DERIVATIVES ANALYSIS AND VALUATION

IMPORTANT QUESTIONS

CLASS WORK QUESTIONS

Question 6:

i. The Forward Price shall be = $S0e^{n(r-y)}$

Where

S_0= Spot price

n = period

r = risk free rate of interest

y = dividend yield

Accordingly,

Forward Price $= 2290\ e^{90/365(0.0416 - 0.0175)}$

$= 2290\ e^{0.005942}$

$= 2290(1.005960)$

$=2303.65$

ii. Gain/loss on Long Position after 28 days

$= 2450 - 2290\ e^{28/365(0.0416 - 0.0175)}$

$= 2450 - 2290\ e^{0.001849}$

$=2450 - 2290(e^{0.001849})$

$= 2450 - 2290(1.001851)$

$= 2450 - 2294.24$

$= 155.76$

iii. Gain/loss on Long Position at maturity

$= S_n - S_0e^{n(r-y)}$

$= 2470.00 - 2303.65 = 166.35$

Question 14:

i. Calculation of Portfolio Beta

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

Portfolio Beta = 0.849

ii. Calculation of Theoretical Value of Future Contract

Cost of Capital = 10.5% p.a. Accordingly, the Continuously Compounded Rate of

Interest ln (1.105) = 0.0998

For February 2013 contract, t= 58/365= 0.1589

Further $F= Se^{rt}$

$F= ₹5{,}900e^{(0.0998)(0.1589)}$

$F= ₹ 5{,}900e^{0.015858}$

F= ₹ 5,900X1.01598 = ₹ 5,994.28

Alternatively, it can also be taken as follows:

$= ₹ 5900e^{0.105\times58/365}$

$= ₹ 5900e^{0.01668}$

= ₹ 5900 x 1.01682 =₹ 5,999.24

iii. When total portfolio is to be hedged:

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

$$= \frac{1{,}88{,}54{,}860}{5994.28 \times 200} \times 0.849$$

= 13.35 contracts say 13 or 14 contracts

iv. When total portfolio beta is to be reduced to 0.6:

$$\text{Number of Contracts to be sold} = \frac{p\left(\beta_p - \beta_p\right)}{F}$$

$$= \frac{1{,}88{,}54{,}860\ (0.849 - 0.600)}{5994.28 \times 200} = 3.92 \text{ contracts say 4 contract}$$

Question 20:

i. Beta of the Portfolio

Security	Market Price	No. of Shares	Value	B	Value x β
A	29.40	400	11760	0.59	6938.40
B	318.70	800	254960	1.32	336547.20
C	660.20	150	99030	0.87	86156.10
D	5.20	300	1560	0.35	546.00
E	281.90	400	112760	1.16	130801.60
F	275.40	750	206550	1.24	256122.00
G	514.60	300	154380	1.05	162099.00
H	170.50	900	153450	0.76	116622.00
			994450		1095832.30

Portfolio Beta =10,95,832.30/9,94,450=1.102

ii. Theoretical Value of Future Contract Expiring in May and June

$F = Se^{rt}$

F_{May}= 8500 x $e^{0.20 \times (2/12)}$ = 8500 x $e^{0.0333}$

$e^{0.0333}$ shall be computed using Interpolation Formula as follows:

$e^{0.03}$ = 1.03045
$e^{0.04}$ = 1.04081
$e^{0.01}$ = 0.01036
$e^{0.0033}$ = 0.00342
$e^{0.0067}$ = 0.00694
$e^{0.0333}$ = 1.03045 + 0.00342 = 1.03387 or 1.04081 – 0.00694 = 1.03387

According the price of the May Contract

8500 X 1.03387 = ₹ 8788

Price of the June Contract

F_{May}= 8500 x $e^{0.20 \times (3/12)}$ = 8500 x $e^{0.05}$= 8500 x 1.05127 = 8935.80

iii. No. of NIFTY Contracts required to sell to hedge until June

$$= \frac{\text{Value of Position to be hedged}}{\text{Value of Future Contract}} \times \beta$$

(A) Total portfolio

$$\frac{994450}{8850 \times 25} \times 1.102 = 4.953 \text{ say 5 contracts}$$

(B) 50% of Portfolio

$$\frac{994450 \times 0.50}{8850 \times 25} \times 1.102 = 2.47 \text{ say 3 contracts}$$

(C) 120% of Portfolio

$$\frac{994450 \times 1.20}{8850 \times 25} \times 1.102 = 5.94 \text{ say 6 contracts}$$

Question 25:

Receipts using a forward contract = $ 48,00,000/0.013889	₹ 34,55,97,235
Receipts using currency futures	
The number of contracts needed is ($ 48,00, 000/0.013881)/28,816,368	12
Initial margin payable is 12 contracts x ₹ 32,500	₹ 3,90,000
On April 1, 2020 Close at 0.013893	
Receipts = US$ 48,00,000/0.013894	₹ 34,54,72,866
Variation Margin	
[(0.013893 – 0.013881) x 12 x 28,816,368]/0.013894	
OR (0.000012 x 12 x 28,816,368)/0.013894 = 4149.5570/0.013894	₹ 2,98,658
Less: Interest Cost – ₹ 3,90,000 x 0.09 x 3/12	₹ 8,775

Net Receipts	₹ 34,57,62,749

Receipts under different methods of hedging

Forward contract	₹ 34,55,97,235
Future Contract	₹ 34,57,62,749
No Hedge (US$ 48,00,000/ 0.013894)	₹ 34,54,72,866

The most advantageous option would have been to hedge with futures as it is slightly higher than Forward Option but comparing to no hedge option it is better proposition.

Question 37:

Instead of selling the stock of Reliance Ltd., Ram must cover his Risk by buying or long position in Put Option with appropriate strike price. Since Ram's risk appetite is 5%, the most suitable strike price in Put Option shall be ₹ 950 (₹ 1000 – 5% of ₹ 1000).

If Ram does so, assuming that the spot price after 1 month is ₹ 942* then overall position will be as follows:

Spot Price after 1 month	Stock Value	Put Payoff	Initial Cash Flow	Total
S < 950	S	950 – S	- 8	942 – S
S > 950	S	-	- 8	S – 8

Thus, from the above, it can be seen that the value of holding of Ram shall never be less than ₹ 942 as Put Option will compensate for loss below spot price of ₹ 950. However, this strategy will involve a cost of ₹ 8.

* Students can assume any price other than ₹ 942 and could answer accordingly.

Question 40:

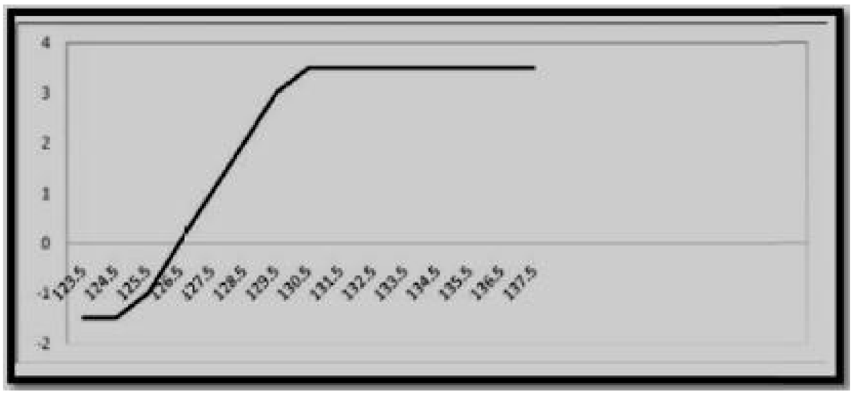
i. The best strategy for Mr. X would be Long Call Spread. It involves buying of one call option at price of ₹ 125 and selling call option at ₹ 130.

ii. The pay-off position can be computed as follows.

Price on date of	Pay-off of Buying option	Pay-off of selling option	Net	Premium spread	Net Pay-off
123.50	-	-	-	(1.50)	(1.50)
124.50	-	-	-	(1.50)	(1.50)
125.50	0.50	-	0.50	(1.50)	(1.00)
126.50	1.50	-	1.50	(1.50)	-
127.50	2.50	-	2.50	(1.50)	1.00
128.50	3.50	-	3.50	(1.50)	2.00
129.50	4.50	-	4.50	(1.50)	3.00
130.50	5.50	(0.50)	5.00	(1.50)	3.50
131.50	6.50	(1.50)	5.00	(1.50)	3.50
132.50	7.50	(2.50)	5.00	(1.50)	3.50

Maximum Possible Profit ₹ 3.50

iii.



iv. Break up Price ₹ 126.50 (₹ 125.00 + ₹ 1.50).

Question 41:

In the given case, the exchange rates are indirect. These can be converted into direct rates as follows:

Spot rate

$$GBP = \frac{1}{USD1.5617} \quad \text{to} \quad \frac{1}{USD1.5673}$$

USD = GBP 0.64033 - GBP 0.63804

6 months' forward rate

$$GBP = \frac{1}{USD1.5455} \quad \text{to} \quad \frac{1}{USD1.5609}$$

USD = GBP 0.64704 - GBP 0.64066

Payoff in 3 alternatives

i. Forward Cover

Amount payable	USD 3,64,897
Forward rate	GBP 0.64704
Payable in GBP	GBP 2,36,103

ii. Money market Cover

Amount payable	USD 3,64,897
PV @ 4.5% for 6 months i.e. $\frac{1}{1.0225} = 0.9779951$	USD 3,56,867
Spot rate purchase	GBP 0.64033
Borrow GBP 3,56,867 x 0.64033	GBP 2,28,512
Interest for 6 months @ 7 %	7,998
	-
Payable after 6 months	GBP 2,36,510

iii. Currency options

Amount payable	USD 3,64,897
Unit in Options contract	GBP 12,500
Value in USD at strike rate of 1.70 (GBP 12,500 x 1.70)	USD 21,250
Number of contracts USD 3,64,897/ USD 21,250	17.17
Exposure covered USD 21,250 x 17	USD 3,61,250
Exposure to be covered by Forward (USD 3,64,897 – USD 3,61,250)	USD 3,647
Options premium 17 x GBP 12,500 x 0.096	USD 20,400
Premium in GBP (USD 20,400 x 0.64033)	GBP 13,063
Total payment in currency option	
Payment under option (17 x 12,500)	GBP 2,12,500
Premium payable	GBP 13,063
Payment for forward cover (USD 3,647 x 0.64704)	GBP 2,360
	GBP 2,27,923

Thus, total payment in:

(i) Forward Cover 2,36,103 GBP
(ii) Money Market 2,36,510 GBP
(iii) Currency Option 2,27,923 GBP

The company should take currency option for hedging the risk.

Question 45:

In order to find out any mispricing we shall use Put Call Parity theorem.

Accordingly,

Value of Call + PV (exercise price) = Value of Put + Share Price

Thus,

For share of X Ltd.

$56 + 100\ e^{-0.045} = 4 + 160$

$56 + 95.60 = 164$

Thus there is price mismatch.

The strategy to be adopted to take advantage of situation will be to buy call and sell putand share. The strategy will lead to cash flow position as follows:

	Inflow Rs.	Outflow Rs.
Buying the Call	-	56
Selling the put	4	---
Short selling the share	160	
Total	**164**	**56**

Net inflow	---	108
	164	164

Invest Rs. 108 for 6 months and get Rs. 108 x $e^{0.045}$ (Rs.108 x1.046)	Rs. 112.97
After 6 months: Inflow from investment	Rs. 112.97
Out flow due to exercise of option	Rs. 100.00
Net Gain	Rs.12.97

Similarly for Share of Y Ltd.

$26 + 80\ e^{-0.045} = 2 + 100$

26 + 76.48 = 102

102.48 = 102

Thus, there is a mismatch

The strategy to be adopted sell call and buy put and share. The position of cash flows onthe strategy adopted will be as follows:

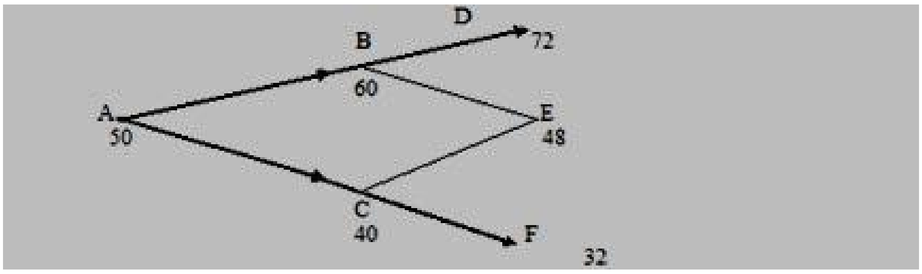
	Inflow Rs.	Outflow Rs.
Buy the Share	----	100
Buy the Put	----	2
Sell the Call	26	----
Total	**26**	**102**
Net inflow	76	----
	102	102

This amount shall be borrowed for 3 months. After the 3 months the position will be as follows:

Repayment of borrowings (76 x $e^{0.045}$)	Rs. 79.50
Inflow due to exercise of option	Rs. 80.00
Net Gain	Rs. 0.50

Question 46:

Stock prices in the two step Binominal tree

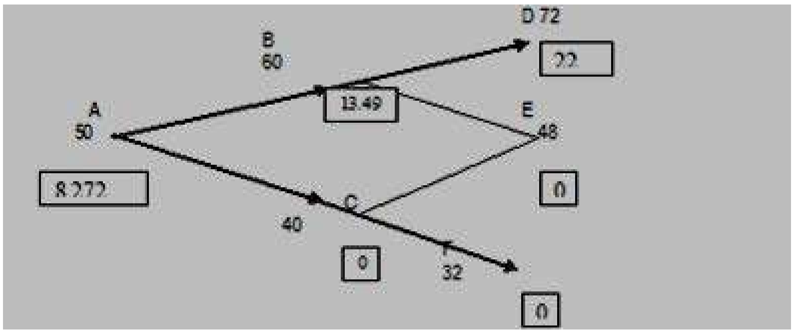


Using the single period model, the probability of price increase is

$$P = \frac{R-d}{u-d} = \frac{1.06-0.80}{1.20-0.80} = \frac{0.26}{0.40} = 0.65$$

Therefore the p of price decrease = 1-0.65 = 0.35

The two step Binominal tree showing price and pay off



The value of an American call option at nodes D, E and F will be equal to the value of European option at these nodes and accordingly the call values at nodes D, E and F willbe 22, 0 and 0 using the single period binomial model the value of call option at node B is

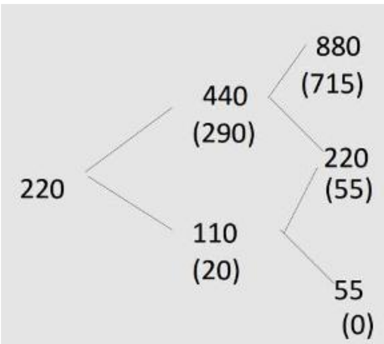
$$C = \frac{Cup + Cd(1-p)}{R} = \frac{22 \times 0.65 + 0 \times 0.35}{1.06} = 13.49$$

The value of option at node 'A' is

$$\frac{13.49 \times 0.65 + 0 \times 0.35}{1.06} = 8.272$$

Question 47:

The possible prices of X Ltd.'s share and the associated call option values shown below:



a. Let p is the probability of a rise in the stock price. Then, if investors are risk-neutral:

   p (1.00) + (1 – p)(–0.50) = 0.10
   p = 0.4

   If the stock price in month 6 is Rs.110, then the option will not be exercised. So expected value of call option is:

   [(0.4 × Rs.55) + (0.6 × Rs.0)]

   And its worth to be

   [(0.4 × Rs.55) + (0.6 × Rs.0)]/1.10 = Rs.20

Similarly, if the stock price is Rs.440 in month 6, then, if it is exercised. The expected value of call option is

[(0.4 × Rs.715) + (0.6 × Rs.55)]

And it will be worth

[(0.4 × Rs.715) + (0.6 × Rs.55)]/1.10 = Rs.290

Value of call today is:

[(0.4 × Rs.290) + (0.6 × Rs.20)]/1.10 = Rs.116.36

b. i. If the price rises to Rs.440:

$$\text{Delta} = \frac{\text{Rs.}715 - Rs.55}{\text{Rs.}880 - Rs.220} = 1.0$$

ii. If the price falls to Rs.110:

$$\text{Delta} = \frac{\text{Rs.}55 - 0}{\text{Rs.}220 - Rs.55} = 0.33$$

c. If the stock price is Rs.110 at 6 months, the option delta is 0.33. Therefore, in order to replicate the stock, we buy three calls and lend, as follows:

	Initial Outlay	Stock Price = 55	Stock Price = 220
Buy 3 calls	-60	0	165
Lend PV(55)	-50	+55	+55
	-110	+55	+220
This strategy is equivalent to:			
Buy stock	-110	+55	+220

Question 48:

i. To compute perfect hedge we shall compute Hedge Ratio (Δ) as follows:

$$\Delta = \frac{C_1 - C_2}{S_1 - S_2} = \frac{150 - 0}{780 - 480} = \frac{150}{300} = 0.50$$

Mr. D should purchase 0.50 share for every 1 call option.

ii. Value of Option today

If price of share comes out to be ₹ 780 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 780)	₹ 390
Loss on account of Short Position (₹ 780 – ₹ 630)	₹ 150
	₹ 240

If price of share comes out to be ₹ 480 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 480)=₹ 240

Accordingly, Premium say P shall be computed as follows:

(₹ 300 – P) 1.025 = ₹ 240
P = ₹ 65.85

iii. Expected Return on the Option

Expected Option Value = (₹ 780 – ₹ 630) × 0.60 + ₹ 0 × 0.40 = ₹ 90

$$\text{Expected Rate of Return} = \frac{90 - 65.85}{65.85} \times 100 = 36.67\%$$

Question 52:

a. $S_0 = 930$
$K = 900$
$t = 2/12$
$r_f = 8\%$
$r = 3\%$
$\sigma^2 = (0.20)^2$

$$c = S_0 e^{-r_f T} N(d_1) - X e^{-rT} N(d_2)$$

$$\text{where } d_1 = \frac{\ln(S_0/x) + (r - r_f + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(S_0/x) + (r - r_f + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_1 = \frac{\ln(930/900) + (0.08 - 0.3 + 0.2^2)2/12}{0.2\sqrt{2/12}} = 0.544$$

$$d_2 = \frac{\ln(930/900) + (0.08 - 0.3 + 0.2^2)2/12}{0.2\sqrt{2/12}} = 0.4628$$

$N(d_1) = 0.7069$

$N(d_2) = 0.6782$

C=\$930 X 0.7069 X $e^{-0.03X2/12}$– \$900 X 0.6782 X $e^{-0.08X2/12}$
C = \$930 X 0.7069 X 0.9950 – \$900 X 0.6782 X 0.9867
C = \$654.13 – \$602.26
C= \$51.87

b. Value of put with same parameters

$$p = X e^{-rT} N(-d_2) - S_0 e^{-r_f T} N(-d_1)$$

$N(-d_1) = 0.2932$

$N(-d_2) = 0.3217$

P = \$900 X 0.3217 X 0.9867 – \$930 X 0.2932 X 0.9950

P = \$285.68 – \$271.31

P= \$14.37

c.

1. The variance will be unchanged for the life of the option. This is likely to be violated because stock price variances do change substantially over time.
2. There will be no early exercise. This is reasonable and is unlikely to be violated.
3. Any deviations from the option value will be arbitraged away.
   While there are plenty of arbitrageurs eager to exploit deviations from true value, arbitraging an index is clearly more difficult to do than arbitraging an individual stock.

Question 61:

i. First of all we shall calculate the Dividend Proceed which is as follows:

$= ₹\ 7.50^{e-0.12X30/360} + ₹\ 8.50e^{-0.12X60/360} + ₹\ 9.00e^{-0.12X90/360}$

$= ₹\ 7.50e^{-0.01} + ₹\ 8.50e^{-0.02} + ₹\ 9.00e^{-0.03}$

= ₹ 7.50×0.9905+ ₹ 8.50×0.9802+ ₹ 9.00X0.97045

= ₹ 7.43+ ₹ 8.33+ ₹ 8.73= ₹ 24.49

Fair Value of Future Contract = $₹\ 1000\ e^{0.12X90/360}$ – Dividend Proceeds

= ₹ 1000 × 1.03045 – ₹ 24.49 = ₹ 1005.96

ii. Since Value of Future Contract = Spot Price + Cost to Carry

₹ 1005.96 = ₹ 1000 +Cost to Carry

Cost to Carry = ₹ 5.96

Question 63:

The optional hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma S}{\sigma F}$$

Where

σS= Standard deviation of ΔS

σF=Standard deviation of ΔF

ρ= coefficient of correlation between ΔS and ΔF

H= Hedge Ratio

ΔS = change in Spot price.

ΔF= change in Future price.

Accordingly

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

No. of contract to be short = 10 x 0.5 = 5

Amount = 5000 x ₹ 474 = ₹ 23,70,000

HOME WORK QUESTION

Question 1:

Initial Margin = $\mu + 3\sigma$

Where μ = Daily Absolute Change, σ = Standard Deviation

Accordingly

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

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

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

Question 7:

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

$$= \frac{10000 \times ₹\ 22 \times 1.5 - 5000 \times ₹\ 40 \times 2}{₹\ 1000}$$

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

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

Cash Outlay

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

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

Cash Inflow at Close Out

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

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

Gain/ Loss

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

Question 10:

Shares	No. of shares (lakhs) (1)	Market Price of Per Share (2)	× (2) (₹ lakhs)	% to total (w)	β (x)	wx
A Ltd.	3.00	500.00	1500.00	0.30	1.40	0.42
B Ltd.	4.00	750.00	3000.00	0.60	1.20	0.72
C Ltd	2.00	250.00	500.00	0.10	1.60	0.16
			5000.00	1.00		1.30

i. **Portfolio beta 1.30**

ii. **Required Beta 0.91**

Let the proportion of risk free securities for target beta 0.91 = p
0.91 = 0 × p + 1.30 (1 – p)
p = 0.30 i.e. 30%
Shares to be disposed off to reduce beta 5000 × 30% = ₹ 1,500 lakh

iii. **Number of shares of each company to be disposed off**

Shares	% to total (w)	Proportionate Amount (₹ lakhs)	Market Price Per Share	No. of Shares (Lakh)
A Ltd.	0.30	450.00	500.00	0.90
B Ltd.	0.60	900.00	750.00	1.20
C Ltd.	0.10	150.00	250.00	0.60

iv. **Number of Nifty Contract to be sold**

$$\frac{(1.30 - 0.91) \times 5000 \text{ lakh}}{8,125 \times 200} = 120 \text{ contracts}$$

v. **2% rises in Nifty is accompanied by 2% x 1.30 i.e. 2.6% rise for portfolio of shares**

	₹ Lakh
Current Value of Portfolio of Shares	5000
Value of Portfolio after rise	5130
Mark-to-Market Margin paid (8125 × 0.020 × ₹ 200 × 120)	39
Value of the portfolio after rise of Nifty	5091
% change in value of portfolio (5091 – 5000)/ 5000	1.82%
% rise in the value of Nifty	2%
Beta	0.91

Question 14:

i. Current Portfolio Beta

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

ii. Portfolio beta after 3 months:

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

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

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

Position taken on 100 lakh Nifty futures : Long

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

Mark-to-market paid = ₹ 2 lakh

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

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

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

Portfolio beta = 0.0472/0.02 = 2.36

Question 28:

i. **Forward contract**:

Dollar needed in 180 days = £3,00,000 x $ 1.96 = $5,88,000/-

ii. Money market hedge

: Borrow $, convert to £, invest £, repay $ loan in 180 days
Amount in £ to be invested = 3,00,000/1.045 = £ 2,87,081
Amount of $ needed to convert into £ = 2,87,081 x 2 = $ 5,74,162
Interest and principal on $ loan after 180 days = $5,74,162 x 1.055 = $ 6,05,741

iii. Call option:

1.91	0.04	No	1.95	5,85,000	0.25	1,46,250
1.95	0.04	No	1.99	5,97,000	0.60	3,58,200
2.05	0.04	Yes	2.01*	6,03,000	0.15	90,450
						5,94,900
Add: Interest on Premium @ 5.5% (12,000 x 5.5%)						660
						5,95,560

* ($1.97 + $0.04)

iv. No hedge option:

Expected Future spot rate	Dollar needed Xi	Prob. Pi	Pi xi
1.91	5,73,000	0.25	1,43,250
1.95	5,85,000	0.60	3,51,000
2.05	6,15,000	0.15	92,250
			5,86,500

Recommendation: No hedging strategy i.e. keeping the position open appears to be most preferable because least number of $ are needed under this option to arrange £3,00,000.

Question 29:

Let the probability of attaining the maximum price be p

$(500 - 420) \times p + (400 - 420) \times (1-p) = 420 \times (e^{0.02} - 1)$

or, $80p - 20(1 - p) = 420 \times 0.0202$

or, $80p - 20 + 20p = 8.48$

or, $100p = 28.48$

$p = 0.2848$

The value of Call Option in ₹ $= \dfrac{0.2848 \times (500 - 450)}{1.0202}$

$$= \frac{0.2848 \times 50 + 0.7152 \times 0}{1.0202} = 13.96$$