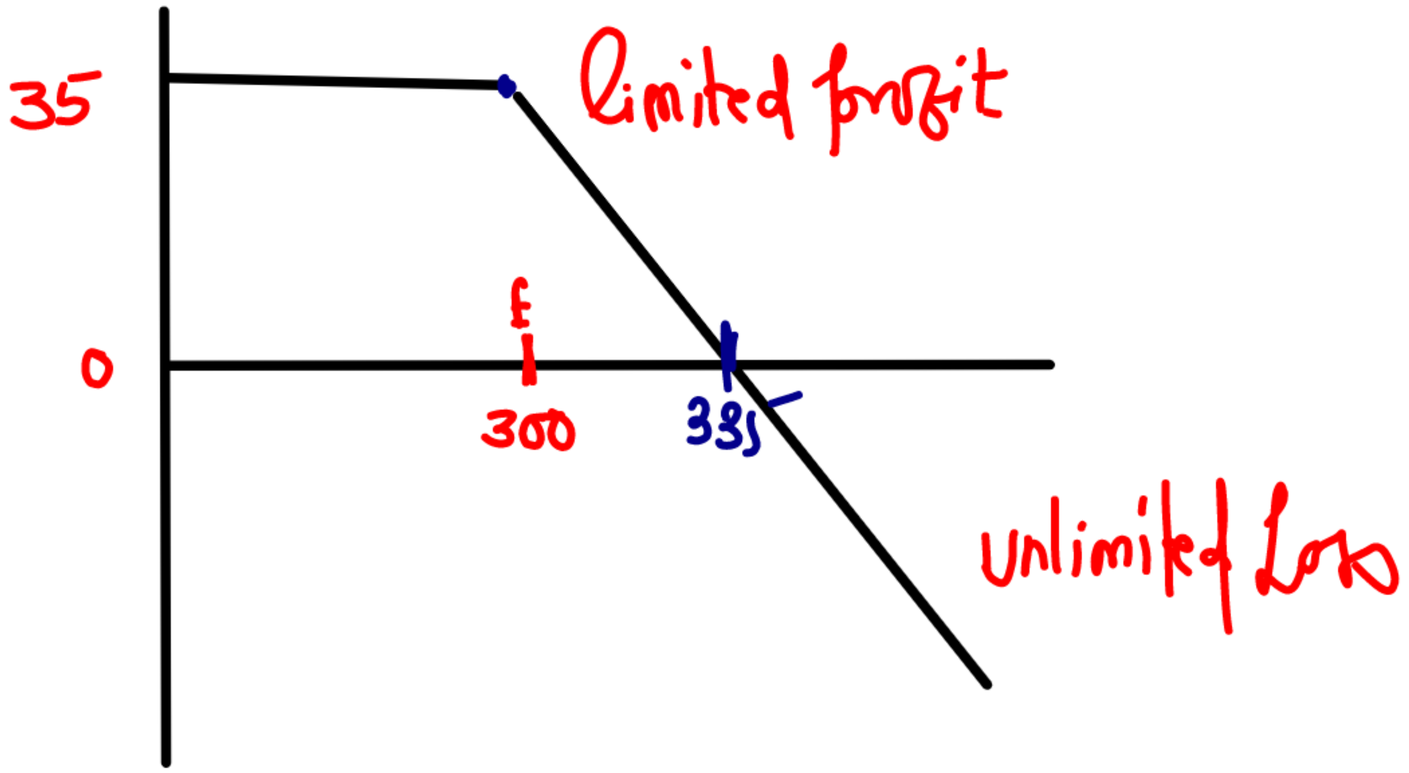
MP	Action	Gross Payoff	Premium	Net Payoff
250	Lapsed	0	(35)	(35)
270	Lapsed	0	(35)	(35)
290	Lapsed	0	(35)	(35)
300	Lapsed	0	(35)	(35)
320	Exercised	20	(35)	(15)
340	Ex.	40	(35)	5
350	Ex	50	(35)	15
335	Ex	35	(35)	0

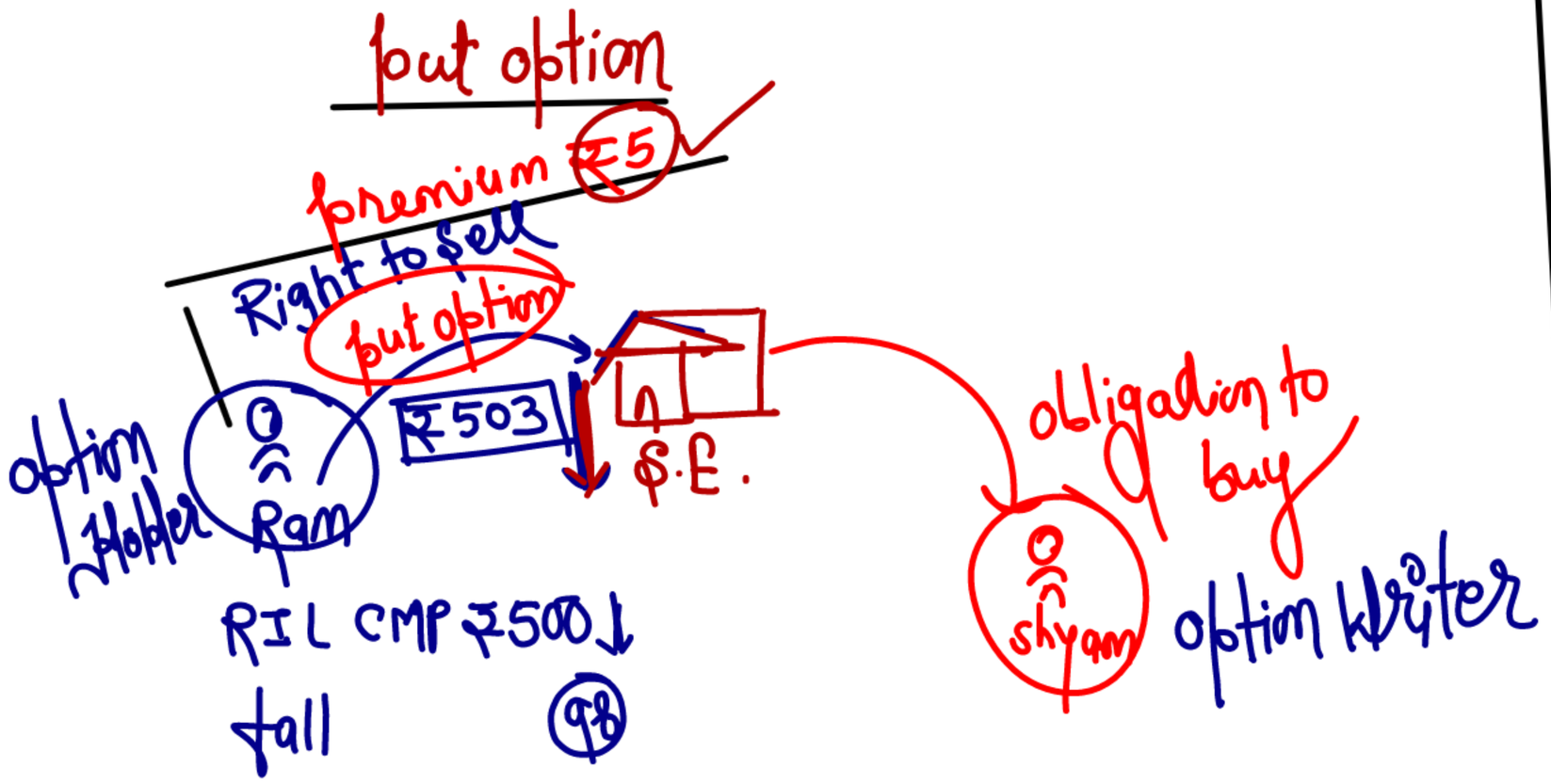
(3)



Payoff option Holder

④ Pay off for option Writer





put option

- Expected to fall in price
- Right to sell

EXAMPLE – 02

Mr. G is hoping that the price of a share of ACC is going to fall. He purchases a put option at an exercise price of ₹ 480. He pays a premium of ₹ 40.

£480↓

Required:-

(i) Determine the breakeven point to Mr. G

(ii) Compute Profit/Loss for Mr. G if the price on maturity is- ₹ 400, 420, 440, 480, 490, 500, 530.

(iii) Draw pay off put option holder.

(iv) Draw pay off put option writer.

(Page No. 01)

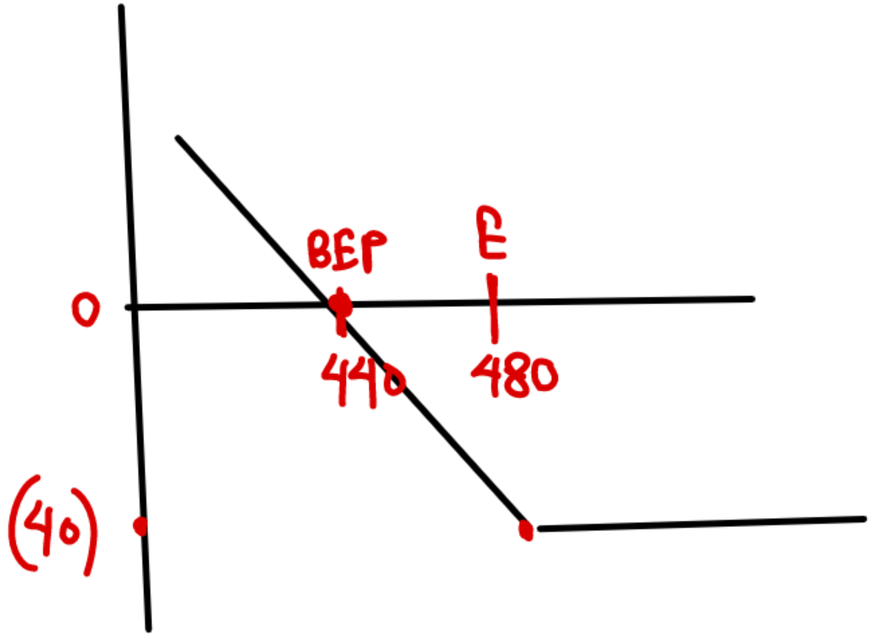
① BEP = EP - premium

= 480 - 40 = 440

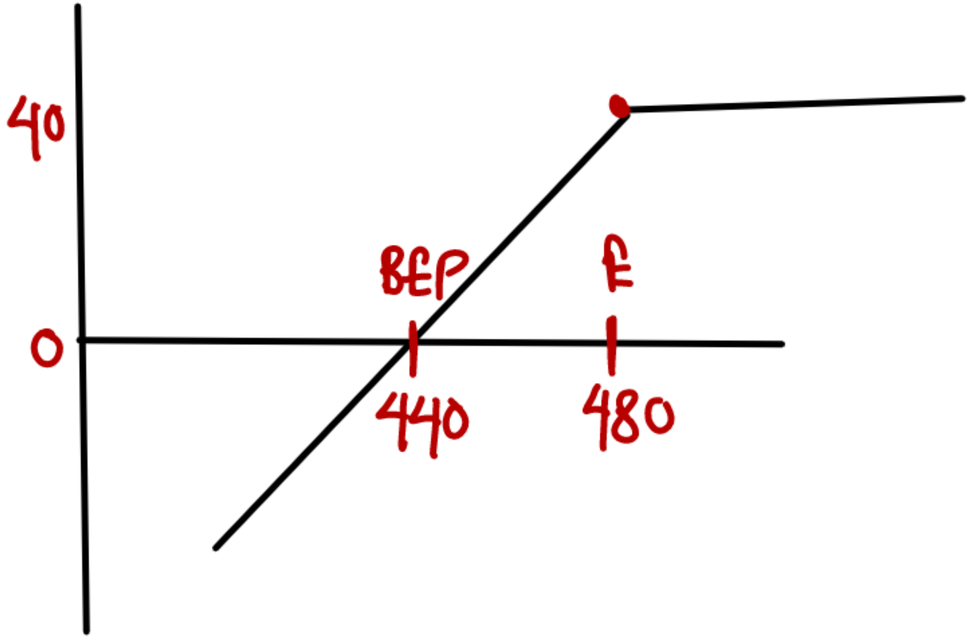
② Calculation of profit/loss £480↓

MP	Action	Gross Payoff	Premium	Net Payoff
400	Exercised	80	(40)	40
420	"	60	(40)	20
440	"	40	(40)	0
480	Lapsed	0	(40)	(40)
490	"	0	(40)	(40)
500	"	0	(40)	(40)
530	"	0	(40)	(40)

③ Payoff for put option Holder



④ Payoff for put option Writer



QUESTION – 01

The equity share of SSC Ltd. is quoted at ₹ 310. A three month call option is available at a premium of ₹ 8 per share and a three month put option is available at a premium of ₹ 7 per share.

Call 320↑ 8

put 320↓ 7

Ascertain the net payoffs to the option holder of a call option and a put option, considering that:

(i) The strike price in both cases is ₹ 320, and

(ii) The share price on the exercise day is ₹ 300, 310, 320, 330 and 340.

Also, indicate the price range at which the call and the put options may be gainfully exercised.

(Exam Nov - 2018)

(Page No. 11)

Calculation of Net payoff (Call option holder)

320↑

MP	Action	Gross Payoff	Premium	Net payoff
300	Lapsed	0	(8)	−8
310	Lapsed	0	(8)	−8
320	Lapsed	0	(8)	−8
330	Exercised	10	(8)	2
340	Exercised	20	(8)	12

Call option is gainfully exercised when price of share on maturity is more than (₹320+8) = ₹328

QUESTION – 03

The equity share of VCC Ltd. is quoted at ₹ 210. A 3-month call option is available at a premium of ₹ 6 per share and a 3-month put option is available at a premium of ₹ 5 per share. Ascertain the net payoffs to the option holder of a call option and a put option separately.

(i) The strike price in both cases in ₹ 220; and

(ii) The share price on the exercise day is ₹ 200,210,220,230,240.

Also indicate the price range at which the call and the put options may be gainfully exercised.

H.W.
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(SM New Syllabus & PM)
(Page No. 13)

QUESTION – 04

Identify the profit or loss (ignoring dealing cost and interest) in each of the following cases:

(a) A call option with an exercise price of ₹ 200 is bought for a premium of ₹ 89. The price of underlying share is ₹ 276 at the expiry date.

(b) A put option with exercise price of ₹ 250 is bought for a premium of ₹ 42. The price of underlying share is ₹189 at the expiry date.

(c) A put option with an exercise price of ₹ 300 is written for a premium of ₹ 57. The price of the underlying share is ₹ 314 at the expiry date.

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(a) Call option is bought at EP ₹200 & paid premium ₹89. On Maturity price of share is ₹276, on this situation Call option will Exercise.

Gross payoff (276-200)	76
(-) premium	89
Loss	13

© A put option is written at EP ₹ 300 & recd premium ₹ 57. On Maturity price of share is ₹ 314 hence put option will Lapse

Gross payoff	= 0
premium recd	= 57
profit	57

Types of option on the basis of Maturity

1. American option

American option can be Exercised on or before maturity.

2. European option

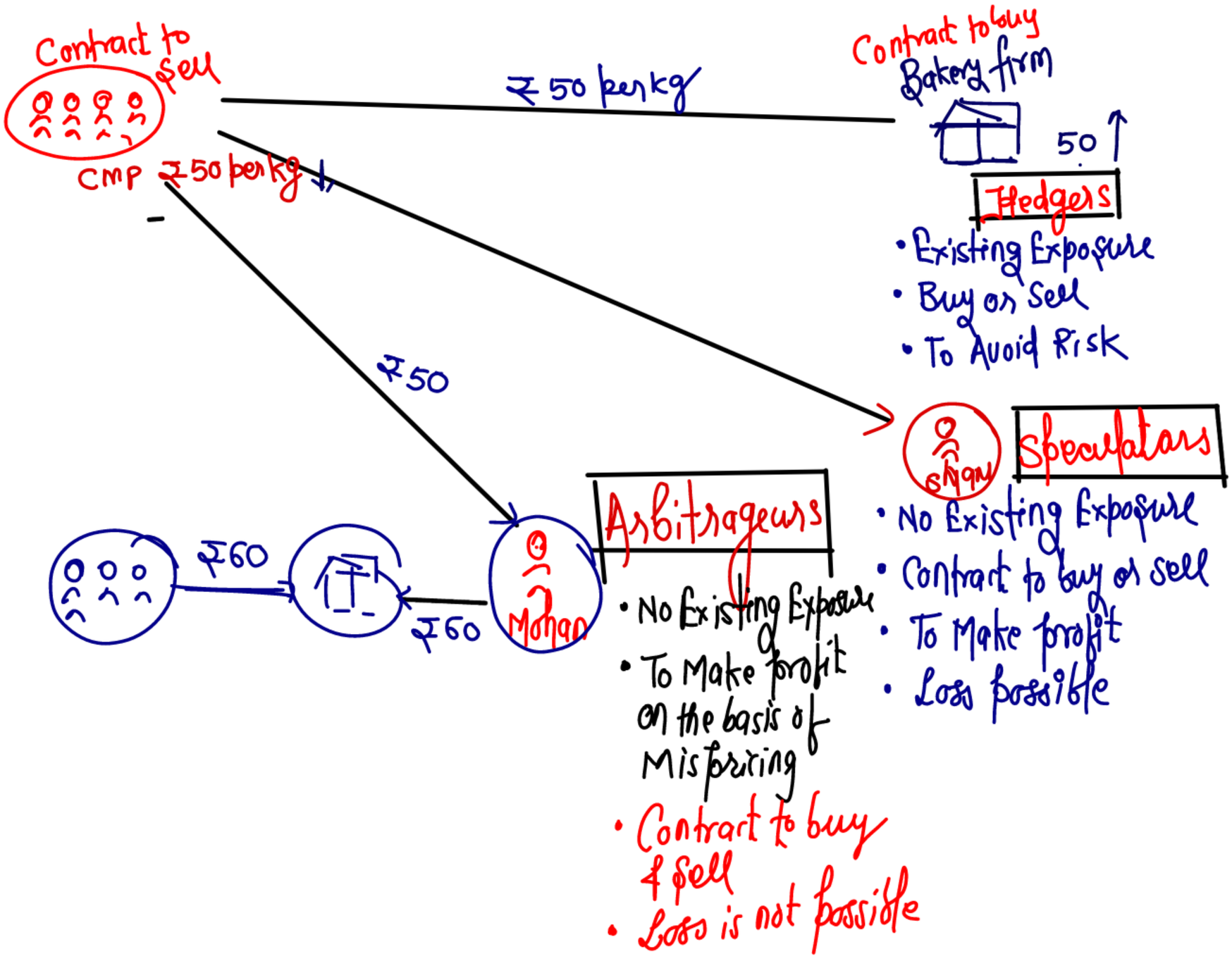
European option can be Exercised only on maturity.

Value of American option is more than Value of European option.

4. Players in Derivative Market

There are three players in Derivative Market

1. Hedgers
2. Speculators
3. Arbitrageurs


Contract to sell
₹50 per kg
Contract to buy
Bakery firm
50
Hedgers
• Existing Exposure
• Buy or Sell
• To Avoid Risk
CMP ₹50 per kg
₹50
Speculators
• No Existing Exposure
• Contract to buy or sell
• To Make profit
• Loss possible
Arbitrageurs
• No Existing Exposure
• To Make profit on the basis of Mispricing
• Contract to buy & sell
• Loss is not possible
₹60
₹60

⑤ In the Money, AT the Money, Out of the Money, Intrinsic Value & Time Value

	ITM	ATM	OTM
Call	CMP > EP	CMP = EP	CMP < EP
put	CMP < EP	CMP = EP	CMP > EP

Intrinsic Value & Time Value

There are two parts of option premium

1. Intrinsic value
2. Time Value or Volatility premium

Call option

- Intrinsic Value = CMP - EP, 0
- Time Value = premium - Intrinsic Value

put option

- Intrinsic Value = EP - CMP, 0
- Time Value = premium - Intrinsic Value

It means if option is ITM then Intrinsic value is difference between CMP & EP.
If option is ATM or OTM then I. Value will be zero & the whole premium Amt will be time value.

EXAMPLE – 03

State whether each one of the following is In the money, At the money or Out of the money.

Option	Exercise price	Stock price	
Call	1360	1340	OTM
Call	1360	1360	ATM
Call	1360	1380	ITM
Call	1360	1400	ITM
Put	1360	1340	ITM
Put	1360	1360	ATM
Put	1360	1380	OTM
Put	1360	1400	OTM

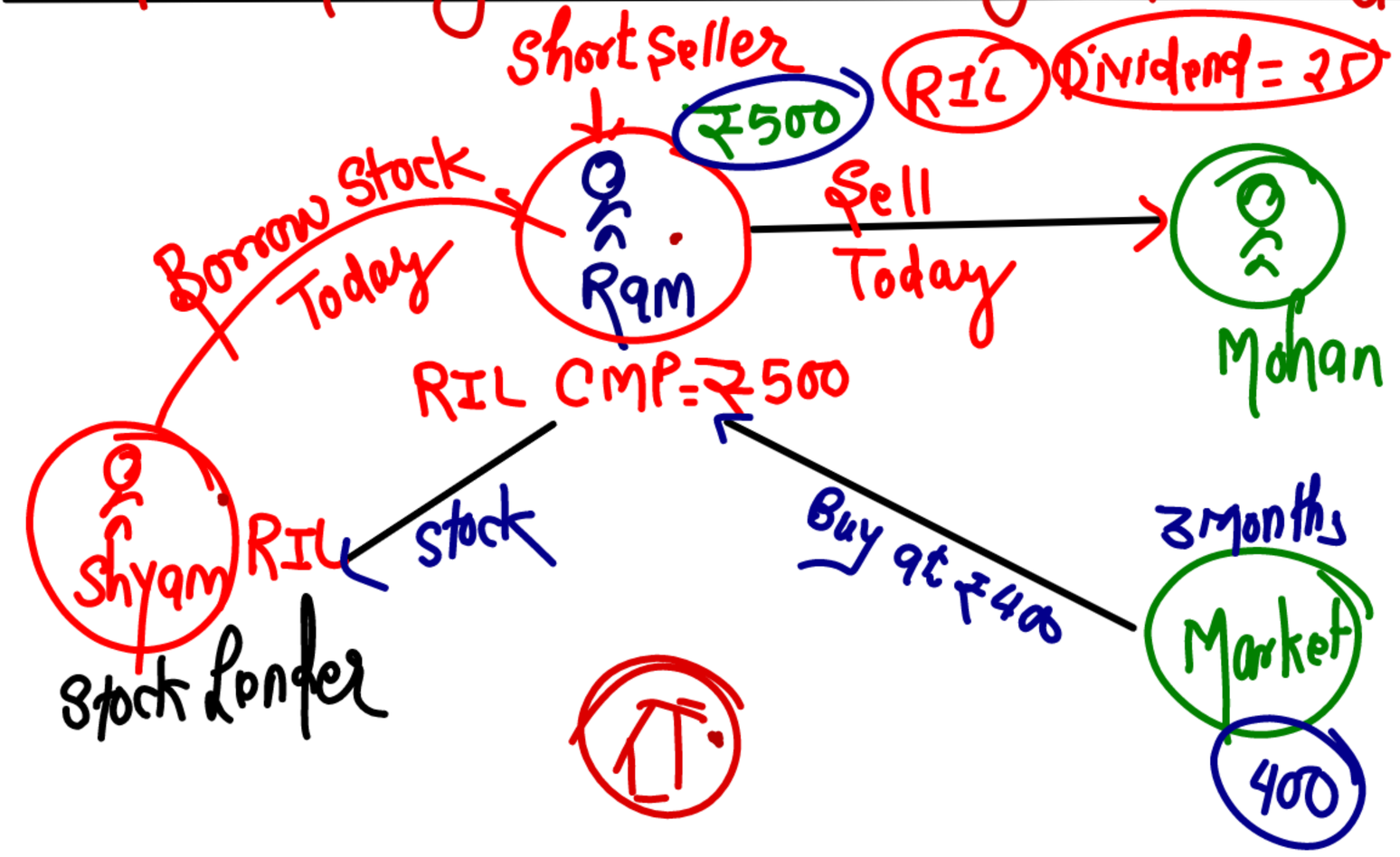
EXAMPLE – 04

Consider the data relating to a stock contained in the following table. Determine both the intrinsic value and the time value in each of the cases.

Option	Strike price	Asset price	Option premium	I.V.	T.V.
Call	90	100	15	10	5
Call	110	100	2	0	2
Put	200	100	135	100	35
Put	90	100	4	0	4
Put	150	125	30	25	5
Call	150	120	22	0	22

(Page No. 02)

© Short Selling or Stock Lending & Borrowing scheme



1. Short Selling is a speculative activity is design to make profit on the basis of bearish price expectation.

2. In short selling, short seller borrows stock from stock Lender & sell it at current Market price with a view to buy Later on at Lower price & return to stock Lender

3. Sources of Return (Short Seller)

- price depreciation
- Interest Earned on short selling Amt

4. Sources of Risk (Short seller)

- price appreciation
- Lending charges
- Dividend Amt [Compensate dividend Amt by short seller to stock Lender]

QUESTION – 02

Mr. A is holding 1,000 shares of face value of ₹ 100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s. XYZ Ltd. has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

(i) Shares to be borrowed for 3 months from 1st January 2020 to 31st March 2020.

(ii) Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and

(iii) Bank Guarantee will be provided as collateral for the value as on 1st January 2020.

Other Information :

(a) Cost of Bank Guarantee is 8% per annum.

(b) On 29th February 2020 M/s. ABC Ltd. declared dividend of 25%.

(c) Closing price of M/s. ABC Ltd.'s shares quoted in Stock Exchange on various dates are as follows :

Date	Share Price in Scenario – 1 Bullish	Share Price in Scenario – 2 Bearish
1st January 2020	1,000	1,000
31st January 2020	1,020	980
29th February 2020	1,040	960
31st March 2020	1,050	940

You are required to find out :

(i) Earnings of Mr. A through Stock Lending Scheme in both the scenarios,

(ii) Total earnings of Mr. A during 1st January 2020 to 31st March 2020 in both the scenarios,

(iii) What is the profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios ?

(Exam January - 2021)
(Page No. 12)

① Earning of Mr. A [Stock Lending]

	Bull	Bearish
Lending charges		
Jan (1% of closing)	10.20	9.80
Feb	10.40	9.60
March	10.50	9.40
	31.10	28.80
(x) No. of shares	1000	1000
Earnings	₹31100	₹28800

② Total Earning of Mr. A

	Bull	Bearish
Lending Income	31.10	28.80
Dividend Income (₹100 x 25%)	25.00	25.00
	56.10	53.80
(x) No. of shares	1000	1000
Total Earnings	₹56100	53800

3 profit or Loss to M/s XYZ

	Bull	Bearish
profit/Loss on short selling	(1000 - 1050) -₹50	(1000 - 940) ₹60
Lending charge	-₹31.10	- 28.80
Int. on Bank Guarantee (8%)	1000 × 8% × 3/12 - 20	1000 × 8% × 3/12 - 20
profit/(Loss)	(101.10)	11.20
(x) No. of shares	1000	1000
	(101100)	11200

7. Expected Value of option (Imp)

Expected Value of option = Σ Gross Payoff x probability

EXAMPLE – 05

Option = Call option

Exercise Price = ₹ 500

Period = 3 months

Price of Maturity	Probability
520	0.3
530	0.2
510	0.1
490	0.3
480	0.1

Calculate Expected value of option.

(Page No. 02)

Expected Value of option

MP	Action	Gross payoff	prob.	G.P × P
520	Exercised	20	0·3	6
530	Ex.	30	0·2	6
510	Ex.	10	0·1	1
490	Lapsed	0	0·3	0
480	Lapsed	0	0·1	0
				₹13

EXAMPLE – 06

Book

H.W

Option = Put option

Exercise Price = ₹ 200

Period = 2 months

Price of Maturity	Probability
170	0.15
180	0.10
200	0.05
220	0.30
160	0.40

Calculate Expected Value of option.

① 22.50

(Page No. 02)

QUESTION – 05

Equity share of PQR Ltd. is presently quoted at ₹ 320. The Market Price of the share after 6 months has the following probability distribution:

Market Price ₹	180	260	280	320	400
Probability	0.1	0.2	0.5	0.1	0.1

A put option with a strike price of ₹ 300 can be written.

You are required to find out expected value of option at maturity (i.e. 6 months)

(SM New Syllabus &PM)

(Page No. 15)

Expected Value of option 300↓

MP	Action	Gross Payoff	P	G.P × P
180	Exercise	120	0.1	12
260	"	40	0.2	8
280	"	20	0.5	10
320	Lapsed	0	0.1	0
400	Lapsed	0	0.1	0
				₹30

QUESTION – 06

You as an investor had purchased a 4 month call option on the equity shares of X Ltd. of ₹ 10, of which the current market price is ₹ 132 and the exercise price ₹ 150. You expect the price to range between ₹ 120 to ₹ 190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	0.05	0.20	0.50	0.10	0.15

COMPUTE:

(i) Expected Share price at the end of 4 months.

(ii) Value of Call Option at the end of 4 months, if the exercise price prevails.

(iii) In case the option is held to its maturity, what will be the expected value of the call option?

(MTP March – 2022, SM New Syllabus& PM)

(Page No. 16)

QUESTION – 07

You had purchased a 3 month call option on the Equity shares of Satya Ltd for a premium of ₹ 30 each the current market price of the share is ₹ 560 and the exercise price is ₹ 590. You expect the price range between ₹ 540 to ₹ 640.

The expected share price of Satya Ltd and related probability is given below:

Expected price (₹)	540	560	580	600	620	640
Probability	0.10	0.15	0.05	0.35	0.20	0.15

Compute the followings:

(i) Expected share price at the end of 3 months

(ii) Value of call option at the end of 3 months if the exercise price prevails,

(iii) In case the option is held to its maturity, what will be the expected value of the call option?

① Expected share price

Expected price = (540 × 0.10) + (560 × 0.15) + (580 × 0.05) + (600 × 0.35) + (620 × 0.20) + (640 × 0.15)

= ₹ 597

② Value of call option, if Exercise price prevails

[अगर Maturity को Exercise price से Market price होगा]

Value of Call = 590 − 590 = 0

(iv) Find out the price of the shares quoted at the stock exchange to get the value of the call option as computed in (iii) above.

(Exam May-2022)

(Page No. 17)

(iv) price of share so that Value of call be ₹17

price of share : 590 + 17

= ₹607

(iii) Expected value of option 590↑

MP	Action	G.Payoff	P	GP×P
540	Lapsed	0	0.10	0
560	"	0	0.15	0
580	"	0	0.05	0
600	Exercised	10	0.35	3.50
620	"	30	0.20	6.00
640	"	50	0.15	7.50
				₹17

QUESTION – 08

The Market Price of the share after 6 months has the following probability distribution.

Market Price	170	190	200	220	240
Probability	0.05	0.20	0.40	0.20	0.15

Options are available with a strike price of ₹ 200 and expiration 6 months from now.

H.W

(i) What is the Expected value of market price per share?

(ii) What is expected value of call option?

(iii) What is the expected value of put option?

(Page No. 18)

8. Concept of Compounding [Imp]

Eg 1 Mr. Ram wants to invest ₹ 100000 for 1 year

Bank A = 12% p.a. Compounded Annually

Bank B = 12% p.a. Compounded SemiAnnually

Bank C = 12% p.a. " Quarterly

Bank D = 12% p.a. " Monthly

✔ Bank E = 12% p.a. Compounded Continuously

Calculate Amount Receivable after 1 year

A

₹ 100000 (1.12) = ₹ 112000

B

₹ 100000 $(1.06)^2$ = ₹ 112360

C

₹ 100000 $(1.03)^4$ = ₹ 112551

D

₹ 100000 $(1.01)^{12}$ = ₹ 112682

E

₹ 100000 × e^{rt}

₹ 100000 × $e^{0.12 \times 1}$

₹ 100000 × 1.1275 = ₹ 112750

Calculator

$e^{0.12}$

0.12

0 4096

+ 1

x = 12 times

Eg 2 P.V. = ₹500

Rate = 10% p.a. CC

F.V. after 3 months = ?

$$F.V. = ₹500 \times e^{0.10 \times 0.25}$$

$$= ₹500 \times e^{0.025}$$

4 digit

$$= ₹500 \times 1.0253$$

$$= ₹512.65$$

CONTINUOUS COMPOUNDING, DISCRETE CASH FLOWS

	SINGLE PAYMENT		UNIFORM SERIES				
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Uniform Series Factor	Capital Recovery Factor	Series Present Worth Factor	Arithmetic Gradient Series Factor
N	(F/P, r, N)	(P/F, r, N)	(A/F, r,N)	(F/A, r, N)	(A/P, r, N)	(P/A, r, N)	(A/G, r, N)
1	1.0101	0.99005	1.00000	1.0000	1.01010	0.99005	0.00000
2	1.0202	0.98020	0.49750	2.0101	0.50755	1.97025	0.49750
3	1.0305	0.97045	0.33001	3.0303	0.34006	2.94069	0.99333
4	1.0408	0.96079	0.24626	3.0303	0.25631	3.90148	1.48750
5	1.0513	0.95123	0.19602	5.1015	0.20607	4.85271	1.98000
6	1.0618	0.94176	0.16253	6.1528	0.17258	5.79448	2.47084
7	1.0725	0.93239	0.13861	7.2146	0.14866	6.72687	2.96000
8	1.0833	0.92312	0.12067	8.2871	0.13072	7.64999	3.44751
9	1.0942	0.91393	0.10672	9.3704	0.11677	8.56392	3.93334
10	1.1052	0.90484	0.09556	10.4646	0.10561	9.46876	4.41751
11	1.1163	0.89583	0.08643	11.5698	0.09648	10.36459	4.90002
12	1.1275	0.88692	0.07883	12.6860	0.08888	11.25151	5.38086
13	1.1388	0.87810	0.07239	13.8135	0.08244	12.12961	5.86004
14	1.1503	0.86936	0.06688	14.9524	0.07693	12.99896	6.33755
15	1.1618	0.86071	0.06210	16.1026	0.07215	13.85967	6.81340

Eg 3 P.V. = ₹600

Rate = 8% p.a. cc

FV after 2 years = ?

$FV = ₹600 \times e^{0.08 \times 2}$

$= 600 \times e^{0.16}$

$= 600 \times 1.1735$

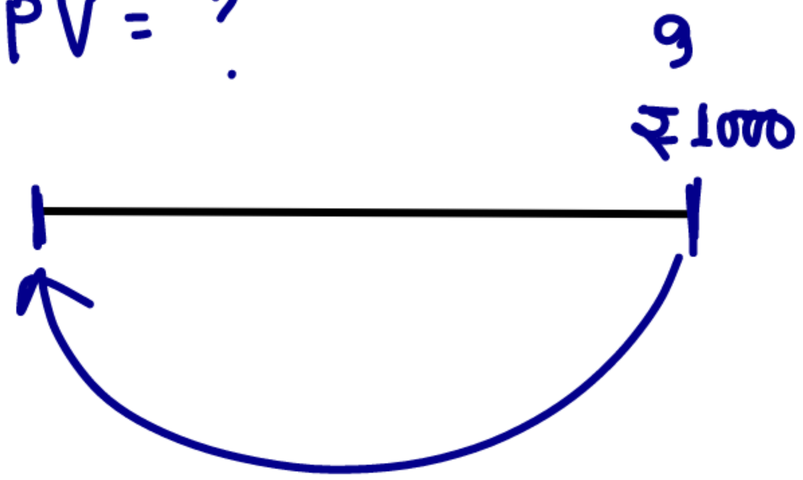
$= ₹ 704.10$

704.10

Eg 4 FV after 9 Months = ₹1000

Rate = 10% p.a. CC

PV = ?



① $P.V. = \frac{₹1000}{e^{0.10 \times \frac{9}{12}}}$

$= \frac{₹1000}{e^{0.075}}$

$= \frac{₹1000}{1.0779}$ $\quad \frac{1}{1.0779}$

$= 927.73$

② $P.V. = 1000 \times e^{-rt}$

$= 1000 \times e^{-0.075}$

$= ₹1000 \times 0.9278$

$= 927.80$

Eg 5 FVF of CC = 1.0725⁻

Rate = ?

Ln 1.0725⁻ = 0.07

↑ Natural Log

Ln 1.0725⁻

1.0725

√ 12 times

− 1

× 4096

= 0.07

0.07

÷ 4096

+ 1

X = 12 times

1.0725⁻

Eg 6 $\ln 1.0672$

Rate = ? 6.5%

Eg 7 Investment Amount = ₹ 100000

Rate = 12% P.A. Compounded Half yearly

1 Calculate Amt Receivable after 1 year

2 Calculate Effective Annual Rate (EAR)

1. $100000\,(1.06)^2 = 112360$

2. $EAR = \dfrac{112360 - 100000}{100000} \times 100 = 12.36\%$ P.A. EAR

Or

$EAR = (1.06)^2 - 1 = 1.1236 = 12.36\%$

Eg Investment = ₹10000

Rate = 12.36% P.A. (EAR)

Cash Inflows after 6 Months = ?

Wrong

× ₹10000 × 1.0618

$12.36 \times \frac{6}{12}$

= 6.18

✓ ₹10000 × $(1.1236)^{\frac{6}{12}}$

₹10000 × 1.06 = ₹10600

Eg Cash Outflows = ₹ 800

Rate 10% P.a. effective

Cash Inflows after 4 months = ?

$$FV = ₹800 \times (1.10)^{\frac{4}{12}}$$

$$= ₹800 \times 1.0323$$

$$= ₹825.84$$

1.10

$\sqrt{\ }$ 12

− 1

× 4/12

+ 1

x = 12

Eg Investment = ₹ 100000

Rate = 12% P.A. Compounded Quarterly

Cash Inflows after 9 Months = ?

Method I

$₹ 100000 (1.03)^3$

$= 100000 \times 1.0927$

$= ₹ 109270$

Method II

$EAR = (1.03)^4 - 1 = 1.1255$ (12.55%)

$₹ 100000 \times (1.1255)^{9/12}$

$₹ 100000 \times 1.0927$

$₹ 109270$

Eg Investment = ₹ 100000

Rate = 10% P.A. Compounded Half yearly

Cash Inflows after 7 Months = ?

$$EAR = (1.05)^2 = 1.1025 \ (10.25\%)$$

$$FV = 100000 \times (1.1025)^{7/12}$$

$$= 100000 \times 1.05857$$

$$= ₹ 105857$$

105857

Eg (Imp)

Investment = ₹ 100000

Cash Inflows after 1 YEAR

of Rate

① 12% P.Q. Compounded Semi Annually

② 12% P.Q. Compounded Continuously (or)

③ 12% P.Q. Effective Power

④ 12% P.Q.

① $100000\,(1.06)^2 = 112360$

② $100000 \times e^{0.12}$

$100000 \times 1.12750 = 112750$

③ $100000 \times 1.12 = 112000$

④ $100000 \times 1.12 = 112000$

PART II option Strategies

1. Straddles & Strangles
2. Strips & straps
3. Bull & Bearish
4. Butterfly

Not In ICAI Module

1 Straddles & Strangles

1 Straddles Strategy

An investor is hoping that wide fluctuation in price of share but he is not sure about movement i.e price goes up or goes down, hence he creates "straddles strategy"

In straddle, we buy 1 call & 1 put at same EP on same asset for same maturity period.

EXAMPLE – 14

An investor expects wide fluctuations in one share of R.I.L. but he is unsure, where the movement will be, hence he buys one put and one call at a strike price of ₹700 after paying a premium of ₹35 for put &₹45 for call, having maturity of 2 months each.

Required:-

(i) Name the Strategy

(ii) Determine Break-Even points & compute the cost of strategy.

(iii) Determine the Profit/Loss if the price on maturity is:-550, 600, 650, 700, 750, 800, 850

(Page No.06)

① Name → Straddles

② Cost of Strategy

= ₹35 + ₹45 = ₹80

BEP £700

① BEP = EP + Cost

= 700 + 80 = 780

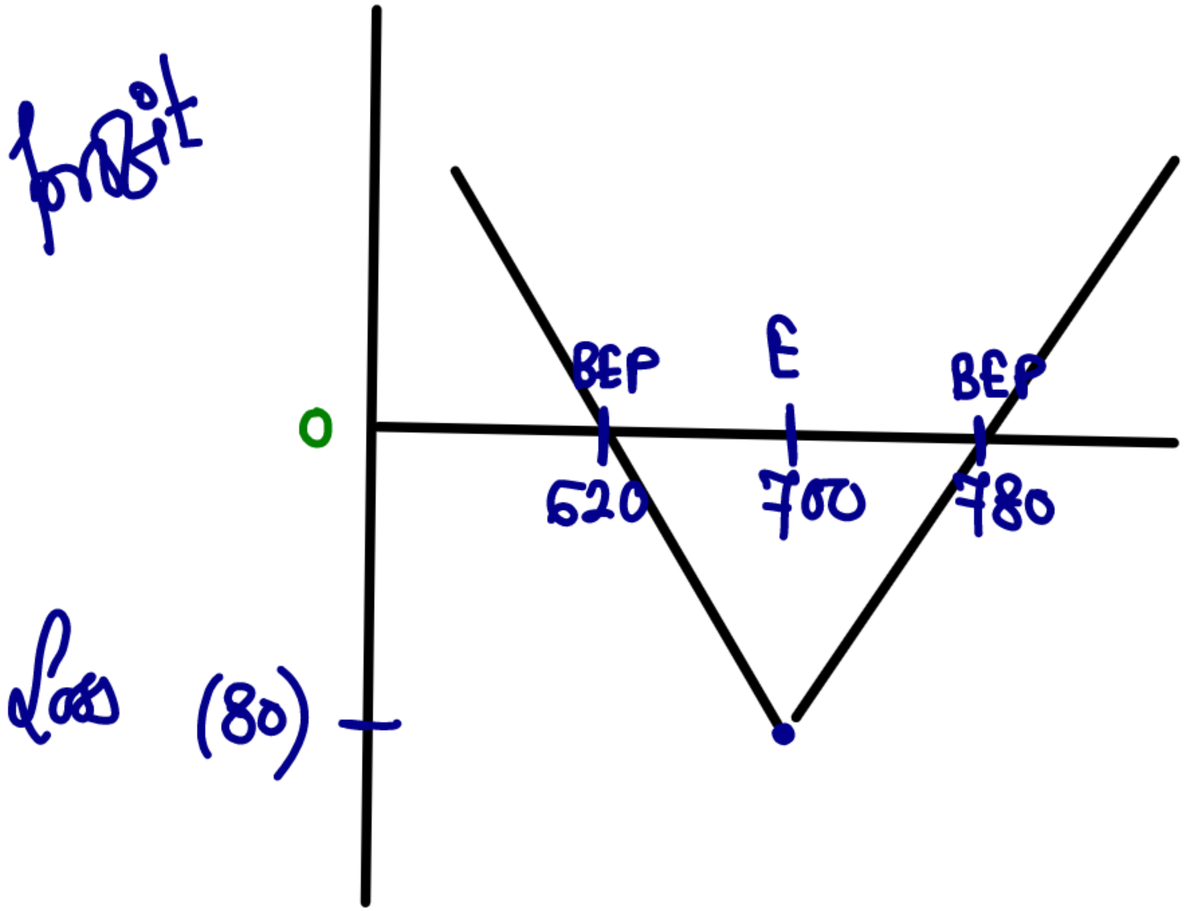
② BEP = EP − Cost

= 700 − 80 = 620

(iii) Calculation of profit/Loss

E 700

MP	Action		Gross Payoff		Cost	Net Payoff
	Call	put	Call	put		
550	Lapse	Exercised	0	150	(80)	70
600	Lapse	"	0	100	(80)	20
650	Lapse	"	0	50	(80)	-30
700	Lapse	Lapsed	0	0	(80)	-80
750	Exercise	Lapsed	50	0	(80)	-36
800	Ex.	"	100	0	(80)	26
850	Ex	"	150	0	(80)	70


Profit
BEP
E
BEP
0
620
700
780
Loss
(80)

(ii) Strangles

An investor is hoping that wide volatility in price of share but he is not sure about movement, hence he creates strangles strategy.

- In strangles, we buy 1 call & 1 put on same asset for same maturity period at different strike price
- Cost of strangles strategy is less than cost of straddles.
- In strangles EP of call is more than EP of put.

EXAMPLE – 15

Mr. G is expecting wide fluctuations in stock of RIL. He buys one call option at a strike price of ₹700 by paying ₹ 45, along with a put option at a strike price of ₹650 by paying a premium of ₹20.

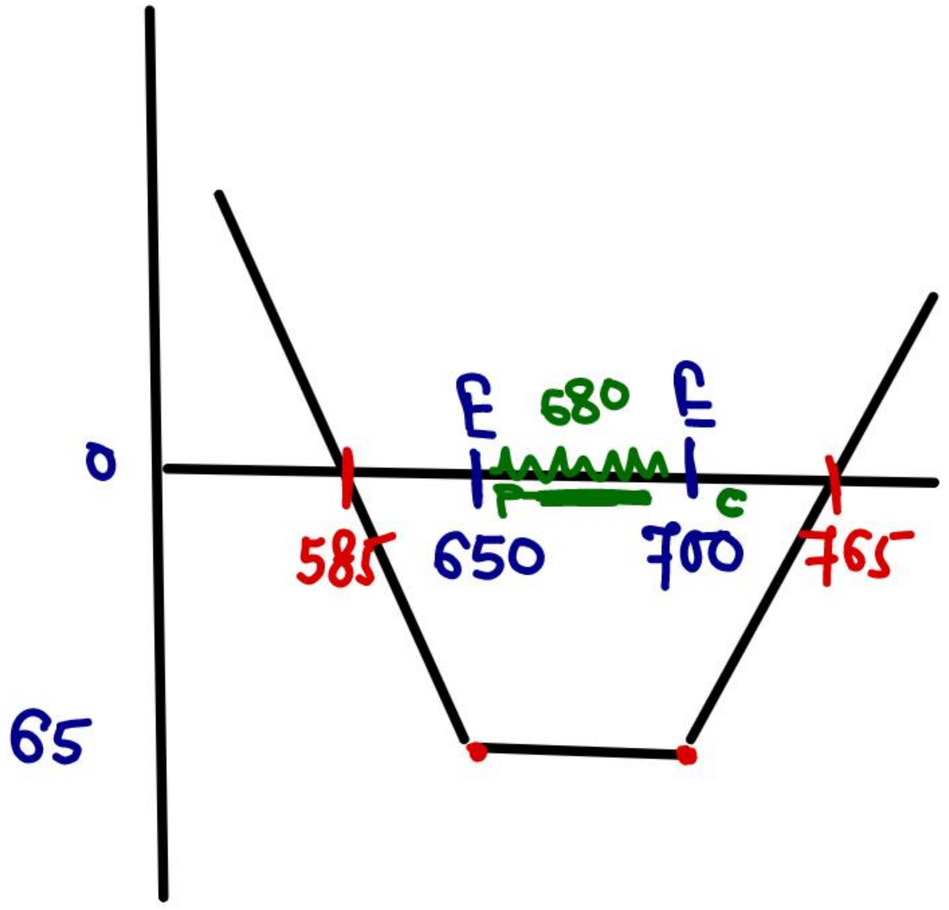
Required:-

(i) Name the strategy.

(ii) Compute the cost of strategy & Break Even Points.

(iii) Compute the profit/Loss if the price on maturity is- ₹500, 550, 600, 650, 680, 700, 750, 800, 850.

(Page No.06)



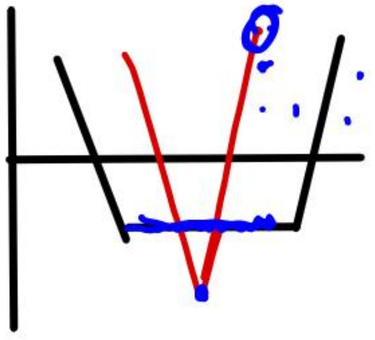
EXAMPLE – 16

Following are the options available for RIL for 3 months.

Exercise Price	Call Option	Put Option
1,000	80	25
1,100	55	40
1,200	35	55

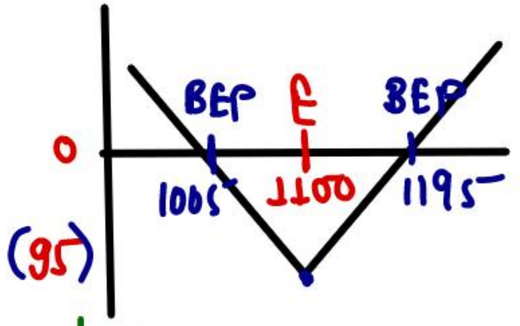
Create Straddles and Strangles Strategy.

(Page No.07)



Straddles

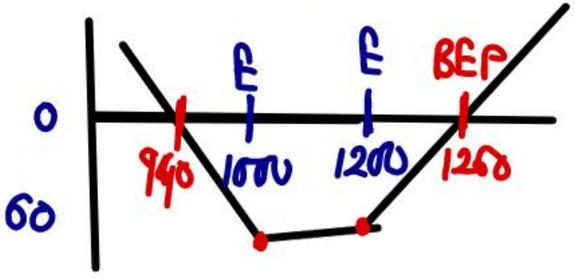
- Buy call & put at E ₹1100
- Cost of strategy = 55+40
  = ₹95



Strangles

Buy 1 call at E 1200 & Buy 1 put at E 1000

Cost = 25+35 = ₹60



QUESTION – 26

Mr. P established the following spread on the Coastal Corporation's stock:

(i) Purchased one 3-month call option with a premium of ₹ 6.5 and an Exercise price of ₹ 110.

(ii) Purchased one 3-month put option with a premium of ₹ 10 and an Exercise price of ₹ 90.

Coastal Corporation's stock is currently selling at ₹ 100. Determine profit or loss, if the price of Coastal Corporation's stock:

(i) Remains at ₹ 100 after 3 months.

(ii) Falls at ₹ 70 after 3 months.

(iii) Rises to ₹ 138 after 3 months. Assume the size of option is 1,000 shares of Coastal Corporation.

(RTP May - 2022)

(Page No.46)

Call option & put option purchased and paid premium ₹6.50 & ₹10

Total premium paid ₹16.50 × 1000

= ₹ 16500

Call option EP = ₹ 110

put option EP = ₹ 90

(i) If price on Maturity ₹ 100

In this situation, both call & put options will lapse

Gross payoff	= 0
premium	= ₹16500
Net Loss	₹16500

(II) If price on Maturity is ₹70

In this situation. Call will Lapse & put option will Exercise

Gross payoff	(90-70)×1000 =	20000
	=	16500
(-) premium		3500
	Net profit	

(III) If price on Maturity ₹138

In this situation Call will Exercise & put will Lapse

Gross payoff	(₹138-110)×1000 =	28000
	=	₹16500
(-) premium		11500
	Net profit.	

QUESTION – 27

Mr. X established the following strategy on the Delta Corporation's stock :

(1) Purchased one 3-month call option with a premium of ₹ 30 and an exercise price of ₹ 550.

(2) Purchased one 3-month put option with a premium of ₹ 5 and an exercise price of ₹ 450.

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Delta Corporation's stock is currently selling at ₹ 500.

CALCULATE profit or loss, if the price of Delta Corporation's stock:

(i) remains at ₹ 500 after 3 months.

(ii) falls at ₹ 350 after 3 months.

(iii) rises to ₹ 600.

Assume the option size is 100 shares of Delta Corporation.

(MTP April – 2022, SM & PM) (Page No.48)

QUESTION – 28

Mr. John established the following spread on the TTK Ltd.'s stock:

(i) Purchased one 3-month put option with a premium of ₹15 and an exercise price of ₹ 900.

(ii) Purchased one 3-month call option with a premium of ₹ 90 and an exercise price of₹1100.

TTK Ltd.'s stock is currently selling) at ₹1000. Calculate gain or loss, if the price of stock of TTK Ltd. –

(i) Remains at ₹1000 after 3 months.

(ii) Falls to ₹700 after 3 months.

(iii) Raises to ₹1200 after 3 months.

Assume the size of option is 200 shares of TTK Ltd.

(Exam May - 2019)

(Page No.49)

QUESTION – 29

Mr. KK purchased a 3-month call option for 100 shares in PQR Ltd. at a premium of ₹40 per share, with an exercise price of ₹560. He also purchased a 3-month put option for 100 shares of the same company at a premium of ₹10 per share with an exercise price of ₹460. The market price of the share on the date of Mr. KK's purchase of options, is ₹500. Compute the profit or loss that Mr. KK would make assuming that the market price falls to ₹360 at the end of 3 months.

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(Exam May - 2018)

(Page No.50)

QUESTION – 30

Mr. A purchased a 3 month call option for 100 shares in XYZ Ltd. at a premium of ₹ 30 per share, with an exercise price of ₹ 550. He also purchased a 3 month put option for 100 shares of the same company at a premium of ₹ 5 per share with an exercise price of ₹ 450. The market price of the share on the date of Mr. A's purchase of options, is ₹ 500. Calculate the profit or loss that Mr. A would make assuming that the market price falls to ₹ 350 at the end of 3 months.

Hw

(SM New Syllabus & PM)

(Page No.50)

QUESTION – 31

The market received rumour about ABC corporation's tie-up with a multinational company. This has induced the market price to move up. If the rumour is false, the ABC corporation stock price will probably fall dramatically. To protect from this an investor has bought the call and put options.

He purchased one 3 months call with a striking price of ₹ 42 for ₹ 2 premium, and paid ₹1 per share premium for a 3 months put with a striking price of ₹ 40.

(i) Determine the Investor's position if the tie up offer bids the price of ABC Corporation's stock up to ₹ 43 in 3 months.

(ii) Determine the Investor's ending position, if the tie up program fails and the price of the stocks falls to ₹ 36 in 3 months.

(SM New Syllabus & PM)

(Page No.51)

QUESTION – 33

Fresh Bakery Ltd.'s share price has suddenly started moving both upward and downward on a rumour that the company is going to have a collaboration agreement with a multinational company in bakery business. If the rumour turns to be true, then the stock price will go up but if the rumour turns to be false, then the market price of the share will crash. To protect from this an investor has purchased the following call and put option:

a) One 3 months call with a striking price of ₹ 52 for ₹ 2 premium per share.

b) One 3 months put with a striking price of ₹ 50 for ₹ 1 premium per share.

Assuming a lot size of 50 shares, determine the followings:

(i) The investor's position, if the collaboration agreement push the share price to ₹ 53 in 3 months.

(ii) The investor's ending position, if the collaboration agreement fails and the price crashes to ₹ 46 in 3 months time.

(Page No.53)

QUESTION – 06

You as an investor had purchased a 4 month call option on the equity shares of X Ltd. of ₹ 10, of which the current market price is ₹ 132 and the exercise price ₹ 150. You expect the price to range between ₹ 120 to ₹ 190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	0.05	0.20	0.50	0.10	0.15

COMPUTE:

(i) Expected Share price at the end of 4 months.

(ii) Value of Call Option at the end of 4 months, if the exercise price prevails.

(iii) In case the option is held to its maturity, what will be the expected value of the call option?

(MTP March – 2022, SM New Syllabus & PM) (Page no.16)

CMP ₹132

EP ₹150↑

• If EP prevails

Value of Call = MP on Maturity − EP

= 150 − 150

= 0

160.50

EP = 150 ↑

10 30 40

PART III option pricing & Valuation

① In this topic, we calculate value of option & compare with Actual premium Amount & decide whether option should be purchased or not?

- If Value of option > premium → Underpriced – Buy
- If Value of option < premium → Overpriced – Not Buy or Sell

② There are three methods for valuation

Model I Binomial Model

Model II put call parity

Model III Black Scholes Model (BSM)

Model I Binomial Model

As the name suggested, there are only Two possible price on Maturity. One is more than CMP & one is Less than CMP.

There are three approaches to calculate Value of option as per Binomial Model

Imp-① Risk Neutral probability Approach
② Delta Hedging ①
× ③ Replicating portfolio Approach

∫ Same

1 Risk Neutral probability Approach

Following steps are applied to calculate Value of option

Step 1 Calculate Risk Neutral probability

$$P = \frac{R - d}{u - d}$$

Step 2 Draw Binomial Tree

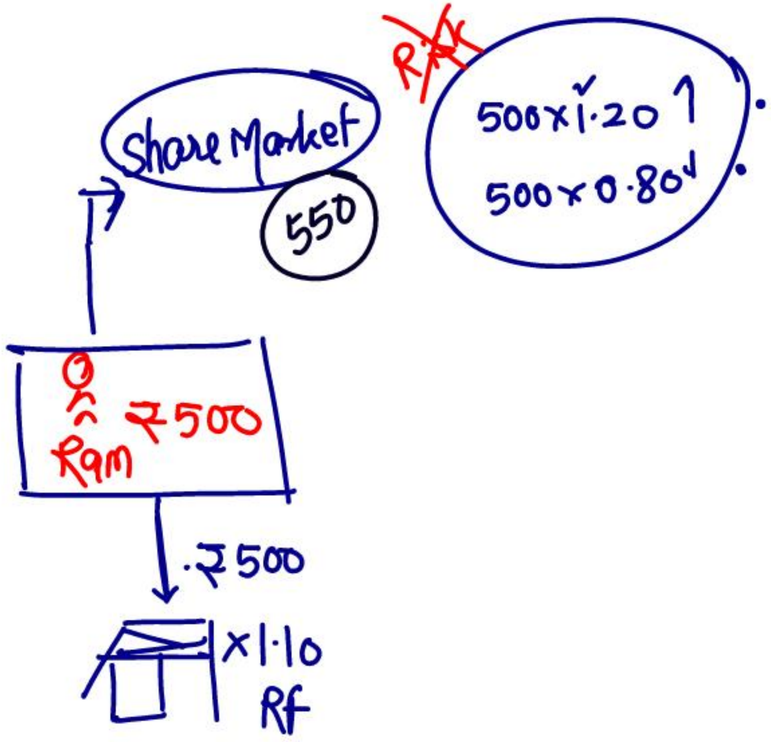
Step 3 Calculate Value of option

- Value of Call option

$$C_0 = \frac{CuP + Cd(1-P)}{R}$$

- Value of put

$$P_0 = \frac{PuP + Pd(1-P)}{R}$$



EXAMPLE – 07

Current market price = ₹ 500

Exercise Price = ₹ 510

Period = 1 year

Risk free rate = 10% p.a.

Price on maturity

Maximum price = ₹ 600

Minimum Price = ₹ 400

Calculate Value of call option as per binomial model.

(Page No. 03)

$$500 \times 1{\cdot}10 = (500 \times 1{\cdot}20 \times P) + 500 \times 0{\cdot}8\,(1-P)$$

$$500 \times 1{\cdot}10 = 500 \times 1{\cdot}20 \times P + 500 \times 0{\cdot}8 - 500 \times 0{\cdot}8 \times P$$

$$500 \times 1{\cdot}10 - 500 \times 0{\cdot}8 = P\left[(500 \times 1{\cdot}20) - (500 \times 0{\cdot}8)\right]$$

$$\frac{500 \times 1{\cdot}10 - 500 \times 0{\cdot}8}{500 \times 1{\cdot}20 - 500 \times 0{\cdot}8} = P = \frac{1{\cdot}10 - 0{\cdot}8}{1{\cdot}20 - 0{\cdot}8}$$

Step 1 Calculation of Risk neutral probability

$$P = \frac{R - d}{u - d}$$

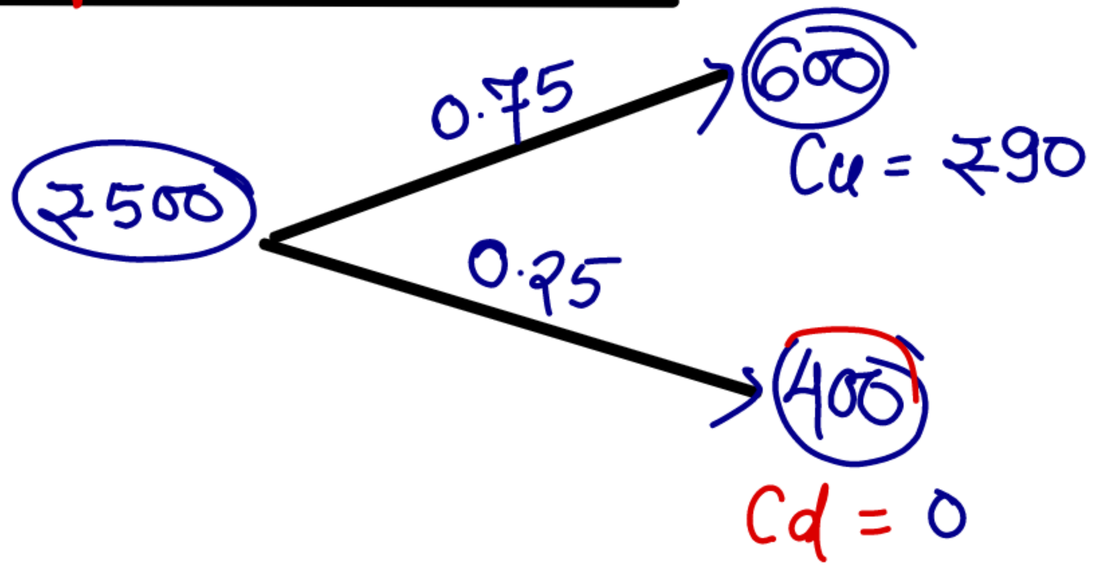
$R = 1{\cdot}10$

$u = \frac{₹600}{₹500} = 1{\cdot}2$

$d = \frac{₹400}{₹500} = 0{\cdot}8$

$$P = \frac{1{\cdot}10 - 0{\cdot}8}{1{\cdot}20 - 0{\cdot}8} = 0{\cdot}75$$

Step 2 Binomial Tree



Step 3 Value of Call

$$C_0 = \frac{C_u p + C_d(1-p)}{R} = \frac{(90 \times 0.75) + (0 \times 0.25)}{1.10}$$

$$= ₹61.36$$

EXAMPLE – 08

Current market price = ₹ 1000

Exercise Price = ₹ 1100

Period = 6 months

Price on maturity

Upper price = ₹ 1300

Lower Price = ₹ 900

Calculate Value of Call option if

Risk free rate

Case 1- 8% p.a. compounded semi annually

Case 2 - 8% p.a. compounded annually

Case 3 - 8% p.a. compounded continuously

(Page No. 03)

Case 1 8% P.A. Compounded Semi-

$$R = 1 + (0.08 \times \frac{6}{12})$$

$$= 1.04$$

$$u = \frac{1300}{1000} = 1.30$$

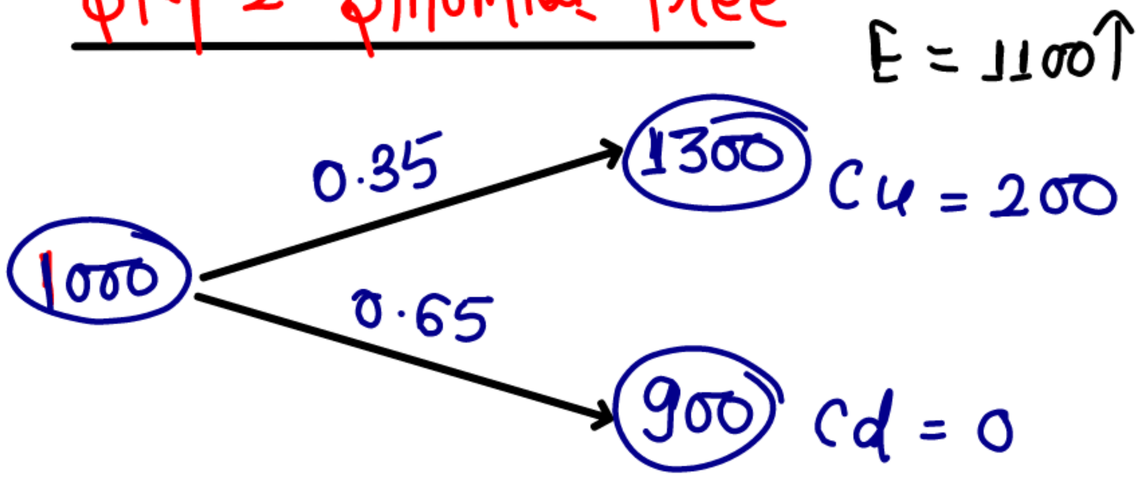
$$d = \frac{900}{1000} = 0.90$$

Step 1 Risk Neutral probability

$$P = \frac{R - d}{u - d} = \frac{1.04 - 0.90}{1.30 - 0.90}$$

$$= 0.35$$

Step 2 Binomial Tree



Step 3 Value of Call

$$C_0 = \frac{C_u P + C_d (1-P)}{R} = \frac{(200 \times 0.35) + (0 \times 0.65)}{1.04}$$

$$= ₹ 67.31$$

SD

Case 2 8% P.A. Compounded Annually [Effective]

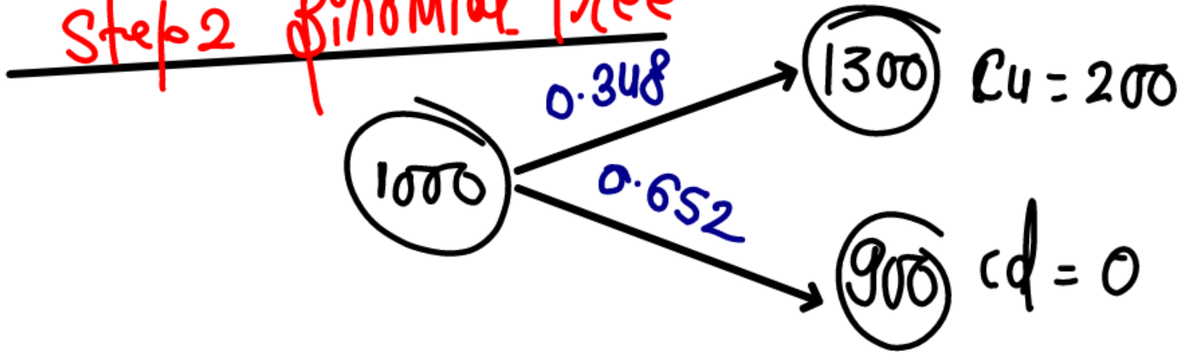
$$R = (1.08)^{\frac{6}{12}} = 1.0392$$

$u = 1.30 \quad d = 0.90$

Step 1 Risk Neutral probability

$$P = \frac{1.0392 - 0.90}{1.30 - 0.90} = 0.3480$$

Step 2 Binomial Tree



Step 3 Value

$$C_0 = \frac{(200 \times 0.3480) + (0 \times 0.652)}{1.0392}$$

$$= ₹ 66.97$$

Case-3 8% P.Q. Compounded Continuously

$$R(e^{rt}) = e^{(0.08 \times \frac{6}{12})}$$

$$= e^{0.04} = 1.0408$$

$u = 1.30$, $d = 0.90$

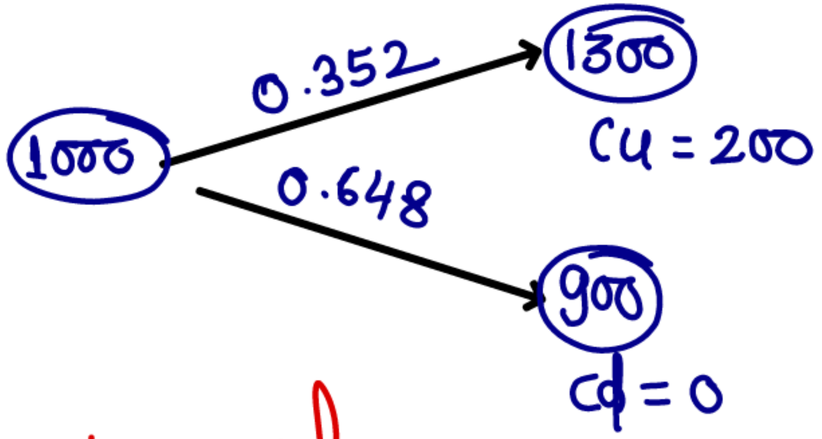
Step 1 Risk Neutral probability

$$P = \frac{e^{rt} - d}{u - d}$$

$$= \frac{e^{(0.08 \times \frac{6}{12})} - 0.90}{1.30 - 0.90}$$

$$= \frac{1.0408 - 0.90}{1.30 - 0.90} = 0.3520$$

Step 2 Binomial Tree



Step 3 Value

$$C_0 = \frac{C_u P + C_d(1-P)}{e^{rt}}$$

$$= \frac{(200 \times 0.352) + (0 \times 0.648)}{1.0408}$$

$$= ₹67.64$$

EXAMPLE – 09

Current market price = ₹ 500

Exercise Price = ₹ 530

Period = 3 months

Risk free rate = 12% p.a. effective

Price on maturity

Maximum price = ₹ 600

Minimum Price = ₹ 400

Calculate Value of put option as per binomial model.

(Page No. 04)

Given

$R = (1.12)^{\frac{3}{12}}$ or $(1.12)^{1/4} = 1.0287$

$u = \frac{600}{500} = 1.20$ $d = \frac{400}{500} = 0.80$

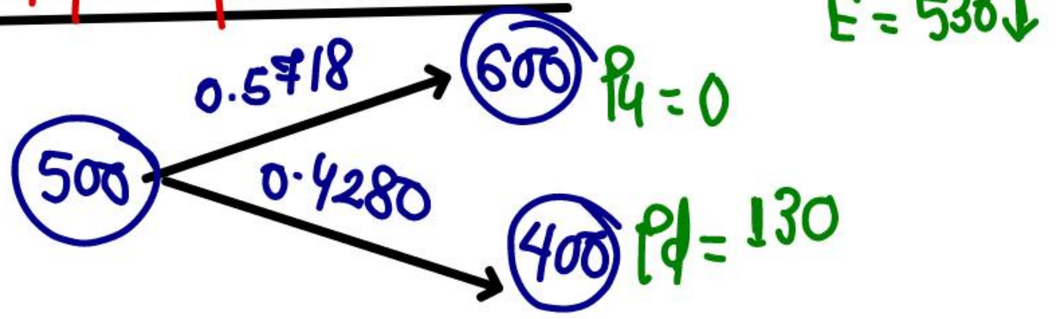
Step 1 Risk Neutral probability

$$P = \frac{R - d}{u - d} = \frac{1.0287 - 0.80}{1.20 - 0.80}$$

$$= 0.5718$$

Step 2 Binomial Tree

E = 530↓



Step 3 Value of put

$$P_0 = \frac{P_u p + P_d (1-p)}{R}$$

$$= \frac{(0 \times 0.5718) + (130 \times 0.4280)}{1.0287}$$

$$= ₹ 54.11$$

QUESTION – 09

The current market price of an equity share of Penchant Ltd is ₹ 420. Within a period of 3 months, the maximum and minimum price of it is expected to be ₹ 500 and ₹ 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of ₹ 450?

Given $e^{0.02} = 1.0202$

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(SM New Syllabus & PM)

(Page No. 19)

QUESTION – 10

The current market price of an equity share of Eagle Ltd is ₹ 950. Within a period of 3 months, the maximum and minimum price of it is expected to be ₹ 1,000 and ₹ 900 respectively. If the risk free rate of interest be 8% p.a.

COMPUTE the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of ₹ 980.

Given $e^{0.02} = 1.0202$

(MTP: Sep – 2022)

(Page No. 20)

QUESTION – 11

Sumana wanted to buy shares of EIL which has a range of ₹ 411 to ₹ 592 a month later. The present price per share is ₹ 421. Her broker informs her that the price of this share can sore up to ₹ 522 within a month or so, so that she should buy a one-month CALL of EIL. In order to be prudent in buying the call, the share price should be more than or at least ₹ 522 the assurance of which could not be given by her broker.

Though she understands the uncertainty of the market, she wants to know the probability of attaining the share price ₹ 592 so that buying of a one-month CALL of EIL at the execution price of ₹ 522 is justified. Advice her. Take the risk-free interest to be 3.60% and $e^{0.036} = 1.037$.

(SM New Syllabus& PM)

(Page No. 21)

Given

$R = e^{rt} = e^{0.036} = 1.037$

$u = \frac{592}{421} = 1.406$

$d = \frac{411}{421} = 0.976$

$$p = \frac{e^{rt} - d}{u - d}$$

$$= \frac{1.037 - 0.976}{1.406 - 0.976}$$

$= 0.1419$

$1.406 - 0.976$
$M +$
$1.037 - 0.976$
$\frac{1}{0}$ MRC

QUESTION – 12

ABC Ltd. share price as on date is ₹ 200. 6 months from now it is expected that the share price will be ₹ 178 or the price will be ₹ 214 per share. A call option of the share can be exercised at the end of six months at exercise price of ₹ 205 per share. The risk free interest rate is 10% p.a. (i.e. 5% for 6 months). Compute the value of call option per share.

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(Page No. 21)

EXAMPLE – 10

The stock of a company is currently quoted in the market at ₹150. The price of the stock is expected to go up or down by 10% in next one year and by 15% in the second year. The risk-free interest rate in the economy is 6%.

Required:

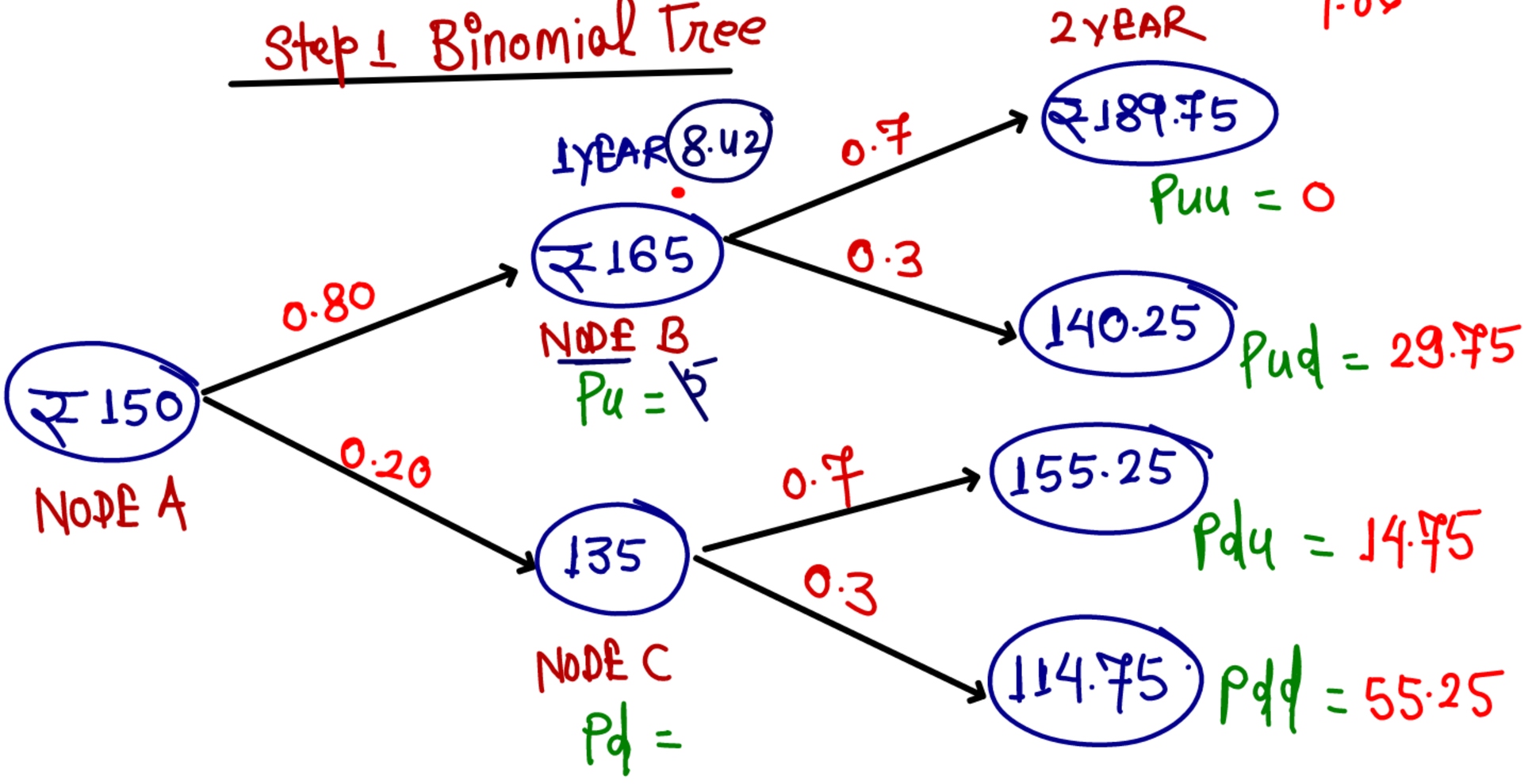
Using two-step Binomial Model, find out the price of a 2-year American put option on the company's stock with strike price of ₹ 170.

(Page No. 04)

E 170 ↓

$\frac{(0 \times 0.7) + (29.75 \times 0.3)}{1.06}$

Step 1 Binomial Tree



Step 2 Risk Neutral probability

NODE A

$R = 1.06 \quad u = 1.10 \quad d = 0.90$

$$P = \frac{R - d}{u - d} = \frac{1.06 - 0.90}{1.10 - 0.90} = 0.8$$

NODE B

$R = 1.06 \quad u = 1.15 \quad d = 0.85$

$$P = \frac{1.06 - 0.85}{1.15 - 0.85} = 0.7$$

NODE C

$P = 0.7$

Step 3 Value of option

NODE B

$$\text{P.V. of Expected payoff} = \frac{(0 \times 0.7) + (29.75 \times 0.3)}{1.06} = 8.42$$

Intrinsic Value at node B = 170 − 165 = ₹5

Value of option at Node B [Higher] = ₹8.42

NODE C

$$\text{P.V. of Expected payoff} = \frac{(14.75 \times 0.7) + (55.25 \times 0.3)}{1.06} = 25.38$$

Intrinsic Value = 170 − 135 = ₹35

Value of option at Node C [Higher] = ₹35

Node A

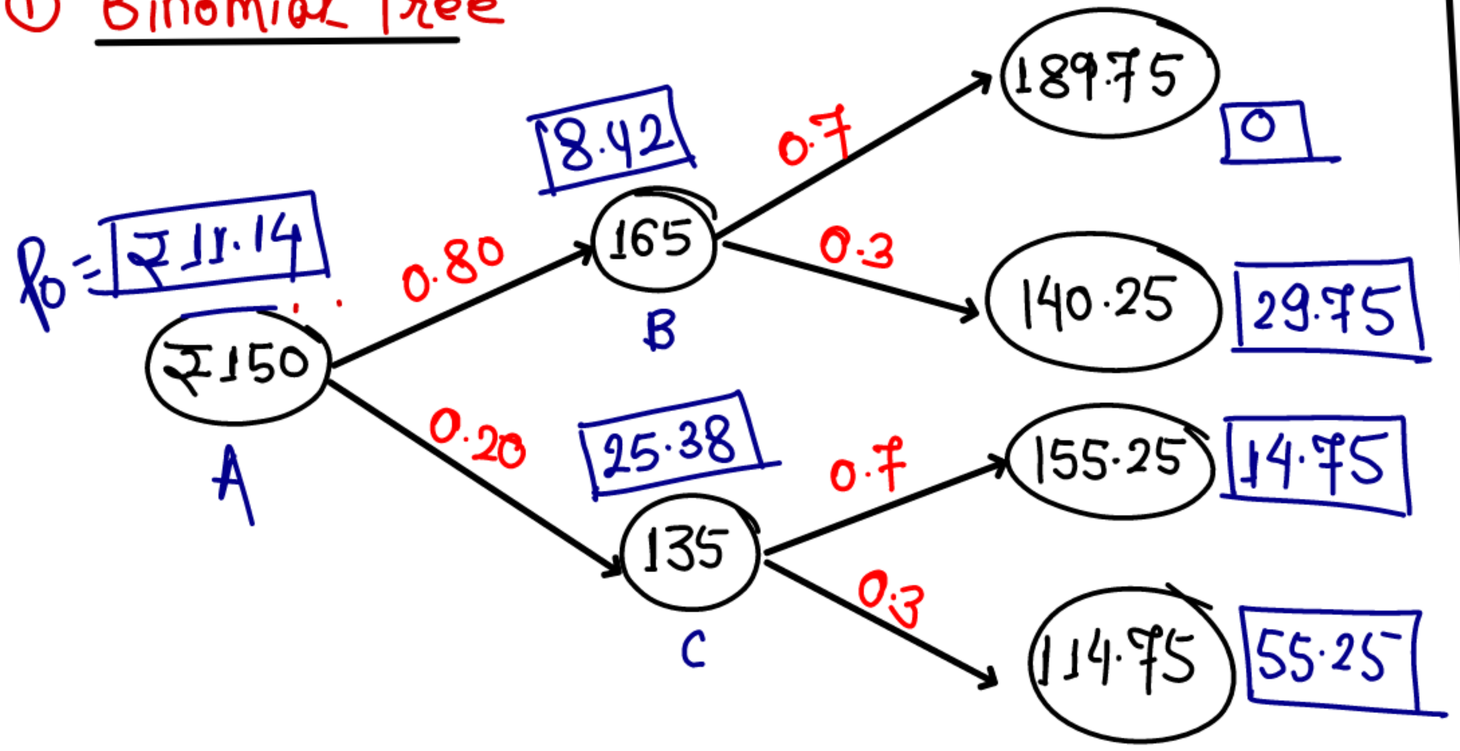
$$\text{Value} = \frac{(₹8.42 \times 0.8) + (35 \times 0.2)}{1.06} = ₹12.96$$

I. Value : ₹170 − 150 = ₹20

Hence Value of option is ₹20

• Assume option is European

① Binomial Tree



Value of option

NODE B

$$\text{Value} = \frac{(0 \times 0.7) + (29.75 \times 0.3)}{1.06}$$

$$= ₹8.42$$

NODE C

$$\text{Value} = \frac{(14.75 \times 0.7) + (55.25 \times 0.3)}{1.06}$$

$$= ₹25.38$$

NODE A

$$\text{Value} = \frac{(8.42 \times 0.8) + (25.38 \times 0.2)}{1.06}$$

$$= 11.14$$

Two period Binomial Model

In two period Binomial Model, we divide option contract in two period & calculate value of option for each node using Backward calculation.

Special care is required in American option. In this value of option should be Higher of two

1. P.V. of Expected Gross Payoff
2. Intrinsic value at that node

No such type of cross check is required in European option.

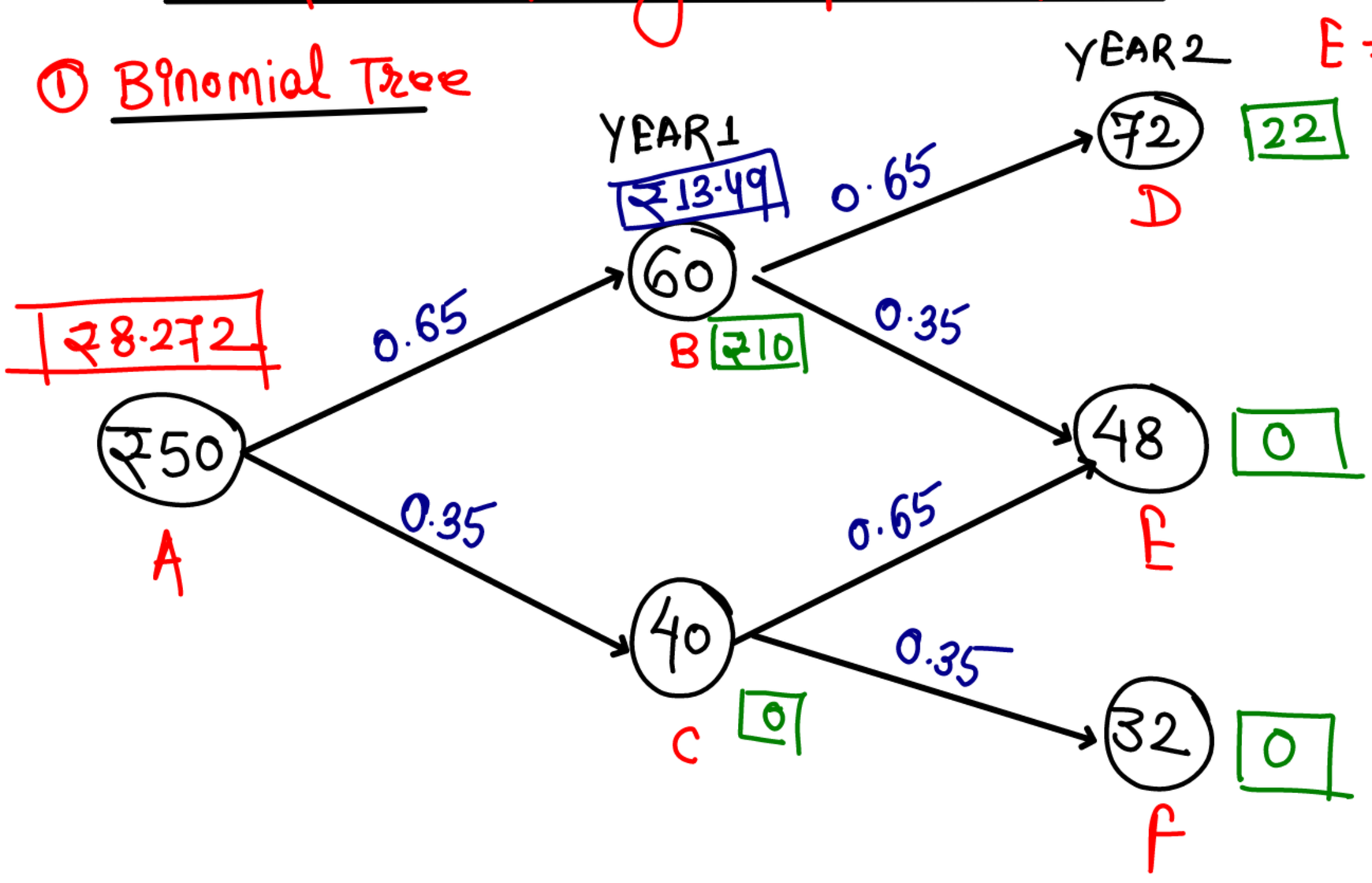
QUESTION – 14

Consider a two-year call option with a strike price of ₹ 50 on a stock the current price of which is also ₹ 50. Assume that there are two - time periods of one year and in each year the stock price can move up or down by equal percentage of 20%. The risk-free interest rate is 6%. Using binominal option model, calculate the probability of price moving up and down. Also draw a two-step binomial tree showing prices and payoffs at each node.

(SM New Syllabus & PM) (Page No. 24)

It is assumed that given option is American

① Binomial Tree



Risk Neutral probability

$R = 6\%$ $\quad u = 1.20$ $\quad d = 0.80$

$$P = \frac{R-d}{u-d} = \frac{1.06-0.80}{1.20-0.80} = 0.65$$

Value of option

$$\text{NODE B} = \frac{(22 \times 0.65)+(0 \times 0.35)}{1.06} = ₹\ 13.49$$

P.V. of Expected Payoff = ₹ 13.49

Intrinsic Value = ₹ 10

Value of option at Node B (Higher) = ₹ 13.49

NODE C Value of option = 0

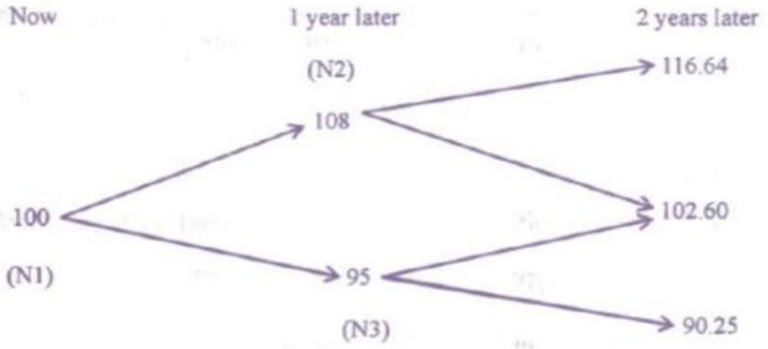
$$\text{NODE A} = \frac{(₹\ 13.49 \times 0.65)+(0 \times 0.35)}{1.06} = ₹\ 8.27$$

I. Value = 50 - 50 = 0

Hence Value of Call option Today is ₹ 8.272

QUESTION – 13

A two year tree for a share of stock in ABC Ltd., is as follows:



Consider a two years American call option on the stock of ABC Ltd., with a strike price of ₹ 98. The current price of the stock is ₹ 100. Risk free return is 5 per cent per annum with a continuous compounding and e0·05 = 1.05127. Assume two time periods of one year each.

Using the Binomial Model, calculate:

(i) The probability of price moving up and down;

(ii) Expected pay offs at each nodes i.e. N1, N2 and N3 (round off upto 2 decimal points).

(Exam Nov - 2020) (Page No. 23)

① Risk Neutral probability

$$p = \frac{e^{rt} - d}{u - d}$$

$$e^{rt} = e^{0.05} = 1.05127$$

$$u = \frac{108}{100} = 1.08$$

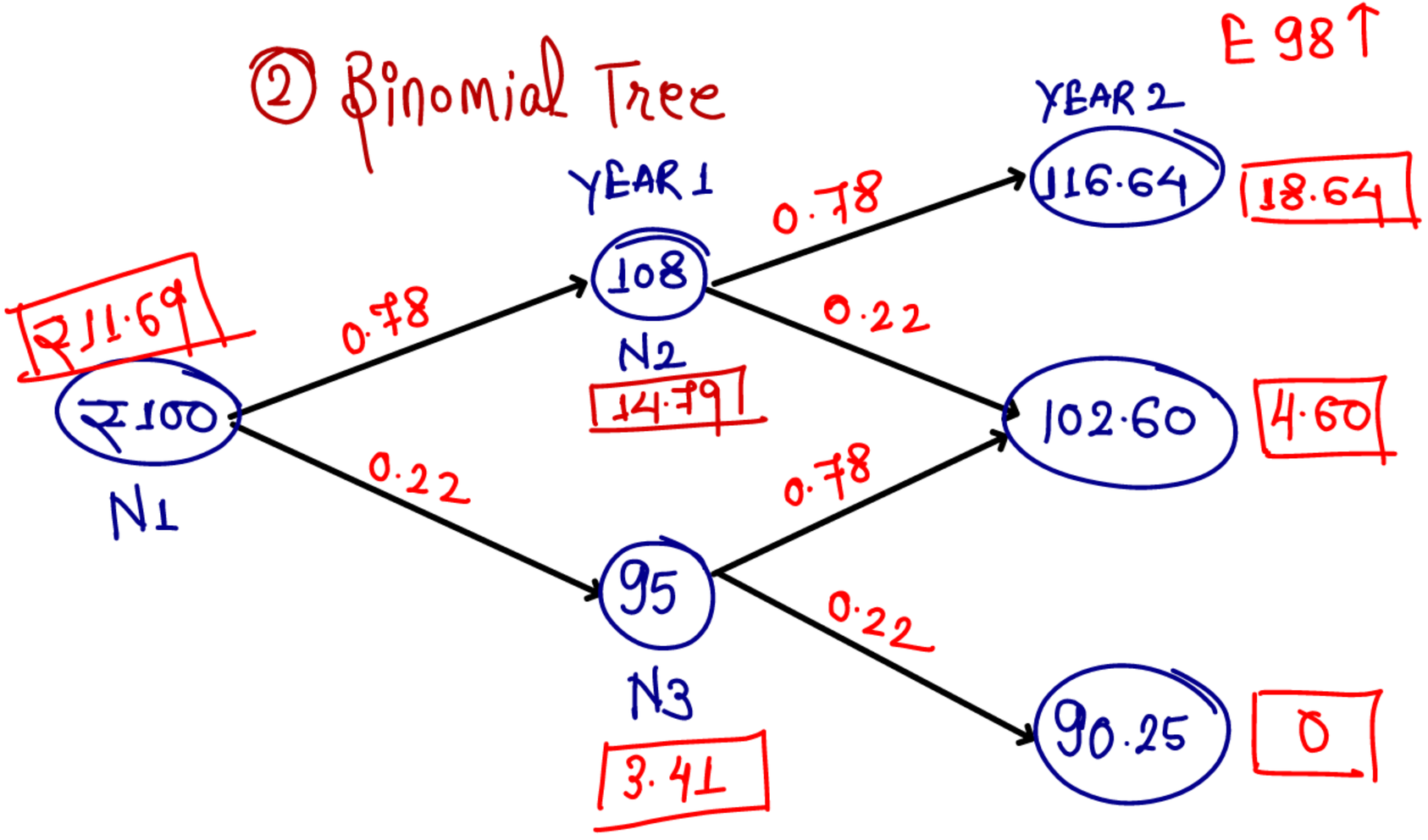
$$d = \frac{95}{100} = 0.95$$

$$p = \frac{1.05127 - 0.95}{1.08 - 0.95}$$

$$= 0.78$$

② Binomial Tree

E 98 ↑



Value of option

Node 2

$$\text{P.V. of Expected payoff} = \frac{(18.64 \times 0.78) + (4.60 \times 0.22)}{1.05127} = 14.79$$

Intrinsic Value : ₹108 - 98 = ₹10

Hence Value of option = ₹14.79

Node 3

$$\text{P.V. of Expected payoff} = \frac{(4.60 \times 0.78) + (0 \times 0.22)}{1.05127} = 3.41$$

Intrinsic Value = 0

Hence Value of option : ₹3.41

N1

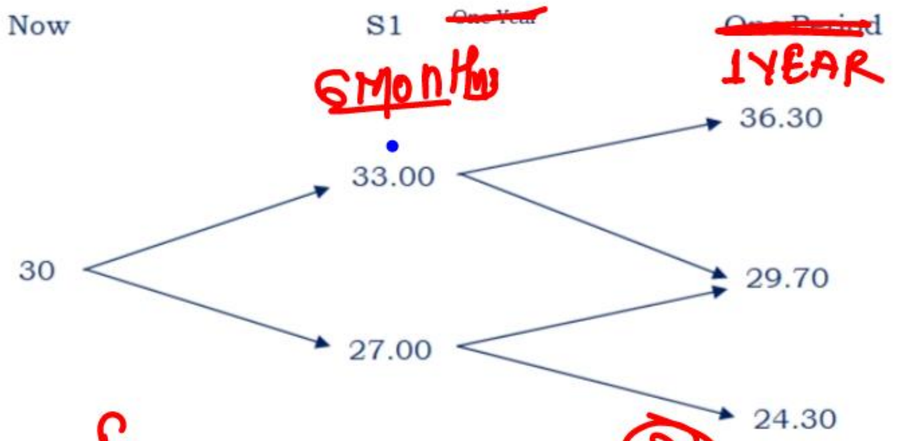
$$P.V. = \frac{(14.79 \times 0.78) + (3.41 \times 0.22)}{1.05127} = ₹ 11.69$$

I. Value = ₹ 2

Hence Value of Call option Today is ₹ 11.69

QUESTION – 15 ✓

Following is a two-period tree for a share of stock in CAB Ltd.:



H.W
C.W. Copy

Using the Binomial model, calculate the current fair value of a regular call option on CAB Stock with the following characteristics: X = ₹ 28, Risk Free Rate = 5 % p.a. (effective). You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

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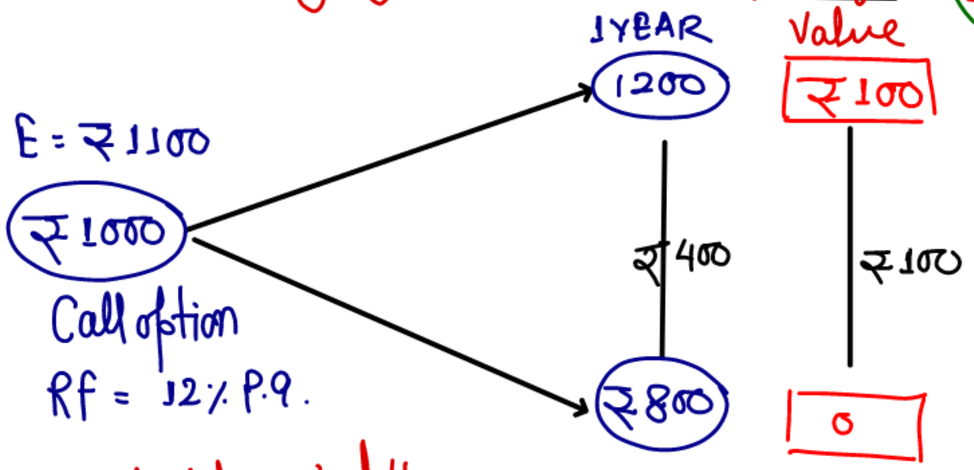
Approach II Delta Hedging or Risk free portfolio

₹ 71.43



Step 1 Calculation of delta

[change in value of option with respect to change in price of stock]

$$\text{Delta} = \frac{\Delta \text{ value of option}}{\Delta \text{ stock price}} \text{ or } \frac{C_1 - C_2}{S_1 - S_2}$$

$$= \frac{100 - 0}{1200 - 800} = 0.25$$

Combination → Write 1 Call & Buy 0.25 share today

Step 2 Calculation of Cash Inflows On Maturity

If price is ₹ 1200

Call Exercise	− 100
Sell share (1200 × 0.25)	+ 300
CI	200

If price is ₹ 800

Call lapse	0
Sell share (800 × 0.25)	+ 200
CI	200

Step 3 Value of Call

$$C_0 = S_0 \times \Delta - \frac{CI}{1+r}$$

$$= 1000 \times 0.25 - \frac{200}{1.12} = ₹ 1.43$$

EXAMPLE – 11

Current market price = ₹ 450

Exercise Price = ₹ 485

Period = 1 year

Risk free rate = 10% p.a.

Price on maturity

Maximum price = ₹ 585

Minimum Price = ₹ 385

Calculate: Value of call option

(i) Using Delta hedging.

(ii) Using Risk Neutral Probability Approach

(iii) Using Replicating Portfolio Approach

(Page No. 11)

① Delta Hedging

Step 1 Calculation of Delta

$$\text{Delta} = \frac{C_1 - C_2}{S_1 - S_2}$$

$$= \frac{100 - 0}{585 - 385} = 0.5$$

Combination → Write 1 call & Buy 0.5 share Today.

Step 2 Calculation of Cash Inflows

① price ₹ 585		① price 385	
Call Exercise	-100	Call Lapse	0
Sell share (585 × 0.5)	292.50	sell share (385 × 0.5)	192.50
CI	192.50		192.50

Step 3 Value of Call

$$C_0 = S_0 \times \Delta - \frac{CI}{1+r}$$

$$= 450 \times 0.5 - \frac{192.50}{1.10}$$

$$= ₹ 50$$

QUESTION – 16

AB Ltd.'s equity shares are presently selling at a price of ₹ 500 each. An investor is interested in purchasing AB Ltd.'s shares. The investor expects that there is a 70% chance that the price will go up to ₹650 or a 30% chance that it will go down to ₹450, three months from now. There is a call option on the shares of the firm that can be exercised only at the end of three months at an exercise price of ₹550.

Calculate the following:

(i) If the investor wants a perfect hedge, what combination of the share and option should he select?

(ii) Explain how the investor will be able to maintain identical position regardless of the share price.

(iii) If the risk-free rate of return is 5% for the three months period, what is the value of the option at the beginning of the period?

(iv) What is the expected return on the option?

(Exam Nov - 2019) (Page No. 27)

① Combination of shares & option

$$\text{Delta} = \frac{C_1 - C_2}{S_1 - S_2}$$

$$= \frac{100 - 0}{650 - 450} = 0.5$$

Combination

Write 1 call & Buy 0.5 share

② position (CI) on Maturity

① price = ₹650		⑪ If price = 450	
Call Exercise	-100	Call Lapse	0
Sell share (650 × 0.5)	+325	Sell share (450 × 0.5)	225
	225		225

(iii) Value of Call

$$C_0 = S_0 \times \Delta - \frac{CI}{1+r}$$

$$= 500 \times 0.50 - \frac{225}{1.05}$$

$$= ₹ 35.71$$

(iv) Expected Return on option

Expected Value of option

$$\text{Expected Value} = (100 \times 0.7) + (0 \times 0.3)$$

$$= ₹ 70$$

$$\text{Expected Return} = \frac{|₹ 70 - 35.71|}{35.71} \times 100$$

$$= 96.02\%$$

QUESTION – 17

Mr. Dayal is interested in purchasing equity shares of ABC Ltd. which are currently selling at ₹ 600 each. He expects that price of share may go upto ₹ 780 or may go down to ₹ 480 in three months. The chances of occurring such variations are 60% and 40% respectively. A call option on the shares of ABC Ltd. can be exercised at the end of three months with a strike price of ₹ 630.

H.W

C.W

(i) What combination of share and option should Mr. Dayal select if he wants a perfect hedge?

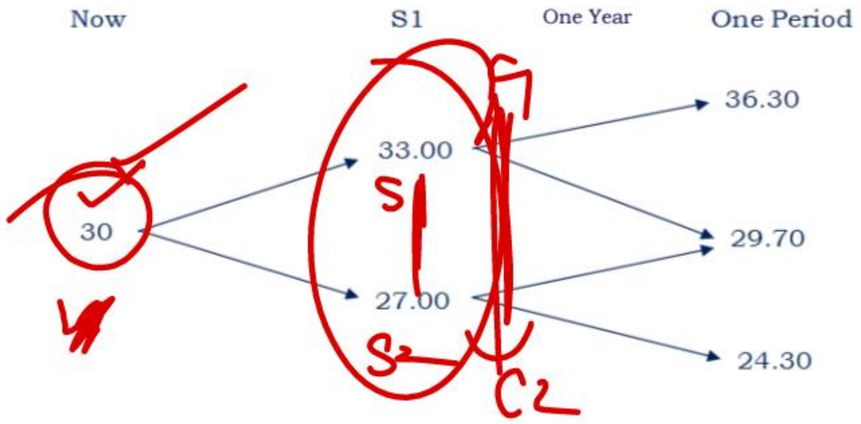
(ii) What should be the value of option today (the risk free rate is 10% p.a.)?

(iii) What is the expected rate of return on the option?

(SM New Syllabus & PM) (Page No. 28)

QUESTION – 15

Following is a two-period tree for a share of stock in CAB Ltd.:



Using the Binomial model, calculate the current fair value of a regular call option on CAB Stock with the following characteristics: X = ₹ 28, Risk Free Rate = 5 % p.a. (effective). You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

(Page No. 27)

LECTURE No. 11

3. Replicating portfolio Approach

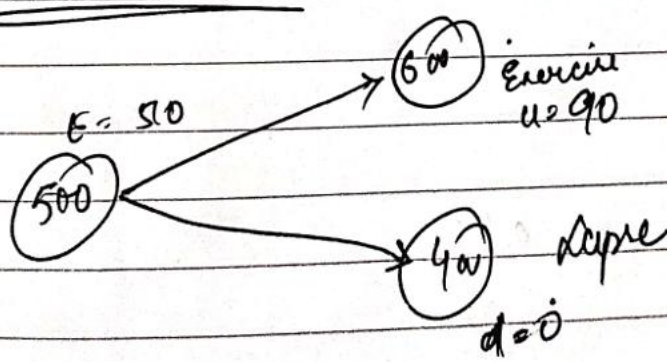
following steps are applied to calculate value of option

Step 1 Draw a Binomial tree
step 2 Calculate delta of option
step 3 Calculate Amt of Borrowing
step 4 Calculate Value of option.

Eg $S_0 = 500$ } 10
$E = 510$ }
$U_S = 600$ } 100
$d_S = 400$ }
Rate = 10%
period = 1 year
Value of option using Replicating approach.

Sol

Binomial Tree



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Value of Call

Ram

Buy 1 call x

Captain

600 90

₹ 510

400 0

Delta = 0.45

Shyam

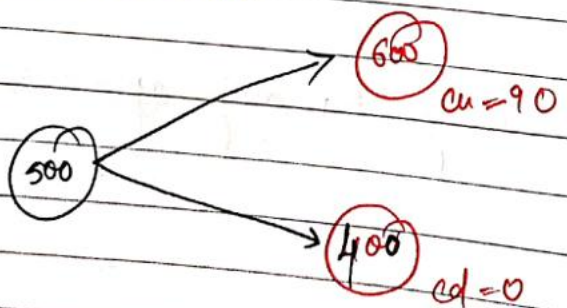
600 x

$270 - x(1.10) = 90$

$180 - 163.64(1.10) = 0$

Value of put

① Binomial Tree



② Delta of Call

$$\text{Delta} = \frac{90-0}{600-400} = 0.45$$

③ Amt of Borrowing

$(600 \times 0.45) - x(1.10) = 90$

Borrowing Amt = 163.64

(4) Value of option

Cash outflow = (500 × 0.45) − 163.64 = 61.36
(इतना पैसा लगेगा) (Bank से लेंगे)

TOPIC → PUT CALL PARITY THEOREM

Put call parity is a combination of put option & Call option at same exercise price for same maturity on same asset.

Equation of put call parity

$S_0 + P_0 = C_0 + P.V \text{ of } EP$

S_0 = CMP
P_0 = Put premium
C_0 = Call premium.

$S_0 = 500$ $E = 510$

Ram

Share = ₹500 (Buy)
Put = E 510 ↓

Shyam

Call E 510 ↑ — ₹63.63

PV
510 / 1.10

EJ

S_0 = ₹500
E = 510
P_0 = 35
C_0 = ₹ 61.36
Period = 1 year
Rate = 10%
Calculate Arbitrage Gain if possible

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Put Call Parity Equation

$$S_0 + P_0 = C_0 + PV \text{ of } EP$$

$$500 + 35 = 61.36 + \frac{510}{1.10}$$

$$535 = 525$$

Protective put fiduciary call

Action

Fiduciary call is less than protective put, hence buy fiduciary call & sell protective put.

Process

Today

Short sell Share		+500
Write put		+35
Buy Call		−61.36
& CB $\left(\frac{510}{1.10}\right)$		−463.64
		₹10

	Cash Inflow
S	800
−S	(800)
0	0
*S − 510	+ 290
+510	+ 510
	0

Date ..../..../....
Page .....

Calculation of Cash flows on Maturity

- If price is more than 510

Cash flows

Buy Back	$-S$
Put lapse	0
Call Exercised	$S - 510$
ZCB	$+ 510$
	0

$-S - (510 - S) + 510$
$-S - 510 + S + 510$

- If price is less than 510

Cash flows

Buy Back	$-S$
Put Exercised	$-(510 - S)$
Call Lapse	0
ZCB	$+ 510$
	0

Eg 9.2

$S_0 = 500$
$E = 510$
$P_0 = 25$
$C_0 = 70$
Period = 1 year
Rate = 10%
Calculate Arbitrage

Sol

Put Call Parity Equation

$S_0 + P_0 = C_0 + PV \text{ of } EP$

$500 + P_0 = 95 + \frac{510}{1.10}$

$\Rightarrow 525 = 70 + 463.63$

$\Rightarrow 525 : 533.63$

Protective put : fiduciary put

Action

Since protective put is less than fiduciary put, hence buy protective put and sell fiduciary put.

Process

Today

Buy	put	-25
Buy	share	-500
Write	Call	+70
Short sell	ZCB	+463.63
Arbitrage Gain =		8.63

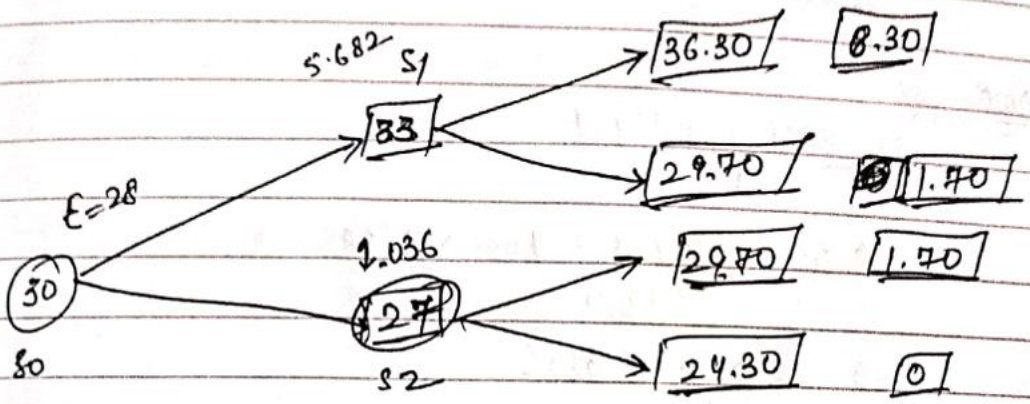
On Maturity

- If price is more than 510

	CF
Put	lapse 0
Sell	share +S
Call	Exercised -(S - 510)
ZCB	-510
	0

If price is less than 510

	CF
Put Exercise	510 − S
sell share	+S
Call lapse	0
ICB	−510
	0



$R = (1.05)^{1/2} = 1.025$

$\mu = \frac{33}{30} = 1.10$

$d = \frac{27}{30} = 0.9$

$p = \frac{R-d}{u-d} = \frac{1.025-0.9}{1.10-0.9}$

$\Rightarrow \frac{0.125}{0.2} \Rightarrow 0.625$

Value of call option

Node S_1 $= \frac{CUP + Cd(1-P)}{R}$

$\Rightarrow \frac{8.30 \times 0.625 + 1.70(1-0.625)}{1.025} \Rightarrow \frac{5.1875 + 0.6375}{1.025}$

$= \Rightarrow 5.682$

Node S_2

$$\Rightarrow \frac{CUP + Cd(1-P)}{R}$$

$$\Rightarrow \frac{1.70 \times 0.625 + 0(1-0.625)}{1.025}$$

$$\Rightarrow \frac{1.0625 + 0}{1.025}$$

$$\Rightarrow \boxed{1.036}$$

Node S_0

$$\Rightarrow \frac{CUP + Cd(1-P)}{R}$$

$$\Rightarrow \frac{5.682 \times 0.625 + 1.036 \times 0.375}{1.025}$$

$$\Rightarrow \frac{3.551 + 0.3885}{1.025}$$

$$\Rightarrow \boxed{3.843}$$

☞ Delta hedging

$\Delta \Rightarrow$ Δ in value of option / Δ in price of share

$$\Rightarrow \frac{5-0}{33-27} \Rightarrow 0.833$$

Combination:- Write 1 call option and buy 0.833 share

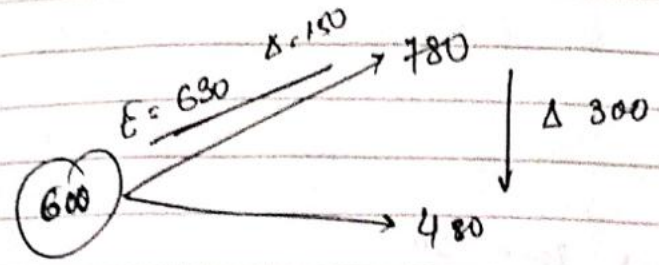
Value of

Write

Date / /

Page

Rule 1:



(i) Delta ⇒ To compute perfect hedge, we need to compute hedge ratio.

$$\text{Delta} = \frac{\Delta \text{ in value option}}{\Delta \text{ in price}}$$

$$\Rightarrow \frac{150 - 0}{780 - 480} \Rightarrow \frac{150}{300} \Rightarrow \boxed{0.5}$$

Action :- Write Call option & buy 0.5 share

(ii) Value of option today

To calculate the value of call option, we need to calculate the cash inflow.

Price 780	Price 480
Call Exercise ⇒ -150	Call lapse = 0
(+) share sold 390	(+) share sold ⇒ 240
(0.5 × 780)	(0.5 × 480)
Cash inflow 240	Cash inflow 240

3

Value of option

$C_0 = SOX\Delta - \frac{CI}{1+R}$

$\Rightarrow 60 \times 0.5 - \frac{240}{(1.10)} \Rightarrow 30 - \frac{240}{1.025}$

$\Rightarrow 300 - 234.14$

$\Rightarrow \boxed{65.85}$

(iii) Expected rate of return

Expected option value $\Rightarrow \frac{150 \times 0.6 + 0.4 \times 0 - 65.85}{65.85}$

$= \frac{90 - 65.85}{65.85}$

$\Rightarrow \frac{24.15}{65.85}$

$\Rightarrow \boxed{36.67\%}$

QUESTION – 18

The following quotes are available for 3 months options in respect of a share of P Ltd. which is currently traded at ₹ 310 :

Strike price	₹ 300
Call option	₹ 30
Put option	₹ 20

An investor devises a strategy of buying a call and selling the share and a put option.

(i) Draw his profit/loss profile if it is given that the rate of interest is 10% per annum.

(ii) What would be the position if the strategy adopted is selling a call and buying the put and the share? ($e^{0.025}$ = 1.0253; $e^{0.25}$ = 1.2840)

(Page No. 29)

put call parity

$$S_0 + P_0 = C_0 + \frac{E}{e^{rt}}$$

$$310 + 20 = 30 + \frac{300}{e^{0.10 \times 0.25}}$$

$$330 = 30 + \frac{300}{e^{0.025}}$$

$$330 = 30 + \frac{300}{1.0253}$$

$$330 = 322.60$$

Investor should buy Call & ZCB & sell Share & put

① Calculation of profit or Loss

Strategy → • Buy call & ZCB
• Sell share & put

Today Cash flows

Buy call	−30
ZCB Buy $\left[\frac{300}{1.0253}\right]$	−292.60
short sell share	+310
Write put	+20
Arbitrage Gain =	₹ 7.40

Calculation of payoff on Maturity

	$S < 300$	$S > 300$
Call	0	$S - 300$
ZCB	300	300
Buy share	$-S$	$-S$
put	$-(300 - S)$	0
	0	0

② Profit/Loss

Strategy:
- Sell Call & ZCB
- Buy share & put

Today Cash flows

Write call	+30
Sell ZCB	+297.60
Buy share	−310
Buy put	− 20
Loss	= 7.40

Calculation of payoff on Maturity

	$S < 300$	$S > 300$
Call	0	$-(S-300)$
ZCB	−300	−300
Sell share	$+S$	$+S$
put	$+300-S$	0
	0	0

3. Black Scholes Model (BSM)

Following steps are applied to calculate value of option

Step 1 Calculate d_1 & d_2

$$d_1 = \frac{\ln\frac{S_0}{E} + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Step 2 Calculate $n(d_1)$ & $n(d_2)$

Step 3 Calculate Value of option

$$C_0 = S_0 \times n(d_1) - \frac{E}{e^{rt}} n(d_2)$$

$$P_0 = \frac{E}{e^{rt}} n(-d_2) - S_0 \times n(-d_1)$$

Eg

S_0 = ₹ 442

E = ₹ 400

$\frac{S_0}{E}$ $\frac{442}{400}$ = 1.105

Ln 1.105 = 0.0998

or

9.98%

$Z = \frac{x - \mu}{\sigma\sqrt{t}}$

Eg 2

$\frac{81}{2}$ = 40.5% Variance = 81%

0 — 6 Months — 12 months

$\sqrt{\frac{81}{2}}$ = 6.36%

σ = 9%

$\frac{9}{\sqrt{2}}$

or

$9\sqrt{0.5}$ =

periodical S.D. = $\sigma\sqrt{t}$

QUESTION – 19

From the following data for certain stock, find the value of a call option:

Price of stock now	S_0	= ₹ 80
Exercise price	E	= ₹ 75
Standard deviation of continuously compounded annual return	σ	= 0.40
Maturity period	$t = 0.5$	= 6 months
Annual interest rate	r	= 12%

Given

Number of S.D. from Mean, (z)	Area of the left or right (one tail)
0.25	0.4013
0.30	0.3821
0.55	0.2912
0.60	0.2743

$e^{0.12 \times 0.5} = 1.062$

In 1.0667 = 0.0646

(SM New Syllabus & PM) (Page No. 31)

Calculation of Value of Call option

$$C_0 = S_0 \times N(d_1) - \frac{E}{e^{rt}} \times N(d_2)$$

$$= ₹80 \times 0.7197 - \frac{75}{e^{0.12 \times 0.5}} \times 0.6176$$

$$= 57.58 - \frac{75}{1.062} \times 0.6176$$

$$= ₹ 13.96$$

W.N.1 Calculation of d_1 & d_2

$$d_1 = \frac{\ln\frac{S_0}{E} + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\frac{80}{75} + \left(0.12 + \frac{0.40^2}{2}\right)0.5}{0.40\sqrt{0.5}}$$

$$= \frac{\ln 1.0667 + 0.10}{0.2828}$$

$$= \frac{0.0646 + 0.10}{0.2828}$$

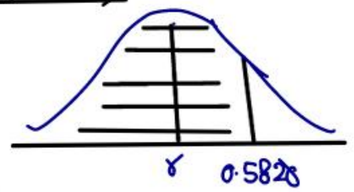
$$= 0.5820$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= 0.5820 - 0.2828 = 0.2992$$

W.N.2 Calculation of $n(d_1)$ & $n(d_2)$

$n(0.5820)$



0.032
0.55
0.5820
0.60

0.2912
0.2740

0.032
0.55 —— 0.2912
0.5820
0.60 —— 0.2743
0.05 —— 0.0169

$$0.2912 + \left(\frac{0.2912 - 0.2743}{0.55 - 0.60}\right)0.032$$

$$0.2912 - \left(\frac{0.0169}{0.05} \times 0.032\right)$$

$$= 0.2803$$

Body Area

$$n(d_1) = 1 - 0.2803$$

$$= 0.7197$$

$$\frac{N(d_2)}{N(0.2992)}$$

0.0492 ↑ 0.25 — 0.4013

0.2992 ↓ 0.30 — 0.3821

0.05 — 0.0192

$$0.4013 - \left(\frac{0.0192}{0.05} \times 0.0492\right)$$

$$= 0.3822$$

$$N(d_2) = 1 - 0.3822 = 0.6178$$

QUESTION – 20

Following information is available for X Company's shares and Call option:

Current share price	₹ 185
Option exercise price	₹ 170
Risk free interest rate	7% p.a.
Time of the expiry of option	3 years
Standard deviation	0.18

Calculate the value of option using Black-Scholes formula.

H.W Copy No

(Practice Manual)

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QUESTION – 21

On April 11th 2004, Ferguson system was trading at ₹ 13.62.

(a) To value a July, 2004 call option with strike price ₹ 15, trading on the board options exchange on the same day for ₹ 2, the following are the other parameter ₹ of the options:

(i) The annualize standard deviation in Ferguson, system stock price over the previous year was 81%.

(ii) The option expiration date is Friday july 23rd 2004, there are 103 days to expiration days (year=365 days) and annualized treasury bill rate corresponding to this option is 4.63%

(iii) The value using normal distribution on N(d1)= 0.5085 and N(d2) was 0.3412

(b) Comment on the trading value as on July 23rd 2004.

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ⓐ Value of Call option

$$C_0 = S_0 \times n(d_1) - \frac{E}{e^{rt}} \times n(d_2)$$

$$= ₹13.62 \times 0.5085 - \frac{₹15}{e^{(0.0463 \times \frac{103}{365})}} \times 0.3412$$

$$= 6.926 - \frac{15}{e^{0.0131}} \times 0.3412$$

$$= 6.926 - \frac{15}{1.0132} \times 0.3412$$

$$= ₹1.87$$

ⓑ premium (₹2) is more than Value of Call (₹1.87), hence it is overpriced.

QUESTION – 22

The Ferguson system was trading at ₹ 134 on april 3, 2009 and call option exercisable in three months' time had a strike price of ₹ 130.

The following are the other parameter of the option:

(i) The annualized standard deviation in Ferguson system stock price over the previous year was 60%

(ii) The annualized Treasury bill rate corresponding to this option life is 8%.

Requirements:

(i) Compute the value of a three month Call option on the stock of Ferguson System using Black and Scholes Model.

(ii) What would be the value of put?

(iii) If this call option is priced at ₹ 15, what investment strategy would you adopt?

$S_0 = ₹134$

$E = ₹130$

$t = 3 \text{ Months } \left(\frac{3}{12}\right) = 0.25 \text{ YEARS}$

Call option

$\sigma = 0.60$

$r = 0.08$

① Value of Call

$$C_0 = S_0 \times n(d_1) - \frac{E}{e^{rt}}\, n(d_2)$$

$$= ₹\,134 \times 0.6946 - \frac{130}{e^{(0.08 \times 0.25)}} \times 0.5071$$

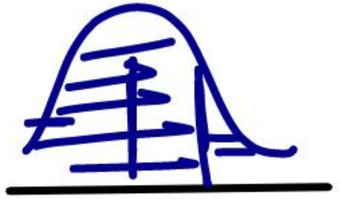
$$= ₹\,83.6964 - \frac{130}{e^{0.02}} \times 0.5071$$

$$= ₹\,83.6964 - 130 \times e^{-0.02} \times 0.5071$$

$$= ₹\,83.6964 - 130 \times 0.9802 \times 0.5071$$

$$= ₹\,19.08$$

(iv) If this put option is available in the market at ₹ 14 what investment strategy would you adopt?



Note: Extracted from the tables:

(a) Natural Logarithm:

(b) Ln(0.9701) = -0.0303

(c) Ln (1.0308) = 0.0303

(d) Value of e : $e^{-0.02}$ = 0.9802, $e^{-0.016}$ = 0.9841

(e) For N(X): where X > 0: N(0.3177) = 0.6246

(f) N(0.0177) = 0.5071

Where X<0: N(−0.3177) = 0.3754

N(−0.0177) = 0.4929

(Page No. 36)

W.N.1 d_1 & d_2

$$d_1 = \frac{\ln \frac{S_0}{E} + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln \frac{134}{130} + \left(0.08 + \frac{0.60^2}{2}\right)0.25}{0.60\sqrt{0.25}}$$

$$= \frac{\ln 1.0308 + 0.065}{0.30}$$

$$= \frac{0.0303 + 0.065}{0.30} = 0.3177$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= 0.3177 - 0.30 = 0.0177$$

W.N.2 $N(d_1)$ & $N(d_2)$

$N(d_1)$

$N(0.3177) = 0.6246$

$N(d_2)$

$N(0.0177) = 0.5071$

(ii) Value of put

$$P_0 = \frac{E}{e^{rt}} N(-d_2) - S_0 N(-d_1)$$

$$= 130 \times 0.9802 \times N(-d_2) - 134 \times N(-d_1)$$

$$= 130 \times 0.9802 \times 0.4929 - 134 \times 0.3754$$

$$= ₹\ 12.50$$

$N(-d_1)$

$N(-0.3177) = 0.3754$

$N(-d_2)$

$N(-0.0177) = 0.4929$

Alternative

Value of put option [PCP]

$$P_0 + S_0 = C_0 + \frac{E}{e^{rt}}$$

$$P_0 + 134 = 19.08 + 130 \times 0.9802$$

$$P_0 = ₹\ 12.50$$

(iii) premium = ₹15

Value of call = ₹19.08

Since call is underpriced, hence it should be purchased.

(iv) put premium = ₹14

Value of put = ₹12.50

Since put is overpriced, hence it should be sold.

QUESTION – 23

The shares of TIC Ltd. are currently priced at ₹ 415 and call option exercisable in three months' time has an exercise rate of ₹ 400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of share price is 22%.

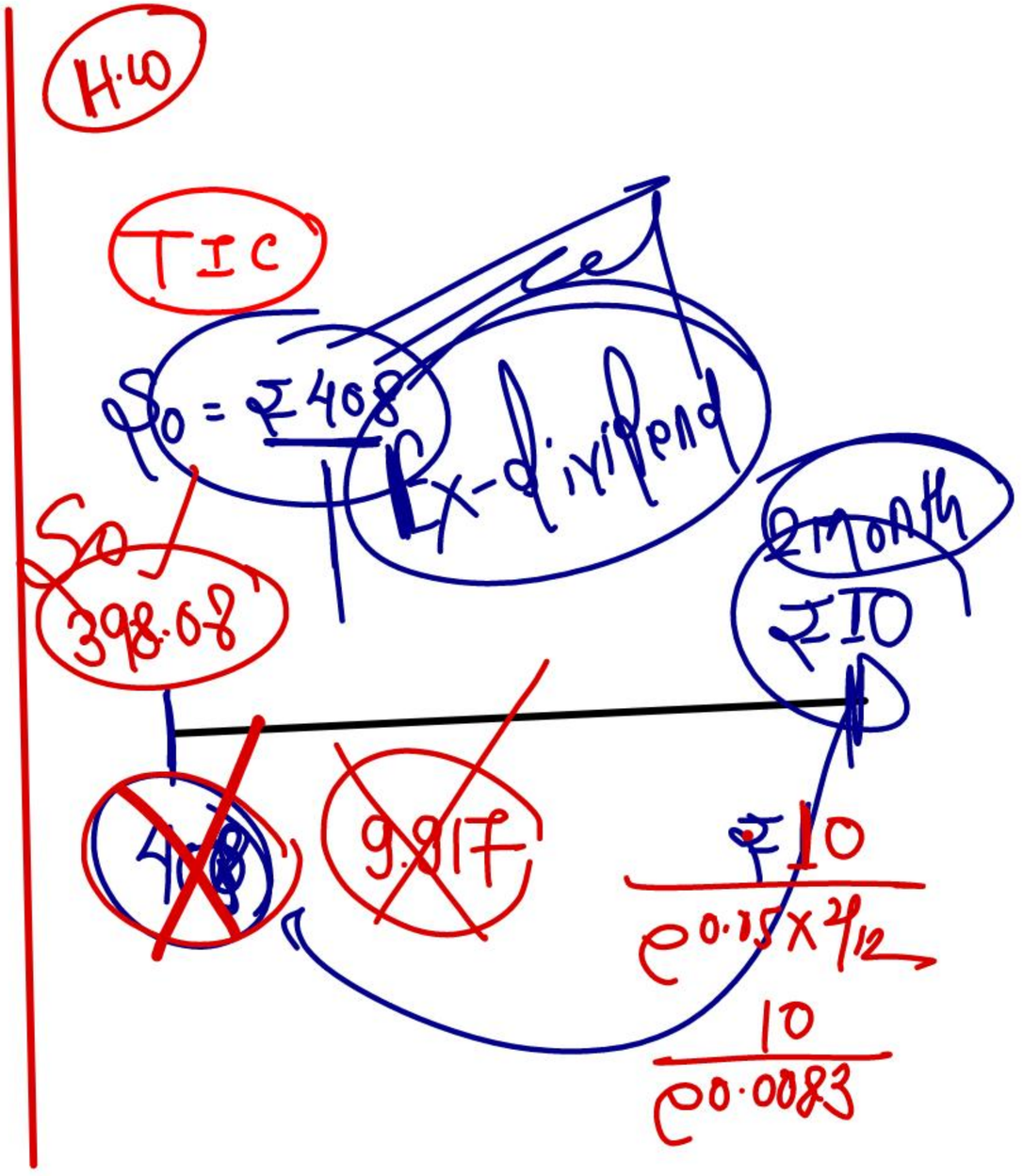
(i) Based on the assumption that TIC Ltd. is not going to declare any dividend over the next three months, is the option worth buying for ₹ 25?

(ii) Calculate value of aforesaid call option based on Block Scholes valuation model if the current price is considered as ₹ 380.

(iii) What would be the worth of put option if current price is considered ₹ 380.

(iv) If TIC Ltd. share price at present is taken as ₹ 408 and a dividend of ₹ 10 is expected to be paid in the two months time, then, calculate value of the call option.

(Page No. 38)



① Value of Call

W.N.1 d_1 & d_2

$$d_1 = \frac{\ln\frac{S_0}{E} + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$d_1 = \frac{\ln\frac{415}{400} + \left(0.05 + \frac{0.22^2}{2}\right)0.25}{0.22\sqrt{0.25}}$$

$$= \frac{\ln 1.0375 + 0.01855}{0.11}$$

$$d_1 = \frac{0.0368 + 0.01855}{0.11} = 0.5032$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= 0.5032 - 0.11 = 0.3932$$

I.N.N.2 $N(d_1)$ & $N(d_2)$

$N(0.5032)$

0.0032 ↑	0.50	0.3085
0.5032 ↓	0.55	0.2812
	0.05	0.0173

$$0.3085 - \left(\frac{0.0173}{0.05} \times 0.0032\right)$$

$$= 0.3074$$

$$N(d_1) = 1 - 0.3074 = 0.6926$$

$N(0.3932)$

	0.35	0.3632
0.3932 ↓	0.40	0.3446
	0.05	0.0186

$$0.3632 - \left(\frac{0.0186}{0.05} \times 0.0432\right) = 0.3471$$

$$N(d_2) = 1 - 0.3471 = 0.6529$$

$$C_0 = S_0 \times N(d_1) - \frac{E}{e^{rt}} N(d_2)$$

$$= 415 \times 0.6926 - \frac{400}{e^{0.0125}} \times 0.6529$$

$$= 287.429 - \frac{400}{1.0126} \times 0.6529$$

$$= ₹\ 29.52$$

Since option is underpriced hence it should be purchased.

(11) Value of Call [$S_0 = ₹380$]

W.N.1 d_1 & d_2

$$d_1 = \frac{\ln\frac{380}{400} + \left(0.05 + \frac{0.22^2}{2}\right)0.25}{\sigma\sqrt{t}}$$

$$= \frac{\ln 0.95 + 0.01855}{0.22\sqrt{0.25}}$$

$$= \frac{-0.0513 + 0.01855}{0.11}$$

$$= -0.2977$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

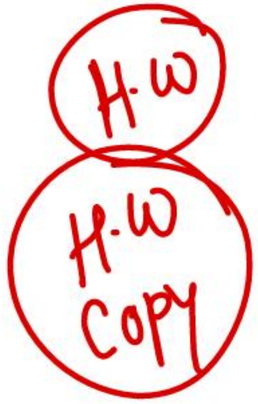
$$= -0.2977 - 0.11 = -0.4077$$

W.N.2 $N(d_1)$ & $N(d_2)$

$N(-0.2977) = 0.3821$

QUESTION – 24

The shares of TIC Ltd. are currently priced at ₹ 415 and call option exercisable in three months' time has an exercise rate of ₹ 400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of the share price is 22%. The TIC Ltd. is not going to declare any dividend over the next three months.



(i) DECIDE whether the option worth buying for ₹ 25.

(ii) CALCULATE the value of aforesaid call option if the current price of share is considered as ₹ 380.

(iii) CALCULATE the value of aforesaid call option if present price of share is taken as ₹ 408 and a dividend of ₹ 10 is expected to be paid in the two months' time.

Given

In (1.0375) = 0.03681, In(0.95) = -0.05129 and In (0.9952) = -0.00481

$e^{0.0125} = 1.0126$ and $e^{0.00833} = 1.0084$

Cumulative Area of Number of S.D. from Mean (z)

Z	0.0150	0.1250	0.3933	0.5033	-0.2976	-0.4076
Area	0.5060	0.5497	0.6530	0.6926	0.3830	0.3418

(MTP: Oct – 2022)

(Page No. 42)

QUESTION – 25

Following information is available for TIC Company's shares and Call option:

Current share price	=	₹415
Option exercise price	=	₹400
Risk free interest rate	=	5%
Time of the expiry of option	=	three months
Standard deviation	=	22%

Is the option worth buying for ₹ 25 using Black-Scholes formula?

(Page No. 45)

QUESTION – 23

The shares of TIC Ltd. are currently priced at ₹ 415 and call option exercisable in three months' time has an exercise rate of ₹ 400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of share price is 22%.

(i) Based on the assumption that TIC Ltd. is not going to declare any dividend over the next three months, is the option worth buying for ₹ 25?

① 29.52

(ii) Calculate value of aforesaid call option based on Block Scholes valuation model if the current price is considered as ₹ 380.

② 10.52

(iii) What would be the worth of put option if current price is considered ₹ 380.

③ 25.54

(iv) If TIC Ltd. share price at present is taken as ₹ 408 and a dividend of ₹ 10 is expected to be paid in the two months time, then, calculate value of the call option.

④ 18.94

(Page No. 38)

QUESTION – 24

The shares of TIC Ltd. are currently priced at ₹ 415 and call option exercisable in three months' time has an exercise rate of ₹ 400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of the share price is 22%. The TIC Ltd. is not going to declare any dividend over the next three months.

(i) DECIDE whether the option worth buying for ₹ 25.

(ii) CALCULATE the value of aforesaid call option if the current price of share is considered as ₹ 380.

(iii) CALCULATE the value of aforesaid call option if present price of share is taken as ₹ 408 and a dividend of ₹ 10 is expected to be paid in the two months' time.

Given

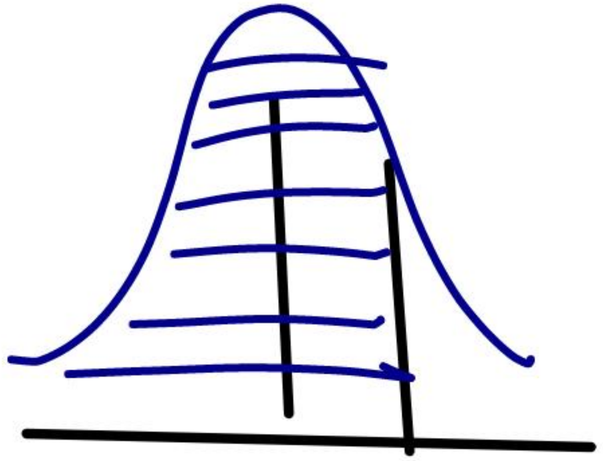
In (1.0375) = 0.03681, In(0.95) = -0.05129 and In (0.9952) = -0.00481

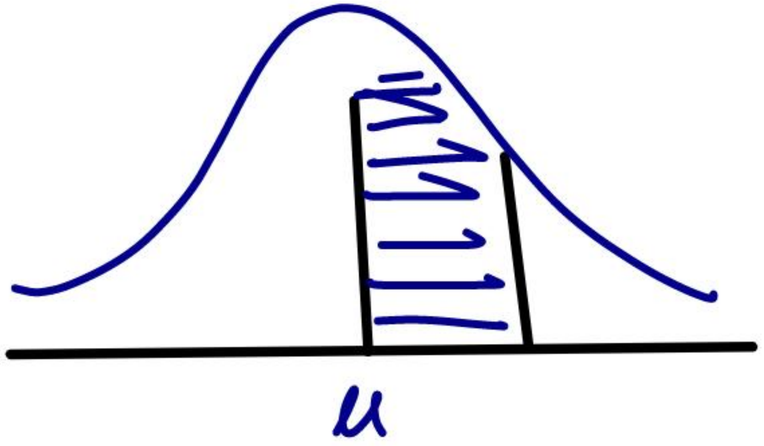
$e^{0.0125} = 1.0126$ and $e^{0.00833} = 1.0084$

Cumulative Area (z)						
Number of S.D. from Mean						
Z	0.0150	0.1250	0.3933	0.5033	-0.2976	-0.4076
Area	0.5060	0.5497	0.6530	0.6926	0.3830	0.3418

(MTP: Oct – 2022)

(Page No. 42)





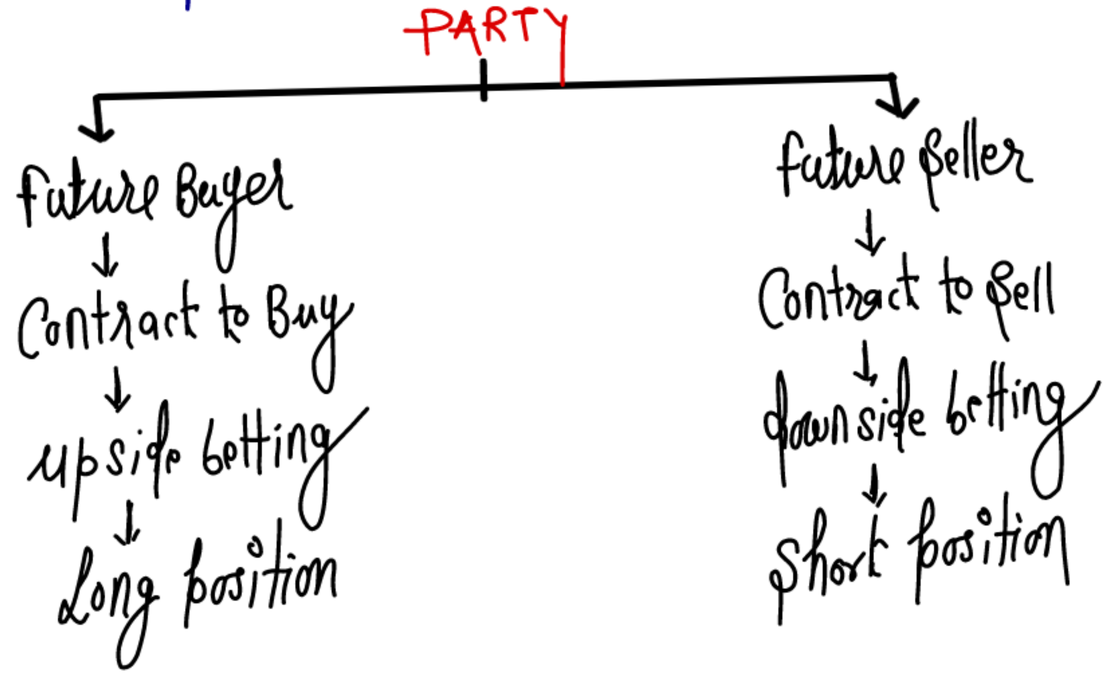
PART II forward & future

forward Contract is a Contract between two parties to buy or sell an underlying asset at predetermined price (forward price).

In forward contract, forward buyer is obligated to buy & forward seller is obligated to sell.

Future Contract

- Future Contract is just like forward Contract
  - → Traded at Stock Exchange
  - → with Margin requirement
  - → No Counterparty default Risk
  - → Mark to Market adjustment in margin
- There are parties in future Contract



Forward Contract v/s Future Contract

Forward	Future
① Customized	① Standardized
② Over the Counter (OTC)	② Exchange Traded
③ No Margin required	③ Margin required
④ Counter party default Risk	④ No Counter party default Risk
⑤ Settlement only on Maturity	⑤ Daily adjustment in margin
⑥ Less Liquidity	⑥ High Liquidity
⑦ Less Regulations	⑦ More Regulation

Numerical

PART 1 Margin A/c

PART 2 future pricing

PART 3 Beta Management [Imp]

PART 4 Commodity future

① Margin

There are three types of Margin

① Initial Margin

Initial margin means margin amount to be deposited at stock Exchange at the time of Execution of Contract.

② Maintenance Margin

Maintenance Margin is minimum margin Amount. If Initial Margin is less than maintenance margin, then investor has to bring in Extra Amount upto Initial Margin.

③ Variation Margin

Extra Amt of Margin Call is Variation Margin

Imp points

① If Margin balance is more than initial Margin then Margin Amt can be withdrawn.

If question is silent about withdrawal, assuming No withdrawal.

② If Contract is squared off (सौदा काटना) then closing balance of Margin Amt is refunded to investor

③ Initial Margin is given in question. If not given then it is calculated as under

$$\text{Initial Margin} = \mu + 3\sigma$$

μ : Average Absolute daily change in price

σ = Standard deviation in price

QUESTION – 35

On 31/08/2021 Mr. R has taken a Long position of Two lots of Nifty Futures at 17300.

One lot of Nifty future is 50 units.

Initial Margin required is 10% of Contract Value.

Maintenance Margin required is 80% of Initial Margin.

The closing price of 5 days are given below –

Date	Closing Price of Nifty Future
01/09/2021	17340
02/09/2021	17180
03/09/2021	16990
06/09/2021	16900
07/09/2021	17120

You are required to-

(i) Prepare a statement showing the daily balances in the margin account & payment on margin calls, if any.

(ii) Compute the Gain or Loss of Mr. R, if contract squared off on 07/09/2021.

(iii) What would be the Gain or Loss if Mr. R, had taken the short position?

(Exam December - 2021) (Page No. 56)

① Calculation of Margin

Contract Value = 17300 × 100 units

= ₹ 1730000

Initial Margin = 1730000 × 10%

= ₹ 173000

Maintenance Margin = 173000 × 80%

= ₹ 138400

① Margin A/C

Date	closing price	profit / Loss	Margin Call	Closing Balance
31/8/2021	17300	—	—	173000
1/9/2021	17340	(17340 - 17300) 100 = 4000	—	177000
2/9/2021	17180	(17180 - 17340) 100 = (16000)	—	161000
3/9/2021	16990	(16990 - 17180) 100 = (19000)	—	142000
6/9/2021	16900	(16900 - 16990) 100 = (9000)	40000	173000
7/9/2021	17120	(17120 - 16900) 100 = 22000	—	195000

② Calculation of Gain or Loss

Closing Balance	195000
(-) Initial Margin	173000
(-) Margin call	40000
Loss	= 18000

or (17120 - 17300) x 100
= Loss 18000

Margin A/c

17300 ↓

Date	closing price	profit/Loss	Margin call	Balance
31/8/21	17300	-	-	17000
1/9/21	17340	(17300 - 17340) × 100 = (4000)	—	16000
2/9/21	17180	(17340 - 17180) × 100 = 16000	-	18500
3/9/21	16990	(17180 - 16990) × 100 = 19000	-	20400
6/9/21	16900	(16990 - 16900) × 100 = 9000	-	21300
7/9/21	17120	(16900 - 17120) × 100 = (22000)	—	19100

Gain/Loss

Closing Balance = ₹ 19100

(-) Initial Margin = ₹ 17300

profit = 1800

QUESTION – 36

The price of March Nifty Futures Contract on a particular day was 9170. The minimum trading lot on Nifty Futures is 50. The initial margin is 8% and the maintenance margin is 6%. The index closed at the following levels on next five days:

Day	1	2	3	4	5
Settlement Price (₹)	9380	9520	9100	8960	9140

H.W.

H.W. Copy

You are required to calculate:

(i) Mark to market cash flows and daily closing balances on account of

(a) An investor who has taken a long position at 9170

(b) An investor who has taken a short position at 9170

(ii) Net Profit/Loss on each of the contract.

(Exam January - 2021) (Page No. 57)

QUESTION – 37

Sensex futures are traded at a multiple of 50. Consider the following quotations of Sensex futures in the 10 trading days during February, 2009:

Day	High	Low	Closing
4-2-09	3306.40	3290.00	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

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

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

(SM New Syllabus & PM) (Page No. 59)

50 units
Long
Buy

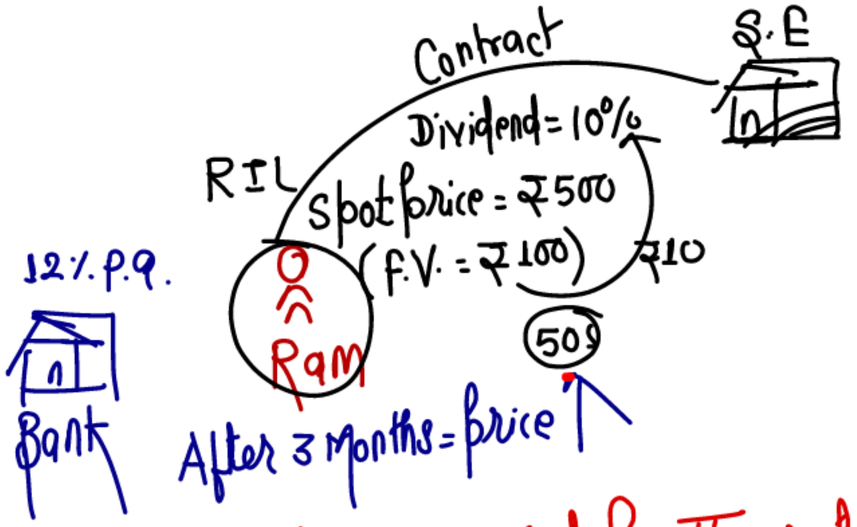
H.W
C.W Copy

10000 + (2000 × 3)
= 16000

Maintenance
= 16000 × 75%
= 12000

PART 2 future pricing

[Cost of Carry Model or Theoretical Minimum price Model]



As per Cost of Carry Model, Theoretical future price is calculated as under

$$f = \text{Spot price} + \text{Intt Saved} - \text{Dividend foregone}$$

$$f = S(1+r) - D$$

EXAMPLE – 17

Spot Price = ₹ 500 (F.V. ₹ 100)

Period = 6 Months

Dividend Rate = 20%

Rate of Interest = 10% p.a.

₹ 20

Dividend Rate – FV
Dividend yield – MPS
Dividend payout Ratio = EPS

Calculate Theoretical Price of Future.

$$F = S(1+r) - D$$

$$= ₹500(1.05) - 20$$

$$= ₹505$$

(Page No. 07)

EXAMPLE – 18

Spot Price = ₹ 500 (F.V. ₹ 100)

Period = 6 Months

Dividend Yield = 5% p.a.

Rate of Interest = 10% p.a.

Calculate fair value of Future.

Dividend =

$₹500 \times 5\% \times \frac{6}{12}$

$= 12.50$

$f = S_0(1+r) - D$

$= ₹500(1.05) - 12.50$

$= ₹512.50$

(Page No. 07)

$f = S \times [1 + (r-q)t]$

$= 500 \times \left[1 + (0.10 - 0.05)\frac{6}{12}\right]$

$= 512.50$

EXAMPLE – 19

Spot Price = ₹ 500

Period = 6 Months

Dividend Yield = 4% p.a. compounded annually.

Rate of Interest = 12% p.a. compounded annually.

Calculate fair value of Future.

(Page No. 07)

fair Value

$$F = S \times [1 + (r - q)^t]$$

$$= ₹500 \times \left[1 + (0.12 - 0.04)\right]^{\frac{6}{12}}$$

$$= ₹500 \times (1.08)^{6/12}$$

$$= ₹519.61$$

EXAMPLE – 20

Consider the following:

Current value of index	- 1400	S
Dividend yield	- 6%	q
CCRRI	- 10%	

Find the value of a 3 month forward contract.

(Page No. 07)

$$f = S \times e^{(r-q)t}$$

$$= 1400 \times e^{(0.10-0.06)\frac{3}{12}}$$

$$= 1400 \times e^{0.01}$$

$$= 1400 \times 1.01005$$

$$= 1414.07$$

EXAMPLE – 21

Consider a 3 months maturity forward contract on a non-dividend paying stock. The stock is available for ₹ 200. With compounded continuously risk-free rate of interest (CCRRI) of 10% per annum, what is the value of the forward contract?

Ans. – 205.06

(Page No. 08)

EXAMPLE – 23

Consider a 4 months forward contract on 500 shares with each share priced at ₹ 75. Dividend @ ₹ 2.50 per share is expected to accrue to the shares in a period of 3 months. The CCRRI is 10% per annum, what is the value of the forward contract?

Arbitrage with future

(i) No dividend paying stock

(ii) Dividend paying stocks

(Page No. 08)

EXAMPLE – 24

Spot Price = ₹ 500

6 Months future price = ₹ 542

No dividend paying stock

Rate of Interest = 10% p.a.

(i) Calculate Theoretical price of future.

(ii) Calculate arbitrage gain.

(Page No. 08)

① Theoretical price of future

$F = S(1+r)$

$= ₹500(1.05) = ₹525$

② Arbitrage

Action

Since Actual future price (₹542) is more than Theoretical future (525) hence future is overpriced

In this situation Buy stock today & Contract to sell in future.

ICAI → Since future is overpriced, hence Sell future & Buy spot.

process

Today

- Borrow ₹500 @ 10% P.A. for 6 months & Buy share.
- Sell future at ₹542
  short position

After 6 months

Sell share at future price	= ₹542
(-) Repayment 500 (1.05)	= ₹525
Arbitrage Gain	₹17

* If two prices are given on Maturity

Suppose ₹375 & 1000

We took short position at ₹542 ↓

	375 ✓	1000 ✓
Sell share	+375	+1000
Gain or Loss on short position	+167	-458
Repayment 500 (1.05)	-525	-525
Arbitrage Gain =	17	17

EXAMPLE – 25

Spot Price = ₹ 400

6 Months future price = ₹ 425

No dividend paying stock

Rate of Interest = 20% p.a.

(i) Calculate Theoretical Price of future.

(ii) Calculate arbitrage gain.

(Page No. 09)

① Theoretical future price

$F = S(1+r)$

$= ₹400(1.10) = ₹440$

② Arbitrage

Action → Since future is underpriced hence Buy future & sell spot.

Arbitrage process

Today

- Short sell share at ₹400 & Invest @ 20% p.a. for 6 months.
- Buy future at ₹425

After 6 months.

Investment 400(1.10) = ₹440

Buy share & Return to Stock Lender = ₹425

Gain = 15

* On Maturity — Long 425↑

	₹308	₹757
Buy share	-308	-757
Gain/Loss on Long position	-117	+332
Investment 400(1.10)	+440	+440
	15	15

EXAMPLE – 26

Spot Price = ₹ 500

6 Months future price = ₹ 573

Dividend per shares = ₹ 5

Rate of Interest = 20% p.a.

(i) Calculate Theoretical price of future.

(ii) Calculate arbitrage gain.

(Page No. 09)

① Theoretical future price

$F = S(1+r) - D$

$= ₹500(1.10) - 5$

$= ₹545$

② Arbitrage

1 Action

future is overpriced, hence sell future & Buy spot.

2. forces

Today

- Borrow ₹500 @ 20% p.a. for 6 months & Buy share
- Sell future at ₹573

After 6 months.

Sell share	₹573
(+) Dividend	₹5
(−) Repayment 500(1.10)	550
Gain =	28

EXAMPLE – 27

Spot Price = ₹ 400

6 Months future price = ₹ 407

Dividend per shares = ₹ 5

Rate of Interest = 20% p.a.

(i) Calculate Theoretical price of future.

(ii) Calculate arbitrage gain.

(Page No. 09)

① Theoretical price of future

$$F = S(1+r) - D$$

$$= 400(1.10) - 5 = 435$$

② Arbitrage

Action

Since future is underpriced,
Hence Buy future & sell spot.

Process

Today

- Short sell share at ₹400 & Invest @ 20% p.a. for 6 months.
- Buy future at ₹407

After 6 months.

Investment 400(1.10) = ₹440

Buy share & Return to stock lender = (407)

Dividend compensation = (₹5)

Gain = ₹28

Long 407 ↑

	348	637
Buy share	-348	-637
Investment 400(1.10)	+440	+440
Gain/Loss on future	-59	+230
Dividend compensation	-5	-5
	28	28

QUESTION – 38

The following data relate to Anand Ltd.'s share price:

Current price per share	₹ 1,800
6 months future's price/share	₹ 1,950

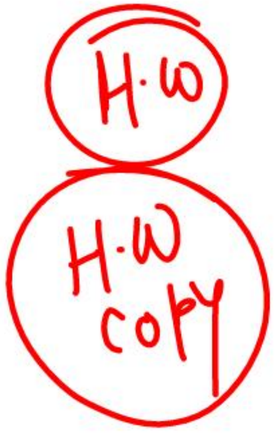
Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are required:

(i) to calculate the theoretical minimum price of a 6-months forward purchase; and

(ii) to explain arbitrate opportunity.

(SM New Syllabus & PM)

(Page No. 61)



QUESTION – 39

The following data relate to R Ltd.'s share price:

Current price per share	₹ 1,900
6 months future's price/share	₹ 2050

Assuming it is possible to borrow money in the market for transactions in securities at 10% per annum,

(i) advise the justified theoretical price of a 6-months forward purchase; and

(ii) evaluate any arbitrage opportunity, if available.

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(RTP May - 2021)

(Page No. 61)

QUESTION – 40

The following data relate to X Ltd.'s share price:

Current price per share	₹ 2000
3 months future's price/share	₹ 2250

Assuming it is possible to borrow money in the market for transactions in securities at 6% per annum, you are required to:

(1) **CALCULATE** the theoretical minimum price of a 6-months forward purchase; and

(2) **EXPLAIN** arbitrate opportunity.

(MTP: Sep – 2022)

(Page No. 62)

QUESTION – 40

The following data relate to X Ltd.'s share price:

Current price per share	₹ 2000
3 months future's price/share	₹ 2250

Assuming it is possible to borrow money in the market for transactions in securities at 6% per annum, you are required to:

(1) **CALCULATE** the theoretical minimum price of a 6-months forward purchase; and

(2) **EXPLAIN** arbitrate opportunity.

(MTP: Sep – 2022)

(Page No. 62)

QUESTION – 41

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

(SM New Syllabus & PM)

(Page No. 63)

Theoretical future price

$$F = S(1+r) - D$$

$$= ₹220(1.0375) - 2.5$$

$$= ₹225.75$$

Action → Since future is overpriced, hence Sell future & Buy spot.

process

Today

- Borrow ₹220 @ 15% p.a. for 3 months & Buy stock
- Sell future at ₹230

After 3 Months

Sell stock at future price = ₹230

(-) Repayment 220×1.0375 = 228.25

(+) Dividend 2.50

Gain = 4.25

QUESTION – 42

The share of X Ltd. is currently selling for ₹ 500. Risk free interest rate is 0.6% per month. A three-month futures contract is selling for ₹ 511.

DEVELOP an arbitrage strategy and show what your riskless profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months.

(MTP: Sep – 2022)

(Page No. 64)

$F = 500 \times 1.018 = 509$

or

$500 \times (1.006)^3 = 509.05$

Class Work

QUESTION – 43

The share of X Ltd. is currently selling for ₹ 300. Risk free interest rate is 0.8% per month. A three month futures contract is selling for ₹ 312. Develop an arbitrage strategy and show what your riskless profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months.

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(SM New Syllabus)

(Page No. 65)

QUESTION – 44

The 6-months forward price of a security is ₹ 208.18. The borrowing rate is 8% per annum payable with monthly rests. What should be the spot price?

(SM New Syllabus & PM)

(Page No. 65)

$$F = S(1+r)^n$$

$$208.18 = S(1.00667)^6$$

$$S = ₹200$$

QUESTION – 45

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

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

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

(SM New Syllabus & PM) (Page No. 66)

Average dividend yield = $\frac{3+3+4+3}{4}$

= 3.25% P.A.

$$F = S \times e^{(r-d)t}$$

$$= ₹2200 \times e^{(0.08-0.0325)\frac{4}{12}}$$

$$= ₹2200 \times e^{0.01583}$$

$$= ₹2200 \times 1.01593$$

$$= ₹2235.046$$

QUESTION – 46

The NSE-50 Index futures are traded with rupee value being ₹100 per index point. On 15th September, the index closed at 1195, and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the index has been 3% per annum and the borrowing rate was 9.5% per annum.

(i) Determine whether on September 15, the December futures were under-priced or overpriced?

(ii) What arbitrage transaction is possible to gain out this mispricing?

(iii) Calculate the gains and losses if the index on 15th December closes at (a) 1260 (b) 1175

Assume 365 days in a year for your calculations

(Exam November - 2019)

(Page No. 67)

① Theoretical future price

$$F = S \times [1 + (r - q)t]$$

$$= 1195 \times \left[1 + (0.095 - 0.03)\frac{91}{365}\right]$$

$$= 1195 \times 1.0162$$

$$= 1214.36$$

$F = 1214.36 \times ₹100 = ₹121436$

Since Actual future $(1225 \times 100) = ₹122500$ is more than theoretical future, hence future is overpriced.

(ii) Since future is overpriced, hence Buy spot & sell future.

(iii) **Arbitrage process**

Today

- Borrow (1195 × 100) = ₹ 119500 @ 9.5% + 2830.31
  for 91 days
- Buy a portfolio in same proportion as Nifty for ₹ 119500
- Take short position at (1225 × 100) = ₹ 122500

After 91 days 1225 ↓

	1260	1175
Sell stocks	126000	117500
Repayment 119500 × 1.02368	-122330	-122330
Gain or Loss on short position	-3500	+5000
Dividend Income 119500 × 3% × 91/365	893.79	893.79
Arbitrage Gain =	1063.79	1063.79

QUESTION – 47

Suppose current price of an index is ₹ 13,800 and yield on index is 4.8% (p.a.). A 6 months future contract on index is trading at ₹ 14,340.

Assuming that risk free rate of interest is 12%. Show Mr. X (an arbitrageur) can earn an abnormal rate of return irrespective of outcome after 6 months . You can assume that after 6 months index closes at ₹ 10,200 and ₹ 15,600 and 50% of stock included in index shall pay dividend in next 6 months. Also Calculate implied risk free rate.

(Page No. 69)

Theoretical future price

$$f = S(1+r) - D$$

$$= ₹13800(1.06) - 331.20$$

$$= ₹14296.80$$

* Dividend = ₹13800 × 50% × 4.8%

= ₹331.20

Action → Since future is overpriced hence sell future & Buy spot.

Arbitrage process

Today

- Buy a portfolio of stock as Same proportion as Index
- Take short position on Index at ₹14340

Calculation of Gain 14340↓

	10200	15600
Sell stocks	10200	15600
Gain/Loss on short position	+4140	-1260
Dividend Income	+331.20	+331.20
Buy stock ('0' period)	-13800	-13800
Gain	871.20	871.20

$$\text{Implied Rf Rate} = \frac{871.20}{13800} \times 100 \times \frac{12}{6} = 12.63\% \text{ p.a}$$

PART III Hedging Through future or Beta Management

- **Stock Index future**
  - Stock Index future means future contract on Stock Index. It could be sectorwise i.e. Bank Nifty, I.T. Index etc. or it could be on overall market i.e. Nifty or Sensex.
  - It is more liquid than Stock future.

- **Hedging through SIF**

Whenever an Investor buys stock & expects that price of stocks will rise but it may be possible that market may go against his expection. In this situation, Investor should take short position on Stock Index future.

No. of contracts is calculated as under

$$\text{No. of Contracts} = \frac{V_P \times (B_T - B_P)}{f \times m \times B_f}$$

V_P = Value of portfolio

B_T = Target Beta

B_P = Beta of portfolio

f = future price

m = multiplier (contract size) or lot

B_f = Beta of future

NOTE
- If B_T is not given assume "0"
- If B_f is not given assume "1"

Example – 28

Consider a fund manager having a corpus of 500 lakhs as shown below:

	₹ (in Lakhs)	Beta
Bond	150	0.8
Equity	300	4
Cash	50	0
	500	

Nifty futures trade at 5750 (lot size 50)

The fund manager is expecting a market crash

(i) Find out the beta of the portfolio and interpret the same

(ii) How many nifty futures should be bought or sold to achieve a beta of 0.5.

(iii) How many nifty futures should be bought or sold foe complete hedging.

(iv) How many nifty futures should be bought or sold to achieve a beta of 3.

① Beta of portfolio

$$B_P = \frac{(150 \times 0.8) + (300 \times 4) + (50 \times 0)}{500}$$

$$= 2.64$$

Interpretation

$B_P = 2.64$ means if Market changes by 1% then portfolio will change by 2.64%

(ii) $B_T = 0.5$

$$\text{No. of Contract} = \frac{500 \times (0.5 - 2.64)}{5750 \times 50 \times 1} = \frac{-1070L}{2.875}$$

$$= 372 \text{ Contracts Sold}$$

Substantiate

Market = 10% ↓

$B_P = 2.64$

PORTFOLIO = ₹500L Long

Loss = $500 \times 26.4\%$

= 132L

Nifty Short = 1070L

Profit = 107L

Overall Loss = 132 - 107 = 25L

$$\% = \frac{25}{500} \times 100 = 5\%$$

$$\text{Beta} = \frac{\Delta \text{ portfolio}}{\Delta \text{ Market}} = \frac{5\%}{10\%} = 0.5$$

(iv) $B_T = 3$

$$\text{No. of Contracts} = \frac{500 \times (3 - 2.64)}{5750 \times 50 \times 1} = \frac{180}{2.875}$$

$$= 63 \text{ contracts Long}$$

Substantiate

Market = 10% ↓

- PORTFOLIO ($B_P = 2.64$) 500 Long
  - Loss = $(500 \times 26.40\%) = 132$
- Market 180 Long
  - Loss = 18

Overall Loss :. $132 + 18 = 150$

$$\% = \frac{150}{500} \times 100 = 30\%$$

$$B = \frac{30\%}{10\%} = 3$$

QUESTION - 56

The price of ACC stock on 31 December 2010 was ₹ 220 and the futures price on the same stock on the same date, i.e., 31 December 2010 for March 2011 was ₹ 230. Other features of the contract and related information are as follows:

Time to expiration - 3 months (0.25 year)

Borrowing rate - 15% p.a.

Annual dividend on the stock

- 25% payable before 31.03.2011

Face Value of the Stock - ₹ 10

i. Based on the above information, what should be the futures price?

ii. Show the process of arbitrage

(Page No. 84)

QUESTION – 50

On April 1, 2019, Kasi has a portfolio consisting of four securities as shown below:

Security	A	K	S	P
Market Price	₹ 48.5	₹ 332.68	₹ 13.99	₹ 292.82
No. of Shares	673	480	721	358
β Value	0.74	1.28	0.54	0.46

Cost of capital is 16% p.a. compounded continuously. Kasi fears a fall in prices of shares in future. Accordingly, he approaches you for the advice to protect the interest of his Portfolio.

You can make use of the following information:

(i) The current NIFTY Value is 9380.

(ii) NIFTY Futures can be traded in units of 25 only.

(iii) Futures for September are currently quoted at 9540 and Future for October are being quoted at 9820.

① Beta of portfolio

Stocks	No. of shares	MPS	No. × MPS	Weight	B	W × B
A	673	48.50	32640.50	0.106	074	0.078
K	480	332.68	159686.40	0.520	1.28	0.666
S	721	13.99	10086.79	0.033	0.54	0.018
P	358	292.82	104829.56	0.341	0.46	0.157
			307243.25			

$B_P = 0.92$

You are required to calculate:

1. The Beta of his Portfolio.
2. Theoretical Value of Futures for contracts expiring in September & October.
   Given
   ($e^{0.67} = 1.0693$, $e^{0.08} = 1.0833$, $e^{0.093} = 1.0975$)
3. The number of NIFTY contract that he would have to sell, if he desires to hedge 150% of the Portfolio until October.

(Exam May-2019)

(Page No. 73)

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2. Calculation of Theoretical future price

$$f = S \times e^{(r-d)t}$$

Sept.

$$f = 9380 \times e^{(0.16 \times \frac{6}{12})}$$

$$= 9380 \times e^{0.08}$$

$$= ₹ 9380 \times 1.0833 = 10161.35$$

Oct

$$f = 9380 \times e^{(0.16 \times \frac{7}{12})}$$

$$= 9380 \times e^{0.093}$$

$$= 9380 \times 1.0975 = \underline{10294.55}$$

3. No. of Contracts for Hedging

$V_P = 307243.25 \times 15\% = ₹ 460864.875$

$$\text{No.} = \frac{V_P \times (B_T - B_P)}{f \times m \times B_f} \qquad r \setminus$$

$$= \frac{460864.875 \times (0 - 0.92)}{9820 \times 25 \times 1}$$

$= 1.727$ contracts

$= 2$ contracts

Sold (short)

QUESTION – 49

On April 1, 2015, an investor has a portfolio consisting of eight securities as shown below:

Security	Market Price	No. of Shares	Value
A	29.40	400	0.59
B	318.70	800	1.32
C	660.20	150	0.87
D	5.20	300	0.35
E	281.90	400	1.16
F	275.40	750	1.24
G	514.60	300	1.05
H	170.50	900	0.76

The cost of capital for the investor is 20% p.a. continuously compounded. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for the advice to protect the interest of his portfolio.

You can make use of the following information:

(1) The current NIFTY value is 8500.

(2) NIFTY futures can be traded in units of 25 only.

(3) Futures for May are currently quoted at 8700 and Futures for June are being quoted at 8850.

You are required to calculate:

(i) The beta of his portfolio.

(ii) The theoretical value of the futures contract for contracts expiring in May and June. Given ($e^{0.03}$ =1.03045, $e^{0.04}$ = 1.04081, $e^{0.05}$ =1.05127)

(iii) The number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:

(A) His total portfolio 100%

(B) 50% of his portfolio

(C) 120% of his portfolio

(SM New Syllabus & PM)

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QUESTION – 52

Details about long term portfolio of shares of an investor is as below:

Shares	No. of shares (lakh)	Market Price per share	Beta
K Ltd.	6	250	1.4
L Ltd.	8	375	1.2
M Ltd.	4	125	1.6

The investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91.

He is considering below mentioned alternative strategies:

(i) Dispose a part of his existing portfolio to acquire risk free securities, or

(ii) Take appropriate position on Nifty Futures which are currently traded at 16,250 and each Nifty points is worth ₹ 100.

You are required to determine:

(i) portfolio beta,

(ii) the value of risk-free securities to be acquired,

(iii) the number of shares of each company to be disposed off,

(iv) the number of Nifty contracts to be bought/sold,

(v) the value of portfolio beta for 1% rise in Nifty.

(Exam Nov - 2022)

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QUESTION – 51

Details about portfolio of shares of an investor is as below:

Shares	No. of shares (Iakh)	Price per share	Beta
A Ltd.	3.00	₹ 500	1.40
B Ltd.	4.00	₹ 750	1.20
C Ltd.	2.00	₹ 250	1.60

The investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91. He is considering two below mentioned alternative strategies:

(i) Dispose off a part of his existing portfolio to acquire risk free securities, or

(ii) Take appropriate position on Nifty Futures which are currently traded at 8125 and each Nifty points is worth ₹ 200.

You are required to determine:

(1) Portfolio beta,

(2) The value of risk free securities to be acquired,

① Portfolio Beta (₹ in Lacs)

Shares	No.	mps	Amt	Weight	B	WxB
A	3.00	500	1500	0.3	1.40	0.42
B	4.00	750	3000	0.6	1.20	0.72
C	2.00	250	500	0.1	1.60	0.16
		Vp=	5000		Bp=	1.30

② Calculation of Value of Rf Securities to be Acquired

$$w_A = \frac{B_f}{B_p} \quad \frac{0.91}{1.30} = 0.7$$

Portfolio of Risky stock = (5000 × 0.7) = 3500

Risk free securities = (5000 × 0.3) = 1500

Value of Rf Securities = ₹ 1500

Alternatives:

$$0.91 = \frac{(5000 \times 1.30) - (x \times 1.30) + (x \times 0)}{5000}$$

$$4550 = 6500 - 1.30x$$

$$x = 1500\ L$$

(3) The number of shares of each company to be disposed off,

(4) The number of Nifty contracts to be bought/sold; and

(5) The value of portfolio beta for 2% rise in Nifty.

(SM New Syllabus & PM)

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③ No. of Shares of each co. to be disposed off

(Lacs)

Stock	Weights	Amt	mps	No. of Shares
A	0.30	450	500	0.90
B	0.60	900	750	1.20
C	0.10	150	250	0.75
		1500		

④ No. of Nifty contracts to be bought or sold

$$\text{No.} = \frac{Vp \times (Bt - Bp)}{f \times m \times Bf}$$

$$= \frac{5000 \times (0.91 - 1.30)}{8125 \times 200 \times 1} = -120$$

= 120 contracts sold

(5) Beta of portfolio if Nifty rise by 2%

Short position on Nifty = ₹1950 Lacs
$\left(\frac{120 \times 200 \times 8125}{100000}\right)$

portfolio = ₹5000 L

Beta of portfolio = 1.30

Gain on Long position of portfolio = 130 L
(5000 × 1.30 × 2%)

Loss on short position of Nifty = −39 L
(1950 × 2%)

Overall Gain 91 L

% increase in portfolio = $\frac{91}{5000} \times 100 = 1.82\%$

$Bp = \frac{\Delta \text{ in portfolio}}{\Delta \text{ Market}} = \frac{1.82}{2} = 0.91$

Market 2% ↑

Bp = 1.30

PORTFOLIO
5000 L
5000 × 2.60%
Gain = 130 L

Market
1950 short
Loss = 1950 × 2%
= 39 L

Overall Gain = 91

% = $\frac{91}{5000} \times 100 = 1.82\%$

QUESTION – 53

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 shares (₹)	1,000	1,500	500
Beta	1.50	1.30	1.70

The CEO is of opinion that the portfolio is carrying a very high risk as compared to the market risk and hence interested to reduce the portfolio's systematic risk to 0.95. Treasury Manager has suggested two below mentioned alternative strategies:

(i) Dispose off a part of his existing portfolio to acquire risk free securities, or

(ii) Take appropriate position on Nifty Futures, currently trading at 8250 and each Nifty points multiplier is ₹ 210.

You are required to:

(a) Interpret the opinion of CEO, whether it is correct or not.

(b) Calculate the existing systematic risk of the portfolio,

(c) Advise the value of risk-free securities to be acquired,

(d) Advise the number of shares of each company to be disposed off,

(e) Advise the position to be taken in Nifty Futures and determine the number of Nifty contracts to be bought/sold; and

(f) Calculate the new systematic risk of portfolio if the company has taken position in Nifty Futures and there is 2% rise in Nifty.

Note: Make calculations in ₹ lakh and upto 2 decimal points.

(RTP May - 2021)

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QUESTION – 54

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

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

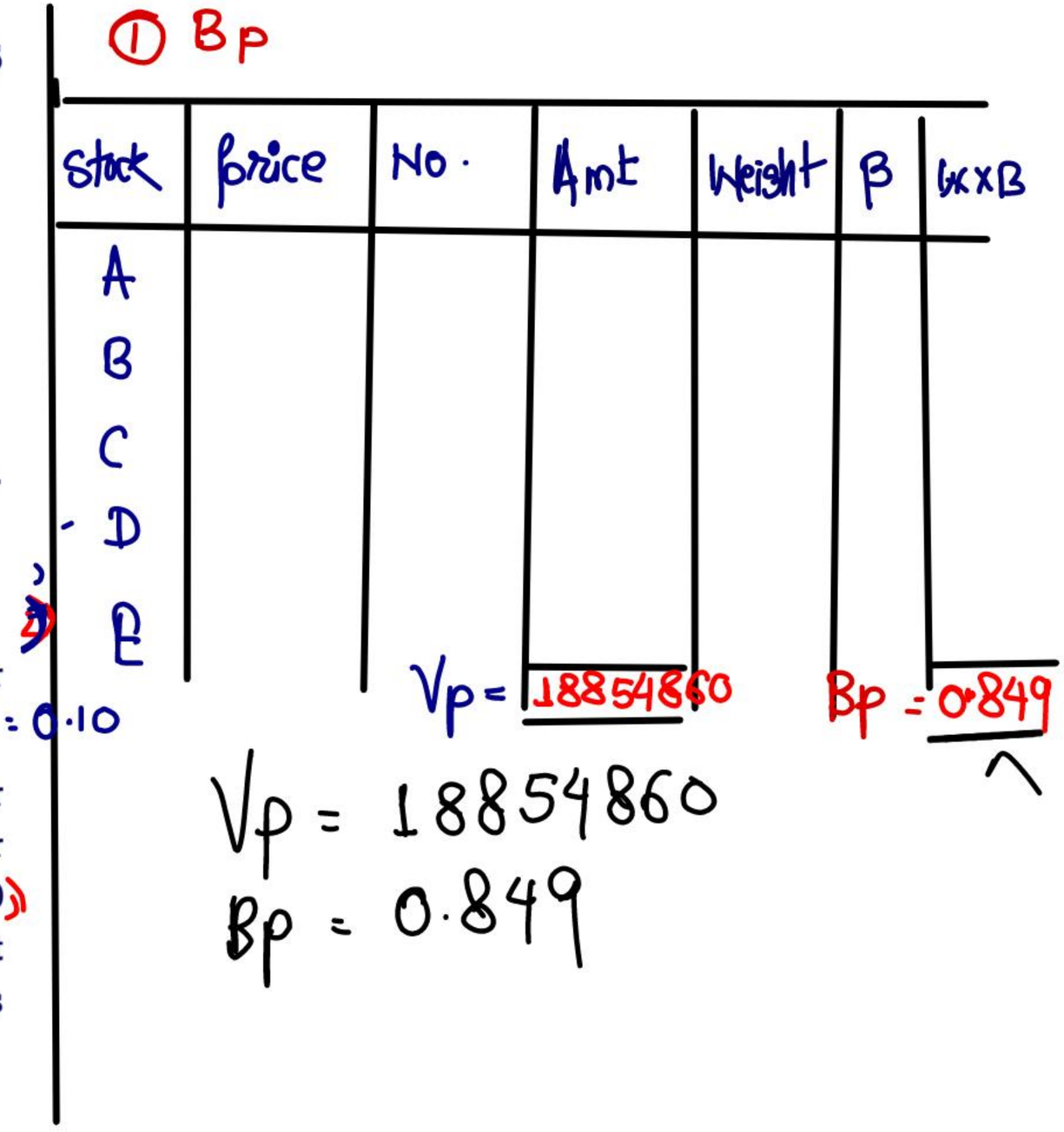
The cost of capital to the investor is 10.5% per annum.

You are required to calculate:

(i) The beta of his portfolio.

(ii) The theoretical value of the NIFTY futures for February 2013.

(iii) The number of contracts of NIFTY the investor needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures have a minimum trade lot requirement of 200 units. Assume that the futures are trading at their fair value.



(iv) The number of future contracts the investor should trade if he desires to reduce the beta of his portfolios to 0.6.

No. of days in a year be treated as 365.

Given: In (1.105) = 0.0998 and $e^{(0.015858)} = 1.01598$

(SM New Syllabus & PM)

(Page No. 81)

(iii) No. of Contract Bf = 0

$$No. = \frac{Vp \times (Bf - Bp)}{f \times m \times Bf}$$

$$= \frac{18854860 \times (0 - 0.849)}{5999.24 \times 200 \times 1}$$

= 13 contracts sold

(ii) Theoretical future price

$$f = S \times e^{(r-d)t}$$

$$= 5900 \times e^{0.105 \times \frac{58}{365}}$$

$$= ₹5900 \times e^{0.016685}$$

$$= ₹5900 \times$$ = 5999.24

Or

$$f = 5900 \times e^{0.0998 \times \frac{58}{365}}$$

$$= 5900 \times e^{0.015858}$$

$$= 5900 \times 1.01598 = 5994.28$$

QUESTION – 64

Shyam buys 10,000 shares of X Ltd., @ ₹ 25 per share and obtains a complete hedge of shorting 400 Nifty at ₹ 1,100 each. He closes out his position at the closing price of the next day when the share of X Ltd., has fallen by 4% and Nifty Future has dropped by 2.5%.

What is the overall profit or loss from this set of transaction?

(Exam January - 2021)

(Page No. 92)

X Ltd 10000 × 25 = ₹ 250000

Nifty 400 × 1100 = ₹ 440000

(₹ 10000)

+ 11000

Gain = 1000

Calculation of Overall profit/Loss

Long position in X Ltd

10000 shares × 25 = ₹ 250000

Short position in Nifty

400 Nifties × 1100 = ₹ 440000

Loss on Long position of X Ltd (250000 × 4%) -10000

Gain on short position of Nifty (440000 × 2.5%) +11000

Overall Gain ₹ 1000

ICAI

Cash flows Today

$(-\ 10000 \times 25) + (400 \times 1100) = 190000$ Cash Inflows

Cash flows at closed out

$10000 \times 25 \times 0.96 - 400 \times 1100 \times 0.975 = 189000$ cash outflows

Gain = $190000 - 189000 = ₹1000$

QUESTION – 65

Mr. X buys 1,000 shares of HPCL at ₹190 each and obtains a complete hedge by selling 300 Nifty at 972 each. He closes his position at the closing price of the next day: at this point HPCL has dropped 5% and Nifty has dropped 4%. What is the overall Profit/Loss of this set of transactions?

H.W

2164 profit

(Page No. 93)

QUESTION – 66

Miss K holds 10,000 shares of IBS Bank @ 2,738.70 when 1 month Index Future was trading @ 6,086 the share has a Beta (β) of 1.2. How many Index Futures should she short to perfectly hedge his position. A single Index Future is a lot of 50 indices.

Justify your result in the following cases:

(i) When the Index zooms by 1%

(ii) When the Index plummets by 2%.

(Page No. 93)

Eg ICICI – Buy 1000 shares @ ₹240 Beta = 2

HDFC – Short sell 800 shares @ ₹245 Beta = 1.5

- Calculate Net position in Nifty for full hedge.

	Amt	position in Cash Market	Beta	position in Nifty
ICICI	240000	Long	2	480000 short
HDFC	196000	short	1.5	294000 Long
				186000 short

Substantiate (Market 10%↓)

Beta=2	Beta = 1.5	
ICICI Bank	HDFC	Nifty
₹240000 Long	₹196000 short	186000 short
-48000	+29400	+18600

QUESTION – 67

Which position on the index future gives a speculator, a complete hedge against the following transactions:

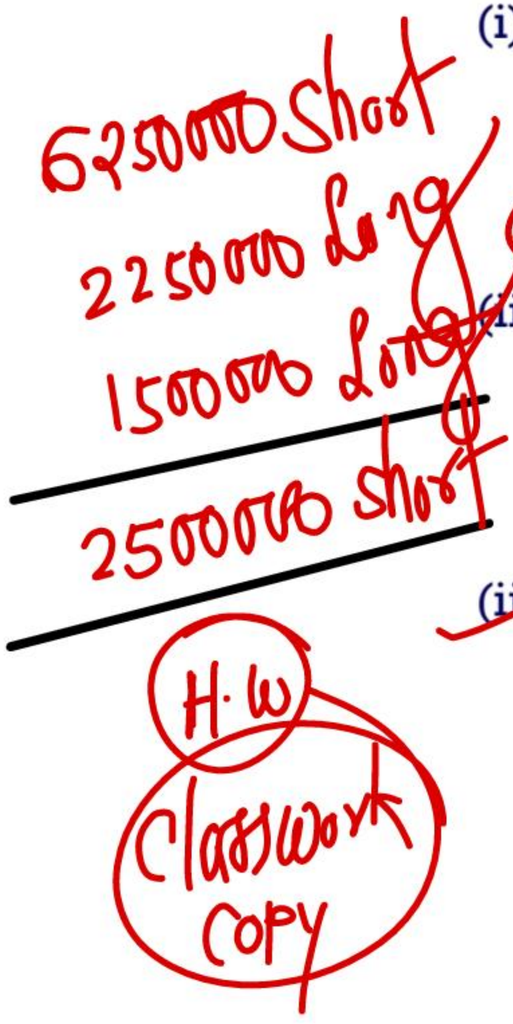
(i) The share of Right Limited is going to rise. He has a long position on the cash market of ₹ 50 lakhs on the Right Limited. The beta of the Right Limited is 1.25

(ii) The share of Wrong Limited is going to depreciate. He has a short position on the cash market of ₹ 25 lakhs on the Wrong Limited. The beta of the Wrong Limited is 0.90.

(iii) The share of Fair Limited is going to stagnant. He has a short position on the cash market of ₹ 20 lakhs of the Fair Limited. The beta of the Fair Limited is 0.75.

(SM New Syllabus & PM)

(Page No. 94)



QUESTION – 68

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

What is the overall profit/loss to Ram?

(SM New Syllabus & PM)

(Page No. 95)

Calculation of Net position in Nifty

Stock	Amt	Position in Cash Market	Beta	Position in Nifty
X Ltd	220000	Long	1.5	330000 short
A Ltd	200000	short	2	400000 Long
				70000 Long

No. of Contracts = $\frac{70000}{1000}$ = 70 Contracts long

Overall profit/loss

Loss on Long position of X Ltd (220000 × 2%) = 4400

Loss on short position of A Ltd (200000 × 3%) = 6000

Loss on Long position of Nifty (70000 × 1.5%) = 1050

Overall Loss = ₹ 11450

QUESTION – 57

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. (Page No. 85)

Long

Calculation of Amount of Nifty future

Overall Loss	$114500
(-) Loss on Long position of X Inc (100000 × $22 × 2%)	$44000
-) Loss on short position of A plc (50000 × $40 × 3%)	$60000
Loss in Long position in Nifty	$10500

Amount in Long position = $\frac{\$10500}{1.5\%}$ = $700000

No. of Contracts = $\frac{\$700000}{\$1000}$ = 700 Contracts Long

Calculation of Beta of X Inc.

Let assume Beta of X Inc. be x

Stock	Amt	position in cash mkt	Beta	position in Nifty
X Inc.	2200000	Long	x	2200000 x short
A Plc.	2000000	short	2	4000000 Long
				700000 Long

$$-2200000x + 4000000 = 700000$$

$$x = \frac{3300000}{2200000} = 1.5$$

QUESTION – 58

Following information is available for consideration:

BSE Index	25,000
Value of portfolio	₹ 50,50,000
Risk free interest rate	9% p.a.
Dividend yield on Index	6% p.a.
Beta of portfolio	1.5

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

Based on the above information calculate:

(i) Price of future contract.

(ii) Gain on short futures position if index turns out to be 22,500 in 3 months.

Note: Daily compounding (exponential) formula is not required to be used.

(RTP May – 2022, Exam July - 2021)

(Page No. 86)

① price of future Contract (4 month)

$$f = S \times [1 + (r-d)t]$$

$$= 25000 \times \left[1 + (0.09-0.06)\frac{4}{12}\right]$$

$$= 25000 \times 1.01$$

$$= ₹ 25250$$

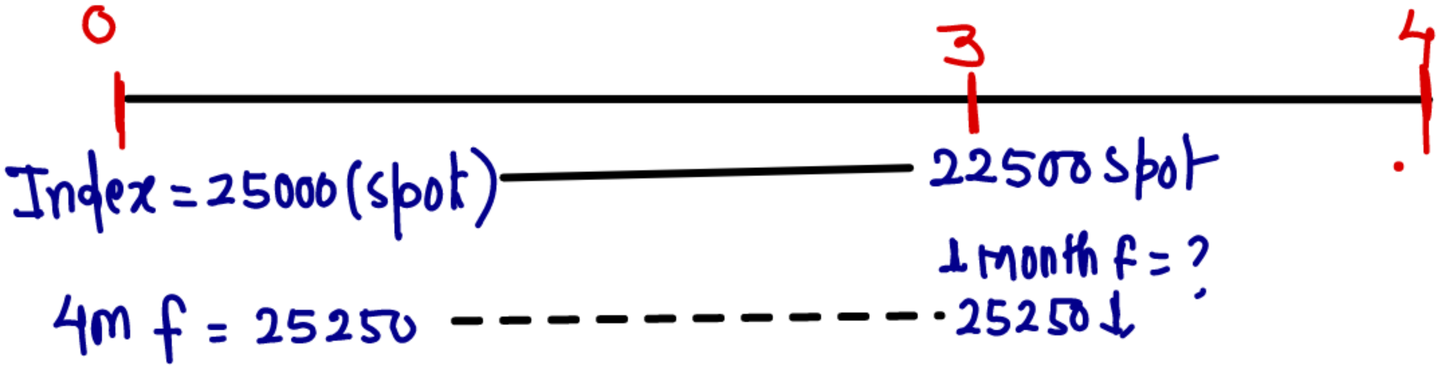
price of future contracts

$$= ₹25250 \times 50 = ₹1262500$$

$$\text{No. of Contract} = \frac{5050000 \times (0-1.5)}{25250 \times 50 \times 1}$$

$$= 6 \text{ Contract Short}$$

(ii) Gain on short position of Index future



$$1 \text{ Month } f = 22500 \times \left[1 + (0.09 - 0.06)\frac{1}{12}\right]$$

$$= 22556.25$$

$$\text{Gain on short position} = (25250 - 22556.25) \times 6 \times 50$$

$$= ₹ 808125$$

QUESTION – 60

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

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

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Based on the above information calculate:

(i) Price of future contract.

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

(SM New Syllabus & PM)

(Page No. 88)

QUESTION – 61

BSE	10000
Value of portfolio	₹ 12,00,000
Risk free interest rate	10% p.a.
Dividend yield on Index	5% p.a.
Beta of portfolio	1.70

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

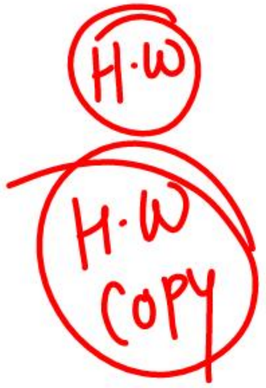
Based on the above information CALCULATE:

(1) Price of future contract.

(2)The gain on short futures position if index turns out to be 8,500 in three months.

(MTP: Sep – 2022)

(Page No. 89)



QUESTION - 62

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for ₹ 9,00,000. At the time of closing of trading on the last Thursday of May 2020 (expiry), Index turned out to be 2100. The contract multiplier is 75. Based on the above information calculate:

(i) The price of one Future Contract on 1st February 2020.

(ii) Approximate Nifty Sensex on 1st February 2020 if the Price of Future Contract on same date was theoretically correct. On the same day Risk Free Rate of Interest and Dividend Yield on Index was 9% and 6% p.a. respectively.

(iii) The maximum Contango/Backwardation.

(iv) The pay-off of the transaction.

Note: Carry out calculation on month basis.

(RTP November - 2020)

(Page No. 90)

(i) price of one future Contract

Amount of short position in Nifty = ₹ 900000

No. of Contracts = 5 Contracts

price of 1 Contract = $\frac{₹\,900000}{5}$

= ₹ 180000

future price of 1 Nifty = $\frac{₹\,180000}{75}$

= ₹ 2400

(ii) spot price

$f = S \times [1 + (r-q)t]$

$2400 = S \times [1 + (0.09 - 0.06)\frac{4}{12}$

$S = 2376.24$

(iii) Maximum Contango / Backwardation

☞ If future is more than spot, then market is said to be "Contango" [सीधा बदला]

☞ If future is Less than spot, then such Market is Called "Backwardation" [उल्टा बदला]

☞ **Basis = S - F**

- If Basis is negative = Contango
- If Basis is positive = Backwardation

In this question, future (2400) is more than spot (2376) hence market is contango

Maximum Contango = 2400 - 2376 = ₹24 or 23.76

(iv) Calculation of payoff

Gain on short position of Nifty = $(2400 - 2100) \times 75 \times 5$

= ₹ 112500

QUESTION – 69

Mr. X is having a portfolio of shares worth ₹ 170 lakhs at current price and cash ₹ 30 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%.

Determine:

(i) Current portfolio beta.

(ii) Portfolio beta after 3 months if Mr. X on current date goes for long position on ₹ 200 lakhs Nifty futures.

(Exam July - 2021)

(Page No. 96)

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① Current portfolio Beta

$$B_P = \frac{(170 \times 1.60) + (30 \times 0)}{200}$$

$$= 1.36$$

② Portfolio Beta after 3 months

- **Calculation of % change in market**

Beta of share portfolio = 1.60

% change in share = 3.2%

$$\text{Beta} = \frac{\Delta \text{ in portfolio}}{\Delta \text{ in Market}}$$

$$1.60 = \frac{3.2}{\Delta \text{ Mkt}}$$

$$\Delta \text{ Mkt} = \frac{3.2}{1.60} = 2\%$$

• Overall profit/Loss after 3 Months

Share Portfolio = 170 Long

Nifty = 200 Long

Loss in Long position on shares (170 × 3.2%) = 5.44 L

Loss in Long position on Nifty (200 × 2%) = 4.00 L

Overall Loss = 9.44 L

$$\% \text{ of Loss} = \frac{9.44}{200} \times 100 = 4.72\%$$

$$\text{Portfolio Beta after 3 months} = \frac{4.72\%}{2\%} = 2.36$$

QUESTION – 70

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

Determine:

(i) Current portfolio beta

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

(SM New Syllabus & PM)

(Page No. 97)

QUESTION – 71

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 (Anticipated on 1st September 2021)	58,580
BSE Sensex on 1st January 2022 (Anticipated on 1st December 2021)	56641.25
Dividend Yield of Index	6% p.a
181 day's treasury bills offers a rate of interest	9% p.a.
Beta of the portfolio	1.5

You are required to calculate

(i) The present value of the Sensex as on 1st September 2021

(ii) Turned out value of the Sensex on 1st December 2021

(iii) The number of contracts to hedge the portfolio.

(Exam December - 2021)

(Page No. 98)

(i) Spot (1/09/2021)

$$F = S \times [1 + (r - d)t]$$

$$58580 = S \times \left[1 + (0.09 - 0.06) \times \frac{4}{12}\right]$$

$$S = ₹ 58000$$

(ii) Spot (1/12/2021)

$$56641.25 = S \times \left[1 + (0.09 - 0.06) \times \frac{1}{12}\right]$$

$$S = ₹ 56500$$

(iii) No. of Contracts

$$\text{No.} = \frac{V_P \times B_P}{F \times M}$$

$$= \frac{11600000 \times 1.5}{58580 \times 50} = 6 \text{ contracts short}$$

QUESTION – 72

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was ₹ 9,94,450, the weighted average of beta of 9 securities was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April.

(a) Calculate the beta of the 10th security.

(b) Reconcile the reasons in spite of 2% fall in the market as per Sunidhi's apprehension if she would have earned some profit on her cash position.

(MTP: March – 2018)

(Page No. 100)

(a)

- Beta of portfolio

$$\text{No.} = \frac{V_P \times B_P}{F \times M}$$

$$5 = \frac{994450 \times B_P}{8767.07 \times 25}$$

$$B_P = 1.102$$

- Beta of 10th stock

$$1.102 = 0.9 \times 1.10 + 0.1 \times B$$

$$B = 1.12$$

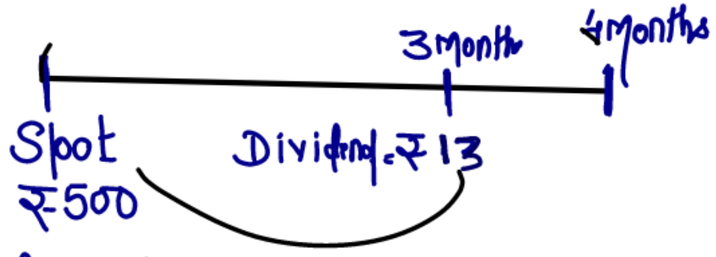
Alternative

$$1.102 = \frac{(9 \times 1.10) + (1 \times)}{10}$$

$$B = 1.12$$

(b) It may be possible that portfolio may change opposite of market due to unsystematic Risk. In this situation she would have earned profit on her cash position if 2% fall in market.

Eg 1



$r = 12\%$ p.a.

period = 4 months

Calculate Theoretical future price.

Method I

$$f = 500(1.04) - 13(1.01) = ₹506.87$$

Method II

$$f = \left(500 - \frac{13}{1.03}\right)(1.04) = ₹506.87$$

$$f = (\text{Spot} - \text{P.V. of dividend})(1+r) =$$

EXAMPLE – 22

Suppose that there is a future contract on a share presently trading at ₹ 1,000. The life of future contract is 90 days and during this time the company will pay dividends of ₹ 7.50 in 30 days, ₹ 8.50 in 60 days and ₹ 9.00 in 90 days.

Assuming that the Compounded Continuously Risk free Rate of Interest (CCRRI) is 12% p.a. you are required to find out:

(i) Fair Value of the contract if no arbitrage opportunity exists.

(ii) Value of Cost to Carry

[Given $e^{-0.01} = 0.9905$, $e^{-0.02} = 0.9802$, $e^{-0.03} = 0.97045$ and $e^{0.03} = 1.03045$]

P.V. of dividend =

$(7.50 \times 0.9905) + (8.50 \times 0.9802) + (9 \times 0.97045) = 24.49$

$F = (1000 - 24.49) \times 1.03045$

$= 1005.21$

Value of Cost to Carry $= 1005.21 - 1000$

$= 5.21$

PART IV Commodity future

1. Margin A/C — NO Question
2. Theoretical future price
3. Hedging through future

2 Theoretical future price

$$F = (S + PVSC - PVCY)(1+r)$$

PVSC = P.V. of Storage cost

PVCY = P.V. of Convenience yield

QUESTION – 73

The following information is available about standard gold.

Spot Price (SP) S ₹ 15,600 per 10 gms.

Future Price (FP) f ₹ 17,100 for one year future contract

Risk free interest Rate $(R)^f$ 8.5%

Present Value of Storage Cost ₹ 900 per year

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

(Page No. 100)

$$f = (S + PVSC - PVCY)(1+r)$$

$$17100 = (15600 + 900 - x)(1.085)$$

$$x = 740$$

QUESTION – 74

The following information about copper scrap is given:

(i) Spot price : $10,000 per ton

(ii) Futures price : $10,800 for a one year contract

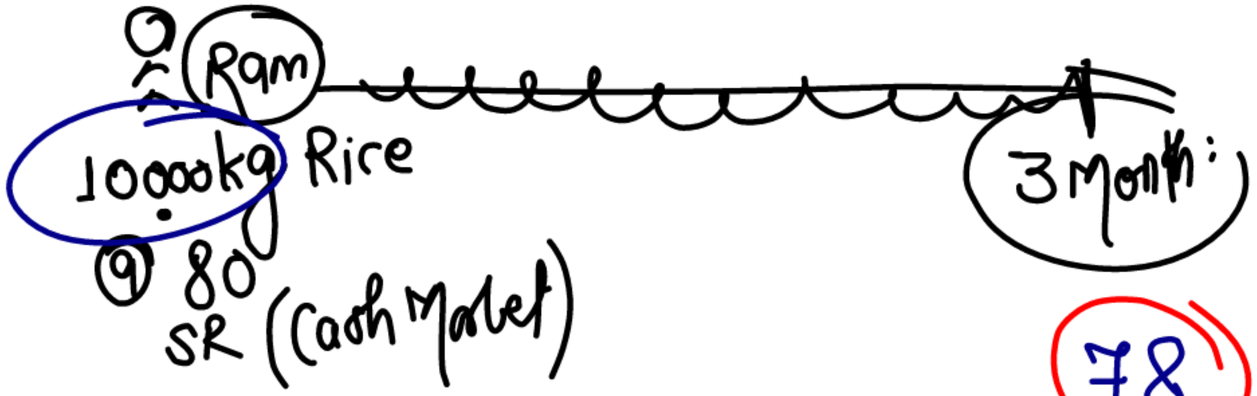
(iii) Interest rate : 12 %

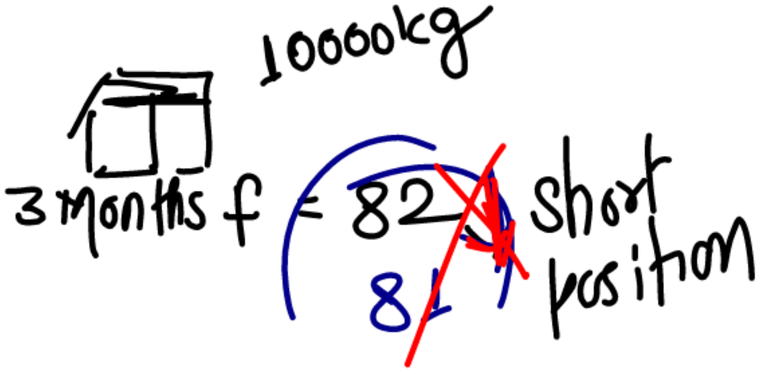
(iv) PV (storage costs) : $500 per year

What is the PV (convenience yield) of copper scrap?

(Page No. 101)

3 Hedging through future





78

10000 × 78 = 780000

+ 10000

790000 = 79

10000

QUESTION – 78

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.

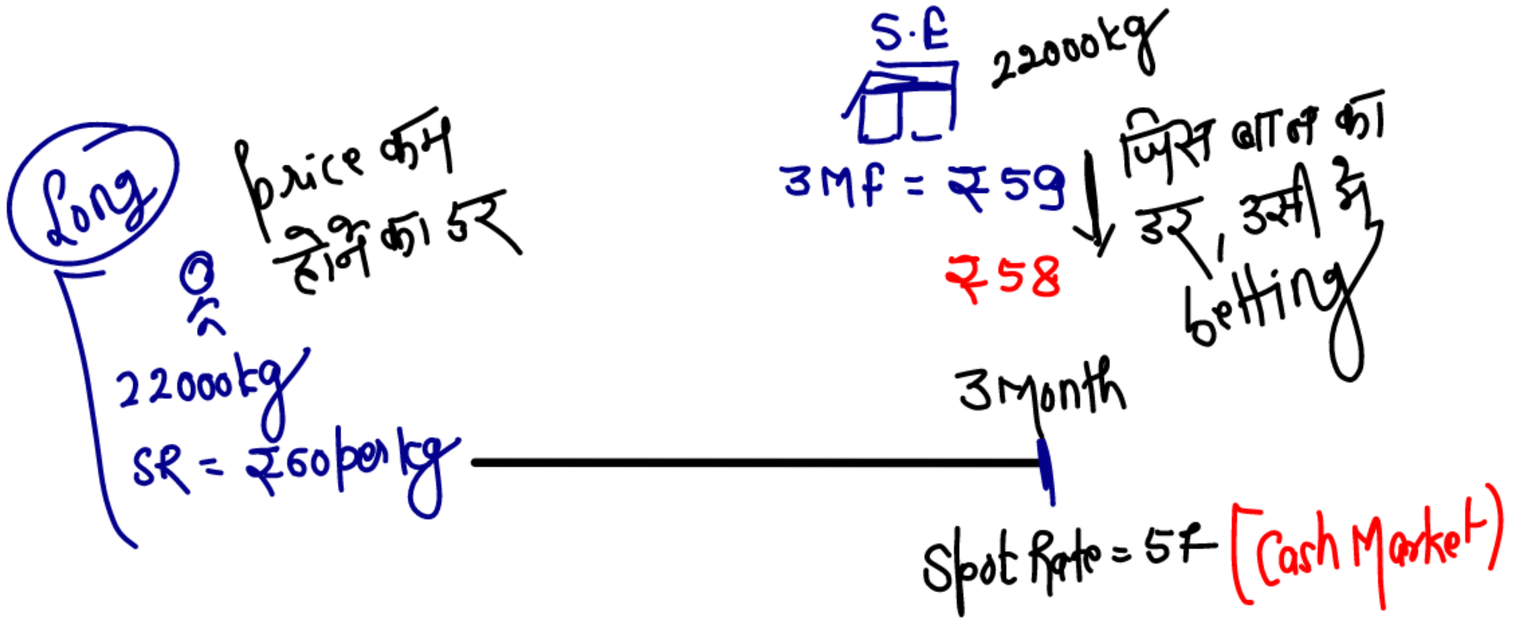
(RTP Nov – 2020 & MTP May - 2019)

① Rice Trader has planned to sell rice after 3 months & Expects that price of Rice will rise, hence Rice Trader has Long position in Cash Market.

② Since Rice Trader has Long position in Cash Market, hence he should take short position in future Market to avoid Risk.

No. of Contract : $\frac{22000 kg}{1000 kg} = 22$ Contract short

③ Effective Realised price



Revenue from Sale of Rice (22000kg × 57) = ₹1254000

Gain on short position of future

(59-58) 22000 = ₹22000

Revenue	₹1276000
÷ Quantity	22000 kg
Effective price	₹58 per kg

QUESTION PAPER Q3 (b)

May 2023

H·W

Mr. V is a commodity trader and specialized himself in trading of rice. He has 24,000 Kg. of rise. The following details are available as on date:

Spot price	₹/Kg.	70
3 month's future is trading at	₹/Kg.	68
Expected Lower price after 3 months	₹/Kg.	64
Contract size	500 Kg./contract	

You are required to advise to Mr. V:

(i) How to mitigate the risk of fall in price.

(ii) How to use the futures market.

(iii) What will be the effective realized price for his sales if, after 3 months, spot price is ₹ 69/Kg and the 3 months future contract price is

a. ₹ 72/Kg. 69-4 = 65

b. ₹ 67/Kg. 69+1 = 70

(Marks 8)

QUESTION – 63

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

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

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

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

(SM New Syllabus & PM)

(Page No. 91)

No. of Contracts

$$\text{No.} = \frac{V_P(B_T - B_P)}{F \times M \times B_F}$$

ICAI

$$= \frac{₹90\text{ Cr.}(0 - 1.10)}{4300 \times 50 \times 1} = 4605 \text{ Contracts short}$$

Substantiate

If Nifty fall by 10%

Loss on Equity (90 × 10% × 1.1)	9.90 Cr.
Gain on Nifty (4300 × 50 × 4605) × 10%	9.90 Cr.
	0

QUESTION – 59

An investor buys a NIFTY futures contract for ₹ 2,80,000 (lot size 200 futures). On the settlement date, the NIFTY closes at 1,378. Find out his profit or loss, if he pays ₹ 1,000 as brokerage. What would be the amount of profit or loss, if he has sold the futures contract.

(Page No. 88)

Long

Nifty = $\frac{280000}{200}$ = 1400

(1400 - 1378) × 200

= 4400

− 1000

3400

(1400 - 1378) × 200

4400

1000

Loss 5400

QUESTION – 48

A future contract is available on R Ltd. that pays an annual dividend of ₹4 and whose stock is currently priced at ₹125. Each future contract calls for delivery of 1,000 shares to stock in one year, daily marking to market. The corporate treasury bill rate is 8%.

Required:

(i) Given the above information, what should the price of one future contract be?

(ii) If the company stock price decreases by 6%, what will be the price of one futures contract?

(iii) As a result of the company stock price decrease, will an investor that has a long position in one futures contract of R Ltd. realizes a gain or loss ? What will be the amount of his gain or loss?

(Ignore margin and taxation, if any)

(Exam Nov - 2019)

(Page No. 70)

① price of one future contract

$F = S(1+r) - D$

$= ₹125(1.08) - 4$

$= ₹131$

$= 131 \times 1000 \text{ shares} = ₹131000$

② If Stock price decreases by 6%

$S = 125 \times 0.94 = 117.50$

$F = 117.50(1.08) - 4$

$= ₹122.90$

$= ₹122.90 \times 1000 \text{ shares} = ₹122900$

③ Gain or Loss on Long position

If stock price decreases then Loss on Long position

$(131000 - 122900) = \text{Loss } 8100$

QUESTION – 55

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield is 1.75% and risk free rate of interest is 4.16%, you are required to determine:

(i) Calculate the justified forward price on this contract.

(ii) Suppose after 28 days of the purchase of the contract the index value stands at 2450 then determine gain/ loss on the above long position.

(iii) If at expiration of 90 days the Index Value is 2470 then what will be gain on long position.

Note: Take 365 days in a year and value of $e^{0.005942}$ = 1.005960, $e^{0.001849}$ = 1.001851.

ICAI (RTP)
(Page No. 83)

① 90 days forward price

$$f = S \times e^{(r-d)t}$$

$$= 2290 \times e^{(0.0416-0.0175)\frac{90}{365}}$$

$$= 2290 \times e^{0.005942}$$

$$= 2290 \times 1.005960 = 2303.65$$

Imp

② Determine Gain/Loss on Long position

28 days f

$$f = 2290 \times e^{(0.0416-0.0175)\frac{28}{365}}$$

$$= 2290 \times e^{0.001849}$$

$$= 2290 \times 1.001851 = 2294.24$$

Gain on Long position = (2450 − 2294.24)

= ₹ 155.76

③ Expiration in 90 days

Gain on Long position = (2470 − 2303.65)

= ₹ 166.35

QUESTION – 32

A call and put exist on the same stock each of which is exercisable at ₹ 60. They now trade for:

Market price of Stock or stock index	₹ 55
Market price of call	₹ 9
Market price of put	₹ 1

Calculate the expiration date cash flow, investment value, and net profit from:

(i) Buy 1.0 call

(ii) Write 1.0 call

(iii) Buy 1.0 put

(iv) Write 1.0 put

for expiration date stock prices of ₹ 50, ₹ 55, ₹ 60, ₹ 65, ₹ 70.

(Practice Manual)

(Page No. 52)

① Expiration date Cash flows

E = 60 ↑

	50	55	60	65	70
Buy 1 call	0	0	0	-60	-60
Write 1 call	0	0	0	+60	+60
Buy 1 put	+60	+60	0	0	0
Write 1 put	-60	-60	0	0	0

② Investment Value / Gross payoff

	50	55	60	65	70
Buy 1 call	0	0	0	5	10
Write 1 call	0	0	0	-5	-10
Buy 1 put	10	5	0	0	0
Write 1 put	-10	-5	0	0	0

③ Net profit

Call = 9

put = 1

	50	55	60	65	70
Buy 1 call	-9	-9	-9	-4	1
Write 1 call	9	9	9	4	-1
Buy 1 put	9	4	-1	-1	-1
Write 1 put	-9	-4	1	1	1

QUESTION – 34

Ram holding shares of Reliance Industries Ltd. which is currently selling at ₹ 1,000. He is expecting that this price will further fall due to lower than expected level of profits to be announced after one month. As on following option contract are available in Reliance Shares.

Strike Price (₹)	Option	Premium (₹)
1030	Call	40
1010	Call	35
1000	Call	30
990	Put	35
970	Put	20
950	Put	8
930	Put	5

Ram is interested in selling his stock holding as he cannot afford to lose more than 5% of its value.

Recommend a hedging strategy with option and show how his position will be protected.

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₹1000

put

Ram holding share & current market price of share ₹1000. Ram can not afford to lose more than 5%.

In this situation Ram should buy put option at EP ₹ 950 (₹1000 × 95%)

If price is more than ₹950

put Lapse	0
sell share	+ S
premium	− 8
	S − 8

If price is Less than 950

put Exercised	950 − S
sell share	+ S
premium	− 8
	942

Right to sell