CBCS SCHEME

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20MBAFM402

Fourth Semester MBA Degree Examination, July/August 2022
Financial Derivatives

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FOUR full questions from Q1 to Q7.***
2. Question No. 8 is compulsory.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Differentiate between exchange traded and OTC traded financial derivatives. **(03 Marks)**

b. What are the functions of derivatives market? **(07 Marks)**

c. What is Derivatives? Distinguish between hedgers, speculator and arbitrageur. **(10 Marks)**

2 a. What is Marketing – to – Market? **(03 Marks)**

b. What is forward and futures contract? What are the features of forward and future contract? **(07 Marks)**

c. Mr. Sharma took long position in five futures contracts on rice at an exercise price of Rs. 50 per Kg. The initial margin on this contract is 10% and maintenance margin is 85% of the initial margin. The size of each futures contract is 1000Kg. The futures prices for the first ten days of the contract are given below :

Day	1	2	3	4	5	6	7	8	9	10
Settlement Price (Rs. Kg)	52.50	51.25	51.00	51.80	51.40	51.10	49.75	50.30	50.50	50.25

Prepare a margin account assuming that all margin calls are honoured immediately and money is excess of the initial margin is withdrawn immediately. **(10 Marks)**

3 a. What is Contango and Backwardation market? **(03 Marks)**

b. Find out the theoretical price of a stock maturing in six months from now, which currently trading at Rs. 540. The annual risk free rate of return continuously compounded 9%.

i) What would an arbitrager do if the six months future contract on this stock is trading at Rs. 600?

ii) What are the risks involved in the arbitrage transactions in futures contracts? **(07 Marks)**

c. A index is assumed to be consisting of only five stocks and is currently quoted at 2500 with lot size of 50. The market capitalization of the index is given below :

Stocks	A	B	C	D	E
MPS (Rs)	500	850	1500	950	450
Mkt. Capitalization (Rs. Cr)	25	50	150	100	75

The company 'C' is expected to pay dividend of Rs. 50 per share 25 days from now and company 'E' Rs. 20 per share 45 days from now. The annual continuously compounded risk – free rate of interest is 10%. Find out fair price of the index futures contract expiring in 90 days on this index. **(10 Marks)**

4 a. What is Triangular Swap? **(03 Marks)**

b. What is Financial Swap? Explain different types of financial swap. **(07 Marks)**

c. Ranbaxy Ltd and Sun Pharma Ltd., requires Rs. 10 million for five years term and have been offered the following interest rates.

Company	Fixed	Floating
Ranbaxy Ltd	12%	MIBOR + 1.25%
Sun Pharma Ltd	15%	MIBOR + 1.75%

Ranbaxy Ltd is interested in floating and sun pharma Ltd., in fixed rate loan. How do you design an interest rate swap which is equally attractive to both the firms? The swap is arranged through a swap dealer who charges 0.4%. **(10 Marks)**

5 a. What is stress testing and Back testing? **(03 Marks)**

b. What is VaR? What are the methods used for estimating VaR? **(07 Marks)**

c. The following table gives the price of bonds :

Bond principal	Time to maturity	Annual coupon	Bond price
100	0.5	0.0	98
100	1.0	0.0	95
100	1.5	6.2	101
100	2.0	8.0	104

[Held the stated coupon is assumed to be paid every 6 months]

i) Calculate the zero rates for maturities of 6 months, 18 months and 24 months

ii) What are the forward rates? **(10 Marks)**

6 a. What is commodity trading? **(03 Marks)**

b. Give a brief account of SEBI guidelines for commodity derivative market? **(07 Marks)**

c. The current spot rate of IOC is Rs. 380 and which is expected to rise by 4% or fall by 2% after a month. The annual continuously compounded risk free interest rate is 9%.

i) What is the value of one month European call option on the stock with strike price of Rs. 365?

ii) How can call option are to be traded to hedge entire risk in the portfolio under Binomial option pricing model? **(10 Marks)**

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7 a. What is Covered and Naked calls? **(03 Marks)**

b. Explain the term intrinsic value and time value? From the following information. Calculate the intrinsic value and time value of the option?

Options	Stock Price	Exercise Price	Options Premium
put	38	34	7.30
call	47	52	7.80
call	111	105	8.40
put	38	45	9.70

(07 Marks)

c. What is a butterfly spread? When do the investors prefer to use this strategy? The following data is given to you about the call options on a share which is currently traded Rs. 54 with the multiplier of 800.

Exercise price (Rs.)	50	55	60
Call price (Rs.)	8	4.5	2

Determine the profit or less from third strategy when the share price is Rs. 42, Rs. 55, Rs. 58 and Rs. 59 respectively. **(10 Marks)**

8 CASE STUDY [Compulsory]

Mr. Kairav on 1st May 2021 has constructed a portfolio consisting five shares the details of which is given below :

Scrips	Market Price	No. of shares	Beta
ACC	1,750	5,000	0.90
Cipla	550	8,000	0.85
BHEL	140	10,000	0.80
GAIL	390	15,000	0.75
IDBI	60	10,000	1.05

The annual cost of capital to the investor is 10% (continuously compounded) and current value of the Nifty is 9950. You are required to :

Questions :

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a. Calculate beta of the portfolio. **(10 Marks)**

b. Calculate the fair value of the Nifty June futures **(05 Marks)**

c. In Nifty futures contract has a lot size of 75 units, find the number of contracts of Nifty futures the investor needs to short in order to get a full hedge until June for his portfolio. Assume that the Nifty futures are trading at their fair value.
Calculate the number of futures contracts the investor should trade if he desires to reduce the beta of his portfolio to 0.75. **(05 Marks)**

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Subject Title : Financial Derivatives Subject Code : 20MBAFM402

Question Number	Solution	Marks Allocated
1a.	The derivatives instruments which are generally standardized & traded in the stock exchanges & commodity exchanges are called as exchange traded derivatives & Derivatives such as forwards, equity swaps swaption, FRA's, CDS, etc are customized as per requirements of the parties to the derivative contract which is called as OTC-traded.	03
1b.	Functions of Derivatives market are: a) Price Discovery b) Risk transfer c) Market completion d) Financing function e) Liquidity f) Price stabilization g) Hedging + (Explanation).	07
1c.	Financial derivatives are defined as "Values derivied from the value & characteristics of underlying assets such as fulcores, Options swaps, Stock, index, currency, Commodity etc. Difference between Hedgers, Speculators & arbitrageurs: ① Hedgers: Traders trading in the derivatives market with an objective of eliminating the losses arising from price fluctuations to which they are already exposed are know as hedgers. Eg:- Exporters & Importers. Oil refineries etc.	10

2a. M to M => The process of adjusting margin account with the market price The effect of M to M is that a futures contract is settled daily instead of being settled at the date of the maturity which reduces default risk. 03

2b. Forward contract: A contract to buy or sell an underlying asset for future delivery at a predetermined price.

Future contract: A contract to buy or sell stocks / commodity etc as underlying asset for a future delivery at a predetermined price 07

Features of forward contract:

* Both the parties are under obligation to buy / sell
* Both the parties of the contract are known to each other
* The underlying Asset can be shares / commdy / Index.
* It is traded in OTC
* Customized to suit the needs of the parties.
* does not insist upon payment of margin

Features of futures Contract:

* There are 2 parties: one take long position & another takes short position
* Both are under obligation to buy / sell
* Both the parties to contract are not known to each other
* It is traded in organized exchange
* margin paid by both the parties is M to M price every day.

3c. Solution:

Value of the Contract = (1000 × ₹ 50 × 5) = ₹ 2,50,000/-

Initial margin = ₹ 2,50,000 × 10% = ₹ 25,000/-

Maintenance margin = ₹ 25,000 × 80% = ₹ 20,000

Margin A/c statement

Day	future price	change in Price	Daily Gain Loss	margin A/c Balance(₹)	margin call @ ₹ 20,000
0	50.00	—	—	25,000	—
1	52.50	2.50	12500	37,500	12500 (with drawn)
2	51.25	-1.25	-6250	18,750	6,250 (deposited)
3	51.00	-0.25	-1,250	23,750	—
4	51.80	0.80	4000	27,750	2750 (w.d)
5	51.40	-0.40	-2000	23,000	—
6	51.10	-0.30	-1,500	21,500	—
7	49.75	-1.35	-6,750	14,750	10,250 (deposited)
8	50.30	0.55	2750	27,750	2750 (w.d)
9	50.50	0.20	1,000	26,000	1,000 (w.d)
10	50.25	-0.25	-1,250	23,750	—

Closing balance ₹ 23750

10

3a. The future price will be always higher than the cash price (i.e, basis being negative) as the futures prices are accurately described by a full carry relationship or cost of carry approach. This condition is called contango market.

when the future prices are determined by consideration other than or in addition to cost of carry factors, the future price will be less than the cash price. This condition is known as Backwardation market.

03

3b. Theoretical Price of the stock: $F_t = S_0 e^{rt}$

$= ₹ 540 e^{(0.09 \times 6/12)} =$ ₹ 564.84 per share

Actual Future Price than the theoretical Price
₹600 > ₹564.84.

Arbitrage Process:

On the date of entering into contract:

① Borrowing ₹540 @annual interest rate of 9% for 6 months.

② Buying the share in the spot market @ ₹540

③ Shorting — 1 — futures contract @ ₹600

On the date of maturity

Selling the share & receiving ₹600

Len. Repaying the borrowed money with int. 564.30

Net gain (per share) 35.70

ii) Risk associated are:

⇒ There can be potential tracking errors

⇒ Mis pricing of the futures contracts do not stay for long.

07

3c. Computation of Present Value of Dividend.

	Company 'C'	Company 'E'
⇒ Share of the co. in the Index	= (₹150/400) × 2500 = 937.50	(₹75/400) × 2500 = 468.75
⇒ No of shares held for each unit of the Index	= 937.50/₹1500 ⇒ 0.625	⇒ 468.75/₹450 = 1.042
⇒ Amount of dividend for each unit of Index	⇒ 0.625 × ₹50 = 31.25	= 1.042 × ₹20 = 20.84
⇒ Present Value of Dividend $I = De^{-rt}$	⇒ $31.25e^{-(0.10\times\frac{25}{365})}$ = 31.04	$= 20.84e^{-(0.10\times\frac{45}{365})}$ = 20.58

10

$F_t = (S_0 - I)e^{rt}$

$= (2500 - 31.04 - 20.58)e^{(0.10 \times 90/365)}$

$= 2448.38 \times 1.0250$

= 2,509.59 per index ₹1,25,480 per contract

4a. A financial swap arranged among three parties with three different forms of borrowing is called triangular swap. — 03

4b. A contract between two parties to exchange one set of cash flows for another is known as financial swap.

Types of financial swaps :-

① Interest rate swaps
② Currency swaps
③ Equity swaps
④ Commodity swaps. (+ Explanation) — 07

4c. Total Potential Gain-

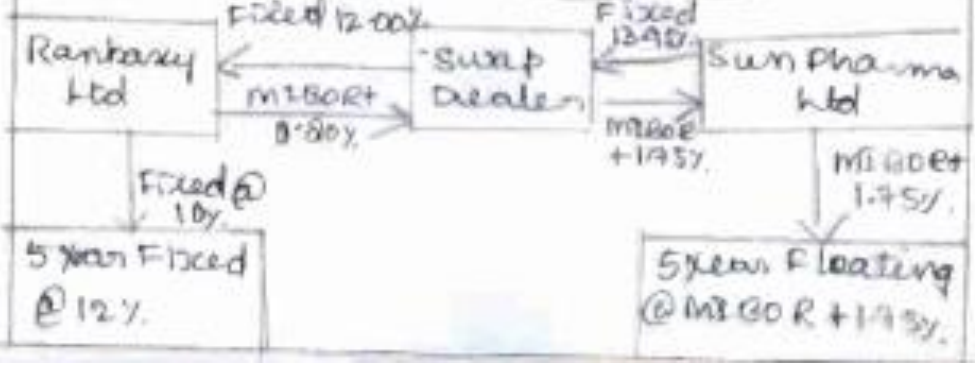
Company	Fixed	Floating
Sun Pharma Ltd	15%	MIBOR + 1.75%
Ranbaxy Ltd	12%	MIBOR + 1.25%
	3% (-) 0.50	
	= 2.5%	

Gain available to each company =
1/2 of (2.5 − 0.4) = 1.05%

Hence effective cost of Borrowing is : — 10

5 years Floating Borrowing of Ranbaxy Ltd = MIBOR + 1.25% − 1.05%
= MIBOR + 0.20%

5 years Fixed Borrowing for Sun Pharma Ltd => 15.00% − 1.05%
= 13.95%



5a. Stress testing implies determining how a portfolio would perform under some of the extreme financial crisis. Back testing is an analytical technique which is used to measure how accurately actual results would have been predicted. 03

5b. VaR → Value at Risk is a financial tool used for finding risk involved in a financial asset/s (shares, debt., bonds etc) or a portfolio of financial assets. It measures potential loss in market value of financial assets using estimated volatility & correlation between the securities, within a given probability, over a pre-determined time horizon. 07

Methods used for estimating VaR

(1) Historical Simulation model:- It is a non-parametric method of estimating VaR & uses the past data as a guide to predict the future directly from the data without making any assumptions.

(2) Model Building Approach:- This method makes the assumption of normal distribution of price returns using simple moving average or exponential weighted moving average.

(3) Monte Carlo Simulation Model:- It is similar to the historical simulation model except the difference that the hypothetical data set used in the Monte Carlo is generated by a statistical distribution rather than historical price levels.

(4) Linear model: estimates VaR by establishing linear relationship b/w risk factors returns & changes in the market value of portfolio & such

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Methods used for estimating VaR

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6b. SEBI Guidelines:

⇒ The Exchange has to provide online trading system.
⇒ Online surveillance to keep check on positions, prices & volumes on real time basis.
⇒ Exchange shall provide information relating to quote, quantities etc.
⇒ Investor grievances redressal mechanism
⇒ Effective system of monitoring investor complaints
⇒ Investor Protection fund
⇒ Should provide Electronic Funds Transfer (EFT)
⇒ It has to segregate initial margin deposited by clearing members.
⇒ Exchange should have a separate 'Trade Guarantee Fund' for the derivatives segment

07

6c. Solution:- Given:

$S_0 = ₹ 380$; $S_1 = ₹ 395.20$ (i.e. 380 × 1.04) &
₹ 372.40 (380 × 0.98); $K = ₹ 365$; $r = 9\%$ &
$i = 1.0075$ [(i.e. (1 + 0.09 × 1/12))]

C_u = Max (₹ 395.20 − 365, 0) = ₹ 30.20

C_d = Max. (372.40 − 365, 0) = ₹ 7.40

u = 395.20/380 = 1.04 d = 372.40/380 = 0.98

(i) Value of call option = $\frac{₹ 30.20 (1.0075 - 0.98)}{(1.04 - 0.98)} + \frac{7.4 (1.04 - 1.0075)}{(1.04 - 0.98)}$ / 1.0075

= 13.93/1.0075 = ₹ 17.78 per share

10

(ii) No. of call options to be traded to hedge entire risk = $\frac{(₹ 30.20 - 7.4)}{₹ 380 (1.04 - 0.98)} = \frac{₹ 22.80}{22.80} = 1$

Interpretation: The hedge ratio of 1 implies that for every one call option, 1 portion of the risk can be eliminated.

7a. **Covered & Naked Calls:** If a call writer (i.e., call seller) owns the asset underlying the call, the call option is said to be covered whereas, if a call is written without having the asset underlying, it is said to be naked. — 03

7b. Intrinsic value is the amount by which it is in-the-money if it is ITM.

Time value is the excess of premium over the intrinsic value.

option type	S.P	E.P	Intrinsic value			Time value
Put	38	34	S>E	OTM	34-38 = 0	7.30-0 = 7.30
Call	47	52	S<E	OTM	47-52 = 0	7.80-0 = 7.80
Call	111	105	S>E	ITM	111-105 = 6	8.40-6 = 2.40
Put	38	45	S<E	ITM	45-38 = 7	9.70-7 = 2.70

— 07

7c. **Butterfly Spread**

It is a strategy created with three different strike prices either using only calls or only put options. It involves on long call at lower strike price & another long call at highest strike price & two short calls @ a price which is half way between long call @ lowest strike price & highest strike price.

It is used when the large price changes are not expected & the mkt is expected to be stagnant. — 10

S.P	1st Long call E_1 = 50(8)	Short call E_2 = 55(4.5)	2nd Long call E_3 = 60(2)	Net P/L	Total Pay Off
42	(8)	9	-2	(1)	(800)
55	(3)	9	-2	4	3200
58	0	3	-2	1	800
59	1	1	-2	0	0

8. (a)

(i) Computation of portfolio beta

Scripts	MPS (₹)	No. of shares	Portfolio value (₹)	Weightage	Beta	W × B
ACC	1750	5,000	87,50,000	0.42	0.90	0.38
Cipla	550	8,000	44,00,000	0.21	0.85	0.18
BHEL	140	10,000	14,00,000	0.07	0.80	0.05
GAIL	390	15,000	58,50,000	0.28	0.75	0.21
IDBI	60	10,000	6,00,000	0.03	1.05	0.03
		P =	2,10,00,000	1.00		β_P = 0.85

(10)

(ii) Calculation of Fair value of Nifty June Futures:

$F_t = S_0 e^{rt}$ = 10201.74 per index

(iii) Calculation of Number of contracts required to be sold to hedge the portfolio:

(5)

$$\frac{\Sigma(P \times \beta_P)}{F_1} = \frac{(₹\ 21,00,000 \times 0.85)}{(10201.74 \times 75)}$$

= 23.33 or 24 contracts

Since the futures contracts cannot be traded in fraction, 23.33 is rounded off to 24 contracts

(iv) Calculation of Number of contracts required to be sold to lower beta of the portfolio: (5)

$$\frac{P(\beta_P - \beta'_P)}{F} = \left[₹\ 21,00,000 \times \frac{(0.85 - 0.75)}{(9950 \times 75)}\right]$$

= 2.81 ≈ 3 contracts

—x—