2025
Edition

Krivii Eduspace

SIMPLIFIED AFM QUES BANK

By Finance Acharya Jatin Nagpal (CA, FRM)

KEY HIGHLIGHTS

- ✔ 100% Coverage: Study Mat, Past exams, MTPs, RTPs
- ✔ Simplified, Short & Standard Solutions
- ✔ Author Notes & Krack Charts
- ✔ Smart Elimination of repeated Ques

A Big thanks to ...

The Almighty - I bow down to your gentle feet. Nothing can be achieved without your ultimate blessing.

My Parents & Elder brother – Whose continuous support & efforts made this book possible.

My Teachers and guides – The one who enlightens the path and make us capable of walking on that path.

Team Krivi – Everyone for your relentless efforts.

And yes.... **TO YOU ALL STUDENTS –** For showering us with your love, faith and support.

Every effort has been taken to avoid any error or omission in this book. However, if you still find any error or omission then please share it at any of the following-

Whatsapp or Telegram us at +91 94784-23144.
or Email us at hello.krivii@gmail.com

The author or the publisher shall not be responsible for any kind of damage or loss due to error or omission.

Scan me to connect with:
Whatsapp student help

Scan me to connect with:
Telegram student help

Index

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index – Chapter name	No. of Main Ques	No. of Add. Ques
01) Financial Policy & Corporate Strategy	1	-- None --
02) Risk Management (VaR)	5	1
03) Advanced Capital Budgeting	28	-- None --
04) Security Analysis	3	-- None --
05a) Equity valuation	21	7
05b) Bonds (Fixed Income)	22	11
05c) Rights, MMI & others	12	6
06) Portfolio Management	45	13
08) Mutual Fund	18	3
09a) Futures	17	6
09b) Options	14	3
09c) Real options	4	2
10a) Forex	35	16
10b) Currency F&O	8	-- None --
11) Internal Financial Management	10	7
12) Interest Rate Risk Management (IRRM)	16	11
13) Business Valuation	23	7
14) M&A	28	10

Note: This book contains **practical questions only**.

For theory part, you can download our **"Simplified AFM Theory book"** (completely FREE) from our Telegram Channel – "Krivii Eduspace".

Reading Instructions (Imp!!)

1) **Main Ques vs Additional Ques vs Low Probability Unique Questions (LPUQ)**

Particulars	Main Ques	Add. Ques	Low Prob. Unique Ques
Basic	Must do ques	Add. ques for practice	Good if AFM target is 85+
Exam Probability	Highest	Relatively lower	Lowest
Frequency	Regularly asked in exam	Sometimes asked	Rarely asked in exam
Revisions	Solve once + 2 revisions	At least solve once	Depends on your time
Analogy	Dil k kareeb Girlfriend	Fling	One time date

2) **Crux:**

MAIN QUES → Must do ques. High exam chance + Helps in building a strong base by providing adequate variety.

ADDITIONAL QUES → Some add. questions for practice purpose mainly. Ideally one should be able to do these if they have a "Strong conceptual base" + have practiced the main ques thoroughly.

LPUQ → These are generally ques from some past RTP / MTP that ICAI asked once and then never looked back. The effort to reward ratio of these questions is not very favourable.

3) **Connect with us for Updates, Free resources & more:**

Scan me to join our: Telegram Channel

Scan to connect with our: Youtube Channel

Ch 1 – Financial Policy & Corporate Strategy

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
External funding requirement	1

Main Questions

👉 External fund requirement

 # Ques 1 - Sanjay Bakshi **{M23 MTP 1}**

The Balance Sheet of Mr. Sanjay Bakshi Ltd. as on 31-03- 2020 is follows:

Liabilities	₹ in lacs	Assets	₹ in lacs
Share Capital	300	Fixed Assets	600
Reserves	200	Inventory	500
Long Term Loan	400	Receivables	240
Short Term Loan	300	Cash	60
Payable & Provisions	200		
Total:	1400		1400

Sales for the year was ₹600 lacs. The sales are expected to grow by 20% during the year. The profit margin and dividend pay-out ratio are expected to be 4% and 50% respectively.

The company further desires that during the current year Sales to Short Term Loan and Payables and Provision should be in the ratio of 4 : 3. Ratio of fixed assets to Long Term Loans should be 1.5. Debt Equity Ratio should not exceed 1.5.

You are required to determine:

(i) The amount of External Fund Requirement (EFR)

(ii) Amount to be raised from Short Term, Long Term and Equity funds.

Note The below solution is directly taken from Suggested answer. The author is not satisfied with the below solution. However, alternative solution is intentionally not given here to avoid confusion.

Ans: **Part A – Calculation of External Fund requirement (EFR)**

•	Expected sales = 600 x 1.2	720
•	Profit = 720 x 4%	28.8
A.	Amount ploughed back into business = 28.8 x 0.5	14.4
B.	Additional funds required = (1400 – 200*) x 0.2	240
C.	EFR = B – A	225.6

* As current liabilities shall also be increased proportionately with increase in sales.

Part B – Amount to be raised from different sources

1.	**Amount to be raised from short term funds:**	**₹ in Lacs**
•	Condition: Sales to short term loans and payables & provisions should be 4:3	
•	New amount = 3/4 x 720	540
•	Less: Existing Amount = 200 x 1.2 + 300	540
»	Amount to be raised from short term funds	Nil
2.	**Amount to be raised from long term funds:**	**₹ in Lacs**
	Condition: Ratio of fixed assets to long term loans should be 1.5	
•	New fixed assets = ₹600 x 1.2	720
•	Total long-term loans can be = ₹720/1.5	480
•	Less: Existing long-term loans	400
»	Amount to be raised from long term funds	80
3.	**Amount to be raised from equity funds:**	**₹ in Lacs**
	Condition: Debt equity ratio should not exceed 1.5.	
•	Amount to be raised from external sources	225.60
•	Less: Amount to be raised from short term funds	-
•	Less: Amount to be raised from long term funds	80.00
»	Balance amount to be raised from equity funds	145.60
•	Note: Checking new Debt to Equity Ratio	
•	$\text{DER} = \frac{\text{Debt}}{\text{Equity Shareholder's funds}} = \frac{480}{300 + 200 + 14.4 + 145.6} = 0.727$	
•	Thus, required condition is satisfied.	

Ch 2 - Risk Management

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	Ques Number
VaR of a single security	1
Portfolio VaR	2 – 3
Special Questions	4 – 5

Index - Additional Questions	Ques Number
Portfolio VaR	1

Main Questions

👉 VaR of a single security

 # Ques 1 – Ecar

Consider a stock of Ecar ltd. with an annual variance of 478%^{2}. A trader is analysing the stock and wants to know about its VaR before any making final decision. He wants to calculate 95% 1- day, 10 days & 1-year VaR. Also, he wants to calculate 1-day 99% VaR of the same stock.

Ans: Annual SD = √478 = 21.863%

1-day SD = 21.863% / √252 = 1.377%

 # VaR = z.SD × √ time

- 1-day 95% VaR = 1.645 x 1.377% = 2.265%
- 10-day 95% VaR = 1.645 x 1.377% x √10 = 7.163%
- Annual 95% VaR = 1.645 x 21.863% = 35.96%
- 1-day 99% VaR = 2.33 x 1.377% = 3.208%

👉 Portfolio VaR

 # Ques 2 – Vasu **{SM TYK, N19 Exam (New)}**

Following is the information about Mr. Vasu's portfolio: Mr. Vasu has invested ₹200 lacs in ABC ltd. and a same amount in XYZ ltd. shares. SD of both the stocks is 1% per day. Correlation between 2 stocks is 0.3.

Determine the 10 days 99% Value at Risk (VaR) for Mr. Vasu 's portfolio. Given: The Z score from the Normal Table at 99% confidence level is 2.33. (Show your calculations up to four decimal points).

Ans: **Method 1 – Preferred in cases like above**

Weight of ABC = Weight of XYZ = 0.5

- Portfolio Variance $(\sigma_P^2) = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + 2\omega_a\omega_b(\sigma_a\sigma_b r_{a,b})$

σ_p^2 = (0.5 x 1)^2 + (0.5 x 1)^2 + 2 x 0.5 x 0.5 (1% x 1% x 0.3) = 0.65

σ_p = √0.65 = 0.8062%

- Portfolio VaR (VaR^2_p) = z.SD$\sqrt{t}$ = 2.33 x 0.8062% x $\sqrt{10}$ = 5.94%

In ₹ amount = 400L x 5.94% = ₹23.76L

→ **Method 2 – Alternative: Using VaR^2 formula**

10-day 99% VaR of ABC = 2.33 x (1% x 200L) x $\sqrt{10}$ = ₹14.736L

10-day 99% VaR of XYZ = 2.33 x (1% x 200L) x $\sqrt{10}$ = ₹14.736L

$VaR^2_P = (VAR_a)^2 + (VAR_b)^2 + 2VAR_aVAR_b(r_{a,b})$

$VaR^2_p = (14.736)^2 + (14.736)^2 + 2\ (14.736)\ (14.736)\ (0.3) = 564.589\%^2$

$VaR_p = \sqrt{564.589}$ = ₹23.76L

Ques 3 - Frisk investments

Frisk investments plc has invested in Govt. bonds & commodities. 1-week 95% VaR of G-bonds is ₹17.4 lacs. Find 1-week 99% VaR of commodities if the Firm's 1-week 95% VaR is ₹32 lacs. Based on historical distribution of returns, the risk manager has come to conclusion that the returns of Govt. bonds & commodities are independent.

Ans: $VaR_{firm} = VaR^2_{G\text{-}bonds} + VaR^2_{commodity} + 2VaR_aVaR_b\ r(a,b)$

Since, Govt. bonds & commodity returns are independent, that means correlation between two = 0

- $VaR^2_{firm} = VaR^2_{G\text{-}bonds} + VaR^2_{commodity}$
- $32^2 = 17.4^2 + VaR^2_{commodity}$
- 1-week 95% $VaR_{commodity}$ = 26.856 lacs

- 1-week 99% VAR = $\frac{2.33}{1.645}$ x 26.856 lacs = ₹38.04 lacs

👉 **Special Questions**

Calculating Maximum possible investment using VaR

Ques 4 – Minato **{N20 Exam (New), N24 MTP 1}**

On Tues morning (before opening of capital market) Mr Minato, an investor, while going through his bank statement, has observed that an amount of ₹7 lakhs is lying in his bank account. This amount is available for use from Tuesday till Friday. The Bank requires a minimum balance of ₹1000 all the time. The investor desires to make a maximum possible investment where Value at Risk (VaR) should not exceed the balance lying in his bank account. The S.D. of market price of the security is 1.5

per cent per day. The required confidence level is 99 per cent.

You are required to determine the maximum possible investment.

Ans: Amount in Bank A/C ₹ 7,00,000

Less: Minimum Balance required (₹ 1000)

» Amount available ₹ 6,99,000

- **Now, the max loss during the 4-day period (from Tues to Fri) should not be more than ₹6,99,000.**
- Let the amount of investment be "A"
- 4-day VaR at 99% confidence level of A = ₹6,99,000.
- A x 1.5% x √4 x 2.33 = 6,99,000
- A = ₹1,00,00,000.

» Hence, maximum possible investment = ₹1 crore.

Calculating "SD of stocks" to find Max. possible investment as per VaR

 # Ques 5 - Bigger Bull {M23 Exam}

Bigger Bull is a rational risk taker. He takes his position in a single stock for 4 days in a week. He does not take a position on Friday to avoid weekend effect and takes position only for four days in a week i.e. Monday to Thursday. He transfers the amount on Monday morning and withdraws balance on Friday morning. He desires to make a maximum investment where Value At Risk (VAR) should not exceed the balance lying in his bank account. The position by his manager, as per standing instructions, is taken on the free balance lying in the bank account in the morning on each Monday.

On Monday morning (before opening of capital market) he has transferred an amount of ₹ 11 Crore to his bank account. A fixed deposit also matured on this Monday. Maturity amount of ₹ 63,42,560 was also credited to his account by the bank in the morning of the Monday. However, Mr. Bull received the intimation of the same in the evening. The bank needs a minimum balance of ₹ 1,000 all the time. The value of Z score, at the required confidence level of 99 percent is 2.33.

The other information with respect to stocks X and Y, which are under consideration for this week, is as under:

Return (x)	Probability (X)	Return (Y)	Probability (Y)
6	0.10	4	0.10
7	0.25	6	0.20
8	0.30	8	0.40

	9	0.25	10	0.20
	10	0.10	12	0.10

You are required to recommend a single stock, where maximum investment can be made.

Ans: **Calculating SD of Security X**

#	Return (X)	Prob (P)	Return*P	$(x-\bar{x})$	$(x-\bar{x})^2P$
	6	0.1	0.6	-2	0.4
	7	0.25	1.75	-1	0.25
	8	0.3	2.4	0	0
	9	0.25	2.25	1	0.25
	10	0.1	1	2	0.4
Sum	-	-	8	-	1.3

- Expected return of X = 8
- Variance of X = $\Sigma (x-\bar{x})^2P$ = 1.30
- SD of X = $\sqrt{1.30}$ = 1.14

Calculating SD of Security Y

	Return (Y)	Prob (P)	Return*P	$(y-\bar{y})$	$(y-\bar{y})^2P$
	4	0.1	0.4	-4	1.6
	6	0.2	1.2	-2	0.8
	8	0.4	3.2	0	0
	10	0.2	2	2	0.8
	12	0.1	1.2	4	1.6
Sum	-	-	8	-	4.8

- Expected return of X = 8
- Variance of X = $\Sigma (x-\bar{x})^2P$ = 4.8
- SD of X = $\sqrt{4.80}$ = 2.19

- **Calculating Amount available for investment**

Amount Transferred	₹ 110000000
Maturity Proceeds of Fixed Deposit	₹ 6342560
Amount available in bank account	₹ 116342560
Minimum balance to be kept	₹ 1000

» Available amount for investment ₹ 116341560

Hence, the 4-day VAR of the position shall be ₹116341560 at max.

<u>Cal amount which can be invested in security X (let it be 'a')</u>

4-day VAR = Amount invested. z.SD √t

116341560 = a x 2.33 x 0.0114 x √4

a = 116341560 / 0.053124

a = ₹ 2,19,00,00,000

<u>Cal amount which can be invested in security Y (let it be 'b')</u>

4-day VAR = Amount invested. z.SD √t

116341560 = b x 2.33 x 0.0219 x √4

b = 116341560 / 0.102054

b = ₹ 1,14,00,00,000

Recommendation: Position should be taken in X.

Additional Questions

👉 Portfolio VaR

 # Ques 1 - Solar plexus

Solar plexus plc is a trading firm. It has bought Govt bonds worth ₹120 crores. It has also invested ₹130 crores in corporate bonds. The two have a correlation of 0.4. The standard deviation of govt. bonds is 9% p.a. whereas SD of corporate bonds is 17% p.a.. The Chief Risk manager wants to know about the minimum loss that the firm may incur on any given day in the worst 5% of the scenarios. You are required to calculate the same.

Ans: Minimum loss that the firm may incur in 5% worst scenarios = VaR at 5% significance level (i.e. VaR at 95% Confidence level).

1-day 95% VaR = z.SD

- Weight of ABC in portfolio = 120 / 250 = 048

  Weight of XYZ in portfolio = 130 / 250 = 0.52

- $$\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + 2\omega_a\omega_b(\sigma_a\sigma_b r_{a,b})$$
- σ_p^2 = (0.48 x 9)^2 + (0.52 x 17)^2 + 2 x 0.48 x 0.52 (9% x 17% x 0.4) = 127.359
- σ_p = 11.285%

- VaR of portfolio = z.SD = 1.645 x 11.285% = 18.5638%

  In amount = 250 crores x 18.5638% = ₹46.41 Crores

- Therefore, the minimum loss that the firm may incur in worst 5% of scenarios = ₹46.41 crores

Ch 3 – Adv Cap Budgeting

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
SD, CV, NPV (including Hiller model, Dependent vs independent prob.)	1 – 8
Sensitivity Analysis	9 – 13
Certainty Equivalent (C.E.), RADR	14 - 16
Nominal vs Real terms	17 – 19
Decision Tree	20
Project Utility	21
Replacement Decisions	22 – 28

Index - Additional Questions	**Ques Number**
-- None --	--

Main Questions

SD, CV, NPV

Hiller Model

 # Ques 1 - Skylark Airways {ICAI TYK}

Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of ₹50,00,000. The expected cash flow after tax for the next three years is as follows:

Year 1 CFAT	Prob.	Year 2 CFAT	Prob.	Year 3 CFAT	Prob.
14L	0.1	15L	0.1	18L	0.2
18L	0.2	20L	0.3	25L	0.5
25L	0.4	32L	0.4	35L	0.2
40L	0.3	45L	0.2	48L	0.1

The Co. wishes to consider all possible risk factors relating to airline operations. It wants to know:

(i) The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.

(ii) The possible deviation in the expected value.

(iii) How would standard deviation of the present value distribution help in Capital Budgeting decisions?

A: **# Expected Cash flows for:**

Year 1 = 14L x 0.1 + 18L x 0.2 + 25L x 0.4 + 40L x 0.3 = ₹ 27L

Year 2 = 15L x 0.1 + 20L x 0.3 + 32L x 0.4 + 45L x 0.2 = ₹ 29.3L

Year 3 = 18L x 0.2 + 25L x 0.5 + 35L x 0.2 + 48L x 0.1 = ₹ 27.9L

i) NPV = PVCI – PVCO

$$NPV = \frac{27}{1.06^1} + \frac{29.3}{1.06^2} + \frac{27.9L}{1.06^3} - 50L = ₹24.974$$

ii) Possible deviation in expected value (EV)

- $$\text{Variance of EV} = \frac{\text{Variance Y1}}{(1+RR)^2} + \frac{\text{Variance Y2}}{(1+RR)^4} + \frac{\text{Variance Y3}}{(1+RR)^6}$$

iii) Calculating Variance & SD

# Variance of Year 1:			# Variance of Year 2:			# Variance of Year 3:		
CFAT (x)	Prob. (P)	P.$(x - \bar{x})^2$	CFAT (x)	Prob. (P)	P.$(x - \bar{x})^2$	CFAT (x)	Prob. (P)	P.$(x - \bar{x})^2$
14L	0.1	16.9	15L	0.1	20.45	18L	0.2	19.60
18L	0.2	16.2	20L	0.3	25.95	25L	0.5	4.21
25L	0.4	1.6	32L	0.4	2.92	35L	0.2	10.08
40L	0.3	50.7	45L	0.2	49.30	48L	0.1	40.40
Total (Variance):		**85.4**	**Total (Variance):**		**98.62**	**Total (Variance):**		**74.29**

- Variance of EV = $\frac{85.4}{1.06^2} + \frac{98.62}{1.06^4} + \frac{74.29}{1.06^6} = 206.493$

- SD of EV = √ Variance = √206.493 = ₹ 14.369 Lacs

iii) **SD in capital budgeting decisions**

- Standard deviation is a statistical measure of dispersion.
- It measures the deviation from mean.
- If 2 projects are giving similar CFs then we can use SD to measure variation (risk) of each project and can select the less risky one.
- Project with lower CV is preferred if sizes are heterogenous.
- If the probability distribution is approximately normal then we can also calculate the probability of NPV being less than or more than a specified amount.

EV, SD of CFs

 # Ques 2 - Cyber company **{ICAI TYK}**

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is ₹5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under:

Situation	Probability	Project A	Project B
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000
Worse	0.3	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted?

Ans: **# Calculating expected Cash flows**

Project A = 6L x 0.3 + 4L x 0.4 + 2L x 0.3 = ₹ 4 Lacs

Project B = 5L x 0.3 + 4L x 0.4 + 3L x 0.3 = ₹ 4 Lacs

(i) **Calculating NPV**

Project A = 4L x PVAF (7%, 5) – 5L = ₹ 11.40 Lacs

Project B = 4L x PVAF (7%, 5) – 5L = ₹ 11.40 Lacs

☞ Since NPV of both the projects is same. So we need to calculate SD of CFs of each project.

(ii) **Calculating SD**

» Variance of Project A			» Variance of Project B		
CFAT (x)	**Prob. (P)**	**P.(x - $\bar{x}$)²**	**CFAT (y)**	**Prob. (P)**	**P.(y - $\bar{y}$)²**
6L	0.3	1.2	5L	0.3	0.3
4L	0.4	0	4L	0.4	0
2L	0.3	1.2	3L	0.3	0.3
Total (Variance):		**2.4**	**Total (Variance):**		**0.6**

- Where $\bar{x}$ = Expected CF = ₹ 4 Lacs
- SD of Project A = √2.4 = ₹ 1.549 Lacs
- Where $\bar{y}$ = Expected CF = ₹ 4 Lacs
- SD of Project A = √0.6 = ₹ 0.7746 Lacs

Conclusion -- SD of Project B (₹0.7746 L) < SD of Project A (₹1.549 L)

So, Select Project B as it is less risky and offers same NPV.

Coefficient of variation calculation

Ques 3 – Dhanush {ICAI TYK}

Dhanush ltd. is considering Projects X and Y with following info:

Project	Expected NPV (₹)	Standard deviation
X	1,22,000	90,000
Y	2,25,000	1,20,000

(i) Which project will you recommend based on the above data?

(ii) Explain whether your opinion will change, if you use coefficient of variation as a measure of risk.

(iii) Which measure is more appropriate in this situation and why?

Ans: (i) SD of Project X (0.9L) < SD of Project Y (1.2L). Select Project X.

(ii) Coefficient of variation (CV) = SD / ENPV

CV of Project X = 90,000 / 1,22,000 = 0.738

CV of Project Y = 1,20,000 / 2,25,000 = 0.533

• Decision - CV of Project Y (0.533) < CV of Project X (0.738). Select Project Y.

(iii) In conflicting situations, use NPV as it is compatible with the objective of wealth maximization in terms of time value.

Basic SD & CV Calculation

 # Ques 4 – Simons **{ICAI TYK}**

Simons plc, is considering taking up one of the two projects: 'Project-K' and 'Project-S'. Both the projects having same life require equal investment of ₹80 lakhs each. Both are estimated to have almost the same yield. As the company is new to this type of business, the cash flow arising from projects cannot be estimated with certainty. An attempt was therefore, made to use probability to analyse the pattern of cash flow from other projects during the first year of operations. This pattern is likely to continue during the life of these projects. The results of the analysis are as follows:

CF of Project K	Probability	CF of Project S	Probability
₹ 11L	0.10	₹ 09L	0.10
₹ 13L	0.20	₹ 13L	0.25
₹ 15L	0.40	₹ 17L	0.30
₹ 17L	0.20	₹ 21L	0.25
₹ 19L	0.10	₹ 25L	0.10

Required:

(i) Calculate variance, standard deviation and co-efficient of variance for both the projects.

(ii) Which of the two projects is riskier?

Ans: **» Project K**

CFAT (x)	Prob. (P)	$\bar{x}$ = Prob. x CF	$P.(x - \bar{x})^2$
11	0.1	1.1	1.6
13	0.2	2.6	0.8
15	0.4	6	0
17	0.2	3.4	0.8
19	0.1	1.9	1.6
Total:		**Mean = 15**	**σ^2 = 4.8**

- SD = √4.8 = ₹ 2.19 Lacs
- Coefficient of Variation (CV) = SD / Mean = 2.19 / 15 = 0.146

» **Project S**

CFAT (x)	Prob. (P)	$\bar{x}$ = Prob. x CF	P.$(x - \bar{x})^2$
9	0.1	0.9	6.4
13	0.25	3.25	4
17	0.3	5.1	0
21	0.25	5.25	4
25	0.1	2.5	6.4
Total:		**Mean = 17**	**σ^2 = 20.8**

- SD = √20.8 = ₹ 4.56 Lacs
- Coefficient of Variation (CV) = SD / Mean = 4.56 / 17 = 0.268

(ii) Project S is riskier as it has higher coefficient of variation.

Hiller Model

 # Ques 5 – Honeywell **{ICAI TYK}**

Project X and Project Y are under the evaluation of Honeywell Co. The estimated cash flows and their probabilities are as below:

(1) Project X : Investment (year 0) = ₹70 lakh

Probability weights	0.30	0.40	0.30
Year 1	30L	50L	65L
Year 2	30L	40L	55L
Year 3	30L	40L	45L

(2) Project Y: Investment (year 0) = ₹80 lakhs

Probability weighted	Annual cash flows through life
0.20	40
0.50	45
0.30	50

(i) Which project is better based on NPV criterion with a discount rate of 10%?

(ii) Compute the SD of the present value distribution and analyse the inherent risk of the projects.

Ans: **(i) NPV**

**Expected CFs of Project X**

Year 1 = 30L x 0.3 + 50L x 0.4 + 65L x 0.3 = 48.5

Year 2 = 30L x 0.3 + 40L x 0.4 + 55L x 0.3 = 41.5

Year 3 = 30L x 0.3 + 40L x 0.4 + 45L x 0.3 = 38.5

- NPV of Project X = $\frac{48.5}{1.1^1} + \frac{41.5}{1.1^2} + \frac{38.5}{1.1^3} - 70$ = ₹ 37.314 Lacs

**Expected CFs & NPV of Project Y**

Expected CF p.a. = 40 x 0.2 + 45 x 0.5 + 50 x 0.30 = ₹ 45.5L

NPV = 45.5 x PVAF (10%, 3) – 80 = ₹ 33.15 Lacs

ii) **SD in PV distribution or SD of expected value (EV)**

- Variance in EV = $\frac{\text{Variance Y1}}{(1 + RR)^2} + \frac{\text{Variance Y2}}{(1 + RR)^4} + \frac{\text{Variance Y3}}{(1 + RR)^6}$

**Project X - Variance of CF for each year**

Y1 = $0.3\times(30 - 48.5)^2 + 0.4\times(50 - 48.5)^2 + 0.3\times(65 - 48.5)^2 = 185.26$

Y2 = $0.3\times(30 - 41.5)^2 + 0.4\times(40 - 41.5)^2 + 0.3\times(55 - 41.5)^2 = 95.26$

Y3 = $0.3\times(30 - 38.5)^2 + 0.4\times(40 - 38.5)^2 + 0.3\times(45 - 38.5)^2 = 35.26$

- Variance of EV = $\frac{185.26}{1.1^2} + \frac{95.26}{1.1^4} + \frac{35.26}{1.1^6}$ = 238.075

- SD of PV distribution for Project X = $\sqrt{238.075}$ = ₹ 15.43 Lacs

**Project Y - Variance of CF for each year**

= $0.2\times(40 - 45.5)^2 + 0.5\times(45 - 45.5)^2 + 0.3\times(50 - 45.5)^2 = 12.25$

i.e. Variance of CF for Year 1 = Year 2 = Year 3 = 12.25

- Variance of EV = $\frac{12.25}{1.1^2} + \frac{12.25}{1.1^4} + \frac{12.25}{1.1^6}$ = 25.40

• SD of PV distribution for Project X = √25.4 = ₹ 5.03 Lacs

☞ **Analysis:** Project Y is less risky as its SD is less than Project X.

Basics NPV, SD & Probability Index Calculation

 # Ques 6 – Shivam ltd. **{ICAI TYK}**

Shivam Ltd. is considering two mutually exclusive projects A and B. Project A costs ₹36,000 and project B ₹30,000. You have been given below the NPV probability distribution for each project.

Project A: NPV estimates	Probability	Project B: NPV estimates	Probability
15,000	0.2	15,000	0.1
12,000	0.3	12,000	0.4
6,000	0.3	6,000	0.4
3,000	0.2	3,000	0.1

(i) Compute the expected net present values of projects A and B.

(ii) Compute the risk attached to each project i.e. standard deviation of each probability distribution.

(iii) Compute the profitability index of each project.

(iv) Which project do you recommend? State with reasons.

Ans: Profitability Index (PI) = $\frac{\text{PVCI}}{\text{Initial Investment}}$

or PI = $\frac{\text{Initial Investment + NPV}}{\text{Initial Investment}}$

 # Calculating Expected value and SD of Project A

NPV (x)	Prob. (P)	$\bar{x}$ = P x NPV	P.$(x - \bar{x})^2$
15000	0.2	3000	7200000
12000	0.3	3600	2700000
6000	0.3	1800	2700000
3000	0.2	600	7200000
Total:		**ENPV = 9000**	**1,98,00,000**

• SD = √1,98,00,000 = ₹ 4450

• Profitability Index (PI) = (9000 + 36000) / 36000 = 1.25

**Calculating Expected value and SD of Project B**

NPV (x)	Prob. (P)	$\bar{x}$ = P x NPV	P.$(x - \bar{x})^2$
15000	0.1	1500	3600000
12000	0.4	4800	3600000
6000	0.4	2400	3600000
3000	0.1	300	3600000
Total:		**ENPV = 9000**	**1,44,00,000**

- SD = √1,44,00,000 = ₹ 3795
- Profitability Index (PI) = (9000 + 30000) / 30000 = 1.30

#	Summary	Project A	Project B
(i)	Expected NPV	9000	9000
(ii)	Standard deviation (SD)	4450	3795
(iii)	Profitability Index (PI)	1.25	1.30

(iv) Both Project A & B have same expected NPV.

But SD of Project B < SD of Project A. Therefore Select Project B as it has lower variation in its CFs.

Dependent & Independent Probability

 # Q 7 - Lemon tree **{ICAI TYK}**

Following are the estimates of the net cash flows and probability of a new project of Lemon tree Ltd.

Initial Investment = 4 lacs.

Particulars	Year	P = 0.3	P = 0.5	P = 0.2
• Estimated net after tax cash inflows p.a.	1 to 5	1L	1.1L	1.2L
• Estimated salvage value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

(i) The expected NPV of the project.

(ii) The best case and the worst case NPVs.

(iii) The probability of occurrence of the worst case if the cash flows are perfectly dependent overtime and independent overtime.

(iv) Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.

(v) Coefficient of variation of X Ltd. on its average project which is in the range of 0.95 to 1.0. If the coefficient of variation of the project is found to be less risky than average, 100 basis points are deducted from the Company's cost of Capital. Should the project be accepted by X Ltd?

Ans: **(i) Expected NPV**

- Expected CF p.a. = 1 x 0.3 + 1.1 x 0.5 + 1.2 x 0.2 = ₹ 1.09L
- Expected Salvage value = 0.2 x 0.3 + 0.5 x 0.5 + 0.6 x 0.2 = ₹ 0.43L
- NPV = 1.09 x PVAF (10%, 5) + 0.43 x PVF (10%, 5) – 4 = ₹ 0.399L

(ii) Best case NPV

1.2 x PVAF (10%, 5) + 0.6 x PVF (10%, 5) – 4 = 0.9215L = ₹ 92,150

Worst case NPV

1 x PVAF (10%, 5) + 0.2 x PVF (10%, 5) – 4 = -0.085L = –₹8500

(iii) Case 1 - CFs are fully Dependent

- Fully dependent CFs means that if co. incurred worst CFs in year 1 then it will continue to earn worst CFs for remaining years as well.
- Prob. of worst CF throughout = Prob. of worst CF in Y1 = 0.3 or 30%

Case 2 – CFs are fully Independent

- It means that even if co. incurred worst CFs in year 1, then also it may or may not earn worst CFs in year 2 and so on….
- Prob. of worst CF throughout = (0.3×0.3×0.3×0.3×0.3) or directly = 0.3^5 = 0.00243 or 0.243%

Basic expected & worst case NPV calculation, Dependent probability cal.

 # Ques 8 – Lynx {ICAI TYK}

Lynx Ltd. has under its consideration a project with an initial investment of ₹1,00,000. Three probable cash inflow scenarios with their probabilities of occurrence have been estimated as below:

Annual cash inflow (₹)	20,000	30,000	40,000
Probability	0.1	0.7	0.2

The project life is 5 years and the desired rate of return is 20%. The estimated terminal values for the project assets under the 3 probability alternatives, respectively, are ₹ 0, 20,000 and 30,000.

You are required to:

(i) Find the probable NPV;

(ii) Find the worst-case NPV and the best-case NPV; and

(iii) State the probability occurrence of the worst case, if the cash flows are perfectly positively correlated over time.

Ans: • ECF = 20,000 x 0.1 + 30,000 x 0.7 + 40,000 x 0.2 = 31,000

• Expected Terminal Value = 0 + 20000 x 0.7 + 30000 x 0.2 = 20,000

(i) Probable NPV = 31,000 x PVAF (20%, 5) + 20,000 x PVF (20%, 5) – 1,00,000 = ₹ 746.52

(ii) Worst case NPV = 20,000 x PVAF (20%, 5) + 0 x PVF (20%, 5) – 1,00,000 = -₹40,188

(iii) Best case NPV = 40,000 x PVAF (20%, 5) + 30,000 x PVF (20%, 5) – 1,00,000 = ₹ 31,681

(iv) If CFs are perfectly dependent, then low CF in 1st year will mean a low CF in every year. Thus, possibility of worst case occurring = probability of getting ₹20,000 net cash flow in year 1 = 10%.

👉 Sensitivity Analysis (SA)

Sensitivity Analysis Master Ques [Must do]

 # Ques 9 – Frank **{ICAI TYK}**

Frank Ltd. is considering a project for which following estimates are available:

Initial Cost of the project	10,00,000
Sales price/unit	60
Cost/unit	40

Sales volumes:

Year 1	20000 units
Year 2	30000 units
Year 3	30000 units

• Discount rate is 10% p.a.

• Measure the sensitivity of the project in relation to each of the following parameters:

(i) Sales Price/unit (ii) Unit cost (iii) Sales volume

(iv) Initial outlay (v) Project lifetime. Taxation may be ignored.

Ans: Expected CFs:

Year 1 = (60 – 40) x 20,000 = 4L

Year 2 = 20 x 30,000 = 6L

Year 3 = 20 x 30,000 = 6L

- NPV = $\frac{4L}{1.1^1} + \frac{6L}{1.1^2} + \frac{6L}{1.1^3} - 10L$ = ₹ 310,293

Alternative 1: (Normal method)

Reduce each variable by 10% and find sensitivity in NPV

(i) If sales price falls by 10%

- New contribution per unit = 60 x 0.9 – 40 = ₹ 14 / unit
- NPV = $\frac{14 \times 20{,}000}{1.1^1} + \frac{14 \times 30{,}000}{1.1^2} + \frac{14 \times 30{,}000}{1.1^3} - 10L$ = - ₹82,790
- Decrease in NPV = $\frac{3{,}10{,}293 - (-82{,}790)}{3{,}10{,}293} \times 100$ = 126.68%

(ii) If unit cost increases by 10%

- New contribution per unit = 60 – 40 x 1.1 = ₹ 16 / unit
- NPV = $\frac{16 \times 20{,}000}{1.1^1} + \frac{16 \times 30{,}000}{1.1^2} + \frac{16 \times 30{,}000}{1.1^3} - 10L$ = ₹ 48,240
- Decrease in NPV = $\frac{3{,}10{,}293 - 48{,}240}{3{,}10{,}293} \times 100$ = 84.45%

(iii) If Sales volume decreases by 10%

- NPV = $\frac{20 \times 18{,}000}{1.1^1} + \frac{20 \times 27{,}000}{1.1^2} + \frac{20 \times 27{,}000}{1.1^3} - 10L$ = ₹ 1,79,264
- Decrease in NPV = $\frac{3{,}10{,}293 - 1{,}79{,}264}{3{,}10{,}293} \times 100$ = 42.23%

(iv) If Initial investment increases by 10%

- New NPV = 13,10,293 – 10,00,000 x 1.1 = ₹ 2,10,293
- Decrease in NPV = $\frac{3{,}10{,}293 - 2{,}10{,}293}{3{,}10{,}293} \times 100$ = 32.23%

(v) Project timeline

- PV of CFs of last year = $\frac{20 \times 30{,}000}{1.1^3}$ = ₹ 4,50,600

- We will break-even if PV of Y3 is 4,50,600 – 3,10,293 = 1,40,307
- Days required to earn 1,40,307 = $\frac{1,40,307}{4,50,600} \times 360$ = 112 days
- Hence, if project runs for 2 years and 112 days then it will break-even representing a fall of = $\frac{2 \times 360 + 112}{3 \times 360} - 1$ = -0.2296 or 22.96%

Alternative 2: (NPV Break-even – Equation Method)

By how much % should each variable fall for NPV to become 0.

(i) **Sensitivity to sales price / unit**

- Let Sales price be "x" such that NPV becomes 0. Therefore,
- $\frac{20,000*(x - 40)}{1.1^1} + \frac{30,000*(x - 40)}{1.1^2} + \frac{30,000*(x - 40)}{1.1^3}$ = 10L
- $(x - 40)*[\frac{20,000}{1.1^1} + \frac{30,000}{1.1^2} + \frac{30,000}{1.1^3}]$ = 10L
- (x – 40) * 65,515 = 10,00,000
- x – 40 = 15.26
- x = 15.26 + 40 = ₹ 55.26
- This means a fall of 55.26 / 60 – 1 = - 0.079 or 7.9% fall.

(ii) **Sensitivity to unit cost**

- Let unit cost be "y" such that NPV becomes 0. Therefore,
- $\frac{20,000*(60 - y)}{1.1^1} + \frac{30,000*(60 - y)}{1.1^2} + \frac{30,000*(60 - y)}{1.1^3}$ = 10L
- (60 – y) * 65,515 = 10,00,000
- 60 – y = 15.26
- y = 44.74
- i.e. Increase of 44.74 / 40 – 1 = 0.1185 or 11.85%

(iii) **Sensitivity to Sales volume**

Let fall in sales volume be "z %" such that NPV becomes zero.

- $\frac{20\ (1-z)*20{,}000}{1.1^1} + \frac{20\ (1-z)*30{,}000}{1.1^2} + \frac{20\ (1-z)30{,}000}{1.1^3} = 10{,}00{,}000$
- $(1-z)*20*65{,}515 = 10{,}00{,}000$
- $(1 - z)*20 = 15.26$
- $1 - z = 0.763$
- $z = 0.237$ or 23.7%

(iv) NPV will become 0 if initial outlay increases by 310,293.

% Increase = 3,10,293 / 10,00,000 = 31.03%

(v) **Project timeline**

- PV of CFs of last year = $\frac{20 \times 30{,}000}{1.1^3}$ = ₹ 4,50,600
- We will break-even if PV of Y3 is 4,50,600 – 3,10,293 = 1,40,307
- Days required to earn 1,40,307 = $\frac{1{,}40{,}307}{4{,}50{,}600} \times 360$ = 112 days
- Hence, if project runs for 2 years and 112 days then it will break-even representing a fall of = $\frac{2 \times 360 + 112}{3 \times 360} - 1$ = -0.2296 or 22.96%

Alternative 3: (NPV Break-even – Shortcut Method)

By how much % should each variable fall for NPV to become 0.

\# **Logic**: If we want NPV = 0, then Total PVCI should fall by ₹3,10,293

(i) **Sensitivity to sales price / unit**

- Total PV of Sales = $\frac{60 \times 20{,}000}{1.1^1} + \frac{60 \times 30{,}000}{1.1^2} + \frac{60 \times 30{,}000}{1.1^3}$ = ₹39,30,900

- Required fall in sales = $\frac{3,10,293}{39,30,900} \times 100 = 7.89\%$

(ii) Sensitivity to unit cost

- Total PV of cost = $\frac{40 \times 20,000}{1.1^1} + \frac{40 \times 30,000}{1.1^2} + \frac{40 \times 30,000}{1.1^3} = ₹26,20,600$
- Required increase in cost = $\frac{3,10,293}{26,20,600} \times 100 = 11.84\%$

(iii) Shortcut for sales volume (where Fixed cost is 0)

Fall in sales % = $\frac{\text{NPV}}{\text{PV of Contribution}} = \frac{3,10,293}{13,10,293} = 23.68\%$

Note: Both FC & Tax = 0. So, PV of contribution = PVCI = 13,10,293

(iv) NPV will become 0 if initial outlay increases by 310,293.

% Increase = 3,10,293 / 10,00,000 = 31.03%

(v) No shortcut for project timeline. (Same Ans as above)

Basic Sensitivity Analysis

 # Ques 10 – Forester **{ICAI TYK}**

Mr. Forester wants to analyse the sensitivity of the following project to changes in initial project cost, annual cash inflow and cost of capital:

Initial Project Cost (₹)	1,20,000
Annual Cash Inflow (₹)	45,000
Project Life (Years)	4
Cost of Capital	10%

To which of the three factors, the project is most sensitive?

(Use annuity factors: for 10% is 3.169 and 11% is 3.103).

Ans: PVCI = 45000 x PVAF(10%, 4) = 1,42,644

PVCO = ₹ 1,20,000

NPV = 45,000 x PVAF(10%, 4) – 1,20,000 = ₹ 22,644

Alternative 1: (Normal method)

Reduce each variable by 10% and find sensitivity in NPV

(i) **If Initial investment increases by 10%**

NPV = 1,42,644 – 1,20,000 x 1.1 = 10,644

Change in NPV = $\frac{22,644 - 10,644}{22,644} \times 100 = 53\%$

(ii) **If Annual CF falls by 10%**

NPV = 45000 x 0.9 x PVAF(10%, 4) – 1,20,000 = ₹ 8380

Change in NPV = $\frac{22,644 - 8345}{22,644} \times 100 = 63.15\%$

(iii) **If Cost of capital increases by 10% (i.e. New = 10% x 1.1 = 11%)**

NPV = 45000 x PVAF(11%, 4) – 1,20,000 = ₹ 19610

Change in NPV = $\frac{22,644 - 19610}{22,644} \times 100 = 13.40\%$

Alternative 2: (NPV Break-even – Shortcut Method)

By how much % should each variable fall for NPV to become 0.

(i) **Sensitivity to Initial project cost**

- NPV will become 0 if initial outlay increases by 22,644
- % Increase = 22,644 / 1,20,000 = 18.87%

(ii) **Sensitivity to Annual Cash inflow**

- Total PV of Annual Cash inflows = ₹ 1,42,644
- Required fall in CF = $\frac{22,644}{1,42,644} \times 100 = 15.87\%$

(iii) **Sensitivity to cost of capital**

Let the cost of capital at which NPV becomes 0 be "k".

45,000 x PVAF(k, 4) = 1,20,000

PVAF(k, 4) = 2.6667

- PVAF at K = 15% → 2.8550
- PVAF at K = 20% → 2.5887

- If K increases by 5%, PVAF falls by 0.2663
- We want PVAF to fall by 0.1883 (i.e. 2.8550 – 2.6667)

-> Required K = 15% + $\frac{5\%}{0.2663}$ x 0.1883 = 18.54%

- Therefore, % Increase in cost of capital such that NPV becomes 0

= $\frac{18.54\% - 10\%}{10\%}$ x 100 = 85.355%

Sensitivity Analysis of a plant with recurring cost & annual savings

 # Ques 11 – Red Melon **{ICAI TYK}**

Red Melon Ltd. is considering a project with the following Cash flows:

Years	Cost of Plant	Recurring Cost	Savings
0	10,000	-	-
1	-	4,000	12,000
2	-	5,000	14,000

The cost of capital is 9%. Measure the sensitivity of the project to changes in the levels of plant value, running cost and savings (considering each factor at a time) **such that the NPV becomes zero**.

- Which factor is the most sensitive to affect the acceptability of the project?

Ans: PVCO = ₹ 10,000

- PV of Recurring cost = $\frac{4000}{1.09^1} + \frac{5000}{1.09^2}$ = 7,878

- PV of Savings = $\frac{12000}{1.09^1} + \frac{14000}{1.09^2}$ = 22,793

- NPV = PV of savings – PV of recurring cost – PVCO = 22,793 – 7,878 – 10,000 = 4,915

(i) Sensitivity to plant cost

- NPV will become 0 if initial plant cost increases by 4,915

- % Increase = 4,915 / 10,000 = 49.15%

(ii) **Sensitivity to running cost**

- NPV will become 0 if PV of running cost increase by 4,915.
- % Increase in running cost = 4,915 / 7,878 = 62.38%

(ii) **Sensitivity to Savings**

- NPV will become 0 if PV of savings falls by 4,915.
- % decrease in savings = 4,915 / 22,793 = 21.56%

Conclusion - Savings factor is the most sensitive factor as compared to other two factors. As a slight % change in this fact shall more affect the NPV than others.

Reverse calculation of PVCO, Sales volume using sensitivity analysis etc.

 # Ques 12 - Easygoing **{ICAI TYK}**

- The Easygoing Company Limited is considering a new project with initial investment, for a product "Survival". It is estimated that IRR of the project is 16% having an estimated life of 5 years.
- Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.
- **Other information available are:**

Profit Volume Ratio (P/V)	70%,
Variable cost per unit	₹ 60
Annual Cash Flow	₹ 57,500

Ignore Depreciation on initial investment and impact of taxation. Calculate:

(i) Initial Investment of the Project (ii) Net Present Value of the Project

(iii) Annual Fixed Cost (iv) Estimated annual unit of sales

(v) Break Even Units

Ans: **(i) Initial investment (PVCO)**

- Annual CF = 57,500
- IRR = 16% (given)
- At IRR, NPV shall be 0.
- Therefore, PVCO = 57,500 x PVAF (16%, 5) = 1,88,272

Cost of capital ("K")

- Sensitivity of cost of capital (K) = 60%

- It means that if K increases by 60%, then NPV will become 0. i.e. NPV = 0 at 1.6K
- Since IRR = 16% (given). Therefore, NPV = 0 at 16%.
- Hence, 1.6K = 16%
- K = 16% / 1.6 = 10%

(ii) **Project NPV**

NPV = 57,500 x PVAF (10%, 5) – 1,88,272 = ₹ 29,700

(iii) **Annual Fixed cost ("y")**

- Fixed cost (FC) sensitivity = 7.8416%
- Then if FC p.a. increases by 7.8416% then NPV will become 0.
- or we can say: PV of increased FC = 29,700.

☞ 0.078416y x PVAF (10%, 5) = 29,700

- 0.297y = 29,700
- y = 1,00,000

(iv) **Annual sales unit ("n")**

	Particulars	Reference	Amount in ₹
	Sale price per unit	100%	200
(-)	Variable cost per unit	30%	60
=	Contribution (PV ratio) per unit	70%	140
=	Total contribution	-	140n
(-)	Fixed cost	-	1,00,000
=	Profit p.a. = CF p.a.	57,500	140n – 100000

- 140n – 1,00,000 = 57,500
- n = 1,57,500 / 140 = 1,125

(v) **Break-even units**

$$\frac{\text{Annual fixed cost}}{\text{Contribution per unit}} = \frac{1,00,000}{140} = 714.285 \text{ units}$$

Sensitivity Analysis + Acceptability of a project based on acceptable level of risk

 # Ques 13 – Unnat **{ICAI TYK}**

Unnat Ltd. is considering investing ₹50,00,000 in a new machine. The expected life of machine is

five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹30.00 per unit. It is expected that the variable costs to be ₹16.50 per unit and fixed costs to be ₹10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.

You are required to measure the sensitivity of the project's net present value to a change in the following project variables: (a) Sale price (b) Sales volume (c) Variable cost

(d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Prob.
Poor	1,75000	0·30
Normal	2,00,000	0·60
Good	2,25,000	0·10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

Ans: Working Notes:

WN 1 - PVAF(12%, 5) = 3.605

WN 2 – Calculation of basic figures

	Particulars	Per unit	Total	Total PV @PVAF = 3.605
•	Sales price	30	30 x 2L = 60L	216.3L
(-)	Variable cost	16.5	16.5 x 2L = 33L	118.965L
=	Contribution	13.5	13.5 x 2L = 27L	97.335L
(-)	Fixed cost	-	10L	36.05L
=	CF p.a.	-	17L	61.285L

• NPV = PVCI – PVCO = 61.285L – 50L = 11.285L or 11,28,500

(a) Sensitivity to sales price

• NPV will become 0 if PV of sales falls by 11.285L.

• % fall in sale price = 11.285 / 216.3 = 5.22%

(b) Sensitivity to sales volume (where fixed cost is given)

- % fall in sales volume = NPV / Total PV of contribution = 11.285L / 97.335L x 100 = 11.59%

(c) **Sensitivity to variable cost**

- NPV will become 0 if PV of variable cost increases by 11.285L
- % increase in variable cost = 11.285 / 118.965 = 9.49%

(d) Expected Annual sales = {1.75L x 0.3 + 2L x 0.6 + 2.25L x 0.1} = 1.95L i.e. 1,95,000 units

- Expected NPV = (1.95L x 13.5 – 10L) x 3.605 – 50L = 8.8516L
- Worst case NPV = (1.75L x 13.5 – 10L) x 3.605 – 50L = -0.8818L
- Best case NPV = (2.25L x 13.5 – 10L) x 3.605 – 50L = 23.4518L

Decision - Thus, there are 30% chances that the outcome will be negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

👉 Certainty Equivalent (C.E.), RADR

V. Basic ques on Certainty Equivalent Approach

 # Ques 14 – Fluid {ICAI TYK}

A Textile Manufacturing Company named Fluid Ltd., is considering one of two mutually exclusive proposals, Projects M and N, which require cash outlays of ₹8,50,000 and ₹8,25,000 respectively. The certainty-equivalent (C.E) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bonds is 6% and this is used as the risk-free rate. The expected net cash flows and their certainty equivalents are as follows:

Year-end	Project M: CF	C.E.	Project N: CF	C.E.
1	4,50,000	0.8	4,50,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,00,000	0.5	5,00,000	0.7

PV factors of ₹1 discounted at 6% at the end of year 1, 2 and 3 are 0.943, 0.890 and 0.840 respectively.

Required:

(i) Which project should be accepted?

(ii) If risk adjusted discount rate method is used, which project would be appraised with a higher rate

and why?

Ans:

	Project M			Project N		
Year	**CF**	**C.E.**	**CF×C.E.**	**CF**	**C.E.**	**CF×C.E.**
1	4.5L	0.8	3.6L	4.5L	0.9	4.05L
2	5L	0.7	3.5L	4.5L	0.8	3.6L
3	5L	0.5	2.5L	5L	0.7	3.5L

- NPV = PV of **Certainty Equivalent** CF **discounted @ Rf** – PVCO
- Project M = (3.6L x 0.943 + 3.5L x 0.890 + 2.5L x 0.840) – 8.5L = ₹ 10,980
- Project N = (4.05L x 0.943 + 3.6L x 0.890 + 3.5L x 0.840) – 8.25L = ₹ 1,71,315

(i) Decision – Select Project N as its NPV is higher.

(ii) C.E. Co-efficient of Project M (2.0) is lower than Project N (2.4).

- This means Project M is riskier than Project N as "higher the riskiness of a cash flow, the lower will be the CE factor". If RADR method is used, Project M would be analysed with a higher rate.

V. Basic Ques on Risk-Adjusted discount rate

 # Ques 15 – FedEx **{ICAI TYK}**

Determine the risk adjusted net present value of the following projects of FedEx ltd.

Particulars	X	Y	Z
Net cash outlays (₹)	2,10,000	1,20,000	1,00,000
Project life	5 years	5 years	5 years
Annual Cash inflow (₹)	70,000	42,000	30,000
Coefficient of variation	1.2	0.8	0.4

The Company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

CV	RADR	PVAF (5 years) at RADR
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

Ans : **(i) Finding appropriate Risk adjusted rate & PVAF for each project**

Project	CV	RADR	PVAF
Project X	1.2	16%	3.274
Project Y	0.8	14%	3.433
Project Z	0.4	12%	3.605

(ii) **NPV**

- Project X = 70,000 x 3.274 – 2,10,000 = ₹ 19,180
- Project Y = 42,000 x 3.433 – 1,20,000 = ₹ 24,186
- Project Z = 30,000 x 3.605 – 1,00,000 = ₹ 8,150

V. Basic - CAPM Style RADR

 # Ques 16 – Triund **{ICAI TYK}**

Triund Ltd. is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

	P-I	P-II	P-III
Cost	15,00,000	11,00,000	19,00,000
Inflows-Year 1	6,00,000	6,00,000	4,00,000
Year 2	6,00,000	4,00,000	6,00,000
Year 3	6,00,000	5,00,000	8,00,000
Year 4	6,00,000	2,00,000	12,00,000
Risk Index	1.80	1.00	0.60

Minimum required rate of return of the firm is 15% and applicable tax rate is 40%. The risk free interest rate is 10%. Required:

(i) Find out the risk-adjusted discount rate (RADR) for these projects.

(ii) Which project is the best?

Ans: **(i) Risk Adjusted Discount Rate (RADR)**

= Rf + (Minimum return – Rf) x Risk Index

- RADR of P I = 10% + (15% - 10%) x 1.8 = 19%
- RADR of P II = 10% + (15% - 10%) x 1 = 15%
- RADR of P III = 10% + (15% - 10%) x 0.6 = 13%

(ii) **NPV**

- NPV of P I = 6L x PVAF(19%, 4) – 15L = 83,150

- NPV of P II = $\frac{6L}{1.15^1} + \frac{4L}{1.15^2} + \frac{5L}{1.15^3} + \frac{2L}{1.15^4} - 11L = 1{,}67{,}305$

- NPV of P III = $\frac{4L}{1.13^1} + \frac{6L}{1.13^2} + \frac{8L}{1.13^3} + \frac{12L}{1.13^4} - 19L = 2{,}14{,}292$

- **Decision** – Project III has highest NPV. So, it should be accepted.

Nominal vs Real terms

V. Basic – Project NPV when CFs are in nominal terms but k = real terms

 # Ques 17 – Tapo **{ICAI TYK}**

Ambiguous: It is not mentioned anywhere that K is in "real" terms.

Tapo ltd. has projected the following cash flows from a project under evaluation:

Year	₹ lakhs
0	(70)
1	30
2	40
3	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%. Show how the viability of the project is to be evaluated.

Author note: **Ambiguous!** It is not mentioned anywhere that K is in "real" terms.

Ans: Cost of Capital (K) in real terms = 10%

- Since CF are given in nominal terms so we need nominal K for discounting.
- Nominal K = (1 + Real K) (1 + Inflation) – 1 = 1.1 x 1.05 – 1 = 0.155 or 15.5%

- NPV = $\frac{30}{1.155^1} + \frac{40}{1.155^2} + \frac{30}{1.155^3} - 70 = 5.429$ Lacs
- Decision – NPV is positive. The project is viable.

Author note: You could have alternatively converted nominal CFs into Real CFs and discounted them @ 'real' Cost of capital. But that method is lengthy and hence not followed here.

Ques 18 – Skipped.

Reason – 100% same as Ques 17. Only initial investment is 72L instead of 70L. Rest all the CFs, Figures etc. are exactly same.

Basic NPV when CFs are in real terms but k = nominal terms

Ques 19 - Time Warner **{ICAI TYK}**

Time Warner Ltd. requires ₹15,00,000 for a new project.

- Useful life of project is 3 years.
- Salvage value - NIL.
- Depreciation is ₹5,00,000 p.a.

» Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year	1	2	3
Revenues in ₹	10L	13L	14L
Costs in ₹	5L	6L	6.5L

» Applicable tax rate is 35%. Assume nominal cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenues %	Costs %
1	9	10
2	8	9
3	6	7

- PVF at 14%, for 3 years = 0.877, 0.769 and 0.675.
- Show amount to the nearest rupee in calculations.
- You are required to calculate net present value of the project.

Ans:

Year	Revenue	Inflation adjusted Revenue (₹)
1	10L	10L x 1.09 = 10.9L
2	13L	13L x 1.09 x 1.08 = 15.3036L
3	14L	14L x 1.09 x 1.08 x 1.06 = 17.4696L

(ii)

Year	Cost	Inflation adjusted Costs (₹)
1	5L	5L x 1.1 = 5.5L
2	6L	6L x 1.1 x 1.09 = 7.194L

	3	6.5L	6.5L x 1.1 x 1.09 x 1.07 = 8.339L

(iii)	Calculating Cash flow	Year 1	Year 2	Year 3 (₹ lacs)
A.	Revenue	10.9	15.3036	17.4696
B.	Costs	5.5	7.194	8.339
C.	PBT = A – B	5.4	8.1096	9.1306
D.	PAT = PBT x 0.65	3.51	5.2712	5.9349
E.	Tax benefit on deprecation (5L x 0.35)	1.75	1.75	1.75
F.	Cash flow = D + E	5.26	7.0212	7.6849

(iv) NPV Calculation = (5.26 x 0.877 + 7.0212 x 0.769 + 7.6849 x 0.675) – 15L = ₹19,630

👉 Decision Tree

Constructing Decision Tree

 # Ques 20 – Tucson **{ICAI TYK}**

Tucson ltd. has an investment proposal, requiring outlay of ₹ 80,000. The investment proposal is expected to have 2 years economic life with no salvage value. In year 1, there is a 0.4 probability that cash inflow after tax will be ₹ 50,000 and 0.6 probability that cash inflow after tax will be ₹ 60,000. The probability assigned to cash inflow after tax for the year 2 is as follows:

Cash inflow in Y1 = ₹50,000		Cash inflow in Y1 = ₹60,000	
Cash Flow Y2	**Probability**	**Cash Flow Y2**	**Probability**
₹ 24,000	0.2	₹ 40,000	0.4
₹ 32,000	0.3	₹ 50,000	0.5
₹ 44,000	0.5	₹ 60,000	0.1

The firm uses a 10% discount rate for this type of investment.

Required:

(i) Construct a decision tree for the proposed investment project and calculate the expected NPV.

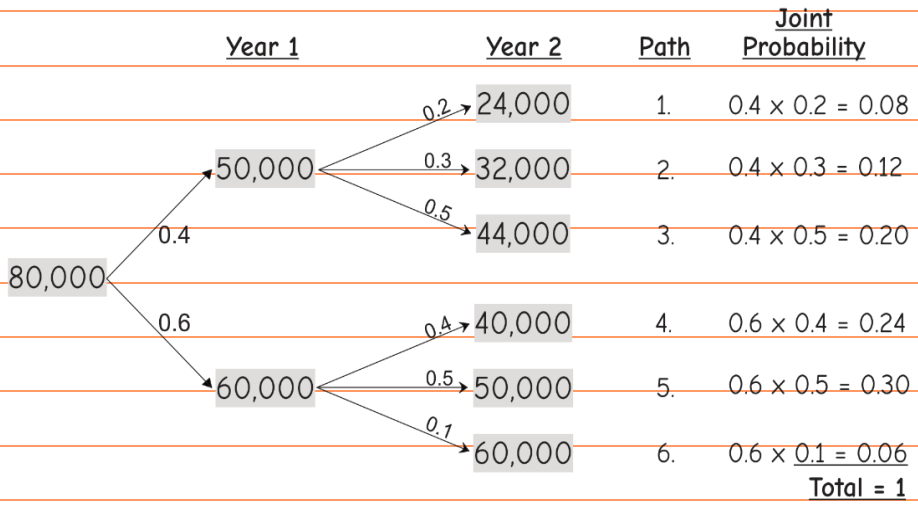
(ii) What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?

(iii) What will be the best outcome and probability of that occurrence?

(iv) Will the project be accepted?

(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

Ans: **Decision Tree:**



Path	NPV	Prob.
1	50,000 x 0.909 + 24,000 x 0.826 – 80,000 = -14,276	8%
2	50,000 x 0.909 + 32,000 x 0.826 – 80,000 = -8118	12%
3	50,000 x 0.909 + 44,000 x 0.826 – 80,000 = 1794	20%
4	60,000 x 0.909 + 40,000 x 0.826 – 80,000 = 7580	24%
5	60,000 x 0.909 + 50,000 x 0.826 – 80,000 = 15840	30%
6	60,000 x 0.909 + 60,000 x 0.826 – 80,000 = 24100	6%

» **Worst & Best outcomes**

	(ii) Worst outcome	(iii) Best outcome
Path	Path 1	Path 6
Probability of the path	8%	6%
NPV if path is realised	–14,276	24,100

(iv) The project should be accepted because the expected NPV is positive at ₹6,223.76 based on joint probability.

👉 **Project Utility**

Basic – Calculation of expected utility of each project

 # Ques 21 – Jumble **{ICAI TYK}**

Jumble Consultancy Group has determined relative utilities of cash flows of two forthcoming projects of its client company as follows:

	Cash flow in ₹	Utilities
	-15000	-100
	-10000	-60
	-4000	-3
	0	0
	15000	40
	10000	30
	5000	20
	1000	10

Distribution of cash flows of project A and Project B are as follows:

Project A

CF	-15000	- 10000	15000	10000	5000
Prob.	0.10	0.20	0.40	0.20	0.10

Project B

CF	- 10000	-4000	15000	5000	10000
Prob.	0.10	0.15	0.40	0.25	0.10

Which project should be selected and why?

Ans:

» **Project A**

Cash flow	Utility	Probability
-15000	-100	0.1
-10000	-60	0.2
15000	40	0.4
10000	30	0.2
5000	20	0.1

» **Project B**

Cash flow	Utility	Probability
-10000	-60	0.1
-4000	-3	0.15
15000	40	0.4
5000	20	0.25
10000	30	0.1

Expected utility of :

- Project A = (-100 × 0.1) + (-60 × 0.2) + (40 × 0.4) + (30 × 0.2) + (20 × 0.1) = 2
- Project B = (-60 × 0.1) + (-3 × 0.15) + (40 × 0.4) + (20 × 0.25) + (30 × 0.1) = 17.55

Decision – Select Project B as its expected utility is higher.

Replacement Decisions

Replace now or later decision (capital charge calculation)

 # Ques 22 – TCS {ICAI TYK}

TCS is contemplating whether to replace an existing machine or to spend money on overhauling it. TCS currently pays no taxes. Replacement machine costs ₹90,000 now and requires maintenance of ₹10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of ₹20,000 and would be sold. Existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for TCS is 15%. Required: When should the co. replace the machine?

Notes: PVAF (15%, 8) = 4.4873, and PVF (15%, 8) = 0.3269.

Ans: **WN 1 - Equivalent cost of (EAC) of new machine**

	Cost of new machine now	90,000
(+)	PV of annual repairs: 10,000 x 4.4873	44,873
(-)	PV of salvage value: 20,000 x 0.3269	(6,538)
=	Total	1,28,335
	Equivalent annual cost (EAC) [1,28,335 / 4.4873]	28,600

Informal note → Capital charge (or average cost) is ₹ 28600 p.a.

Roughly we can say that Cost of using new machine is 28,600 p.a.

 # WN 2 - PV of Capital charge

Replace after	Capital charge p.a.	Years used	PVAF @ 15%	PV of capital Charge
Now	28,600	1 – 4	2.8550	81652
1 year	28,600	2 – 4	1.9854	56783
2 years	28,600	3 – 4	1.2293	35157
3 years	28,600	4	0.5718	16352
4 years	-	-	-	-

WN 3 - PV of Maintenance and Salvage value

Yr	Maintenance	Resale value	PV of Maintenance	PV of Salvage Value
1	10,000	25,000	8696	21739
2	20,000	15,000	15123	11342
3	30,000	10,000	19725	6575
4	40,000	0	22870	0

WN 4 - PV of maintenance cost if existing machine is used for:

1 Year = 8696

2 Years = 8696 + 15123 = 23819

3 Years = 8696 + 15123 + 19725 = 43544

3 Years = 8696 + 15123 + 19725 + 22870 = 66414

☞ **Calculating PV of Total cost based on replacement timing**

	Particulars	Today	1 Year	2 Years	3 Years	4 Years
	New m/c capital Charge PV	81652	56783	35157	16352	0
(+)	PV of Maintenance	0	8696	23819	43544	66414
(-)	PV of Salvage	(40000)	(21739)	(11342)	(6575)	0
=	PV of total cost for 4 years	41652	43740	47634	53321	66414

Basic Incremental CF approach (New vs upgraded machine)

Ques 23 – Godavari {ICAI TYK}

Godavari ltd. has an old machine having book value zero – which can be sold for ₹ 50,000. The co. is thinking to choose one from following two alternatives:

(i) To incur additional cost of ₹ 10L to upgrade the old existing machine.

(ii) To replace old machine with a new machine costing ₹ 20,00,000 plus installation cost ₹ 50,000.

Both above proposals envisage useful life to be five years with salvage value to be nil. The expected after tax profits for the above three alternatives are as under:

Year	Old existing Machine (₹)	Upgraded Machine (₹)	New Machine (₹)
1	5,00,000	5,50,000	6,00,000
2	5,40,000	5,90,000	6,40,000
3	5,80,000	6,10,000	6,90,000
4	6,20,000	6,50,000	7,40,000

	5	6,60,000	7,00,000	8,00,000

- Tax rate is 40%. Co. follows straight line method of depreciation. Assume cost of capital to be 15%.
- You are required to advise the co. as to which alternative is to be adopted.

Ans: **WN 1 – Depreciation**

- Existing machine = 0 (as 0 BV given)
- Upgraded machine = ₹ 10L / 5 = ₹ 2L p.a.
- New machine = (20L + **0.5L**) / 5 = ₹ 4.1L p.a.

WN 2 – Tax Calculation

- New Machine = (50,000 – 0) x 40% = 20,000

a) Calculation of Net (Incremental) Cash outflow

- Upgraded Machine = 10 Lacs
- New Machine = (20L + 0.5L) – 0.5L + 0.2L = 20.2L

b) Calculation of Incremental Cash Inflows

» **Upgraded Machine (₹ in lacs)**

Yr	Old Machine PAT (A)	Upgraded Machine PAT (B)	Inc. PAT (C) = B – A	Inc. CFs = C + 2L (Add. Dep)	PV of Inc CFs
1	5	5.5	0.5	2.5	2.1750
2	5.4	5.9	0.5	2.5	1.8900
3	5.8	6.1	0.3	2.3	1.5134
4	6.2	6.5	0.3	2.3	1.3156
5	6.6	7	0.4	2.4	1.1928
				Total (PVCI) :	8.0868

- NPV of Upgraded Machine = 8.0868 – 10 = – ₹ 1.9132 Lacs

» **New Machine (₹ in lacs)**

Yr	Old Machine PAT (A)	New Machine PAT (B)	Inc. PAT (C) = B – A	Inc. CFs = C + 4.1L (Add. Dep)	PV of Inc CFs
1	5	6	1	5.1	4.437
2	5.4	6.4	1	5.1	3.8556
3	5.8	6.9	1.1	5.2	3.4216
4	6.2	7.4	1.2	5.3	3.0316

	5	6.6	8	1.4	5.5	2.7335
					Total (PVCI)	17.4793

• NPV of Upgraded Machine = 17.4793 – 20.2 = – ₹ 2.7207 Lacs

☞ As NPV in both the new proposals is negative, the co. should continue with the existing old Machine.

Comparing 2 machines using EAC (V. basic EAC calculation)

 # Ques 24 – Graham **{ICAI TYK}**

Graham plc has to choose between two machines A and B. The 2 machines are designed differently but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

PVAF @ 10% for 2 years = 1.735 and for 3 years = 2.486.

Ans:

	Cal. PV of Total cost	**Machine A**	**Machine B**
	Life of Machine	3 years	2 years
i.	Purchase cost	1,50,000	1,00,000
ii.	PV of operating cost	99,440	1,04,100
		(40000 × 2.486)	(60000 × 1.735)
iii.	PV of Total costs	2,49,440	2,04,100
iv.	PVAF (10%, n)	2.486	1.735
v.	EAC = PV of Cost / PVAF	1,00,338	1,17,637

Decision: Company X should buy machine A since its equivalent cash outflow is less than machine B.

When ICAI forgot to calculate equivalent EAC

 # Ques 25 – Globemaster **{ICAI TYK}**

Globemaster ltd. is operating an elderly machine that is expected to produce a net cash inflow of ₹40,000 in coming year & ₹40,000 next year. Current salvage value is ₹80,000 and next year's salvage value is ₹70,00. The machine can be replaced now with a new machine which costs ₹1.5L but is more efficient and will provide a cash inflow of ₹80,000 p.a. for 3 years. Co. warts to know whether it should replace the equipment now or wait a year with the clear understanding that the new machine is best of the available alternatives and that it in tern be replaced at the optimal point. Ignore tax. Take opportunity cost of capital as 10%. Advice.

Ans:	**NPV of new machine**					
•	PV of cash inflow = 80,000 x 2.486 =		1,98,880			
(-)	Purchase Cost of New Machine =		1,50,000			
=	NPV of new machine		48,880			
•	Since NPV of New Machine is positive, it should be purchased.					
#	**Timing decision**					
	Case 1 – Replace now					
•	Current Realizable Value	80,000				
(+)	NPV of New Machine	48,880				
=	Total NPV	1,28,880				
	Case 2 – Replace after 1 year					
•	Cash Inflow for Year 1	40000				
(+)	Realisable Value of Old Machine	70000				
(+)	NPV of New Machine	48,880				
=	Total NPV of new machine	1,58,880				
•	PV of Total NPV (158880/1.1)	1,44,436				
	Advise: Since Total NPV is higher in case of Replacement after 1 year Machine should be replaced after 1 year.					
	Author Note → Why we have not calculated Equivalent NPV here?					
	Reason → Because ICAI did not calculate Eq. NPV in this ques. 😕					
	Optimum replacement cycle					
#	**Ques 26 - Gravity India**					**{ICAI TYK}**
	Gravity India owns a machine which must be replaced at least every 4 years. Costs incurred to run the machine according to its age are:					
	Age of the Machine (years)	**0**	**1**	**2**	**3**	**4**
	Purchase price	60,000	-	-	-	-
	Maintenance		16,000	18,000	20,000	20,000
	Repair		0	4,000	8,000	16,000
	Scrap Value		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

Ans: **WN 1 – Calculating PV of Repairs, Salvage value etc.**

Yr	Maintenance	Salvage value	PVF @ 15%	PV of Repair etc.	Salvage Value PV
1	16,000	32,000	0.8696	13,914	27,827
2	22,000	24,000	0.7561	16,634	18,146
3	28,000	16,000	0.6575	18,410	10,520
4	36,000	8,000	0.5718	20,585	4,574

 # Finding optimum Replacement cycle (RC)

	Particulars	RC = 1 Year	RC = 2 years	RC = 3 years	RC = 4 years
a)	Cost of Machine	60,000	60,000	60,000	60,000
b)	Maintenance PV	13,914	30,548	48,958	69,543
			[13,914 + 16,634]	[30,548 + 18410]	[48,958 + 20,585]
c)	(-) PV of Salvage	(27,827)	(18,146)	(10,520)	(4,574)
d)	PV of Total cost	46,087	72,402	98,438	1,24,969
e)	÷ PVAF	0.8696	0.7561	0.6575	0.5718
f)	EAC (d ÷ e)	52,997	44,536	43,114	43,772

Optimum replacement cycle

 # Ques 27 - Trouble Free **{ICAI TYK}**

Trouble Free Solutions (TFS) is an authorized service center of a reputed domestic air conditioner manufacturing company. All complaints/service related matters of Air conditioner are attended by this service center. The service center employs a large number of mechanics, each of whom is provided with a motor bike to attend the complaints. Each mechanic travels approx. 40000 kms p.a. TFS decides to continue its present policy of always buying a new bike for its mechanics but wonders whether the present policy of replacing the bike every 3 year is optimal or not. It is of believe that as new models are entering into market on yearly basis, it wishes to consider whether a replacement of either one year or two years would be better option than present three year period. The fleet of bike is due for replacement shortly in near future.

The purchase price of latest model bike is ₹55,000. Resale value of used bike at current prices in market is as follows:

	Period	₹
	1 Year old	35,000
	2 Year old	21,000
	3 Year old	9,000

Find Optimal replacement period if cost of capital is 10% and Running & Maintenance expenses (excluding depreciation) are as:

Year	Road taxes, Insurance etc.	Petrol, repair maintenance etc.
1	3,000	30,000
2	3,000	35,000
3	3,000	43,000

Ans: **WN 1 – PV of operating cost and Salvage value**

Yr	Petrol, Repair, taxes etc.	Resale value	PV of Petrol, taxes etc.	Salvage Value PV
1	33,000	35,000	30,000	31,818
2	38,000	21,000	31,405	17,355
3	46,000	9,000	34,560	6,762

 # Calculating EAC for different replacement cycles (RC)

	Particulars	RC = 1 year	RC = 2 years	RC = 3 years
a)	Purchase cost	55,000	55,000	55,000
b)	PV of petrol, taxes etc.	30,000	61,405	95965
			[30000 + 31405]	[61405 + 34560]
c)	(-) PV of resale	(31,818)	(17,355)	(6,762)
d)	PV of total cost	53,182	99,050	1,44,203
e)	÷ PVAF(10%, n)	0.9091	1.7355	2.4869
f)	EAC	58,500	57,073	57,985

Decision: Equivalent Annual cost (EAC) is lowest for 2 years. Hence, Optimum replacement cycle should be 2 years.

Incremental CF Approach

 # Ques 28 – Roby's Cube **{ICAI Illus}**

A Co. named Roby's cube decided to replace the existing Computer system of their organisation. Original cost of old system was ₹ 25,000 and it was installed 5 years ago. Current market value of old system is ₹ 5,000. Depreciation of the old system was charged with life of 10 years with

	Estimated Salvage value as Nil.	
	Depreciation of the new system will be charged with life over 5 years. Present cost of the new system is ₹ 50,000. Estimated Salvage value of the new system is ₹ 1,000. Estimated cost savings with new system is ₹ 5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of ₹ 10,00,00. Company follows straight line method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30%.	
Ans:	**WN 1 – Depreciation**	
•	Old machine = 25,000 / 10 = 2500 p.a.	
•	New Machine = (50,000 – 1000) / 5 = 9800 p.a.	
#	**WN 2 – Tax on sale of old machine**	
•	Tax = (MV – BV) of old machine x Tax %	
•	Tax = (5000 – 12500) x 30% = – 2250 (tax savings)	
a)	Net outflow = MV of new machine – MV of old machine + Tax = 50,000 – 5000 + 2250 = 42,750	
b)	**Incremental Cash inflows p.a.**	
•	Increase in sales: 1,00,000 x 10%	10,000
(+)	Decrease in costs:	5,000
		15,000
(-)	Tax @ 30% : 15,000 x 30%	(4,500)
		10,500
(+)	Tax savings on depreciation: [9800 – 2500] x 30%	2,190
	Net (Incremental) Cash savings p.a. =	12,690
#	**Alternatively, Incremental cash flows:**	
=	[Increase in Sale + Decrease in cost] (1 – t) + (Change in dep) x tax	
=	[1,00,000 x 0.1 + 5,000] (1 – 0.3) + [9800 – 2500] x 0.3 = 12,690	
•	NPV = PVCI – PVCO	
•	NPV = 12,690 x PVAF (10%, 5) + **1000 x PVF (10%, 5)** – 42,750 = 5,976	
•	NPV is positive. Replace existing machine with new machine.	

Ch 4 – Security Analysis

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
EMA (Exponential Moving average)	1
Testing Market efficiency	2 – 3

Index - Additional Questions	**Ques Number**
-- None --	--

Main Questions

EMA (Exponential Moving average)

EMA Calculation

 # Ques 1 – Keshav {SM TYK, M18 Exam (New), N19 Exam (New), M22 Exam, M24 Exam}

Closing values of NSE Nifty from 6th to 17th day of the month of January of the year 2020 were as follows:

Days	Date	Day	Sensex
1	6	THU	14522
2	7	FRI	14925
3	8	SAT	No Trading
4	9	SUN	No Trading
5	10	MON	15222
6	11	TUE	16000
7	12	WED	16400
8	13	THU	17000
9	14	FRI	No Trading
10	15	SAT	No Trading
11	16	SUN	No Trading
12	17	MON	18000

Mr. Keshav wants to calculate Exponential Moving Average (EMA) of Sensex during the above period. The previous day exponential moving average of Sensex can be assumed as 15000. The value of exponent for 31 days EMA is 0.062. Give detailed analysis on the basis of your calculations.

Ans:

Date	Sensex (1)	Previous EMA (2)	3= 1 -2	4 = 3x0.062	EMA (2+/- 4)
6	14522	15000	(478)	(29.636)	14970.364
7	14925	14970.364	(45.364)	(2.812)	14967.55
10	15222	14967.55	254.45	15.776	14983.32
11	16000	14983.32	1016.68	63.034	15046.354
12	16400	15046.354	1353.646	83.926	15130.28
13	17000	15130.28	1869.72	115.922	15246.202
17	18000	15246.202	2753.798	170.735	15416.937

Conclusion: - The market is bullish. The market is likely to remain bullish for short term to medium term if other factors remain the same. On the basis of indicator (EMA) the investors/brokers can take long position.

Note: A buy (bullish) signal is generated when actual price line (NIFTY in the give case) rises through the moving average, while a sell a (bearish) signal is generated when actual NIFTY level declines through the moving averages.

👉 Testing Market efficiency

Testing market efficiency using Auto-Correlation test

 # Ques 2 - Falcon

Mr. Falcon is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days. Test whether Mr. Falcon's opinion is right using **auto-correlation test** (take time lag of 10 days).

Days	Open	High	Low	Close
1	33470.94	33513.79	33438.03	33453.99
2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.6	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95

	18	33322.81	33345.98	33317.44	33319.67
	19	33317.51	33321.18	33294.19	33302.32
	20	33290.86	33324.96	33279.62	33319.61

Ans:

Days	Closing price	Change	Days	Closing price	Change
1	33453.99	-	11	33251.53	-
2	33434.83	-19.16	12	33285.89	34.36
3	33431.93	-2.9	13	33329.28	43.39
4	33383.41	-48.52	14	33284.17	-45.11
5	33370.93	-12.48	15	33298.78	14.61
6	33340.75	-30.18	16	33325.38	26.6
7	33330.98	-9.77	17	33329.95	4.57
8	33335.08	4.1	18	33319.67	-10.28
9	33301.97	-33.11	19	33302.32	-17.35
10	33259.03	-42.94	20	33319.61	17.29

» Calculating correlation

Let daily change during the 1st 10 days be denoted by x and during 11th to 20th day be denoted by y.

X	Y	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$
-19.16	34.36	2.5	26.8	6.26	718
-2.9	43.39	18.76	35.83	352.02	1283.47
-48.52	-45.11	-26.86	-52.67	721.34	2774.6
-12.48	14.61	9.18	7.05	84.31	49.64
-30.18	26.6	-8.52	19.04	72.55	362.35
-9.77	4.57	11.89	-2.99	141.42	8.97
4.1	-10.28	25.76	-17.84	663.69	318.42
-33.11	-17.35	-11.45	-24.91	131.05	620.73
-42.94	17.29	-21.28	9.73	452.74	94.59
-194.96	**68.08**	**-**	**-**	**2625.4**	**6230.77**
-21.66	**7.56**	**-**	**-**	**291.71**	**692.31**

- Variance (σ^2) = $\frac{\Sigma(x - \bar{x})^2}{N}$

σ_A^2 = 2625.4/9 = 291.71 => σ_A = 17.08

σ_B^2 = 6230.77/9 = 692.31 => σ_B = 26.31

- Covariance$_{xy}$ = $\frac{\Sigma(x - \bar{x})(y - \bar{y})}{N}$ = $\frac{1639.44}{9}$ = 182.16

- Correlation = $\frac{\text{Covariance}}{\sigma_A \times \sigma_B}$ = $\frac{182.16}{17.08 \times 26.31}$ = 0.405

There is moderate degree of correlation between the returns of two periods hence it can be concluded that the market does not show the weak form of efficiency.

Testing market efficiency using Run test

 # Ques 3 – Mukunda **{SM TYK, N23 RTP}**

The closing value of a Stock Market Index for the month of October, 2007 is given below:

Date Closing	Index Value
1.10.07	2800
3.10.07	2780
4.010.0	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360
22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	3260

Your manager, Mr. Mukunda has asked you to test the weak form of efficient market hypothesis by

applying the run test at 5% and 10% level of significance. Following values can be used:

Value of t at 5% is 2.101 at 18 degrees of freedom.

Value of t at 10% is 1.734 at 18 degrees of freedom.

Ans:

Date	Closing Index	Sign of Price Charges
1.10.07	2800	
3.10.07	2780	-
4.10.07	2795	+
5.10.07	2830	+
8.10.07	2760	-
9.10.07	2790	+
10.10.07	2880	+
11.10.07	2960	+
12.10.07	2990	+
15.10.07	3200	+
16.10.07	3300	+
17.10.07	3450	+
19.10.07	3360	-
22.10.07	3290	-
23.10.07	3360	+
24.10.07	3340	-
25.10.07	3290	-
29.10.07	3240	-
30.10.07	3140	-
31.10.07	3260	+

- Total of sign of price changes (r) = 8

No. of positive changes = n_1 = 11

No. of negative changes = n_2 = 8

- $\mu_r = \frac{2n_1n_2}{n_1 + n_2} + 1$

$\mu = \frac{2 \times 11 \times 8}{11 + 8} + 1 = 176/19 + 1 = 10.26$

- $\hat{\sigma}_r = \sqrt{\frac{2n_1n_2\,(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}}$

$\hat{\sigma}_r = \sqrt{\frac{(2 \times 11 \times 8)(2 \times 11 \times 8 - 11 - 8)}{(11 + 8)^2(11 + 8 - 1)}} = \sqrt{4.252}$

$\hat{\sigma}_r = 2.06$

- Since too few runs in the case would indicate that the movement of prices is not random. We employ a two-tailed test the randomness of prices.

- Test at 5% significance level at 18 degrees of freedom using t-table.

The lower limit => $\mu - t \times \hat{\sigma}_r = 10.26 - 2.101 \times 2.06 = 5.932$

The Upper limit => $\mu + t \times \hat{\sigma}_r = 10.26 + 2.101 \times 2.06 = 14.588$

At 10% level of significance at 18 degrees of freedom

Lower limit = $10.26 - 1.734 \times 2.06 = 6.688$

Upper limit = $10.26 + 1.734 \times 2.06 = 13.832$

As seen r lies between these limits. Hence, the market exhibits weak form of efficiency.

*For a sample of size n, the t distribution will have n - 1 degree of freedom.

Ch 5A – Equity

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
DDM – Basics	1 – 3
Using CAPM to calculate Ke	4
Two Stage DDM	5 – 7
Linear decline in growth rate	8 – 9
Share sale after n^{th} year	10
Models / Approaches other than DDM (Walter mode, PE mode, H-model)	11 – 13
Tiny topics block (Floatation cost, HPR, Ke cal.)	14 – 16
Home-made dividend	17
Making income statement	18
Special cases (Impact of taxes, Impact of new investment, impact of Bonus)	19 – 21

Index - Additional Questions	**Ques Number**
DDM – Basics	1 – 2
Using CAPM to calculate Ke	3
Ques based on Growth rate (g)	4
Low Probability – Unique Questions (LPUQ):	
- Calculating PVGO	5
- CHANGING Retention Ratio	6
- Calculating Total Earnings using market share of segments	7

Main Questions

DDM – Basics

DDM: Very basic question

 # Ques 1 – Woodstone **{N20 MTP 1 (Old)}**

Woodstone ltd. had paid dividends of at ₹2 per share last year. The growth of dividends from the co. is estimated to be 5% p.a. The required rate of return of equity investors is 15.5%. Determine the estimated market price of the equity share if the estimated growth rate of dividends:

(i) Rises to 8% and (ii) Falls to 3%.

Ans: Value as per Gordon's Model = $\frac{D_0(1+g)}{Ke - g}$

» Value when g is 5% = $\frac{2 \times 1.05}{0.155-0.05}$ = ₹20

(i) Value when g is 8% = $\frac{2 \times 1.08}{0.155-0.08}$ = ₹28.8

(ii) Value when g is 3% = $\frac{2 * (1.03)}{0.155-0.03}$ = ₹16.48

Reverse calculating Ke from CMP (CMP calculated using PE ratio)

 # Ques 2 – Voyage **{SM TYK, N18 Exam (New), N23 RTP, M24 MTP 2}**

Shares of Voyage Ltd. are being quoted at a PE ratio of 8 times. The company retains ₹ 5 per share which is 45% of its Earning Per Share. **Required:**

i) The cost of equity to the company if the market expects a growth rate of 15% p.a.

ii) If anticipated growth rate is 16% p.a., calculate indicative market price with the same cost of capital.

iii) If the company's cost of capital is 20% p.a. & the anticipated growth rate is 19% p.a., calculate the market price per share.

Ans: Assuming EPS & DPS to be EPS 1 & DPS 1 respectively.

- EPS x Retention ratio = REPS => EPS x 45% = 5 => EPS = ₹ 11.11
- DPS = EPS – REPS => 11.11 – 5 => ₹ 6.11
- PE ratio = $\frac{\text{Price}}{\text{Earnings}}$ => 8 = $\frac{\text{Price}}{11.11}$ => Price = ₹ 88.88

(i) **Ke when g = 15%**

- Value = $\frac{DPS}{Ke - g}$ => 88.88 = $\frac{6.11}{Ke - 0.15}$
- Ke - 0.15 = 0.0687
- Ke = 0.2187 or 21.87%

(ii) **When g = 16%**

Value = $\frac{6.11}{0.2187 - 0.16}$ = ₹104.08

(iii) **When g = 19% and Ke = 20%**

Value = $\frac{6.11}{0.20 - 0.19}$ = ₹611

Reverse calculating Growth rate

 # Ques 3 – Bajaj Auto **{N18 Exam (Old), N20 MTP 1 (New)}**

Bajaj Auto has an EPS of ₹2.5 for the last year and DPS of ₹1. The earnings are expected to grow at 2% a year in long run. Currently it is trading at 7 times its earnings. If the required rate of return is 14%, compute the following:

(i) An estimate of the P/E ratio using Gordon growth model.

(ii) The Long-term growth rate implied by the current P/E ratio.

Ans: (i) Value of share (P_0) = $\frac{DPS_1}{(Ke - g)}$ = $\frac{1 \times 1.02}{(0.14 - 0.02)}$ = 8.5

- Implied PE ratio = Price / EPS = 8.5 / 2.5 = 3.4 times.

(ii) **Calculation of Implied growth rate if PE ratio = 7**

- Price = PE ratio x EPS => 7 × 2.5 = 17.5
- $P_0 = \frac{DPS_0(1+g)}{Ke - g}$ => 17.5 = $\frac{1\ (1 + g)}{0.14 - g}$

=> 17.5 (0.14 - g) = 1+g

=> 2.45 - 17.5g = 1+g

=> g = 0.07838 or 7.838%

Using CAPM to calculate Ke

Cal. CMP using DDM under current & revised conditions

 # Ques 4 – Angad **{SM TYK}**

An investor is holding 1,000 shares of Angad Ltd. company. Presently the rate of dividend being paid by company is ₹2 per share and the share is being sold at ₹25 per share in the market. However, several factors are likely to change during the year as indicated below:

	Existing	Revised
Risk free rate	12%	10%
Market risk Premium (Rm-Rf)	6%	4%
Beta Value	1.4	1.25
Expected Growth rate	5%	9%

(i) Calculate Fair price per share under existing & Revised situation

(ii) Compare this price with CMP of ₹25 and state whether to hold or sell the share and Why?

Ans: Return as per CAPM (Ke) = Rf + (Rm – Rf) Beta

Value of share (P0) = DPS 1 / (Ke – g)

Details	Present Situation	New Situation
Ke	12 + 6 x 1.40 = 20.4%	10 + 4 x 1.25 = 15%
P0	2 x 1.05 / 0.204 - 0.05 = ₹13.63	2 x 1.09 / 0.15 - 0.09 = ₹36.33

(ii) Existing situation: CMP (25) > Value (13.63) → Over-valued. Sell the shares.

- Revised situation: CMP (25) < Value (36.33) → Under-valued. Hold the shares.

Two stage dividend discount model

 # Ques 5 – Coal India **{SM TYK, M19 Exam (New)}**

Coal India ltd. has declared and paid annual dividend of ₹4 per share. It is expected to grow at 20% for the next 2 years & 10% thereafter. The required rate of return of equity investors is 15%. Compute the current price at which equity shares should sell.

Ans: **Calculation of Dividend**

Year	Growth	Dividend
0	-	4
1	20%	4.8

	2	20%	5.76
	3	10%	6.336
	∞	∞	∞

• Value = PVCI => $\frac{4.8}{(1.15)^1} + \frac{5.76}{(1.15)^2} + \frac{6.336}{(0.15-0.10)(1.15)^2} \times 1 = ₹104.35$

 # Ques 6 - Seawell Corporation

Seawell Corporation, a Manufacturer of do-it-yourself hardware and housewares, reported earnings per share of €2.10 in 2003, on which it paid dividends per share €0.69. Earning is expected to grow 15% a year from 2003 to 2008, during which period the dividend pay-out ratio is expected to remain unchanged. After 2008 the growth rate is expected to drop to a stable 6% and the pay-out ratio is expected to increase 65% of earning. The firm has a beta of 1.40 currently, and is expected to have a beta of 1.10 after 2008. The market risk premium is 5.5%. The Treasury bond rate is 6.25%

(a) What is the expected price of the stock at the end of 2008?

(b) What is the value of the stock as on today, using the two-stage dividend discount model?

Ans: **Calculation of Dividends**

Year	Growth	EPS	Pay-out%	Dividends
2003	-	2.10	32.86	0.69
2004	15%	2.415	32.86	0.794
2005	15%	2.78	32.86	0.913
2006	15%	3.194	32.86	1.05
2007	15%	3.67	32.86	1.207
2008	15%	4.22	32.86	1.388
2009	6%	4.477	65	2.91

Calculation of Ke

Upto 2008: 6.25% + (5.5% x 1.40) = 13.95%

After 2008: 6.25% + (5.5% x 1.10) = 12.30%

(a) Value at 2008 end = $\frac{\text{DPS 2009}}{\text{Ke - g}} = \frac{2.91}{0.1230 - 0.06} = ₹46.19$

(b) Value = $\frac{0.794}{1.1395^1} + \frac{0.913}{1.1395^2} + \frac{1.05}{1.1395^3} + \frac{1.207}{1.1395^4} + \frac{1.388}{1.1395^5} + \frac{2.91}{(0.123-0.06)} \times \frac{1}{1.1395^5} = €27.59$

 # Ques 7 - Swastika Consultants {M19 RTP (Old), N20 RTP (Old)}

X Ltd is a Shoe manufacturing company. It is all equity financed and has a paid-up capital of ₹10,00,000 (₹10 per share) X Ltd has hired Swastika Consultants to analyse the future earning. The report of Swastika Consultants states as follow:

(i) The earnings and dividend will growth at 25% for next two years

(ii) Earning are likely to grow at rate of 10% from third year onwards

(iii) Dividend payout will increase to 50% if earning growth reduces.

Year	EPS	Net Dividend per share	Share price
2010	6.30	2.52	63.00
2011	7.00	2.80	46.00
2012	7.70	3.08	63.75
2013	8.40	3.36	68.75
2014	9.60	3.84	93.00

Tax rate of 30% is not expected to change in future. The cost of equity of firm is 15%. Calculate:

(i) Expected Market Price per Share (ii) PE ratio

Ans: Note: Tax rate is irrelevant. Since EPS, DPS are after tax figures only.

Calculating EPS and DPS

Year	Growth	EPS	DPS
2014	-	9.60	3.84
2015	25%	12	4.80
2016	25%	15	6
2017	10%	16.5	8.25

(i) $\text{Value} = PVCI = \frac{4.80}{(1.15)^1} + \frac{6}{(1.15)^2} + \frac{(8.25)}{(0.15-0.10)} \times \frac{1}{(1.15)^2} \Rightarrow ₹133.57$

(ii) $\text{P/E Ratio} = \frac{\text{Price}}{\text{Earning per share}} \Rightarrow \frac{133.57}{9.60} \Rightarrow ₹13.91$

Linear decline in growth rate

 # Ques 8 – Shree Cement {M19 Exam (Old), N20 Exam (New), Dec 21 MTP 1 (Old)}

An investor is considering purchasing the equity shares of Shree Cement Ltd., whose current market price (CMP) is ₹150. The company is purposing a dividend of ₹6 for the next year. Shree Cement is expected to grow @ 18% p.a. for the next 4 years. The growth rate will decline linearly to 14% p.a. after first 4 years. Thereafter, it will stabilize at 14% p.a. infinitely. The required return is 18% p.a. Find:

(i) The intrinsic value of one share.

(ii) Whether it is worth to purchase the share at this price.

Ans: **Krack Chart: The ques mentions that growth rate will decline linearly to 14% p.a. after first 4 years. Ques want to imply that rate of decline p.a. will be constant. So, we can easily calculate the p.a. decline in this case as => (18-14)/4 = 1% p.a.**

Year	Growth rate	Dividend
1	---	6
2	18%	6 x 1.18 = 7.08
3	18%	7.08 x 1.18 = 8.354
4	18%	8.354 x 1.18 = 9.858
5	17%	9.858 x 1.17 = 11.534
6	16%	11.534 x 1.16 = 13.379
7	15%	13.379 x 1.15 = 15.386
8	14%	15.386 x 1.14 = 17.54

(i) Value of share = PV of Dividends

$$= \frac{6}{1.18} + \frac{7.08}{1.18^2} + \frac{8.354}{1.18^3} + \frac{9.858}{1.18^4} + \frac{11.534}{1.18^5} + \frac{13.379}{1.18^6} + \frac{15.386}{1.18^7} + \frac{(17.54)}{(0.18-0.14)} \times \frac{1}{1.18^7} = 172.85$$

(ii) Since CMP (150) < Value of share (172.85) , hence We should buy it.

Linear decline in growth rate – Reverse calculating "g"

 # Ques 9 - Super Alpha {M23 Exam}

An investor is considering purchasing equity shares of Super Alpha Ltd., whose current Market price is ₹ 172.45. The co. is proposing a dividend of ₹ 6 for the year ending 31st March, 2024. Super Alpha is expected to grow @ 20 percent per annum for the next 4 years. Thereafter, the growth, over the next three years, will decline linearly by 100 basis points p.a.. Thereafter, it will stabilize at a certain

growth rate per annum infinitely. Required rate of return for investor is 20%.

Dividend value is to be taken in 2 decimal points only. Required to:

(i) Calculate stable growth rate of Alpha Ltd. after the end of 7 years.

(ii) Advise whether it is worth to purchase the share at this price if the investor has a stable target growth rate of 15% per annum.

Ans: Value of share = PVCI = PV of dividends

Year	Growth	Dividend	PV @ 20%
1	-	6	5.00
2	20%	7.2	5.00
3	20%	8.64	5.00
4	20%	10.37	5.00
5	19%	12.34	4.96
6	18%	14.56	4.88
7	17%	17.04	4.76
		Total :	34.59

Value = PV of dividends for first 7 years + PV of dividends thereafter

$$172.45 = 34.59 + \frac{17.04 \times (1 + g)}{0.2 - g} \times \frac{1}{1.2^7}$$

- $137.86 = \frac{17.04\ (1+g)}{0.2 - g} \times \frac{1}{1.2^7}$
- $\frac{137.86}{17.04} \times 1.2^7 = \frac{(1 + g)}{0.2-g}$
- $28.9893\ (0.2 - g) = 1 + g$
- $5.79786 - 28.9893g = 1 + g$
- $4.79786 = 29.9893g$

» g = 0.15999 or 0.16 (approx.) i.e. 16% p.a.

Thus, stable growth rate after the end of 7 years shall be 16%.

(ii) Since growth rate is more than target growth rate it is worth to purchase the share.

Share sale after n^{th} year

 # Ques 10 – JSW Steel **{SM TYK, N18 RTP (Old)}**

JSW Steel Ltd. just declared a dividend of ₹14 per share. Mr B is planning to purchase the share of JSW Steel Ltd, anticipating increase in growth rate from 8% to 9% which will continue for three years. He also expects the market price of this share to be ₹360 after three years.

You are required to determine:

(i) The maximum amount Mr. B should pay for shares, if he required a rate of return of 13% per annum

(ii) The maximum price Mr B is willing to pay for shares, if he is of the opinion that 9% growth can be maintained indefinitely and requires 13% rate of return p.a.

(iii) The price of share at the end of three years, if 9% growth rate is achieved and assuming other conditions remaining same as in (ii) above

Ans: **Calculation of Dividends:**

Year	Dividends
0	14
1	14 x 1.09 = 15.26
2	15.26 x 1.09 = 16.63
3	16.63 X 1.09 = 18.13

(i) Value of Share = $\frac{DPS_1}{(1+Ke)^1} + \frac{DPS_2}{(1+Ke)^2} + \frac{DPS_3 + \text{Price after 3 years}}{(1+Ke)^3}$

(= PVCI)

$= \frac{15.26}{1.13} + \frac{16.63}{(1.13)^2} + \frac{18.13 + 360}{(1.13)^3}$ = ₹288.56

(ii) Value of share using DDM = $\frac{DPS1}{Ke - g} = \frac{14 \times 1.09}{0.13 - 0.09}$ = ₹381.50

(ii) Value after 3 years: $\frac{DPS_4}{Ke - g} = \frac{18.13 \times 1.09}{0.13 - 0.09}$ = ₹494

👉 Models / Approaches other than DDM

Walter Model

 # Ques 11 – Goldilocks {Dec 21 MTP 2 (Old)}

Goldilocks ltd. was started a year back with equity capital of ₹40 lacs. The other details are as under:

Earnings	₹4,00,000	Price earnings ratio	12.5
Dividend paid	₹3,20,000	Number of shares	40,000

Find the current market price of the share. Use Walter's model.

Ans: EPS = Earnings / No. of shares = 4,00,000 / 40,000 = ₹ 10

- DPS = Dividend / No. of shares = 3,20,000 / 40,000 = ₹ 8
- Retained earnings per share (REPS) or (b) = EPS – DPS = ₹ 2
- r = Earnings / ESH's funds = 4,00,000 / 40,000 = 10%
- Ke = 1/PE ratio = 1 /12.5% = 8%

- Value as per Walter model = $\frac{DPS + re \times REPS}{Ke \quad Ke^2} = \frac{8 + 10\% \times 2}{0.08 \quad (0.08)^2}$ = ₹ 131.25

PE Multiple model

 # Ques 12 – Hindalco {SM TYK, M24 MTP 1}

(i) Calculate present value of Hindalco ltd.'s stock which is growing at 2% p.a.

Some other info:
- Current Dividend (D_0) = ₹2.50
- Discount Rate (k) = 10.5%

(ii) Is the stock overvalued if stock price is ₹35, ROE = 9%, and current EPS = ₹2.25 Show your calculation under: (a) **PE multiple approach** (taking current EPS)

(b) Earning growth Model. Assume ROE = Ke.

Ans: (i) Value using DDM = $\frac{DPS_0 \times (1+g)}{Ke - g} = \frac{2.50 \times (1.02)}{0.105 - 0.02}$ = ₹30

(ii) **As per PE Multiple**

Value = EPS x PE multiple = EPS x $\frac{1}{Ke}$ = 2.25 x $\frac{1}{0.09}$ = ₹ 25

- **Comment**: Share is over-valued as Actual price (35) > Value (25).

 # As per Earning Growth model

Value = $\frac{EPS_0 \times (1+g)}{}$ = $\frac{2.25 \times (1.02)}{}$ = ₹ 32.79

Ke – g 0.09 – 0.02

• **Comment**: Share is over-valued as Actual price (35) > Value (32.79).

H-Model

 # Ques 13 – Hyuga

Hyuga ltd. currently pays a dividend of ₹4 per share. It is expected to growth at an abnormal growth rate of 15% p.a. Its normal growth rate after 4 years is expected to be 6% p.a. Find its share value using H-model if cost of equity (Ke) is 10%.

Ans: Ga = Abnormal growth rate = 15%

Gn = Normal growth rate = 6%

H = Years of abnormal growth = 4/2 = 2

2

• Value as per H-Model = $\frac{DPS_0 (1+Gn)}{Ke - g} + \frac{DPS_0 \times H \times (Ga - Gn)}{Ke - g}$

= $\frac{4 (1 + 0.06)}{0.10 - 0.06} + \frac{4 \times 2 \times (0.15 - 0.06)}{0.10 - 0.06} = 106 + 8 = ₹ 124$

👉 **Tiny topics block**

Floatation cost

 # Ques 14 – Aranya

Current market price of Aranya corp. shares is ₹125 per share.

D0 = 14. Floating costs will be 4% of the issue price which is ₹125. Growth rate (g) = 8.776%.

DETERMINE:

(i) Cost of existing equity shares (Ke)

(ii) Cost of new equity shares.

Ans: i) **Cost of existing equity shares (Gordon)**

Value = $\frac{DPS\ 0 \times (1+g)}{Ke - g}$ => 125 = $\frac{14 \times 1.08776}{Ke - 0.08776}$

Ke – 0.08776 = $\frac{14 \times 1.08776}{125}$ => Ke = 0.2096 or 20.96%

ii) **Cost of new Eq. shares (Gordon model)**

$125 \times (1 - 0.04) = \frac{14 \times 1.08776}{Ke - 0.08776}$

$Ke - 0.08776 = \frac{14 \times 1.08776}{120}$ => Ke = 0.2147 Or 21.47%

Holding period return (HRP)

 # Ques 15 - IndusInd

Following information about IndusInd bank is given: • Dividend after 1 year (DPS 1) = ₹ 2.15

• Growth rate (g) = 11.2% p.a.

(i) What is the intrinsic value (P0) as on today if cost of equity (Ke) = 15.2% p.a.

(ii) What is the next year's expected price at the end of year 1?

(iii) Calculate Dividend yield, Capital gain yield and Holding period return (HPR) for an investor who bought the share today and intends to sell it after 1 year after receiving the dividend of ₹ 2.15.

Ans: Value as on today (P0) = $\frac{DPS\ 1}{ke - g} = \frac{2.15}{0.152 - 0.112}$ = ₹53.75

• Value after 1 year (P1) = $\frac{DPS\ 2}{ke - g} = \frac{2.15 \times 1.112}{0.152 - 0.112}$ = ₹59.77

(i) Capital Gain yield = $\frac{P1 - P0}{P0} = \frac{59.77 - 53.75}{53.75}$ = 11.2%

(ii) Dividend Yield = $\frac{DPS1}{P0} = \frac{2.15 \times 100}{53.75}$ = 4%

(iii) Holding period return (HPR) = $\frac{DPS\ 1 + (V1 - V0)}{V0} = \frac{2.15 + (59.77 - 53.25)}{53.25}$ = 15.2%

Calculating cost of equity (Ke) using IRR method

 # Ques 16 - Piyush Loonker {SM TYK, N18 RTP (New)}

Piyush Loonker and Associates presently pay dividend of ₹1 per share and has share price of ₹20.

(i) If this dividend were expected to grow at a rate of 12% per annum forever, what is the firm's

expected or required return on equity using a dividend-discount model approach?

(ii) Instead of this situation in part (i), suppose that the dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter. Now what is the firm's expected, or required, return on equity?

Ans: (i) **Calculating Required return (Ke) if g = 12% p.a.**

Value (P_0) = $\frac{DPS_0 (1 + g)}{Ke - g}$ => $20 = \frac{1 \times 1.12}{Ke - 0.12}$ => Ke = 17.6%

(ii) **Ke if g = 20% for first 5-years, then 10% p.a.**

Value = $\frac{DPS_1}{1+Ke} + \frac{DPS_2}{(1+Ke)^2} + \frac{DPS_3}{(1+Ke)^3} + \frac{DPS_4}{(1+Ke)^4} + \frac{DPS_5}{(1+Ke)^5} + \frac{DPS_6}{(Ke-g)} \frac{1}{(1+Ke)^5}$

$20 = \frac{1.2}{(1+Ke)^1} + \frac{1.44}{(1+Ke)^2} + \frac{1.73}{(1+Ke)^3} + \frac{2.07}{(1+Ke)^4} + \frac{2.49}{(1+Ke)^5} + \frac{2.74}{(Ke-0.10)} \times \frac{1}{(1+Ke)^5}$

- **Calculating Ke using hit and trial method.**

(a) Value of share if Ke = 18%

Value = $\frac{1.2}{1.18} + \frac{1.44}{1.18^2} + \frac{1.73}{1.18^3} + \frac{2.07}{1.18^4} + \frac{2.49}{1.18^5} + \frac{2.74}{0.18-0.10} \times \frac{1}{1.18^5}$ = 20.23

(b) Similarly, Value when Ke is 19% = 17.89

» IRR = Lower % + $\frac{\text{(Change in \%)}}{\text{(Change in value)}}$ x (Required Value – Value @ Lower%)

Ke = 18% + $\frac{1\%}{-2.34}$ (20 – 20.23) = 18.10%

Questions Based on application

Home-made dividend

 # Ques 17 – SAM Homemade Dividend {SM TYK, M18 RTP (New), N22 MTP 2}

SAM ltd. has just paid a dividend of ₹2 per share and it is expected to grow @ 6% p.a. After dividend, the board declared to take up a project by retaining the next three annual dividends. It is expected that this project is of same risk as the existing projects. The results of this project

will start coming from the 4th year onward from now. The dividends will then be ₹2.50 per share and will grow @ 7%p.a. An investor has 1,000 Shares in SAM Ltd. and want a receipt of at least ₹2,000 p.a. from in his investment.

(a) How the market value of share will be affected by board's decision?

(b) Also Show as to how the investors can maintain his target receipt from the investment from first 3 years and improved income thereafter, given that the cost of equity of the firm is 8%.

Ans: Value under existing situation $= \frac{DPS_0(1+g)}{Ke - g} = \frac{2 \times 1.06}{0.08 - 0.06} = ₹106$

Value under new situation $= \frac{(DPS_4)}{Ke - g} \times \frac{1}{Ke^3} = \frac{2.50}{0.08 - 0.07} \times \frac{1}{1.08^3} = ₹198.46$

(ii) If new policy is followed:

- P_0 at Yr 1 end $\Rightarrow \frac{(DPS_4)}{Ke - g} \times \frac{1}{(1+ke)^2} \Rightarrow \frac{2.50}{0.08-0.07} \times \frac{1}{(1.08)^2} = ₹214.33$

- P_0 at Yr 2 end $\Rightarrow \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1.08)^1} = ₹231.48$

- P_0 at Yr 3 end $\Rightarrow \frac{2.50}{0.08 - 0.07} = ₹250$

\# A Shareholder who wants to maintain an income of ₹2,000 can sell some shares during the 1st + and 3 years (when no dividends are received) to maintain his target income.

Year 1: 10 Shares @ 14.33 = ₹2143.3

Year 2: 09 Shares @ 231.48 = ₹2083.32

Year 3: 08 Shares @ 250.00 = ₹2000.00

Year 4: 2.50 x (1,000 - 10 - 9 - 8) shares = 2.50 x 973 Shares = ₹2432.50

Hence, the shareholder will be able to maintain his earnings target of ₹2000.

Making income statement

\# Ques 18 – L&T {SM TYK, M19 Exam (New), N20 RTP (Old), Jul 21 Exam (New)}

Following Financial data are available for L&T Ltd for the year ending 2008

	Particulars	(₹ In Lakhs)
	Debentures	125
	bonds (2007)	50
	Equity Shares (₹10 each)	100
	Reserve and Surplus	300
	Total Assets	600
	Asset Turnover Ratio	1.1
	Interest rates of Debentures & Bonds	8%
	Tax rates	40%
	Current market price of Shares	14
	Required rate of return in investors (Ke)	15%
	Operating Profit Margin	10%
	Dividend Pay-out ratio for the year ending 2008 (D_0)	16.67%
	You are required to:	
(i)	Draw income statement for the year	
(ii)	Calculate its Growth Rate	
(iii)	Calculate fair price of co.'s share using dividend discount model	
(iv)	What is your opinion on investment in the company's share at current price?	
Ans:	Asset turnover ratio = Sales / Total Assets	
•	1.1 = Sales / 600 => Sales = ₹ 660 lacs	
i)	**Income statement**	**₹ in Lakhs**
	Sales	660
(-)	Operating costs (90% of sales)	(594)
=	Operating profit (10% of sales)	66
(-)	Interest: 8% of (125 + 50)	(14)
=	EBT (Earning before Tax)	52
(-)	Tax @ 40%	(20.8)
=	EAT	31.2
(-)	Dividend to equity shareholders : 31.2 x 16.67%	5.2
=	Retained earnings	26
ii)	**Growth rate (g)**	
•	r = Earnings available for ESHs / ESHs funds = 31.2 / (100 + 300) = 7.8%	
•	g = b x r = (1 – 0.1667) x 7.8% = 6.5%	

iii) DPS = Dividend / No. of Equity shares = 5,20,000 / 10,00,000 = ₹ 0.52 per share

- Value (using DDM) = $\frac{DPS_0 \times (1+g)}{Ke - g}$ = $\frac{0.52 \times (1.065)}{0.15 - 0.065}$ = ₹ 6.52

iv) **Opinion**: Share is overvalued as CMP (₹14) > Value (₹6.52). Do not buy the share.

Special cases

Impact of taxes

 # Ques 19 – Maruti

Mr A is contemplating purchase of equity shares of Maruti td. His expectation of return is 10% before tax by way of dividend with annual growth of 5%. Company's last dividend was ₹2 share.

Even as he is contemplating, Mr A finds that due to a budget announcement dividend have been exempted from tax in hands of the shareholders (recipients). But imposition of Dividend Distribution Tax (Corporate Dividend tax) on the company is likely to lead to a fall in dividend of 20 paise per share. A's marginal tax rate is 30%.

Calculate what should be Mr A's estimate of price per share before and after budget announcement?

Ans: **Before Budget (Dividend taxable)**

- Required return (Ke) = 10%
- Value = $\frac{DPS_1}{Ke - g}$ = $\frac{2 \times 1.05}{0.10-0.05}$ = ₹42

 # After Budget (Dividend tax free)

- Required return (Ke) after dividends became tax free = 10% - 30% = 7%
- Value = $\frac{DPS_1}{Ke - g}$ = $\frac{1.80 \times 1.05}{0.07 - 0.05}$ = ₹94.20

Impact of new investment on dividends

 # Ques 20 – Rahim Enterprises {Dec 21 MTP 1 (Old)}

Rahim Enterprises is a manufacturer and exporter of woollen garments to European countries. Their **business is expanding day by day and in the previous FY the company registered a 25% growth in export business.** The co. is in the process of considering a new investment project. It is an all equity financed co. with 10,00,000 equity shares of face value of ₹50/share. The current issue price of this share is ₹125 ex-dividend. Annual earning are ₹25 per share and **in the absence of new**

investments will remain constant in perpetuity. All earnings are distributed at present. A new investment is available which will cost ₹1,75,00,000 in one year's time and will produce annual cash inflows thereafter of ₹50,00,000. Analyse the effect of the new project on dividend payments and the share price.

Ans: **Krack Chart** Biggest Confusion!! At one place it is mentioned that "Co. has registered a 25% growth in export business." and later ques says 'Earnings will remain constant till perpetuity'.

- **So, which one shall be followed?**

Ans: 2nd statement -> Assume growth = 0

(1st statement is more of a blah blah paragraph. Whereas 2nd statement talks about "Numbers". In such case prefer concrete numerical information over paragraph.)

Krack Chart 2: Value of share = PV of Dividends. So, all we need is:

(a) Find Future Dividends (b) Find Discount Rate (ke)

Finding Ke using given info.

- Value = DPS / Ke
- 125 = 25 / Ke => Ke = 20%

Estimating future dividends

Year	Total Earning	Investment	Dividends	DPS
1	25 x 10 L = 250L	(175L)	250-175 = 75L	75L/10L = 7.5
2	250L + 50L = 300L	--	300L	300L/10L = 30

- EPS & DPS of ₹30 shall continue till perpetuity (because no growth)

» Value of share = PV of Dividends = $\frac{7.5}{(1.20)^1} + \frac{30}{(0.20)} \times \frac{1}{1.20}$ = ₹ 131.25

Purchase price when bonus is expected

Ques 21 – Olov **{SM TYK, N19 RTP (New), N22 MTP 1}**

Mr. Olov is thinking of buying shares at ₹500 each having face value of ₹100. He is expecting a bonus at the ratio of 1:5 during the 4th year. Annual expected dividend is 20% and same rate is expected to be maintained on the expanded capital base. He intends to sell the shares at the end of 7th year at an expected price of ₹900 each. Incidental expenses for purchase and sale of shares are estimated to be 5% of the market price. He requires a minimum return of 12% p.a. Should Mr. Olov

buy the share?

If so, what maximum price should he pay for each share? Assume no taxes.

Ans: **Krack chart: Value = PV of CFs. So, all we need is: (a) CFs = Dividends & sale proceed**

(b) Discount rate (directly given = 12%)

Therefore, All we have to do is calculate CFs.

 # Calculation of cash flows per annum

Year	No. of shares	DPS or sale value per share	Total CF
1	1	20	20
2	1	20	20
3	1	20	20
4	1 + (1 x 1/5) =1.2	20	24
5	1.2	20	24
6	1.2	20	24
7	1.2	20 + (900 – 5%) = 875	1050

Value of share today = PV of CFs

» $\frac{20}{1.12} + \frac{20}{1.12^2} + \frac{20}{1.12^3} + \frac{24}{1.12^4} + \frac{24}{1.12^5} + \frac{24}{1.12^6} + \frac{1050}{1.12^7}$ = ₹564

Slippery Slope!! Since 5% expense is incurred on purchase of shares, so maximum purchase price (PP) that Mr. A will be willing to bear will be given by:

» PP x 1.05 = 564 => PP = 537.14

Since CMP (500) < Max. purchase price (537.14) . So, Mr. A should by these shares.

Additional Questions

DDM – Basics

Calculating DPS & g from given data for DDM

 # Ques 1 – Adani Ports

Following information is collected from the annual reports of Adani Ports ltd.

Profit before tax at year end 1 – ₹2.50 crores Tax rate – 40 %

Number of outstanding shares – 50,00,0000 Retention ratio - 40%

Rate of return on investment - 15% Equity capitalization rate – 12%

What should be the market price per share according to Gordon's model of dividend policy?

Ans: Profit after tax (PAT) = 2.5 - (2.5 x 40%) = ₹ 1.5 crores

- EPS_1 = PAT @ year end 1 / No. of shares = 1.5 crores / 0.5 crores = ₹ 3 / share
- DPS_1 = EPS x (100% - retention ratio) = 3 x (100% - 40%) = ₹ 1.8
- Growth rate (g) = Retention ratio (b) x Return on equity (r) = 40% x 15% = 6%

» Value of share = $\frac{D1}{Ke - g} = \frac{1.8}{0.12 - 0.06}$ = ₹30

Total earnings = Total assets x Return on investment

 # Ques 2 – Axis

Axis Ltd has invested ₹500 lakhs in assets. There are 50 lakhs shares outstanding. The Par value per share is ₹10. It earns a rate of 15% on its investment has a policy of retaining 50% of the earning If Ke is 10% what is the price of its share using the Gordon's Model. What will happen to the price of the share if the company is retaining 80% of its earning?

Ans: **Return on investment (this is total earnings for Eq. SHs) = 500 L x 15% = ₹ 75 lacs**

- EPS = Total earnings of ESHs / No. of Equity shares = 75L / 50L = ₹ 1.5 per share

(i) **When retention (b) is 50%**

- Growth = b x r => 50% x 15% => 7.5%
- DPS = EPS (100% - Retention ratio) =1.5 x (100% - 50%) = ₹0.75

» Value = $\frac{DPS}{Ke - g} = \frac{0.75}{0.10 - 0.075}$ = ₹ 30/-

(ii) **When retention (b) is 80%**

Growth = b x r => 80% x 15% => 12%

But Ke is only 10% (i.e. g > Ke).

Since g > Ke → Value cannot be calculated using the Gordon model.

👉 Using CAPM to calculate Ke

Cal. CMP using DDM under current & revised conditions (similar to "Angad")

 # Ques 3 – Anant {SM TYK, M24 Exam}

An investor is holding 5,000 shares of Anant Ltd. Current year dividend rate is ₹ 3/ share. Market price of the share is ₹ 40 each. The investor is concerned about several factors which are likely to change during the next financial year as indicated below

	Current Year	Next Year
Dividend paid / anticipated per share (₹)	3	2.5
Risk free rate	12%	10%
Market Risk Premium	5%	4%
Beta Value	1.3	1.4
Expected growth	9%	7%

In view of the above, advise whether the investor should buy, hold or sell the shares.

Ans: Return as per CAPM (Ke) = Rf + (Rm – Rf) Beta

Value of share (P0) = DPS 1 / (Ke – g)

Details	Present Situation	New Situation
Ke	12 + 5 x 1.30 = 18.5%	10 + 4 x 1.4 = 15.6%
P0	$\frac{3 \times 1.09}{0.185 - 0.09}$ = ₹34.42	$\frac{2.50 \times 1.07}{0.156 - 0.07}$ = ₹31.10

- Market price of share of ₹ 40 is higher in comparison to current equilibrium price of ₹ 34.42 and revised equity price of ₹ 31.10. Under this situation investor should sell the share.

👉 Ques based on Growth rate (g)

Calculating g from historical dividend data

 # Ques 4 - Fast Fly

Beta for ordinary shares of Fast Fly ltd. is 1.60 and its market risk premium (Rm - Rf) is 5%. The risk-free return is 10%. The latest dividend declared by the co. on 31/03/03 is ₹3. Dividend declared by the company on 31/03/97 was 2.115 per share. The co.'s earnings and dividends experienced a constant growth. Calculate intrinsic (fair) value of the shares.

Ans: Ke as per CAPM (Ke) = 10 + 5x 1.60 = 18%

» Calculation of growth rate (using historical data)

- $DPS_{2003} = DPS_{1997} \times (1 + g)^6$
- $3 = 2.115 \times (1+g)^6$
- $0.705 = \frac{1}{(1 + g)^6}$
- g = 6%

» Value of share using DDM = $\frac{DPS\ 0 \times (1+g)}{Ke - g} = \frac{3 \times 1.06}{0.18-0.06}$ = ₹26.50

👉 **Low Probability – Unique Questions (LPUQ)**

PVGO = Value with growth (-) Value without growth

 # Ques 5 - Moodswing

Moodswing ltd.'s current EPS is ₹10 / share. It can grow at 12% p.a. if it retains 60% of these earnings. Alternatively, it can distribute 100% of its earnings. But growth rate will then become zero.

Find Present value of growth opportunity (PVGO) if Ke = 16%.

Ans:

Details	If retention = 60%	If retention = 0%
• DPS0	10 x 0.4 = 4	10
• DPS1	4 x 1.12 = 4.48	10
• Value as per DDM	$\frac{4 \times 1.12}{16\% - 12\%}$ = 112	$\frac{10}{0.16}$ = 62.5

» PVGO = Value with growth (–) Value without growth = 112 – 62.5 = ₹ 49.5

CHANGING Retention Ratio

 # Ques 6 – Nestle **{N18 RTP (Old)}**

In December, 2011 Nestle Co's. share was sold for ₹146 per share. A long-term earnings growth rate of 7.5% is anticipated. AB Co. is expected to pay dividend of ₹3.36 per share.

(i) What rate of return an investor can expect to earn assuming that dividends are expected to grow along with earning at 7.5% per year in perpetuity?

(ii) It is expected that Nestle Co. will earn about 10% on book Equity and shall retain 60% of earnings. In this case whether, there would be any change in growth rate and cost of equity?

Ans: (i) Value of share = $\frac{DPS_1}{(Ke - g)}$ => 146 = $\frac{3.36}{(Ke - 7.5\%)}$

=> Ke – 7.5% = 3.36/146 => Ke = 9.80%

(ii) Return on Equity (r) = 10%

Retained Earnings = 60%

New growth rate = b*r = 0.10 x 0.60 = 0.06 or 6%

Krack Chart: Growth rate has changed from 7.5% to 6%.

Since g = b×r, it means that either "b" or "r" has changed from last year.

Q: How do we know which one has changed?

A: ICAI has consistently assumed that "r" will remain same & it is "b" that is changing.

 # Calculating New Ke

- Value of share (P0) = $\frac{DPS_1}{(Ke - g)}$ => 146 = $\frac{5.3}{Ke - 0.06}$ => Ke = 9.63%

WN 1: Calculation of DPS 1

 # Existing DPS

- DPS 1 = 3.36
- g = 7.5%
- Hence, DPS 0 = 3.36 / (1.075) = 3.1256

 # Old retention ratio:

- old g = b × r
- 0.075 = b × 0.10

•	b = 0.75 or 75%
∴	$EPS_0 = \frac{DPS_0}{DPR} = \frac{3.1256}{(1 - 0.75)} = 12.50$
•	New $EPS_1 = EPS_0 (1+g) = 12.5 \times 1.06 = 13.25$
•	New $DPS_1 = 13.25 \times 40\% = 5.3$
	Calculating Total Earnings using market share of segments
#	**Ques 7 - Rocket King** **{N19 Exam (Old)}**
	You are interested in buying some equity stocks of Rocket King (RK) Ltd. The company has 3 divisions operating in different industries. Division A captures 10% of its industries sales which is forecasted to be ₹50 crore for the industry. Division B and C captures 30% and 2% of their respective industry's sales, which are expected to be ₹20 crore and ₹8.5 crore respectively. Division A traditionally had a 5% net income margin, whereas divisions B and C had 8% and 10% net income margin respectively. RK Ltd. has 3,00,000 shares of equity stock outstanding, which sell at ₹250.
	The company has not paid dividend since it started its business 10 years ago. However from the market sources you come to know that RK Ltd. will start paying dividend in 3 years time and the pay-out ratio is 30%. Expecting this dividend, you would like to hold the stock for 5 year. By analysing the past financial statements, you have determined that RK Ltd.'s required rate of return is 18% and that **P/E ratio of 10 for the next year** and on ending P/E ratio of 20 at the end of the fifth year are appropriate.
	Required:
(i)	Would you purchase RK Ltd. equity at this time **based on your one-year forecast**?
(ii)	If you expect earnings to grow @ 15% continuously, how much are you willing to pay for the stock of RK Ltd ?
	Ignore taxation.
	PV factors are given below :

Years	1	2	3	4	5
PVIF @ 18%	0.847	0.718	0.609	0.516	0.437

Ans:	**# Calculating EPS of the co.**
•	Total earnings = {50 x 10% x 5%} + {20 x 30% x 8%} + {8.5 x 2% x 10%} = ₹ 74.7 lacs
•	EPS = Total earnings / No. of shares = 74.7 Lacs / 3L = ₹ 24.9

(i) Expected Market Price at the end of the year = 24.90 x 10 = ₹ 249

- PV of the Expected Price = 249 x 0.847 = 210.90
- Comment – Do not buy as CMP (250) > Value of share (210.90).

(ii) **Value if earnings are expected to grow @ 15% continuously**

Year	EPS	DPS
1	28.64	0
2	32.93	0
3	37.87	11.36
4	43.55	13.07
5	50.08	15.02

- Value of share = $0 + 0 + \{11.36 \times 0.609\} + \{13.07 \times 0.516\} + \{15.02 \times 0.437\} + \frac{\{15.02 \times 1.15\}}{0.18 - 0.15} \times 0.437$
- Value of share = ₹ 271.83
- Comment – The maximum price that should be paid for this stock in this case is ₹271.83.

Ch 5B – Bonds

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Bonds Valuation	1 – 2
YTM Calculation	3 – 6
Forward rate	7 – 8
Tiny Topics block	9 – 10
Duration. MD, Convexity	11 – 13
Bond Immunization	14 – 16
Bond refunding	17 – 18
Convertible bonds	19 – 22

Index - Additional Questions	**Ques Number**
Bond valuation	1 – 4
Bond yield	5
Tiny topics block	6
Duration, MD	7
Convertible bond	8
Low Probability – Unique Questions (LPUQ)	
- Reverse calculating coupon, B0 using duration info	9
- Duration of a Semi-Annual bond + Realized yield when RR is Nil	10
- Duration of portfolio (ICAI wrong technical treatment)	11

Main Questions

👉 Bonds Valuation

Value & YTM of perpetual bond

 # Ques 1 - Chisel tools

Chisel tools has issued a ₹100 perpetual bond. It is currently selling for ₹95. The coupon rate of interest is 14.5% and the appropriate discount rate is 16%.

(i) Calculate the fair value of the bond.

(ii) Should it be bought?

(iii) What is its yield at maturity other than that as given in question?

Ans: Value of perpetual bond = $\frac{\text{Coupon}}{\text{YTM}} = \frac{14.5}{16\%}$ = ₹90.625

(ii) The actual price > Value. Hence, it should not be bought.

(iii) Actual YTM that will be earned by investor:

$95 = \frac{14.5}{\text{YTM}}$ => YTM = 15.26%

Life missing = Assume perpetual.

 # Ques 2 - Atharv {SM TYK}

Mr. Atharv has collected the current Data of GOI bonds. 10% Government of India, Security is currently quoted at ₹110. Now if interest rate is expected to go up by 1%, calculate new market price.

Ans: **Assumptions:** 1. Life of the Bond is not given. ∴ Assume perpetual.

2. Face Value of Bond is not Given ∴ Assuming it = ₹100

Bond Value = $\frac{\text{Interest}}{\text{YTM}}$ => $110 = \frac{10}{\text{YTM}}$ => YTM = 9.09%

- Revised value if rate increases by 1% = $\frac{10}{9.09\% + 1\%}$ = ₹99.099

YTM Calculation

Basic yield calculation – Approx. method & IRR method

 # Ques 3 – Ganesh

Ganesh want to find the YTM on a 10 Year, 10% bond which is currently selling for 900. Face Value is 1000. Calculate the YTM using:

(i) Approx. formula (ii) Trial-and-error Method (IRR)

Ans: (i) YTM using approx. Formula

$$YTM = \frac{\text{Interest} + (RV - CMP) \div \text{No. of periods}}{(RV - CMP) \div 2} = \frac{100 + (1000 - 900) \div 10}{(1000 + 900) / 2} = 11.58\%$$

Where: RV = redeemable value ; CMP = current market price

(ii) YTM Using IRR Formula

- Value if Kd is 10% = 100 x PVAF (10%, 10) + 1000 x PVF (10%, 10) = ₹1,000
- Value if Kd is 12% = 100 x PVAF (12%, 10) + 1000 x PVF (12%, 10) = ₹887

- IRR = Lower% + $\frac{\text{(Change in \%)}}{\text{(Change in value)}}$(Required Value–Value@ Lower%)

- YTM = 10% + $\frac{2\%}{-113}$ x (900 - 1000) => 10% + 1.77% = 11.77%

YTM when Income tax and Capital gain tax is given

 # Ques 4 – Uloopi

There is a 9%, 5-year bond issue in the market. The issue price is ₹ 90 and the redemption Price is ₹ 105. Mrs. Uloopi has marginal Income tax rate of 30% and capital gains of 10%. What is the post tax YTM for Mrs. Uloopi?

Ans: Interest receipt net of tax = ₹9 x 0.7 = ₹ 6.3

- Capital gain (before tax) = 105 – 90 = ₹ 15
- Capital gain tax = 15 x 10% = ₹ 1.5
- Redemption price net of CG tax (RV*) = 105 - 1.5 = ₹ 103.5

$$YTM \text{ (post-tax)} = \frac{\text{Int (net of tax)} + (RV^* - CMP) \div \text{No. of periods}}{(RV^* - CMP) \div 2}$$

YTM (post-tax) = $\frac{6.3 + (103.5 - 90) \div 5}{(103.5 + 90) / 2}$ = 9.30%

YTM of Semi-Annual bond (give Final Ans in "p.a." form always)

Ques 5 – Mahendra

Bond face value = 1000. Life = 5-years

Issue value = 900. Coupon rate = 10% p.a. (Interest paid half-yearly)

Mrs. Mahendra wants to know the YTM of this bond. Calculate YTM using approx. method.

Ans: Yield per period = $\frac{\text{Int per period} + (\text{RV} - \text{Price}) / \text{No. of periods}}{(\text{RV} + \text{Price}) / 2}$

• YTM for 6 months = $\frac{50 + (1000 - 900) / 10}{(1000 + 900) / 2}$ = 6.32% for 6 months

» YTM p.a. = 6.32% x 2 => 12.64% **p.a.**

Calculating Yield to call (YTC)

Ques 6 - Kripa

Nominal value of 10% debentures of a Kripa ltd. is ₹ 100. The debentures can be called at call price of ₹ 110 after 4 Years. Interest is paid annually. Determine Yield to Call (YTC) if current market price of callable Bonds is ₹ 102. Maturity 10 Years.

Ans: YTC = $\frac{\text{Interest} + (\text{Call value} - \text{CMP}) \div \text{No. of periods}}{(\text{Call value} - \text{CMP}) \div 2}$

YTC = $\frac{10 + (110 - 102) \div 4}{(110 + 102) / 2}$ = 11.32% p.a.

👉 **Forward rates**

Bond valuation using Forward rates

Ques 7 – Sonic **{N18 Exam (Old), N20 MTP 1 (New)}**

Sonic Ltd issued 9%, 5-year Bonds of ₹1,000 each having a maturity of 3 years. The present rate of interest is 12% for one Year tenure. It is expected that forward rate of Interest for one- year tenure is going to fall by 75 basic Points and further by 50 bps next year in future. This bond has a Beta

value of 1.02 and is more popular in the market due to less Credit risk. Calculate:

(i) Intrinsic Value of Bond (ii) Expected Market Price of Bond

Ans: **Calculation of forward rates**

1st year -> 12%

2nd year -> 12% - 0.75% = 11.25%

3rd year -> 11.25% - 0.50% = 10.5%

- Value of bond = $\frac{90}{1.12} + \frac{90}{(1.12)(1.1125)} + \frac{1090}{(1.12)(1.1125)(1.1075)} = 942.47$

- **Expected price = Intrinsic Value x Beta = 942.47 x 1.02 = 961.32**

Calculating Forward rates using given Bond prices

 # Ques 8 - Mahadevi

Mahadevi has provided you the following info about G-Secs. Calculate Forward rates from the given info:

Face Value	Coupon Rate	Maturity(Year)	Current Price
₹1,00,000	0%	1	₹91,500
₹1,00,000	10%	2	₹98,500
₹1,00,000	10.5%	3	₹99,900

Ans: **1 year bond**

Value = $\frac{RV}{(1+ FR1)^1}$

$91500 = \frac{1,00,000}{1 + FR1}$ => FR 1 = 9.29%

- **2 year bond**

$98500 = \frac{10,000}{1.0929} + \frac{1,10,000}{(1.0929)(1 + FR2)}$ => FR 2 = 12.65%

- **3 year bond**

$99,900 = \frac{10,500}{1.0929} + \frac{10,500}{(1.0929)(1.1265)} + \frac{1,10,500}{(1.0929)(1.1265)(1+FR3)}$ => FR 3 = 9.77%

Tiny Topics block

When Re-investment rate (RR) is given in Ques

 # Ques 9 – Citigroup

Citigroup Ltd.'s bond (Face Value of ₹1000) with four years maturity is currently trading at ₹900 carrying a coupon rate of 15%. Assuming that the reinvestment rate (rr) is 16%, you are required to calculate Realized Yield to maturity of the bond.

Ans: When RR is given, we will assume that all the CFs will be re- invested at RR. So, we will first compute the FV of these re- invested CFs.

 # Calculating FV of re-invested CFs

Year	CF	FV@ Year 4 end @ 16%
1	100x15% = 150	$150 \times 1.16^3 = 234.1344$
2	150	$150 \times 1.16^2 = 201.84$
3	150	$150 \times 1.16 = 174$
4	150 + 1000	$1150 \times 1 = 1150$
		₹ 1760 approx.

 # Calculating Yield

Value of Bond = FV of the CFs @ Year 4 end / $(1+ \text{Yield})^4$

=> $900 = \frac{1760}{(1+r)^4}$ => $(1+r)^4 = \frac{1760}{900}$

=> r = 0.1825 or 18.25% p.a.

Calculating HPR (Yield) when more than 1 bonds is purchased / sold during period

 # Ques 10 – Alphabet

Alphabet purchased at par a bond with a face Value of ₹1,000. The bond had 5-year to maturity & a 10% coupon rate. The bond was called two years later for a price of ₹1,200 after making its second annual interest payment. Alphabet then purchased a bond selling at its Face Value of ₹1,000 with 3-years to maturity and a 7% coupon rate. What was Alphabet's actual YTM over the five - year period? Use IRR technique.

Ans: **We can calculate YTM using IRR**

Recall that IRR is the rate at which: - PVCO = PVCI

=> $1000 + \frac{1000}{(1+r)^2} = \frac{100}{(1+r)^1} + \frac{100}{(1+r)^2} + \frac{1200}{(1+r)^2} + \frac{70}{(1+r)^3} + \frac{70}{(1+r)^4} + \frac{70+1000}{(1+r)^5}$

- **Let r = 10%**

PVCO = 1826.45

PVCI = 1930.08

NPV = PVCI – PVCO = 1930.08 – 1826.45 => 103.65

- **Let r = 14%**

PVCO = 1769.47

PVCI = 1732.46

NPV = PVCI – PVCO = 1732.46 – 1769.47 => -37.01

- By Interpolation = $10\% + \frac{4\%}{140.64} \times 103.63$ => 12.95%

Duration, MD, Convexity

Basic Duration, MD calculation

 # Ques 11 – Yuga {SM TYK}

Yuga ltd. issued bonds with 6 years to maturity.

Face value	₹ 1,000	Coupon Rate	16%
Redemption value	₹ 1,000	Yield to maturity	17%

Required – (i) Current market price (ii) Duration (iii) Volatility

(iii) Expected market price, if yield increase by 75 basis points.

Ans: i) Current Market price = 160(PVAF 17%,6) + 1,000 (PVF 17%,6) = 574.24 + 390 = 964.24

(ii) Duration of bond (DoB) = $\frac{1}{\text{Bond Value}} \left(\frac{1 \times \text{Interest}_1}{(1+Kd)^1} + \frac{2 \times \text{Interest}_2}{(1+Kd)^2} + \ldots\ldots + \frac{n \times (\text{Int} + RV)}{(1+Kd)^n} \right)$

- DoB = $\frac{1}{964.24} \left(\frac{1 \times 160}{1.17^1} + \frac{2 \times 160}{1.17^2} + \ldots\ldots + \frac{6\,(160+1000)}{1.17^6} \right)$ = 4.247 years

(iii) Modified Duration = $\frac{\text{Duration}}{\text{(Volatility)}} = \frac{4.247}{1.17} = 3.63$

(iv) % Change in price as per MD = – MD × Change in yield = –3.63 x 0.75% = –2.7225%

- New price = 960.26 x (1 – 0.027225) = ₹ 934.118

Duration, MD & Convexity

 # Ques 12 – Panchala {N20 Exam (New), M23 RTP}

Panchala has a 5-years, 8.5% bond with Face value of ₹10,000. It is currently trading at a yield to maturity (YTM) of 10%. Calculate bond's

(i) Current market price (ii) Macaulay's Duration

(iii) Volatility **(iv) Convexity**

(v) Expected market price, if YTM decreases by 200 basis points

(a) By Macaulay's Duration based estimate

(b) By Intrinsic Value Method.

Ans: (i) Value (B_0) = 850xPVAF(10%, 5)+10,000xPVF(10%, 5) = ₹9431.38

(ii) $\text{Duration} = \frac{1}{\text{Bond value}} \times \left[\frac{1 \times \text{Interest}}{(1+kd)^1} + \ldots\ldots + \frac{n \times (\text{Int} + \text{RV})}{(1+kd)^n}\right]$

$\text{Duration} = \frac{1}{9431.38} \times \left[\frac{1x850}{(1.1)^1} + \frac{2x850}{(1.1)^2} + \ldots\ldots + \frac{5 \times (850+10000)}{(1.1)^5}\right] = 4.252 \text{ years}$

(iii) Volatility of bond is given by its Modified duration = $\frac{\text{Duration}}{(1 + y/n)}$

Modified duration = 4.252 / 1.10 = 3.865%

(iv) Calculating Convexity (by using shock of 2%)

- Bond value at 8% YTM (V_-) = 850 x PVAF (8%, 5) + 10,000 x PVF (8%, 5) = ₹10,200
- Bond value at 12% YTM (V_+) = 850 x PVAF (12%, 5) + 10,000 x PVF (12%, 5) = ₹8,738.33

-> $\text{Convexity} = \frac{V_- + V_+ - 2V_0}{2V_0 (\Delta y)^2} = \frac{10200 + 8738.33 - (2 \times 9431.38)}{2 \times 9431.38 \times (0.02)^2} = \frac{75.57}{7.545} = 10.01$

(v) New market price if yield decreases by 200 bps i.e. new yield = 8%

a) By Macaulay's Duration based estimate

- Change in price = −MD x Δ yield % = −3.865 x (-2%) = + 7.73% increase in price.
- New price = 9431.38 x 1.0773 = 10,160.425

b) By intrinsic value method

Value = 850 x PVAF (8%, 5) + 10,000 x (8%, 5) = 10,200

MD of bond portfolio

 # Ques 13 - Dell

Mr. Dell have purchased 1 bond A & 1 bond B:

Bond A: FV = ₹100, Current price = ₹120, Modified Duration = 5

Bond B: FV = ₹100, Current price = ₹80, Modified Duration = 10

If the interest rate falls by 1%, find the new value of portfolio -

(i) Using Modified Duration of individual bonds (ii) Using duration of bond portfolio.

Ans:

(i) Using Modified Duration of individual bonds	Bond A	Bond B
Change in price = −MD × Change in yield	−5 x −1% = 5%	−10 x −1% = 10%
New price of bond	120 x 1.05 = 126	80 x 1.1 = 88

» Total new price of portfolio = 126 + 88 = ₹214

(ii) Duration of portfolio = Weighted average duration = {5 x 120/200} + {10 x 80/200} = 7

- Increase in portfolio = 200 x 7% = 14

» New value of portfolio = 200 + 14 = 214

👉 Bond Immunization

Basic immunization using 2 bonds

 # Ques 14 – Legend {SM TYK, Dec 21 RTP (Old)}

Mr. Legend will need ₹1,00,000 after two years for which he wants to make one Necessary investment now. He has choice of two types of bonds. Their details are as below:

	Bond X	Bond Y
Face Value	₹1,000	₹1,000
Coupon	7% payable annually	8% payable annually
Years to Maturity	1 Year	4 Year

	Current Price	₹972.73	₹936.52
	Current Yield	10%	10%

Advice how to is fully immunized in current situation?

Ans: Duration of bond (DoB) = $\frac{1}{\text{Bond Value}} \left[\frac{1 \times \text{Interest}_1}{(1+Kd)^1} + \frac{2 \times \text{Interest}_2}{(1+Kd)^2} + \ldots\ldots + \frac{n \times (\text{Int} + RV)}{(1+Kd)^n} \right]$

- Bond X = $\frac{1}{972.73} \times \frac{(1070 \times 1)}{1.1}$ = 1 year.

- Bond Y = $\frac{1}{936.52} \times \left[\frac{1 \times 80}{(1.1)^1} + \frac{2 \times 80}{(1.1)^2} + \ldots\ldots + \frac{4 \times (80+1000)}{(1.1)^4} \right]$ = 3.562 years

- Let weight of Bond X = x. Then weight of Bond Y = (1 – x)

Portfolio is immunised when:

Weighted average duration of portfolio = Investor's time horizon

1x + 3.562 (1 - x) = 2

x = 60.96%

» Weight of X = 60.6%, Weight of Y = 39.04%

Immunization using 3 bonds + Re-immunization when interest rate changes

Ques 15 – Yadav **{N18 Exam (New), N20 MTP 1 (Old)}**

The following data are available for three bonds, A, B & C. These bonds are used by Mr. Yadav, a bond portfolio manager to fund an outflow scheduled in 6 years. Current yield is 9%. All bonds have face value of ₹100 each & will be redeemed at par. Interest is payable annually.

Bond	Maturity (years)	Coupon rate
A	10	10%
B	8	11%
C	5	9%

(i) Calculate the duration of each bond.

(ii) The bond portfolio manager has been asked to keep 45% of portfolio money in Bond A. Calculate %

amount to be invested in bonds B & C that need to be purchased to immunise the portfolio.

(iii) After the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. The new duration of these bonds are: Bond A= 7.15 years, Bond B= 6.03 years and Bond C= 4.27 years. Is the portfolio still immunized? Why or why not?

(iv) Determine the new percentage of B and C bonds that are needed to immunize the portfolio. Bond A remaining at 45% of the portfolio.

Ans: **Calculating Value of bonds**

Bond A = 10 x PVAF(9%, 10) + 100 x PVF(9%, 10) = ₹106.42

Bond B = 11 x PVAF(9%, 8) + 100 x PVF(9%, 8) = ₹111.07

Bond C = 100 (i.e. Face Value as in this case coupon rate=Yield = 9%)

- $\text{Duration} = \frac{1}{\text{Bond value}} \times \left[\frac{1 \times \text{Interest}}{(1+kd)^1} + \ldots\ldots + \frac{n \times (\text{Int} + \text{RV})}{(1+kd)^n} \right]$

- $\text{Bond A} = \frac{1}{106.42} \times \left[\frac{1\times10}{1.09^1} + \frac{2\times10}{1.09^2} + \ldots\ldots\ldots + \frac{10\times(10+100)}{1.09^{10}} \right] = 6.862 \text{ years}$

- $\text{Bond B} = \frac{1}{111.07} \times \left[\frac{1\times11}{1.09^1} + \frac{2\times11}{1.09^2} + \ldots\ldots\ldots + \frac{8\times(11+100)}{1.09^{8}} \right] = 5.835 \text{ years}$

- $\text{Bonds C} = \frac{1}{100} \times \left[\frac{1\times9}{1.09^1} + \frac{2\times9}{1.09^2} + \ldots\ldots\ldots + \frac{5\times(9+100)}{1.09^{5}} \right] = 4.240 \text{ years}$

(ii) Weight of Bond A = 45% (given)

Let weight of Bond B = w

weight of Bond C = 1 – 0.45 – w = 0.55 - w

» **Portfolio is immunized when:** Weighted average duration of portfolio = Investor time horizon

- 6.862 x 0.45 + 5.835w + 4.24 (0.55 – w) = 6
- 3.0879 + 5.835w + 2.332 – 4.24w = 6
- 1.595w = 0.5801
- w = 0.3637 or 36.37%

» Weight of Bond B = w = 6.37%

» Weight of Bond C = 0.55 – w = 0.55 – 0.3637 = 0.1863 or 18.63%

(iii) **Revised duration of Portfolio after change in yield.**

(7.15 x 0.45) + (6.03 x 0.3637) + (4.27 x 0.1863) = 6.20 years.

Hence, the portfolio is no longer immunized as its duration has increased from 6 years to 6.20 years.

(iv) **New required weights to immunize the portfolio:**

7.15 x 0.45 + 6.03w + 4.27(0.55 – w) = 6

3.2175 + 6.03w + 2.3485 – 4.27w = 6

» w = 0.2466 or 24.66%

» Weight of Bond C = 0.55 – w = 0.55 – 0.2466 => 0.3034 or 30.34%

Calculating Weighted average duration of liabilities (for immunization)

Ques 16 – Kyoto

The worker's welfare fund of Kyoto ltd. has following liabilities:

₹ 15 lacs payable after 1 year, and ₹ 40 lacs payable after 4 years.

The fund manager is planning to invest in three different ZCBs with maturity of 1 year, 3 years and 8 years respectively. You are required to find the amount to be invested in each of the ZCBs if the fund manager wants to invest ₹10 lacs in 3y ZCB. Prevailing market yield is 12% pa.

Ans: **Krack chart:** Portfolio is immunized when -

Weighted average Duration of assets = Weighted average duration of liabilities

So, 1st we need to calculate weighted average duration of liabilities.

Calculating weighted average duration of liabilities

- PV of 1-year liability = $15/(1.12)^1$ = 13.39 lacs
- PV of 4-years liability = $40/(1.12)^4$ = 25.42 lacs
- Total PV of liabilities ₹38.81 lacs

» Weighted average duration of liabilities = 1 x {13.39 / 38.81} + 4 x {25.42 / 38.81} = 2.965 years

∴ We need assets with PV of ₹38.81 lacs and Duration of 2.965 years

Let weight of 1y ZCB be w.

Weight of 3y ZCB = 10/38.81 = 0.2576 or 25.76%

Weight of 8y ZCB = 1 -w -0.2576 = 0.7424 – w

Required Weighted average duration of assets = 2.965

1w + 3×0.2576 + 8×(0.7424 - w) = 2.965

3.747 = 7w => w = 0.5353 or 53.53%

- Hence, required weight of 1y ZCB = 0.5353
- Required weight of 8y ZCB = 0.7424 - 0.5353 = 0.2071

Summary,

ZCB	1 year	3 year	8 year
Weight	53.53%	25.76%	20.71%
Amount invested	20.775 lacs	10 lacs	8.035 lacs

👉 Bond refunding

Basic bond refunding - Without overlapping interest

 # Ques 17 – Harini {SM TYK, N20 RTP (Old), Dec 21 Exam (New), N22 RTP, M24 MTP 1}

Harini Ltd. has ₹300 million, 12 % bonds outstanding with six years remaining to maturity. Since interest rates are falling, Harini Ltd.is contemplating of refunding these bonds with a ₹300 million issue of 6 years bonds carrying a coupon rate of 10%. Issue cost of a new bond will be ₹6 million & the call premium is 4%. ₹9 million being the unamortized portion of issue cost of old bonds can be written off no sooner the old bonds are called off. Marginal tax rate of Harini Ltd. is 30%. You are required to analyse the bond refunding decision.

Ans:

Calculation of initial outlay	(₹ in Million)
* Face Value of old bonds	300
(+) Call premium (net of tax): 300 x 4% x 0.7	8.4
(-) Proceeds from new issues	(300)
(+) Issue cost of new shares	6
(-) Tax savings on unamortized issue cost: 9 x 0.3	(2.7)
	11.7

# Calculation of Net Cash outflow p.a.	Old	New (₹ in Million)
Interest (net of tax)	300L x 12% x 0.7 = 25.2	300L x 10%x 0.7 = 21
Tax savings on unamortized costs	9/6 x 0.3 = (0.45)	6/6 x 0.3 = (0.3)
Net Cash outflow p.a.	24.75	20.7

- Net savings p.a. = 24.75 – 20.7 = ₹4.05 million p.a.

•	Therefore, PVCI = 4.05 x PVAF (7%, 6) = ₹ 19.304 Lacs
»	NPV = PVCI – PVCO = 19.304 – 11.7 = ₹7.604 million
»	NPV is positive. So, Bonds should be refunded.

Bond refunding with over-lapping interest

 # Ques 18 – Tangent {N18 Exam (New)}

Tangent Ltd. is considering calling ₹3 crores of 30 years, ₹1,000 bond issued 5 years ago with a coupon interest rate of 14%. The bonds have a call price of ₹1,150 and had initially collected proceeds of ₹2.91crores since a discount of ₹30 per bond was offered. The initial floating cost was ₹3,90,000. The company intends to sell ₹3 crores of 12% coupon rate, 25 years bonds to raise funds for retiring the old bonds. It proposes to sell the new bonds at their par value of ₹1,000. The estimated floatation cost is ₹4,25,000. The company is paying 40% tax and its after tax cost of debt is 8%. As the new bonds must first be sold and then their proceeds to be used to retire the old bonds, the co. expect a 2-month period of overlapping interest during which interest must be paid on both the old and the new bonds. You are required to evaluate the bond retiring decision.

Ans:

	Calculation of initial outflow	**₹ in Lacs**
	FV of Old Bonds	300
(+)	Call premium (net of tax): 300 x 15% x 0.6	27
(-)	Proceeds from new issue	(300)
(+)	Issue cost of New Bonds:	4.25
(+)	**Over-lapping Int. (2 months): 300L x 14% x 2/12 x 0.6**	**4.2**
(-)	Tax saved on unamortized discount & floatation cost: (9 + 3.9) x 25/30 x 40%	(4.3)
	» Net Initial Cashflow =	31.15

#	**Calculation of Net Cash outflow p.a.**	**Old bonds**	**New bonds**
	Interest (net of tax)	300L x 14% x 0.6 = 25.2	300L x 12%x 0.6 = 21.6
	Annualized tax shield on costs*	(9+3.9)÷30 × 0.4 = (0.172)	(42.5/25) x 0.4 = (0.068)
	Net Cash outflow p.a.	25.028 Lacs	21.532 Lacs

•	Net savings p.a. = 25.028 – 21.532 = ₹ 3.496 Lacs p.a.
•	Therefore, PVCI = 3.496 x PVAF (8%, 25) = ₹ 37.319 Lacs
»	NPV = PVCI – PVCO = 37.319 - 31.15 = ₹6.169 lacs
»	NPV is positive. So, Bonds should be refunded.

Convertible bonds

Basic ques on convertibles (Practice multiple times)

 # Ques 19 – Kalpa {SM TYK, M19 RTP (Old), Jul 21 Exam (New), N23 MTP 1}

The data given below relates to a convertible bond issued by Kalpa plc. CMP of this bond is ₹265.

Face Value	₹250	No. of shares per bond	20
Market price of equity share	₹12	Straight value of bond	₹235

Calculate:

(i) Conversion Ratio (ii) Stock value of bond or fair conversion value of bond as on today.

(iii) Down side risk %. (iv) Premium %.

(v) Conversion parity price of the stock.

Ans: (i) Conversion ratio = 20:1

(ii) Fair conversion value as on today = ₹12 x 20 = ₹240

(iii) Downside risk in amount (₹) = 265 – 235 = ₹30

Downside risk in % = 30/265 = 11.32% or 30/235 = 12.77%

(iv) Premium = {Actual price of convertible bond (–) Fair conversion price} / Fair conversion price

Premium = (265 – 240) / 240 = 10.42%

(v) Conversion parity price (CPP) x Conversion ratio = Actual price of convertible bond

CPP x 20 = 265 => CPP = 13.25

Reverse calculating Share price, bond price etc

 # Ques 20 - Brown Granite (N23 MTP 2)

Following information is related to the Convertible Bond of Brown Granite Ltd. (BGL) which is currently priced at ₹1060 per Bond:

(1) Conversion Parity Price – ₹53

(2) Conversion Premium – 10.41667%

(3) Percentage of Downside Risk with respect to Straight Value of Bond – 12.766%

Calculate:

(i) No. of shares on Conversion (ii) Current Market Price Per Share (iii) Straight Value of Bond

Ans: (i) Conversion parity price = $\frac{\text{Bond price}}{\text{No. of shares on conversion (n)}}$

•	53 = $\frac{1060}{n}$
•	n = 1060 / 53 = 20 shares
(ii)	Conversion premium = $\frac{\text{MPS of bond} - \text{Conversion value of bond}}{\text{Conversion value of bond (CV)}}$
•	0.1041667 = $\frac{1060 - CV}{CV}$
•	1.1041667 CV = 1060
•	Conversion value of bond = ₹ 960
•	Since, number of shares on conversion = 20, so CMP of share = 960/20 = ₹48 per share
(iii)	% of downside risk = $\frac{\text{Market price of bond} - \text{Straight value of bond}}{\text{Straight value of bond (SV)}}$
•	0.12766 = $\frac{1060 - SV}{SV}$
•	1.12766 SV = 1060
•	Straight value of bond = ₹ 940 per bond
	Impact of Convertible Preference Shares on EPS & Diluted EPS
#	**Ques 21 – Kuru** **{N23 RTP}**
	Kuru ltd. has current earnings of ₹3 per share with 5,00,000 shares outstanding. The company plans to issue 40,000, 7% convertible preference shares of ₹50 each at par. The preference shares are. convertible into 2 shares for each preference shares held. The equity share has a current market price of ₹21 per share. **Calculate**:
(i)	Preference share's conversion value (ii) Conversion premium
(ii)	Assuming that total earnings remain same, calculate the effect of the issue on basic EPS
	(a) before conversion (b) after conversion.
(iv)	If profits after tax increases by ₹1 million what will be the basic EPS
	(a) before conversion and (b) on a fully diluted basis.
Ans:	(i) Conversion Value = MPS x Conversion ratio = 21 x 2 = ₹ 42
(ii)	Conversion premium = CMP (-) Fair conversion value = 50 – 42 = ₹ 8
	If PAT is same **If PAT increase by 10L**

#	**Basic EPS**		
	Total PAT: 3 x 5L	15	15 + 10 = 25
(-)	Preference dividend: 40,000 x (50 x 7%)	(1.4)	(1.4)
=>	Earnings available for ESHs:	13.6	23.6
÷	Number of equity shares	5	5
=>	EPS	2.72	4.72
#	**Diluted EPS**		
	Total PAT = 3 x 5L	15	15 + 10 = 25
÷	No. of Equity shares: (5 + 0.4 x 2)	5.8	5.8
=>	Diluted EPS	2.59	4.31

Minimum share price when conversion should be exercised

 # Ques 22 – Saranam **{SM TYK, M18 Exam (New), M19 RTP (Old)}**

Saranam Ltd. has issued convertible debentures with coupon rate 12%. Each debenture has an option to convert to 20 equity shares at any time until the date of maturity. Debentures will be redeemed at ₹ 100 on maturity of 5 years. An investor generally requires a rate of return of 8% p.a. on a 5-year security. As an investor when will you exercise conversion for given market prices of the equity share of: (i) ₹4 (ii) ₹5 (iii) ₹6

Ans: (i) Bond Value (if not converted) = 12 x PVAF(8%, 5) + 100 x PVF(8%, 5) = 116.016

ii) Value of Equity Shares:

Case	Market price/share	Total Value
I	4	4 x 20 = 80
ii	5	5 x 20 = 100
iii	6	6 x 20 = 120

» If market price is 6, only then it is advisable to exercise conversion.

Additional Questions

👉 Bond valuation

Bond value where life of bond can be extended by the issuer

 # Ques 1 – Gaurika

Gaurika Ltd. Has outstanding, a high yield Bond with following features:

Face Value	£10,000
Coupon	10%
Maturity period	6 years

Co. can extend the life of bond to 12 years. Presently the interest rate on equivalent Bond is 8%

(i) If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.

(ii) Now suppose, on the basis of that expectation, he invested in the bond, but interest rate turns out to be 12%, six years from now, then what will be his potential gain/loss

Ans: (i) Value if Kd is 8% = 1000 x PVAF (8%, 6) + 10000 x PVF (8%. 6) = ₹10,924.58

(ii) Value if Kd is 12% = 1000 x PVAF (12%, 6) + 10000 x PVF (12%, 6) = ₹9177.72

∴ Loss to Investor = ₹9177.72 - ₹10,924.58 = ₹1746.86

Value of floating rate bond

 # Ques 2 – Tata Motors

Tata Motors Ltd. Has the following outstanding Bonds:

Series X Bonds → 8%

Series Y Bonds → Variable, changes annually comparable to prevailing rate

Initially these bonds were issued at face value of ₹10,000 with YTM of 8%. Assuming that:

(i) After 2 Years from the date of issue, interest on comparable bonds is 10%, then what should be the price of each bond.

(ii) What conclusion you can draw.

Ans: Assumption: Since life is missing in ques → Assume perpetuity

Value of perpetual bond = Coupon ÷ Kd

• **Calculation of coupon amount:**

Series X bonds = 10000 x 8% = ₹800

Series Y bond = (floating bond) Equal to prevailing market rate

	Details	Value of Series X bond	Value of Series Y bond
(i)	When market yield = 8%	800 / 8% = ₹ 10,000	800 / 8% = ₹10,000
(ii)	When market yield = 10%	800 / 10% = ₹8,000	1000 / 10% = ₹10,000

Conclusions: Unlike the fixed coupon bonds, the floating coupon rate bonds are not affected by change in market interest rates.

Bond value where Entire amount is received @ maturity

 # Ques 3 - Rivet Industries

Rivet Industries has analysed that the yield structure of AAA rated debenture is as follows:

Period (or Maturity)	Yield or Discount Rate (%)
1 year	10.50
2 years	11.25
3 years and above	12.00

If the interest rate increases by 50 basis points, what will be the percentage change in the price of the Bond having a maturity of 5 years? Assume that currently the bond is fairly-priced at ₹1,000.

Assume that the entire amount is received at the end of year 5.

Ans: **Assumption:** The par value of the bond is ₹1000.

• Bond maturity 5 years. Therefore, required YTM = 12%.

• The bond is trading at par. Therefore, coupon rate = YTM = 12%.

Bond's entire amount is received @ end of year 5.

• Amount received @ end of year 5 = $1000 \times 1.12^5 = 1762.34$

New YTM, if interest rate increase by 50 bps = 12 + 0.5 = 12.5%

• New Value of bond = PVCI = $1762.34 / 1.125^5 = 977.97$

• Percentage change in bond price = {977.97 – 1000} / 1000 = 2.2%

Valuation between Coupon date

 # Ques 4 – Alark

Alark Ltd. issued a new series of bonds on January 1, 2000. The bonds were sold at par (₹1000),

Having a coupon rate 10% p.a. and mature on 31st December, 2015. Coupon payments are made semi-annually on June 30th and December 31st each year. **Required:**

(i) What was the YTM of Alark Ltd. Bonds as on January 1, 2000?

(ii) Assumed that you purchased an outstanding Alark Ltd. Bond on 1st March, 2008 when the going interest rate was (Kd) 12%. What amount you should pay to complete the transaction for purchasing the bond on 1st March 2008?

(iii) Of that amount how much should be accrued interest and how much would be bond's basic value.

Ans: i) YTM = Coupon rate (as bonds are selling at par) = 10%

• **Or alternatively, Calculation of YTM**

Yield per period = $\frac{\text{Int per period} + (\text{RV} - \text{Price}) / \text{No. of periods}}{(\text{RV} + \text{Price}) / 2}$

YTM = $\frac{50 + (1000 - 1000) \div 32}{(1000 + 1000) / 2}$ = 5% for 6 months i.e. 10% p.a.

ii) Value as on 1st March 2008 = PV of value of as on 30 June

• Value (on 30 Jun) = Value of bond + Accrued interest on that date

= {50 x PVAF(6%, 15) + 1000 x PVF(6%, 15)} + {1000 x 10% x ½} = 902.88 + 50 = ₹ 952.88

» Value as on 1 March* = PV of value receivable on 30 June = $\frac{952.88}{(1.06)^{4/6}}$ = ₹ 916.58

iii) Bifurcating Value of ₹916.58 into value due to accrued interest and value due to basic bond value.

• Value to due to accrued interest** = PV of interest component = $50 / (1.06)^{4/6}$ = ₹48.10

• Value to due to basic bond value = 916.58 – 48.10 = ₹868.48

or = $902.88 / (1.06)^{4/6}$ = ₹868.48

Alternate Ans --

1* Bond value as on 1 March can also be calculated as = $\frac{952.88}{(1 + 0.06 \times 4/6)}$ = ₹ 916.23

2** Accrued interest for 2 months can also be calculated as = 50/6 x 2 = 16.67

👉 Bond Yield

YTM calculation when bond is issued at Par, Premium or Discount [Easy]

 # Ques 5 – Walmart

Walmart Ltd. issues ₹10,00,000 12% debentures of ₹100 each. The debentures are redeemable after 7 years. The company is in 35% tax bracket. Calculate the cost of debt after tax, if debentures are issued at (i) Par (ii) 10% Discount (iii) 10% Premium

(iv) If brokerage is paid at 2%, What will be the cost of debentures, if issue is at par?

Ans: YTM (post-tax) = $\frac{\text{Int (net of tax)} + (\text{RV} - \text{iPrice}) \div \text{No. of periods}}{(\text{RV} - \text{iPrice}) \div 2}$

where: iPrice = Issue price net of floatation cost

i) YTM (par) = $\frac{12(1-0.35) + (100 - 100) \div 7}{(100 + 100) / 2}$ = 7.8%

ii) YTM (Discount) = $\frac{12(1-0.35) + (100 - 90) \div 7}{(100 + 90) / 2}$ = 9.71%

iii) YTM (Premium) = $\frac{12(1-0.35) + (100 - 110) \div 7}{(100 + 110) / 2}$ = 6.07%

iv) YTM when 2% floatation cost is incurred.

Issue price net of floatation cost = 100 x 0.98 = ₹98

= $\frac{12(1-0.35) + (100 - 98) \div 7}{(100 + 98) / 2}$ = 8.17%

👉 Tiny Topics block

Bifurcating increase in value into – Increase due to IO Strip & Increase due to PO Strip

 # Ques 6 – Coca Cola

Bond Coca Cola with 5 years to maturity have a face value of ₹1,000 and coupon rate 8% (with annual Interest payments). The bond is selling at par. Assume that the yield falls to 6%.

(i) Whether the price of bond will increase or decrease?

(ii) Calculate New Fair Value of Bond?

(iii) What percentage of this increase/decrease comes from a change in the present value of Bond's Principal amount & what percentage comes from a change in PV of bond's interest payments?

Ans: (i) Bond value and yield has inverse relation. So, bond value will increase if the yield decreases.

(ii) New fair value = 80 x PVAF (6%, 5) + 1000 x PVF (6%, 5) = 1084.25

(iii) Total change in bond value = 1084 – 1000 = ₹84

Details	Principal strip	Interest strip
Earlier value (8%)	1000 x PVF (8%, 5) = 680.58	80 x PVF (8%, 5) = 319.42
New value (6%)	1000 x PVF (6%, 5) = 747.26	80 x PVF (6%, 5) = 337
Change in value	747.26 – 680.58 = 66.68	337 – 319.42 = 17.58
% of total change	66.68 / 84 = 79.38%	17.58 / 84 = 20.92%

WN 1: Earlier bond was trading at par. Therefore, Coupon rate = required yield. So, earlier yield = 8%.

👉 Duration, MD

Normal Duration, MD Calculation (Quick Look)

 # Ques 7 – Bhanu **{M23 Exam}**

Mr. Bhanu is an investor. In the beginning of 2022, he purchased substantial number of 8 year 7.50%, ₹1000 bond with 5% premium on maturity at a required Yield to Maturity (YTM) of 8.50%. However, due to the continuing war in Europe, the inflation is running very high in the economies of the countries. The yield on the bonds is decreasing. The risk averse investor wants to protect himself from further loss and decides to sell the bonds in 2023. He has got a proposal from another investor who is willing to purchase these bonds by shelling out a maximum amount of ₹797.50 per bond.

Investor follows intrinsic value method for valuation of the Bonds.

You are required to determine:

(i) The Market price, Duration and Volatility of the bond.

(ii) Will it be a right decision of the new investor if he is looking for Required Yield to Maturity (YTM) as 12% p.a. ?

Ans : (i) Price of bond = 75 x PVAF (8.5%,7) + 1,050 x PVF(8.5%,7) = ₹ 977.04

b) Duration of bond (DoB) = $\frac{1}{\text{Bond Value}} \left[\frac{1 \times \text{Interest}_1}{(1+Kd)^1} + \frac{2 \times \text{Interest}_2}{(1+Kd)^2} + \ldots\ldots + \frac{n \times (\text{Int} + RV)}{(1+Kd)^n} \right]$

- DoB = $\frac{1}{977.04}\left[\frac{1 \times 75}{1.085^1} + \frac{2 \times 75}{1.085^2} + \ldots\ldots + \frac{7 \times (75 + 1050)}{1.085^7}\right] = \frac{5563.18}{977.04} = 5.69$ years

c) Modified Duration (Volatility) = $\frac{\text{Duration}}{(1 + \text{Yield})} = \frac{5.69}{1.085} = 5.24$

(ii) Value of bond @ 12% Required yield

Value = 75 x PVAF (12%, 7) + 1,050 x PVF(12%, 7) = ₹ 817.24

Comment - Intrinsic value of bond (817.24) > Price (797.50). So, the new investor should purchase it.

👉 Convertible bonds

Floor value of convertible bond

 # Ques 8 – Hidimbi

Suppose Mrs. Hidimbi is offered a 10% Convertible Bond (par value ₹ 1,000) which either can be redeemed after 4 years at a premium of 5% or get converted into 25 equity shares currently trading at ₹33.50 and expected to grow by 5% each year. You are required to determine the minimum price. Mrs. Hidimbi shall be ready to pay for bond if her expected rate of return is 11%.

Ans: (i) Bond Value (if not converted) = 100 x PVAF(11%, 4) + 1050 x PVF(11%,4) = 1002 (approx.)

(ii) <u>Value if conversion is exercised at the end of 4th year</u>

- Value of share at the end of year 4 = $33.50 \times (1 + 0.05)^4$ = 40.72
- Total expected value of shares to be received = 40.72 x 25 = ₹1018
- Bond Value = 100 x PVAF(11%,4) + 1018 x PVF(11%,4) = ₹980.83

☞ The value calculated in case of share conversion is estimated using the expected growth rate of 5% p.a. However, value calculated in 1st case i.e. when conversion is not exercised is based on contractual guaranteed CFs. Hence, Floor Value in this case shall be value as under case 1 i.e. ₹1002 (approx..)

👉 Low Probability – Unique Questions (LPUQ)

Reverse calculating Coupon & Bond value using Duration info

 # Ques 9 - Goldman Sachs

Find the CMP of Goldman Sachs Ltd.'s bond having face value ₹ 1,00,000 redeemable after 6 years

maturity with YTM at 16%. Coupon is payable annually and duration 4.3202. Given $1.16^6 = 2.4364$.

Ans: Let coupon rate be C%, coupon amount = C & current price be P.

(i) Value of bond = C x PVAF (16%, 6) + 1,00,000 x PVF (16%, 6)

P = 3.6847 C + 41,044.23 ...(1)

(ii) Duration of bond (DoB) = $\frac{1}{\text{Bond Value}} \left(\frac{1 \times \text{Interest}_1}{(1+Kd)^1} + \frac{2 \times \text{Interest}_2}{(1+Kd)^2} + \ldots\ldots + \frac{n \times (\text{Int} + RV)}{(1+Kd)^n} \right)$

- DoB = $\frac{1}{P} \left(\frac{1 \times C}{1.16^1} + \frac{2 \times C}{1.16^2} + \ldots\ldots + \frac{6 \times C + 6 \times 1{,}00{,}000}{1.16^6} \right)$

- $4.3202 = \frac{11.323\ C + 2{,}46{,}265.35}{P}$ => P = 2.6209 C + 57,0003.23 ... (2)

Equating equation 1 & 2, we get:

3.6847 C + 41,044.23 = 2.6209 C + 57,0003.23

1.0638 C = 15,959

C = 15,000

» Therefore, the coupon rate is 15% p.a.

» Price of bond = 15,000 x PVAF (16%, 6)+1,00,000xPVF (16%, 6^{th}) = ₹96,315.264

Duration of a Semi-Annual bond + Realized yield when RR is Nil

Ques 10 - TXL Ispat **{M18 RTP (New)}**

TXL Ispat Ltd. Has made an issue of 14% non-convertible debenture (NCD) on Jan 1,2007. These Debenture have a face value of ₹100 and is currently traded in the market at a price of ₹90. Interest on these NCDs will be paid through post-dated cheques dated June 30 and December 31. Interest payment for the first 3 years will be issued in advance through post-dated cheques while for the last 2 years post dated cheques will be issued at the third year. The bond is redeemable at par on December 31,2011 at the end of five years. **Required**:

(i) Current yield (ii) YTM of the bond (ii) Duration of the NCD.

(iii) If the intermediate coupon payments are not available for reinvestment, then find the realised yield.

Ans: i) Current yield = Interest / Price = 7 / 90 = 7.78% for half year or **15.56% p.a.**

(ii) Yield per period = $\frac{\text{Int per period + (RV – Price) / No. of periods}}{\text{(RV + Price) / 2}}$

- YTM = $\frac{7 + (100 - 90) \div 10}{(100 + 90) / 2}$ = 8.42% for 6 months i.e. 16.84% p.a.

(iii) Duration of bond (DoB) = $\frac{1}{\text{Bond Value}} \left(\frac{1 \times \text{Interest}_1}{(1 + Kd)^1} + \frac{2 \times \text{Interest}_2}{(1 + Kd)^2} + \ldots\ldots + \frac{n \times (\text{Int} + RV)}{(1 + Kd)^n} \right)$

- DoB = $\frac{1}{90} \left(\frac{1 \times 7}{1.0842^1} + \frac{2 \times 7}{1.0842^2} + \ldots\ldots + \frac{10\,(7 + 100)}{1.0842^{10}} \right) = \frac{668.67}{90}$ = **7.43 Half yrs or 3.715 years.**

Imp Note: Since interest is payable half yearly, we have calculated duration with 6- months as base. But final answer must be in complete years form & not in half- year form.

iii) Calculating realised yield if coupons are not available for reinvestment.

Half Year	Coupons	Future Value
1	7	$70 \times (1 + 0)^1 = 7$
2	7	7
3	7	7
4	7	7
5	7	7
6	7	7
7	7	7
8	7	7
9	7	7
10	107	107
		1700

Note: **Future value = Coupon amount only. (as reinvestment rate = 0)**

Calculating realized yield (r)

- $90(1 + r)^{10} = 170$
- $(1 + r)^{10} = 170/90$
- r = 0.06566 or 6.566% per half year i.e. **13.132% p.a.**

Duration of portfolio (ICAI wrong technical treatment)

 # Ques 11 - Comcast

The investment portfolio of Comcast bank is as follows:

Bond	Purchase rate	Duration
G.O.I. 2006	106.5	3.50 years
G.O.I. 2010	105	6.50 years
G.O.I. 2015	105	7.50 years
G.O.I. 2022	110	8.75 years
G.O.I. 2032	101	13.00 years

Face value of total investment is ₹5 crores in each Govt. Bond. Face value of each bond is ₹100.

(i) Calculate actual investment in portfolio.

(ii) Calculate Existing Average Duration of Portfolio. What are suitable steps (action) in following 2 scenarios assuming you have to buy one security and sell Another security?

(iii) Interest rates are expected to lower by 25 basis point. Also Calculate the revised duration.

(iv) Interest rates are expected to raise (increase) by 75 basis points (assuming 75 basis point change will take a longer period and such change will have no effect on GOI 2006 Bonds). Calculate the revised duration.

Ans: **(i) Investment in portfolio:** **(in ₹ crores)**

G.O.I.2006 = (5 crores / 100) x 106.5		5.325
G.O.I.2010 = (5 crores / 100) x 105		5.25
G.O.I.2015 = (5 crores / 100) x 105		5.25
G.O.I.2022 = (5 crores / 100) x 110		5.50
G.O.I.2032 = (5 crores / 100) x 101		5.05
	Total:	26.375

(ii) Average duration of portfolio

$= \{\frac{3.50 + 6.50 + 7.50 + 8.75 + 13}{5}$ = 7.85 years

Faculty Note: This is how ICAI solved this ques. But this treatment is technically wrong.

(iii) When interest rates are expected to fall by 25 bps

- Bond value increase if interest rates fall. Also, the higher the DoB -> the more the increase will be. Therefore, we shall sell off the low duration bond and shall buy high duration bond.

» **Strategy**: Sell GOI 2006 (as it has least DoB) & buy GOI 2032 (as it has max duration).

- Revised Duration of portfolio = $\frac{13+6.50+7.50+8.75+13}{5}$ = 9.75 years

(iv) **When interest rates are expected to rise by 75 bps**

- A rise in interest rates means a decrease in bond value. But, lower the DoB -> lesser will be decrease in value. Therefore, we shall sell off high duration bond and shall buy low duration bond.

» **Strategy**: Sell GOI 2032 (as it has max DoB) & buy GOI 2010.

- **Comment:** Why are we buying GOI 2010 when GOI 2006 has lower duration?
  As per the ques the change of 75 bps will take place over a longer time, the GOI 2006 would have been already redeemed. Hence, we shall buy next better alternate i.e., GOI 2010.

- Revised Duration of portfolio = $\frac{3.5+6.50+7.50+8.75+6.5}{5}$ = 6.55 years

Ch 5c - Rights, MMI + Other Minor Topics

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Money Market instruments	1 – 3
Repo Rate	4 – 5
Warrants	6
Value of Preference shares	7
Right shares	8 – 9
Enterprise value (EV multiple)	10 – 11
Value as per Yield Approach	12

Index - Additional Questions	**Ques Number**
Application based questions	1
Right Shares	2 – 3
Low Probability Unique Questions	
- Right vs Public issue + Reverse calculation of issue price	4
- Impact of Additional debt on interest coverage ratio	5
- Maximum loan under given condition	6

Main Questions

👉 Money Market instruments

Issue price (Net amount) of commercial paper

 # Ques 1 – Zuricon {SM TYK, Dec 21 MTP 2 (Old)}

Zuricon Ltd. issued commercial paper worth ₹10 crores. Details are:

Date of Issue:	16th Jan, 2019	Date of Maturity:	17th Apr, 2019
No. of days:	91	Interest Rate:	12.04% p.a.

What was the net amount received by the company on issue of CP?

Ans: Net amount of commercial paper price = $\frac{10 \text{ crores}}{(1 + 0.1204 \times 91/365)}$ = ₹ 9.7086 crores

Discount vs Yield of commercial bill

 # Ques 2 – Kinzal {SM Illus}

Kinzal bank discounted a commercial bill with a face value of ₹100 @ 15% for 2 months. Calculate

a) Amount of discount

b) The amount paid by bank for this bill i.e. Sale value (SV) of bank.

c) The yield of the bank (or the cost of the customer / borrower).

Ans: i) Discount amount = 100 x 15% x 2/12 = ₹ 2.50

ii) Amount paid by bank = Face value – Discount = 100 – 2.50 = ₹ 97.50

iii) Bank's yield (or cost of borrower) = $\frac{\text{Discount}}{\text{Sale amount}} \times \frac{12}{N} = \frac{2.5}{97.5} \times \frac{12}{2} = 0.1538$ or 15.38%

Note: Same Ques can be framed for certificate of deposit (CD) or CP. **Treatment will remain same.**

Calculating "Effective interest cost" of CP issue

 # Ques 3 – Sutala {N20 Exam (Old), M23 RTP}

From the following particulars, calculate the **Effective rate of interest p.a.** as well as the total cost of funds to Sutala Ltd., which is planning a CP issue?

Issue Price of CP (P)	₹ 97,550
Face Value (F)	₹ 1,00,000
Maturity Period	3 Months

	Issue Expenses:			
	Brokerage	0.15% for 3 months		
	Rating Charges	0.50% p.a.		
	Stamp Duty	0.175% for 3 months		
Ans:	Yield of CP = $\frac{F - P}{P}$	= $\frac{1,00,000 - 97,550}{97,550}$	=	2.512% for 3 months.
•	**Effective annual rate = $(1 + 0.02512)^4$ = 10.43% p.a.**			
(ii)	**Cost of funds to company:**			
	Effective Interest =	10.43%		
(+)	Brokerage: 0.15 x 4 =	0.6%		
(+)	Rating charges =	0.5%		
(+)	Stamp duty: 0.175 x 4 =	0.7%		
	Total:	12.23% p.a.		
👉	**Repo Rate**			
	Repo rate – Repayment @ Maturity			
#	**Ques 4 – Bank Vacu**			**{SM TYK, N23 MTP 2, M24 MTP 2}**
	Bank Vacu entered into a Repo for 14 days with Bank B in 10% GOI Bonds 2028 @ 5.65% for ₹8 crore. Assuming that clean price be ₹99.42 and initial Margin be 2% and days of accrued interest be 262 days. Assume 360 days in a year. You are required to determine:			
(i)	Dirty Price	(ii) Repayment at maturity.		
Ans:	i) Dirty Price = Clean price + Accrued Interest = 99.42 + {100 x 10% x 262/360} = ₹106.70			
(ii)	**Repo Rate Calculations:**			**(₹ Crores)**
	Face Value of Bonds:			8
	Market value of Bonds: = 8 x 106.70%			8.536
(-)	Initial margin @ 2%			(0.17072)
=>	Value of 1st leg of repo =			8.36528
	Calculating Value of 2nd (i.e., re-payment at maturity)			
•	Value of 1st leg =			8.36528
(+)	Interest under repo = 8.36528 x 5.65% x 14/360 =			0.01838
=>	Value of 2nd leg =			8.38366

- Therefore, the repayment amount on maturity is ₹8.38366 crores.

Reverse calculating Repo rate from given data

 # Ques 5 - Power Kuretz **{N24 RTP}**

The Bank Power Kuretz (Bank PK) enters into a Repo for 9 days with Bank JJ in 6% Government Bonds 2022 for an amount of ₹20 crore. The other relevant details are as follows:

- First Leg Payment (Start Proceed) ₹ 20,00,67,500
- Second Leg Payment (Repayment Proceed) ₹ 20,03,17,590
- Initial Margin 1.25%
- Days of accrued interest 240

Assume 360 days in a year.

Calculate: (i) Repo Rate (ii) Dirty Price (iii) Clean Price

Ans: Second Leg = Start Proceed x $\{1 + \text{Repo rate} \times \frac{\text{No. of days}}{360}\}$

- 20,03,17,590 = 20,00,67,500 x {1 + Repo rate x 9/360}
- Repo rate = 0.05 or 5% p.a.

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

- 20,00,67,500 = 20,00,00,000 x $\frac{\text{Dirty Price}}{100} \times \frac{\text{100-1.25}}{100}$
- 10003.375 = 98.75 x Dirty Price
- Dirty price = ₹ 101.30

(iii) Dirty Price = Clean Price + Interest Accrued

- 101.30 = Clean Price + 100 x 6% x 240/360
- Clean price = ₹ 97.30

👉 Warrants

 # Ques 6 – Bossy

Calculate theoretical value of warrant with provides an option (right) to purchase 10 Equity shares of Bossy Ltd. at ₹80 per share if current market price per share (CMP) is: -

(i) ₹95 (ii) ₹70

Ans: Theoretical value of warrant (W) = Max { (CMP – E) x n, 0}

Where E = Exercise price & n = no. of shares.

i) W = Max { (95 – 80) x 10, 0} = ₹ 150

ii) W = Max { (70 – 80) x 10, 0} = ₹ 0. Since value of warrant cannot be negative. Hence, value = zero.

👉 Value of Preference shares

Value of a portfolio containing preference shares

 # Ques 7 – Microsoft {N23 RTP}

Compute the current value of Microsoft's portfolio. Microsoft holds securities as detailed herein below. Compute the current value of Microsoft portfolio.

	Security	Face Value	Qty	Rate	Maturity years	Annual yield
(i)	Bond A	1,000	100	9	3	12%
(ii)	Bond B	1,000	100	10	5	12%
(iii)	Pref. share C	100	1,000	11	*	13%*
(iv)	Pref. share D	100	1,000	12	*	13%*

*Likelihood of being called (redeemed) at a premium over par.

Ans:	Value		Qty	Total value
•	Bond A = 90 x PVAF(12%, 3) + 1000 x PVF(12%, 3)	= 927.945	100	92,794.5
•	Bond B = 100 x PVAF(12%, 5) + 1000 x PVF(12%, 5)	= 927.904	100	92,790.4
•	Preference Share C = Coupon / Yield = 11 / 13%	= 84.615	1000	84,615
•	Preference Share D = Coupon / Yield = 12 / 13%	= 92.308	1000	92,308
»	Total			362507.90

So, current value of portfolio is ₹362507.90.

👉 Right shares

Right issue + Impact if SH do nothing

 # Ques 8 – Urvashi {N23 Exam}

Urvashi Ltd. currently have 10,000 shares. Current MPS = ₹15. It is offering a right issue of 1 share for every 4 shares held. Right offer price is ₹10 per share. Calculate:

(i) Theoretical post right price i.e., Ex-right price per share.

(ii) Theoretical value of right

(iii) A shareholder owns 1000 shares of the Co. Calculate his gain or loss if he decides to:

(a) sell the rights (b) Do nothing.

Ans: Ex-right price = $\frac{nP_0 + n_1P_1}{n + n_1} = \frac{15 \times 10000 + (2500 \times 10)}{10000 + 2500} = ₹14$

Where: n = no. of existing equity shares P_0 = CMP

n_1 = no. of new shares offered P_1 = Right issue price

(ii) Theoretical value of right = Ex-right price – Cost of right share = 14 – 10 = ₹4

or Value per share basis = 4/4 = ₹1 per share

(iii)	Gain / Loss in wealth	(a) If rights are sold	(b) If rights are not sold
A.	**Value before Right issue**		
	Value of 1000 shares	1000 x 15 = 15,000	1000 x 15 = 15,000
B.	**Value after Right issue**		
	Value of 1000 shares after right issue	1000 x 14 = 14,000	1000 x 14 = 14,000
	Sale proceeds from rights:	(1000 / 4) x 4 = 1000	Nil
	Total value:	15000	14000
C.	Loss in wealth = A – B	Nil	1000

Right issue + Change in wealth after right

 # Ques 9 – Six Paths **{SM TYK, N18 RTP (New)}**

Six paths Ltd's shares are currently selling at 13 per share. There are 10,00,000 shares outstanding. The firm is planning to raise 20 lakhs to Finance a new project.

Required: What are the ex-right price of shares and the value of a right, if

(i) The firm offers one right share for every two shares held.

(ii) The firm offers one right share for every four shares held.

(iii) How does the shareholders' wealth (holding 100 shares) change from (i) to (ii)? How does right issue increases shareholders' wealth?

Ans:	Particulars	1:2 Right shares	1:4 Right shares
•	Requirement	20,00,000	20,00,000
•	Number of shares	10L x ½ = 5L	10L x ¼ = 2.5L
•	Subscription price	20L / 5L = 4	20L / 2.5L = 8
•	Ex-right price	$\frac{130L + 20L}{10L + 5L} = 10$	$\frac{130L + 20L}{10L + 2.5L} = 12$

•	Value of right	10 – 4 = 6	12 – 8 = 4
•	Value of right per share	6 / 2 = 3	4 /4 = 1

(iii)	**Total wealth after Right Issue**	**(a) 1:2 Right shares**	**(b) 1:4 Right shares**
•	Number of shares after right	100 x 3/2 = 150	100 x 5/4 = 125
•	Value of shares after right issue	150 x 10 = 1,500	125 x 12 = 1,500
•	Less: Amount paid to acquire shares	50 x 4 = (200)	25 x 8 = (200)
»	Total wealth:	1,300	1,300

» Wealth before right issue = 100 x 13 = 1,300.

» Thus, there will be no change in the wealth of shareholders from (i) and (ii).

👉 Enterprise value (EV multiple)

Reverse calculating MV of equity using EV/EBITDA ratio

 # Ques 10 – Oak

Calculate Market value (MV) of equity of Oak plc using the following info:

(i) EV / EBITDA ratio = 6.8 (iii) EBITDA = ₹12 Lacs

(ii) MV of Debt = ₹50 Lacs (iv) Cash & Cash equivalent = ₹7 Lacs.

Ans: EV / EBITDA = 6.8

» EV = 6.8 x 12 = ₹ 81.6 L

• EV = MV of Equity + MV of Debt – Cash & Cash Equivalent.

• 81.6 = MV of Equity + 50 – 7

» MV of Equity = ₹38.6 lacs.

Basic calculation – EV/EBITDA ratios, Price/EBITDA ratio

 # Ques 11 – Chaturangna

Following is Balance Sheet of Chaturangna Ltd. **(₹ crores)**

Equity Share capital (Face value = ₹10)	500	PPE	2850
Reserve and Surplus	2000	Capital work in progress	750
Long term Debt (12%)	600	Current assets except cash	200
Other long-term liabilities	800	Cash & cash equivalent	400
Current liabilities	300		
	4200		4200

	Further relevant extracts from P&L account are:	
	Depreciation	35
	Amortization	15
	Net Income	260
	Net income from continuing operations	235
	Tax	40

Current market price of Equity share is ₹68 per share.

Calculate: (i) EV/EBITDA ratio (ii) Price/EBITDA ratio

Ans: EV = MV of Equity + MV of debt (-) cash & cash equivalents = {50 x 68} + 600 – 400 = ₹3600

Note 1 -- No. of equity shares = 500/10 = 50 crores

Note 2 -- MV of debt is not given. So, book value is used.

- EBITDA = Net operating income from continuing operations + Tax + Interest + D&A
- EBITDA = 2350 + 40 + {600 x 12%} + 35 + 15 = 397

» EBITDA per share = 397/50 = 7.94

(i) EV / EBITDA = 3600 / 397 = 9.068

(ii) Price / EBITDA = 68 / 7.94 = 8.56

👉 **Value as per Yield Approach**

Value of share as per Yield approach

 # Ques 12 – Sun **{SM TYK}**

Capital structure of Sun Ltd., as at 31.03.2003 was as under:	(₹ in lacs)
Equity share capital	80
8% Preference share capital	40
12% Debentures	64
Reserves	32

Sun Ltd. earns a profit of ₹32 lacs annually on an average before deduction of income tax, which works out to 35%, and interest on debentures. Sun Ltd. has been regularly paying equity dividend of 8%. Normal return on equity shares of similar Co.'s is 9.6% provided:

(i) PAT covers fixed interest and fixed dividends at least 3 times.

(ii) Capital gearing ratio is 0.75.

(iii) Yield on share is calculated at 50% profits distributed and at 5% on undistributed profits.

Calculate value per equity share of the co. assuming risk-free premium as:

(a) 1% for every one time of difference for Interest and Fixed Dividend Coverage.

(b) 2% for every one time of difference for Capital Gearing Ratio.

Ans: **(i) Calculation of Profit after Tax (PAT)** **(₹)**

	Profit before interest and Tax (PBIT)	32,00,000
(-)	Debenture interest (64,00,000 x 12/100)	(7,68,000)
»	Profit before tax (PBT)	24,32,000
»	Profit after tax (PAT) = PBT x 0.65	15,80,800
(-)	Preference Dividend (40,00,000 x 8/100)	(3,20,000)
(-)	Equity Dividend (80,00,000 x 8/100)	(6,40,000)
»	Retained earnings (Undistributed profit)	6,20,800

 # Interest and Fixed Dividend Coverage

$$\frac{\text{PAT + Debenture interest}}{\text{Debenture interest + Preference Dividend}} = \frac{15,80,800 + 7,68,000}{7,68000 + 3,20,000} = \frac{23,48,800}{10,88,000} = 2.16 \text{ times}$$

(ii) Calculation of Capital Gearing Ratio

$$\text{Capital Gearing Ratio} = \frac{\text{Fixed interest-bearing funds}}{\text{Equity shareholder's funds}} \text{ or } \frac{\text{Pref Share capital + Debentures}}{\text{Equity Share capital + reserves}}$$

$$\Rightarrow \frac{40,00,000 + 64,00,000}{80,00,000 + 32,00,000} \Rightarrow \frac{1,04,00,000}{1,12,00,000} \Rightarrow 0.93$$

(iii) Calculation of "Actual" Yield on Equity Shares: **(₹)**

•	50% on distributed profits = 6,40,000 x 50%	3,20,000
•	5% on undistributed profits = 6,20,800 x 5%	31,040
	Yield on Equity shares	3,51,040

- Yield on equity shares % = $\frac{\text{Yield on shares x 100}}{\text{Equity Share Capital}} = \frac{3,51,040 \times 100}{80,00,000} = 4.39\%$

(iii) Calculation of "Expected" Yield on Equity shares

(A) Interest and Fixed dividend coverage of Sun Ltd. is 2.16 times but the industry average is 3 times.

- Therefore, risk premium is added to Sun Ltd. shares @ 1% for every 1 time of difference
- Risk Premium = (3 – 2.16) x 1% = 0.84 x 1% = 0.84%

(B) Capital gearing ratio of Sun Ltd. is 0.93 but the industry average is 0.75 times.

- Therefore, risk premium is added to Sun Ltd. shares @ 2% for every 1 time of difference.
- Risk Premium = (0.75 – 0.93) x 2% = 0.18 x 2% = 0.36%

» Expected yield on Sun ltd. = Normal expected return + Additional Risk premium for higher risk

= 9.60 + 0.84 + 0.36 = 10.80%

» Value of Equity share = $\frac{\text{Actual Yield}}{\text{Expected Yield}} \times \text{Paid-up value of share} = \frac{4.39}{10.80} \times 100 = ₹ 40.65$

Additional Questions

👉 Application based questions

Reverse calculation – Period of investment to achieve desired return

 # Ques 1 – Wonderland {SM TYK, N20 MTP 1 (Old)}

Wonderland Limited has excess cash of ₹20 lakhs, which it wants to invest in short term marketable securities. Expenses relating to investment will be ₹50,000. The securities invested will have an annual yield of 9%. The company seeks your advice:

(i) As to the period of investment so as to earn a pre-tax income of 5%.

(ii) Minimum period for the co. to breakeven its investment expenditure over time value of money.

Ans: Let months of investment be "P".

Case 1 – Required income = 20L x 5% = 1L

- {20 x 9% x P/12} – 0.5 = 1
- 0.15P = 1.5
- P = 10 months

Case 2 – Break-even period

- {20 x 9% x P/12} – 0.5 = 0
- 0.15P = 0.5
- P = 3.33 months

👉 Right shares

Reverse calculation – Ratio of right issue to achieve desired Ex-right price

 # Ques 2 – Salesforce {N22 MTP 2}

Salesforce Ltd. is proposing to fund its expansion plan of ₹12 crore by making a rights issue. The current market price (CMP) is ₹40. The Board is willing to offer a discount of 20% on the CMP for the rights issue. The Board is also desirous that the fall in Ex-right price of the shares be restricted to 10% of CMP. **Calculate**:

(1) The number of new equity shares to be offered for each rights held

(2) Theoretical value of right and

(3) The total number of equity shares to be issued.

Ans: **(i) Number of new equity shares to be offered for each rights head**

- Subscription Price = ₹40 × 0.80 = ₹32 per share
- Ex Right Price to be restricted to = ₹40 × 0.90 = ₹36
- Let R be the ratio in which right share to be issued then:
- $36 = \frac{40 + 32R}{1 + R}$ → R = 1
- Thus, 1 equity share be offered for each share held.

(ii) Theoretical Value of right = 36 – 32 = ₹ 4

(iii) No. of equity share to be issued = 12 crore / 32 = 37,50,000 or 0.375 crore shares

Profit on sale of Rights

 # Ques 3 – Nue

Nue Ltd.'s stock is selling at ₹50. The Co. announces a 1:5 right issue at a price of ₹40. **Calculate**:

(i) New theoretical ex-right price.

(ii) Theoretical value of right when the stock is selling rights on?

(iii) Theoretical value of right when the stock sells ex-right at ₹50.

(iv) Sumira has ₹1000 & believes that stock price (ex-right) will increase from ₹50 to ₹60. She has two alternates:

(a) Go long on the shares of Nue Ltd.'s

(b) Purchase rights at the prevailing market price of rights (as computed in part C) and later sell these rights. Calculate her profit/loss under each scenario.

Ans: (i) Ex-right price = $\frac{nP_0 + S}{n + n_1} = \frac{5\times50 + 1\times40}{6}$ = ₹48.33

(ii) Value of right = 48.33 – 40 = ₹8.33

(iii) Value of right **if ex-rights price of share is ₹50** = 50 – 40 = ₹10

(iv)

(a) Long shares	**(₹Amt.)**
Go long on 20 shares (i.e. 1000 ÷ 50)	1000
Sell 20 shares @ ₹60: 20 x 60	1200
Profit:	200

	(b) Buy rights	**(₹Amt.)**
	Buy 100 rights (1000 ÷ 10)	1000
	Sell 100 rights @ ₹20 (i.e., 60 – 40)	2000
	Profit:	1000
	Hence, Trading rights is more profitable.	

👉 Low Probability Unique Questions

Right vs Public issue + Reverse calculation of issue price

 # Ques 4 - Telbel

Telbel Limited is considering undertaking a major expansion an immediate cash outlay of ₹150 crore. The Board of Director of co. are expecting to generate an additional profit of ₹15.3 crore after a period of one year. Further it is expected that this additional profit shall grow at the rate of 4% for indefinite period in future. Presently, Telbel Ltd. is completely equity financed and 50 crores shares of ₹10 each. The current market price of each share is ₹22.60 (Cum dividend). The company has paid a dividend of ₹1.40 per share in last year. For the last few years dividend is increasing at a compound rate of 6% p.a. and it is expected to be continued in future also. This growth rate shall not be affected by expansion project in any way.

 # Boards of Directors are considering following ways of financing the possible expansion:

1. A right issue on ratio of 1:5 at price of ₹15 per share.
2. A public issue of shares.

In both cases the dividend shall become payable after one year.

 # You as a Financial Consultant required to:

(a) Determine whether it is worthwhile to undertake the project or not.

(b) Calculate ex-dividend market price of share if complete expansion is financed from the right issue.

(c) Calculate the number of new equity shares to be issued and at what price assuming that new shareholders do not suffer any loss after subscribing new shares.

(d) Calculate the total benefit from expansion to existing shareholders under each of two financing option.

Ans: **Calculating cost of Capital (Ke)**

- Ex-dividend price (P_0) = 22.60 – 1.40 = 21.20
- $P_0 = \frac{DPS_0 \times (1+g)}{Ke - g}$ => $21.20 = \frac{1.40 \times 1.06}{Ke - 0.06}$ => Ke = 13%

(a) Project NPV = PVCI – PVCO = $\frac{15.30}{0.13 - 0.04}$ – 150 = ₹20 crores

- NPV is positive. Accept project.

(b) Ex-dividend MPS if expansion is financed via right issue

- New MV of co. = Current MV + Amount raised from new issue + NPV of new project
- New MV of co. = {50 x 21.20} + 150 + 20 = ₹ 1230 crores
- New Ex-right MPS = $\frac{\text{New MV of Co.}}{\text{No. of shares after right issue}} = \frac{1230}{50 + \{50 \times 1/5\}}$ = ₹ 20.5 per share

(c) Price such that new subscribers do not suffer any loss.

- i.e. MPS after issue should be equal to Issue Price (P).
- No. of new shares to be issued = 150 / P
- MPS after issue = Issue price
- $\frac{1230}{50 + 150/P} = P$
- 1230 = P (50 + 150/P)
- P = ₹21.6

» Hence, issue price should be ₹21.6.

» No. of new shares to be issued = 150/21.6 = 6.9444 crores.

(d)	Calculating Benefit	1:5 Right issue	Public issue
•	Total MV of Co. after issue	1230	1230
(-)	Current shareholders wealth = 50 x 21.20	(1060)	(1060)
(-)	Amount paid to acquire new shares	15 x 10 = 150	6.944 x 21.6 = 150
	» Benefit	₹20 crores	₹20 crores

Faculty Note: Note that the benefit is equal to NPV of new project.

Impact of Additional debt on interest coverage ratio

 # Ques 5 – Bhishma

Bhishma Ltd. is presently working with an EBIT of ₹90 lacs. Its present borrowings are as follows:

•	12% term loan ₹ 300 Lacs
•	Working capital borrowings: From Bank @ 15% ₹ 200 Lacs
	Public Deposit @ 11% ₹ 100 Lacs
	The sale of the company is growing and to support this, the company proposes to obtain additional borrowing of ₹100 lacs expected to cost 16%. The increase in EBIT is expected to be 15%. Calculate the change in interest coverage ratio after the additional borrowing is affected and comment on the arrangement made.
Ans:	**Present scenario**:
•	Total interest payable = {300 x 12%} + {200 x 15%} + {100 x 11%} = 36 + 30 + 11 = ₹ 77 Lacs
•	Interest coverage ratio = EBIT / Interest charges = 90 / 77 = 1.169
#	**Revised scenario as per new proposal**
•	Revised EBIT = 90L x 1.15 = ₹ 103.50 Lacs
•	Revised total interest = Existing interest cost + Additional cost = 77 + {100 x 16%} = ₹ 93 Lacs
•	Revised Interest coverage ratio = 103.50 / 93 = 1.113
	Comment: The burden of interest on additional borrowing of ₹100 lacs will adversely affect the interest coverage ratio which has been reduced (i.e. from 1.169 to 1.113).
	Maximum loan under given condition
#	**Ques 6 – Hill**
	Hill plc is having ₹8 Crore of 10% mortgage bonds outstanding under a plan. The plan allows additional bonds to be issued as long as all the following conditions are met:
(1)	Pre-tax interest coverage (Income before tax + bond interest) remains 4.
(2)	Net depreciated value of mortgage assets remains twice the amount of the mortgage debt.
(3)	Debt to equity ratio remains 5.
	The HILL has a net income, after taxes ₹2 Crore and a 40% tax rate, ₹40 Crore in equity and ₹30 Crore in depreciated assets, covered by the mortgage. Assuming, that 50% of the proceeds of a new issue would be added to the base of mortgage assets, how much more mortgage 10% debt could be sold under each of three conditions? Which protective convent (minimum limit) is binding or under which condition amount of additional bond is coming least?
Ans:	Let the additional amount of debt issued be a.
#	**Condition 1: Minimum Interest coverage ratio = 4**
	Interest coverage ratio = Profit before tax & Interest / Total Interest payments

$$4 = \frac{(2 \div 0.6) + 8 \times 0.1 + a \times 0.1}{8 \times 0.1 + a \times 0.1}$$

=> $4 \times (0.8 + 0.1a) = 4.133 + 0.1a$

=> $a = 3.11$ crores.

Condition 2: $\frac{\text{Mortgage assets}}{\text{Mortgage bonds}} = 2$

$$\frac{30 + 0.5a}{8 + a} = 2$$

=> $30 + 0.5a = 16 + 2a$

=> $a = 9.33$ crores.

Condition 3: Debt to equity ratio = 5

$$\frac{8 + a}{40} = 5 \quad \Rightarrow a = 192 \text{ crores.}$$

∴ Condition I is binding. The maximum possible debt issue ₹3.11 crores.

Ch 6 – Portfolio Mngt

Index - Main Questions	**Ques Number**
Basic Questions	1 – 6
CAPM, SML, CML etc.	7 – 8
Assuming Portfolio = Market type questions	9 – 11
Sharpe's, Treynor ratio, Jenson's Alpha	12 – 14
Beta Calculation of individual stock	15 – 17
Portfolio Beta	18 – 21
Using Risk-free securities to change portfolio beta	22
Using Price & div. data to cal. Beta, CAPM etc.	23 – 24
Total, Systematic & Unsystematic Risk	25 – 29
Efficient Frontier, Minimum variance portfolio	30 – 31
Arbitrage Pricing Theory (APT)	32 – 36
Co. Beta = Weighted avg beta of equity & debt	37
Portfolio Rebalancing	38 – 40
Corner Theorem	41
Discrete Ques	42 – 45

Index - Additional Questions	**Ques Number**
Basic Questions, CAPM + SML etc., Ratios	1 – 4
Portfolio Rebalancing	5
Master practice example	6
Low probability – Unique questions	
- Constant Risk Premium vs Historical Risk Premium	7
- Reverse calculation – SD of stock & market using given info	8
- $Beta_{Equity}$ when $Beta_{Debt} \neq 0$ & capital structure of the co. is changing	9
- Beta of co. = Weighted avg beta of departments	10
- Sharpe Cut-off model	11
- Bifurcating Active return	12
- Beta of merged entity	13

Main Questions

Basic Questions

Basic Portfolio SD calculation

 # Ques 1 – Tilottama {SM TYK, Dec 21 RTP (Old)}

Tilottama is interested to invest ₹1,00,000 in the securities market. He selected two securities B and D for this purpose. The risk return profile of these securities are as follows:

Security	Risk	Expected Return (ER)
B	10%	12%
D	18%	20%

Co-efficient of correlation between B and D is 0.15. You are required to calculate the portfolio risk and return of the following portfolios of B and D to be considered for this investment:

(a) 100% investment in B only

(b) 75% of the fund in B and 25% of the fund in D

(c) 100% percent investment in D only

Ans: **I. Calculation of portfolio returns**

Return of portfolio (R_p) = Weighted average return of components

Case	Weight of B	Weight of D	Portfolio Return
a)	100%	0%	100% x 0.12 = 12%
b)	75%	25%	75% x 0.12 + 25% x 0.2 = 14%
c)	0%	100%	100% x 0.2 = 20%

II. SD of portfolio (σ_p)

$$\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + 2\omega_a\omega_b(\sigma_a\sigma_b r_{a,b})$$

a) σ_p if 100% is invested in stock B = 10% (i.e. SD of Stock B)

b) 75% in stock B and 25% in stock D

σ_p^2 = $(0.1 \times 0.75)^2 + (0.18 \times 0.25)^2 + 2\times0.75\times0.25(0.1\times0.18\times0.15)$ = 0.0086625

σ_p = $\sqrt{0.0086625}$ = 0.093 or 9.3%

c) σ_p if 100% is invested in stock D = 18% (i.e. SD of Stock D)

Master practice example (using historical data) – Cal. of SD, Covariance, Correlation

 # Ques 2 – Kunoichi **{SM TYK, M18 Exam (New), N19 RTP (New), N20 RTP (Old)}**

Your manager Kunoichi is considering information on two stocks - Stock A & Stock B.

Year	Return on A%	Return on B%
2006	10	12
2007	16	18

You are required to determine:

(i) Average return on a portfolio containing A and B in the proportion of 40% and 60% respectively

(ii) Standard deviation of return from each of the two stocks

(iii) The covariance of returns from the two stocks

(iv) Correlation coefficient between the returns of the two stocks

(v) The risk of a portfolio containing A and B in the proportion of 40% and 60%

Ans:

	R(x)	R(y)	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$	$(x - \bar{x})(y - \bar{y})$
	10	12	-3	-3	9	9	9
	16	18	3	3	9	9	9
Total:	26	30	-	-	18	18	18
Avg:	13	15	-	-	9	9	9 (Cov)

i) Average return of portfolio (R_p) = {13 x 0.4} + {15 x 0.6} = 14.2%

ii) Variance (σ^2) = $\Sigma(x - \bar{x})^2 \div n$

- σ_A^2 = 18/2 = 9 => σ_A = 3%
- σ_B^2 = 18/2 = 9 => σ_B = 3%

iii) Covariance (x,y) = $\Sigma(x - \bar{x})(y - \bar{y}) \div n$ = 18/2 = 9

iv) Correlation = $\frac{\text{Covariance}}{\sigma_A \times \sigma_B} = \frac{9}{3 \times 3} = 1$

v) Risk of portfolio (σ_p)

- When r = 1, SD of portfolio = weighted average SD
- σ_p = {3 x 0.4} + {3 x 0.6} = 3%

Master practice example (using probabilities) – Cal. of SD, Covariance, Correlation

 # Ques 3 – Simha **{SM TYK, N18 Exam (Old)}**

Mr. Simha expects the distribution of return of security 'X' and the Stock 'M' is given below:

Probability	Return of X %	Return of M %
0.30	30	-10
0.40	20	20
0.30	0	30

You are required to calculate:

(i) Average return on a portfolio containing X and M in the proportion of 70% and 30% respectively

(ii) Standard deviation of return from each of the two stocks

(iii) The covariance of returns from the two stocks

(iv) Correlation coefficient between the returns of the two stocks

(v) The risk of a portfolio containing X and M in the proportion of 70% and 30%

Ans: **Calculating Expected Return (ER)**

ER of security X (E.Rx) = 30 x 0.3 + 20 x 0.4 + 0 = 17%

ER of security M (E.Rm) = 10 x 0.3 + 20 x 0.4 + 30 x 0.3 = 14%

Prob.	Rx	Rm	$(x - \bar{x})$	$(m - \bar{m})$	$P(x - \bar{x})^2$	$P(m - \bar{m})^2$	$P(x - \bar{x})(m - \bar{m})$
0. 3	30	-10	13	-24	50.7	172.8	-93.6
0. 4	20	20	3	6	3.6	14.4	7.2
0. 3	0	30	-17	16	86.7	76.8	-81.6
	Total :				141	264	-168

(i) Average return of portfolio (70% X, 30% M) = (17% x 0.7) + (14% x 0.3) = 16.1%

(ii) SD of each stock	Stock X	Stock M
• Variance = $\Sigma P(x - \bar{x})^2$	141	264
• Standard deviation (σ) = $\sqrt{}$Variance	11.87%	16.29%

(iii) Covariance (x,m) = -168

(iv) Correlation = $\frac{\text{Covariance}}{\sigma_x \times \sigma_M} = \frac{-168}{11.87 \times 16.29} = -0.8688$

v) Risk of portfolio (σ_p)

- $\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + 2\omega_a\omega_b(Cov_{a,b})$
- σ_p^2 = (0.7 x 11.87) + (0.3 x 16.29) + 2(0.7×0.3)× −168 = 22.36
- σ_p = √22.36 = 4.73%

Calculation of SD of stock return (using expected price data)

 # Ques 4 – Texas {SM TYK}

Texas Ltd. stock costing ₹120 pays no dividends. Calculate expected return & SD of returns if the possible prices at the end of the year with the respective probabilities are:

Price (P1)	115	120	125	130	135	140
Probability	0.1	0.1	0.2	0.3	0.2	0.1

Ans: **Calculation of mean and SD**

Price	Prob.	Return*	Return %	P x Return	(x - $\bar{x}$)	P(x - $\bar{x}$)²
115	0.1	-5	-4.17%	-0.4167	-11.25	12.66
120	0.1	0	0%	0	-7.083	5.017
125	0.2	5	4.17%	0.8334	-2.913	1.698
130	0.3	10	8.33%	2.5	1.247	0.467
135	0.2	15	12.50%	2.5	5.417	5.869
140	0.1	20	16.67%	1.667	9.587	9.191
Total:				**7.083**		**34.902**

- Average return = 7.083%
- Variance (σ^2) = ΣP(x - $\bar{x}$)² = 34.902
- σ_S = √34.902 = 5.908%

SD of a portfolio consisting of 'three' stocks

 # Ques 5 – Shesha

Mr. Shesha has given the following information in respect of his portfolio:

Security	A	B	C
Weight	25%	50%	25%
S.D.	0.1689	0.0716	0.0345
Correlation with A	-	0.45	0.35
Correlation with B	-	-	0.20

Find out the S.D. of the portfolio.

Ans: $\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + (w_c\sigma_c)^2 + 2(\omega_a\sigma_a)(\omega_b\sigma_b)r_{a,b} + 2(\omega_a\sigma_a)(\omega_c\sigma_c)r_{a,c} + 2(\omega_b\sigma_b)(\omega_c\sigma_c)r_{b,c}$

- σ_p^2 = (25% × 0.1689)² + (50% × 0.0716)² + (25% × 0.0345)² + {2(25% × 0.1689)(50% × 0.0716)×0.45} + {2(25% × 0.1689)(25% × 0.0345)×0.35} + {2(50% × 0.0716)(25% × 0.0345)×0.20} = 48.779

- SD (σ_p) = √48.779 = 6.984%

Risk & return of a portfolio consisting of Risky & Risk-free asset

 # Ques 6 - Golf

If the rate of return and Standard Deviation of Market Portfolio (index) is 8% and 6% respectively and the risk-free rate of return is 5%, you are required to:

(i) Construct an efficient portfolio which produces expected return of 7.5% taking market and risk-free securities.

(ii) Calculate the risk of above portfolio (SD).

(iii) Suppose if Mr. Golf has ₹1,00,000 of his personal funds, then how he would construct his portfolio giving expected return of 10% and what will be risk of this portfolio.

Ans: Let weight of market be W_m. ∴Weight of risk free (W_{rf}) = 1 - W_m

i) Target return = 7.5%

- {8 x Wm} + {5 x (1 - Wm)} = 7.5
- Wm = 83.33% & Wrf = 100% - 83.33% = 16.667%

ii) SD of portfolio (σ_p) = Weight of risky asset x SD of risky asset = 6 x 83.33% = 5%

(iii) Target return = 10%

- {8% x Wm} + {5% x (1-Wm)} = 10%
- Wm = 166.67% & Wrf = -66.67%
- Hence, borrow 66.67% at rf and invest 166.67% in market.

👉 CAPM, SML, CML ETC.

Over/under valued using CAPM

 # Ques 7 – Jivika {SM Illus, M24 MTP 1}

Jivika Mf has gathered some data on 3 stocks. Expected returns & Beta of 3 stocks are:

	Stock	A	B	C
	Expected Return (%)	18	11	15
	Beta Factor	1.7	0.6	1.2

If Rf is 9% and the expected rate of return on the market portfolio is 14% which of the above stocks are over, under or correctly valued in the market? What shall be the strategy?

Ans: • Return as per CAPM = Rf + (Rm – Rf) β = 9 + (14 – 9).Beta = 9 + 5×Beta

Stock	Req. Return	Exp. Return	Valuation	Decision
A	9 + 5x1.7 = 17.5%	18%	Under Valued	Buy
B	9 + 5x0.6 = 12%	11%	Over Valued	Sell
C	9 + 5x1.2 = 15%	15%	Correctly Valued	Hold

Reverse calculation – Finding Rm & Rf using CAPM return data of 2 stocks

 # Ques 8 – Astika **{SM TYK}**

Assuming that shares of Astika Ltd. and XYZ Ltd. are correctly priced according to Capital Asset Pricing Model. The expected return from and Beta of these shares are as follows:

Share	Beta	Expected return
ABC	1.2	19.8%
XYZ	0.9	17.1%

You are required to derive Security Market Line.

Ans: CAPM = Rf+ β (Rm –Rf)

Accordingly

R_{ABC} = Rf + 1.2(Rm – Rf) = 19.8 (1)

R_{XYZ} = Rf + 0.9(Rm – Rf) = 17.1 (2)

Deduct (2) from (1)

2.7 = 0.3 (Rm – R f)

Rm – Rf = 9 (3)

Substituting in equation (1)

19.8 = Rf + 1.2×9

Rf = 9%

Rm – Rf = 9% -> Rm – 9% = 9% -> Rm = 18%

Security Market Line

= Rf + β (Market Risk Premium)

= 9% + β× 9%

👉 **Assuming Portfolio = Market type questions** (Absurd!! Technically incorrect!!)

Rm = Portfolio return (+ Cal. CAPM return of each security)

 # Ques 9 – Adya {SM TYK, M18 Exam (Old), N19 Exam (New)}

Mrs. Adya holds the following portfolio:

Share or Bond	Beta	Initial Price	Dividend	Market price at year end
Epsilon	0.8	25	2	50
Sigma	0.7	35	2	60
Omega	0.5	40	2	135
GOI Bonds	0.01	1,000	140	1,005

Risk-free return is 14%. **Calculate:**

i) The expected rate of return of each security using Capital Asset Pricing Method (CAPM)

ii) The average return of his portfolio.

Ans: **Calculating market return:**

- Total Po = 25 + 35 + 45 + 1000 = 1105
- Total P1 = 50 + 60 + 135 + 1005 = 1250
- Total dividend (D1) = 2 + 2 + 2 + 140 = 146

- $Rm = \frac{(P1 - P0) + D1}{P0} = \frac{(1250 - 1105) + 146}{1105} = 26.33\%$

 # CAPM E(Rp) = Rf + (Rm – Rf).β

Epsilon Ltd = 14 + 0.8 (26.33 - 14) = 23.86%

Sigma Ltd. = 14 + 0.7 (26.33 - 14) = 22.63%

Omega Ltd. = 14 + 0.5 (26.33 - 14) = 20.17%

GOI Bonds = 14 + 0.01 (26.33 - 14) = 14.12%

ii) Average Return of Portfolio

$\frac{23.86 + 22.63 + 20.17 + 14.12}{4} = \frac{80.78}{4} = 20.20\%$

• Alternatively, Average Beta (0.8+0.7+0.5+0.1)/4 = 0.5025

Average return = 14 + 0.5025 (26.33 - 14) = 14 + 6.20 = 20.20%

Rm = Portfolio return (+ Cal. CAPM return of each security)

 # Ques 10 – Camry {SM TYK}

Mr. Camry is holding the following securities:

Securities	Cost	Dividend	Price	Beta
Gold Ltd.	10,000	1,725	9,800	0.6
Silver Ltd.	15,000	1,000	16,200	0.8
Bronze Ltd.	14,000	700	20,000	0.6
GOI Ltd.	36,000	3,600	34,500	0.01

Average return of the portfolio is 15.7% using Average Beta.

(i) Calculate the expected rate of return in each case, using CAPM.

(ii) Also find the Risk-free rate of return.

Ans: **Calculating market return**

Total Po = 10,000 + 15,000 + 14,000 + 36,000 = 75,000

Total P1 = 9,800 + 16,200 + 20,000 + 34,500 = 80,500

Total dividend (D1) = 1725 + 1000 + 700 + 3600 = 7025

$$Rm = \frac{(P1 - P0) + D1}{P0} = \frac{(80500 - 75000) + 7025}{75000} = 16.70\%$$

• **Average beta (β_p) Calculator**

Whether to use P0 for the weight of beta or we should use P1?

Ans: None! This is not weighted average beta but rather simple average beta.

Hence, Average beta = $\frac{0.6 + 0.8 + 0.6 + 0.01}{0.75}$ = 0.50 (approx.)

ii) Average portfolio return using average Beta (i.e. Beta = 0.5) is 15.7%

15.7% = Rf + (16.7 – Rf) x 0.50

Rf = 14.7%

i) **Expected return of each security as per CAPM**

Expected return (as per CAPM) = Rf + (Rm – Rf)xβ

Gold Ltd. = 14.7 + (16.7 – 14.7) 0.6 = 15.90%

Silver Ltd. = 14.7 + (16.7 – 14.7) 0.8 = 16.30%

Bronze Ltd = 14.7 + (16.7 – 14.7) 0.6 = 15.90%

GOI Bonds = 14.7 + (16.7 – 14.7) 0.01 = 14.72%

Alternative Ans by ICAI:

Weighted average beta of portfolio:

- = $0.6 \times \frac{9,800}{80,500} + 0.8 \times \frac{16,200}{80,500} + 0.6 \times \frac{20,000}{80,500} + 0.01 \times \frac{34,500}{80,500} = 0.387$

Rf using G-securities

- Rf = $\frac{(34,500 - 36,000) + 3,600}{36,000} = 5.83\%$

Calculating Rm using CAPM:

- Return of portfolio = Rf + (Rm – Rf) x Beta
- 0.157 = 0.0583 + (Rm – 0.0583) x 0.387
- 0.25504 = Rm – 0.0583
- Rm = 0.31334 or 31.334%

Surprise!! Technically correct question under the type Rm = Portfolio return

 # Ques 11 – Silverado **{M24 MTP 2}**

Mr. Silverado is holding the following securities:

Particulars	Cost	Dividends/ Interest	Closing MPS	Beta
G Ltd.	20,000	1,450	19,600	0.6
S Ltd.	30,000	1,000	30,400	0.8
B Ltd.	28,000	1,400	32,000	0.6
GOI Bonds	72,000	5,060	71,980	0.01

(i) Find the Risk-free rate of return (Rf)

(ii) Calculate Expected rate of return of each security (except GOI Bond), using CAPM.

Notes: (1) Use weighted average Beta in calculations.

(2) Round off calculations upto 3 decimal points.

Ans: **(i) Rf = Return on GOI Bond** = $\frac{5,060 + (71,980 - 72,000)}{72,000}$ = 7%

(ii) **CAPM return of each security**

a. **Calculating portfolio return**

- Total Po = 20,000 + 30,000 + 28,000 + 72,000 = 1,50,000
- Total P1 = 19,600 + 30,400 + 32,000 + 71,980 = 1,53,980
- Total dividend (D1) = 1,450 + 1,000 + 1,400 + 5,060 = 8,910

- Rp = $\frac{(P1 - P0) + D1}{P0}$ = $\frac{(1,53,980 - 1,50,000) + 8,910}{1,50,000}$ = 8.593%

b. **Weighted Average of Beta**

- [0.6 x 19,600/1,53,980] + [0.8 x 30,400/1,53,980] + [0.60 x 32,000/1,53,980] + [0.01 x 71,980/1,53,980] = 0.076 + 0.158 + 0.125 + 0.005 = 0.364

c. **Calculating Market Return**

- 8.593% = 7% + (Rm – 7%) x 0.364
- Rm = 11.376%

d. **Return as per CAPM = Rf + β(Rm – Rf)**

- G Ltd. = 7% + 0.6 (11.376% – 7%) = 9.626%
- S Ltd. = 7% + 0.8 (11.376% – 7%) = 10.501%
- B Ltd. = 7% + 0.6 (11.376% – 7%) = 9.626%

👉 **Sharpe's, Treynor ratio, Jenson's Alpha**

Basic ratios calculation

 # Ques 12 – Mahika {SM TYK, Dec 21 RTP (Old), N18 RTP (New), M19 RTP (Old), N22 MTP 1}

Mahika MF observed that 5 Portfolio experienced the following results during a 7-year period:

Portfolio	Avg Annual Return (%)	SD %	Corelation with market Return (r)
A	19.0	2.5%	0.840

	B	15.0	2.0%	0.540
	C	15.0	0.8%	0.975
	D	17.5	2.0%	0.750
	E	17.1	1.8%	0.600

If Market Risk (SD) is 1.2%, Market Rate of return (Rm) is 14% and Risk-free rate (Rf) is 9%, then:

Rank the portfolio using:

(i) Sharpe's Method

(ii) Treynor's Method

(iii) Jensen's Alpha

Ans: **Calculating Beta & CAPM return of securities**

- CAPM return = Rf + (Rm – Rf)β = 9 + (14 – 9)β = 9 + 5β

#	Portfolio	Beta = $(\sigma_s \times r_{s,m}) / \sigma_m$	CAPM Return
	A	(2.5 x 0.84) / 1.2 = 1.75	9 + 5 x 1.75 = 17.75%
	B	(2 x 0.54) / 1.2 = 0.9	9 + 5 x 0.9 = 13.50%
	C	(0.8 x 0.975) / 1.2 = 0.65	9 + 5 x 0.65 = 12.25%
	D	(2 x 0.75) / 1.2 = 1.25	9 + 5 x 1.25 = 15.25%
	E	(1.8 x 0.6) / 1.2 = 0.90	9 + 5 x 0.9 = 13.50%

 # Calculations of Ratios

- Sharpe's Ratio = (Rp – Rf) / σ_p
- Treynor ratio = (Rp – Rf) / $Beta_p$
- Jenson's Alpha = Actual return – CAPM return

#		Sharpe		Treynor		Jenson's Alpha	
	Security	Ratio	Rank	Ratio	Rank	Ratio	Rank
	A	4	4	5.71	5	1.25	5
	B	3	5	6.67	4	1.50	4
	C	7.5	1	9.23	1	2.75	2
	D	4.25	3	6.80	3	2.25	3
	E	4.5	2	9	2	3.60	1

Sharpe/Treynor ratio calculation (when ratios give negative result)

 # Ques 13 – Outback {N20 Exam (New), M23 MTP 2}

The following are the details of three mutual funds of Outback:

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7.00	6.00	5.00	9.00
Variance	92.16	54.76	40.96	57.76
Coefficient of Determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 per cent per annum. You are required to:

(i) Rank the funds as per Sharpe's measure.

(ii) Rank the funds as per Treynor's measure.

(iii) Compare the performance with the market.

Ans:

Particulars	Growth	Balanced	Regular
• SD (√ Variance)	9.6	7.40	6.40
• Correlation (√Coefficient of determination)	0.55	0.81	0.98
• Beta ($r.\sigma_p / \sigma_m$)	0.695	0.789	0.825

• Sharpe ratio $(Rp - Rf)/\sigma_p$

• Treynor ratio $(Rp - Rf)/\beta$

Fund	Sharpe ratio	Sharpe rank	Treynor ratio	Treynor rank
Growth	(7 - 9) / 9.6 = -0.208	1	(7 - 9) / 0.695 = -2.878	1
Balanced	(6 - 9) / 7.4 = -0.405	2	(6 - 9) / 0.789 = -3.802	2
Regular	(5 - 9) / 6.4 = -0.625	3	(5 - 9) / 0.825 = -4.84	3

iii) **Comparison with market**

• SD of market = √57.76 = 7.6

• Sharpe ratio of market = (9-9) / 7.6 = 0

• Treynor ratio = 9 -9 / 1 = 0

» The performance of funds is poor since all values are negative as compared to market performance.

Reverse calculation – Using Jensen Alpha, Treynor ratio to calculate Rf

 # Ques 14 – Potential **{M23 Exam}**

Mr. Potential has made investments in two mutual funds. The following information is available:

Mutual Fund	Smart	Growth
Jensen Alpha	1.10%	1.50%
Treynor's Ratio	0.0714	0.0775

	Actual Return	8.50%	9.10%	
	Risk Premium		4%	
	You are required to calculate:			
(i)	Beta (β) for both the funds			
(ii)	Risk free Rate			
(iii)	Security Market Line			
Ans:	**For Smart Mutual fund**			
#	Jenson Alpha (α) = Actual return – CAPM Return			
•	0.011 = 0.085 – CAPM return			
•	CAPM return = 0.074			
»	Rf + Risk premium × Beta = CAPM return			
•	Rf + 0.04β = 0.074			
•	Rf = 0.074 – 0.04β			... (1)
#	Treynor ratio = $\frac{(Rp - Rf)}{\beta}$			
•	$0.0714 = \frac{(0.085 - Rf)}{\beta}$			
•	Putting value of Rf from (1)			
•	$0.0714 = \frac{0.085 - (0.074 - 0.04\beta)}{\beta}$			
•	0.0714β = 0.011 + 0.04β			
•	β = 0.011 / 0.0314 = 0.35			
(ii)	Hence, Rf = 0.074 – 0.04 × 0.35 = 0.06 or 6%			
(iii)	SML equation = Rf + Risk premium x Beta = 6% + 4% x Beta			
#	**For Growth Mutual fund**			
•	Treynor ratio = 0.0775			
•	$\frac{0.091 - 0.06}{\beta} = 0.0775$			
•	β = 0.4			

Beta Calculation

Basic calculations – Beta, Alpha, SML Equation

 # Ques 15 – Rover {SM TYK, M18 RTP, M19 RTP (Old), N20 MTP 1, N20 MTP 1 (Old), N23 MTP 1}

Probability	Market Return	A Ltd. Shares	B Ltd. Shares
0.5	7%	4%	9%
0.5	25%	40%	18%

An investor Mr. Rover wants to calculate:

(i) Beta of the two stocks (ii) Expected Return of each stock

(iii) Alpha of the two stocks (iv) SML Equation, if Rf is 7.5%

Ans: Particulars	Stock A	Stock B
(i) Beta = $\frac{\Delta \text{ in Rs}}{\Delta \text{ in Rm}}$	$\frac{40 - 4}{25 - 7} = 2$	$\frac{18 - 9}{25 - 7} = 0.5$
(ii) Expected return	4×0.5 + 40×0.5 = 22%	9×0.5 + 18×0.5 = 13.5%
(iii) CL Alpha = Rs – β.Rm (WN 1)	22 – 2×16 = –10%	13.5 – 0.5×16 = 5.5%
(iv) SML Equation = Rf + (Rm – Rf)β = 7.5% + (16% - 7.5%)×β = 7.5% + 8.5%×β		

Working Notes:

- Expected Return of Market = {7 x 0.5} + {25 x 0.5} = 16%
- Imp! Only Alpha is mentioned is written in ques. But it does not mention which Alpha i.e., Characteristic Line alpha or Jenson's alpha. If nothing is given -> Prefer Characteristic Line Alpha
- Characteristic Line → Rs = α + β.Rm

» α = Rs – β.Rm

Calculating Beta using historical return data

 # Ques 16 – Prana {SM TYK}

Mr. Prana has gathered info on market rates of Returns and Data from two Companies A and B:

	Year 2007	Year 2008	Year 2009
Market (%)	12.0	11.0	9.0
Company A (%)	13.0	11.5	9.8
Company B (%)	11.0	10.5	9.5

Determine the beta coefficients of the Shares of Company A and Company B.

Ans: Let a = Return of stock A, b = Return of stock B and Y = Market return

Year	a	b	y	(a - $\overline{a}$)	(b - $\overline{b}$)	(y - $\overline{y}$)	(y - $\overline{y}$)^2	(a - $\overline{a}$) (y - $\overline{y}$)	(b - $\overline{b}$) (y - $\overline{y}$)
1	13	11	12	1.57	0.67	1.33	1.77	2.09	0.89
2	11.5	10.5	11	0.07	0.17	0.33	0.11	0.02	0.06
3	9.8	9.5	9	-1.63	-0.83	-1.67	2.79	2.72	1.39
Sum:	34.3	31	32				4.67	4.83	2.34
Avg:	11.43	10.33	11.67				1.557	1.61	0.78

- Variance of market (σ_m^2) = 1.557

#	Calculating Beta	Stock A	Stock B
•	Covariance = $\Sigma(x - \overline{x})(y - \overline{y}) \div n$	4.83 / 3 = 1.61	2.34 / 3 = 0.78
•	Beta = Covariance / σ^2_m	1.61 / 1.557 = 1.03	0.78 / 1.557 = 0.5

Calculating Beta using ex-ante return data

 # Ques 17 – Narayanastra {SM TYK}

Mr. Narayanastra holds two stocks A and B. An analyst prepared ex-ante probability distribution for the possible economic scenarios and the Economic scenario Probability Conditional Returns %.

	Probability (P)	A	B	Market
Growth	0.40	25	20	18
Stagnation	0.30	10	15	13
Recession	0.30	(5)	(8)	(3)

The risk-free rate during the next year is expected to be around 11%. Determine whether the investor should liquidate his holding in stocks A and B or on the contrary make fresh investment in them if CAPM assumptions are holding true.

Ans: **Calculation of expected return (ER)**

ER of A = {25 x 0.4} + {10 x 0.3} + {-5 x 0.3} = 11.5%

ER of B = {20 x 0.4} + {15 x 0.3} + {-8 x 0.3} = 10.1%

ER of Market = {18 x 0.4} + {13 x 0.3} + {-3) x 0.3} = 10.2%

(ii) Calculating Covariance of stocks and Variance of market

Prob.	Ra %	Rb %	Rm %	(a - $\overline{a}$)	(b - $\overline{b}$)	(m - $\overline{m}$)	P(m - $\overline{m}$)^2	P.(a - $\overline{a}$) (m - $\overline{m}$)	P.(b - $\overline{b}$) (m - $\overline{m}$)
0.4	25	20	18	13.5	9.9	7.8	24.34	42.12	30.88
0.3	10	15	13	-1.5	4.9	2.8	2.35	-1.26	4.12
0.3	-5	-8	-3	-16.5	-18.1	-13.2	52.27	65.34	71.68
Avg:	11.5	10.1	10.2	-	-	-	78.96	106.20	106.68

- Variance of market = σ^2 = Σ P(m - $\overline{m}$)^2 = 78.96

(iii)	Details	Stock A	Stock B
•	Covariance = Σ P$(x - \overline{x})(y - \overline{y})$	106.20	106.68
•	Beta = Covariance / variance	106.20/78.96 = 1.345	106.68/78.96 = 1.351
•	CAPM Required return	11 + (10.2–11)1.345 = 9.924%	11 + (10.2–11)1.351 = 9.92%
•	Expected (estimated) return	11.5%	10.1%

(iv) **Comment** - Both stock A & B are undervalued as the actual/expected return > required return. Therefore, the investor should buy more shares of both Stock A and Stock B.

👉 Portfolio Beta

Basic question on portfolio risk & return

**Ques 18 – Aniruddha** **{SM TYK, N22 RTP, N22 MTP 2, M23 RTP}**

Aniruddha Ltd (A ltd.) has an Expected return of 22% and S.D. 40% B Ltd has an expected return of 24% and S.D. of 38%. A Ltd has a beta of 0.86 and B Ltd has a beta of 1.24. Correlation coefficient between the return of A Ltd and B Ltd is 0.72. The S.D. of the market return is 20%. **Suggest:**

(i) Is investing in B Ltd. is better than investing in A Ltd.?

(ii) If you invest 70% in A ltd. and 30% in B ltd. then what will be the expected return and SD of portfolio.

(iii) What is the market return and how much is the risk-free rate?

(iv) Derive SML (Security market line) equation.

(v) What is the beta of Portfolio if A Ltd.'s weight is 70% and B Ltd.'s weight is 30%?

Ans: i) B ltd has higher return and lower risk. So, its better to invest in B ltd.

(ii) Expected portfolio return (Rp) = {0.22 x 0.7} + {0.24 x 0.3} = 22.6%

- $\sigma_P^2 = (\sigma_a w_a)^2 + (\sigma_b \omega_b)^2 + 2(\sigma_a \omega_a)(\sigma_b \omega_b) r_{a,b}$
- σ_p^2 = (40 x 0.7)^2 + (38 x 0.3)^2 + 2.(40 x 0.7)(38 x 0.3)×0.72 = 1373.608

- σ_p = 0.3706 or 37.06%

iii) CAPM = Rf + (Rm – Rf) x Beta

- A ltd => 22 = Rf + (Rm – Rf) x 0.86 ……..1
- B ltd => 24 = Rf + (Rm – Rf) x 1.24 ……..2

Subtracting 1 from 2

- 2 = (Rm – Rf) x 0.38
- Rm = Rf + 5.263%

Putting in 1, we get:

- 22 = Rf + (Rf + 5.263% - Rf) x 0.86
- » Rf = 17.47%
- » Rm = 17.47% + 5.263% = 22.734%

iv) SML Equation = Rf + (Rm – Rf)β = 17.47% + (22.734% - 17.47%).β = 17.47% + 5.264% x Beta

v) Portfolio beta = weighted average beta = {0.86 x 70%} + {1.24 x 30%} = 0.974

Basic portfolio beta & return (non-CAPM) calculation

 # Ques 19 – Ekta {SM TYK, N18 RTP (Old), N19 RTP, Jul 21 Exam, N22 Exam, M23 MTP 1}

Ekta Ltd. has a choice of investment between several different equity oriented mutual funds. The company has an amount of ₹1 Crore to invest. The details of the mutual funds are as follows:

Mutual Fund	A	B	C	D	E
Beta	1.6	1.0	0.9	2	0.6

Required:

(i) If the company invests 20% each of its investment in the first two mutual funds and an equal amount in mutual funds C, D and E, what is the beta of the portfolio?

(ii) If the expected return of market is 12% at a beta of 1, what will be the portfolio expected return?

(iii) If the co. changes its policy to invest in any 3 securities with a minimum of 20% in each of these 3 securities to diversify risk, you are requested to advise the company to have a right mix of securities to maximize the return in the following two scenarios and also calculate the expected return:

(a) Bull Phase: Expected Market returns 10%

(b) Bear Phase: Expected Market returns -5%

Ans: i) Portfolio beta = Weighted average beta of components

- Beta(p) = {1.6×0.2} + {1×0.2} + {0.9×0.2} + {2×0.2} + {0.6×0.2} = 1.22

ii) **Author Note: Rf is missing in ques. Also, the ques is not very much centric around CAPM. Therefore, we cannot use CAPM here. ∴ Rp = Beta x Rm**

- Since portfolio Beta = 1.22 → Its return should be 1.22 times the market returns.
- Rp = 1.22 x 12 = 14.64%

iii)

Scenario	Bull Phase	Bear Phase
Preference	Select high beta stocks	Select low beta stocks
Weights:	60% in D, 20% each in A & B	60% in E, 20% each in C & B
Weighted Avg Beta	2×0.6 + 1.6×0.2 + 1×0.2 = 1.72	0.6×0.6 + 0.9×0.2 + 1×0.2 = 0.74
Expected return	1.72 x 10% = 17.2%	0.74 x -5% = -3.7%

Basic portfolio Beta & CAPM return calculation

 # Ques 20 – FedUp **{SM TYK, N18 RTP (New), N18 RTP (Old), N19 RTP (Old)}**

Mr. FedUp wants to invest an amount of ₹520 lakhs and had approached his Portfolio Manager. The Portfolio Manager had advised Mr. FedUp to invest in the following manner:

Security	Moderate	Better	Good	V. Good	Best
Amt. (₹Lacs)	60	80	100	120	160
Beta	0.5	1.00	0.80	1.20	1.50

You are required to advise Mr. FedUp in regard to the following, using CAPM:

(i) Expected return on portfolio, if the G-Secs are at 8% and the NIFTY is yielding 10%.

(ii) Advisability of replacing Security 'Better' with NIFTY.

Ans: Beta of Portfolio (B_P) = Weighted average Beta

$$B_P = 0.50 \times \frac{60}{520} + 1 \times \frac{80}{520} + 0.80 \times \frac{100}{520} + 1.20 \times \frac{120}{520} + 1.50 \times \frac{160}{520} = 1.104$$

(i) Expected return = $R_F + (R_M - R_F) \times \text{Beta} = 8 + (10 - 8) \times 1.104 = 10.208\%$

(ii) As computed above the expected return from better is 10% same as from Nifty, hence there will be no difference even if the replacement of security is made. The main logic behind this neutrality is that the beta of security Better is 1 which clearly indicate that this security shall yield same return as market return.

Portfolio Beta + Over/Under valued using CAPM

 # Ques 21 – Rogue **{SM TYK, N20 RTP (Old)}**

Rogue Ltd. has substantial cash flow and until the surplus funds are utilised to meet the future capital expenditure, likely to happen after several months are invested in a portfolio of short-term equity investment, details for which are given below:

Co.	Quantity	Beta	MPS (₹)	Expected Dividend yield
D ltd	60,000	1.16	4.29	19.5%
E ltd	80,000	2.28	2.92	24.0%
F ltd	1,00,000	0.90	2.17	17.5%
G ltd	1,25,000	1.50	3.14	26.0%

The current market return is 19% p.a. and the risk-free rate 11% pa.

(i) Calculate portfolio beta or calculate the risk of Rogue's short-term investment portfolio relative to that of the market.

(ii) Whether Rogue should change the composition of its portfolio

Ans: Portfolio beta = Weighted average beta of components

Stock	Amount invested	Beta
D	60,000 x 4.29 = 2,57,400	1.16
E	80,000 x 2.92 = 233600	2.28
F	100,000 x 2.17 = 217000	0.90
G	125000 x 3.14 = 392,500	1.50
Total:	11,00,500	

- Portfolio beta = Weighted average Beta of components
- $1.16 \times \frac{257400}{1100500} + 2.28 \times \frac{233,600}{1100500} + 0.90 \times \frac{217000}{1100500} + 1.50 \times \frac{392500}{1100500} = 1.468$ times
- The portfolio is 1.468 times risky than the market.

b) P1 & P0 are missing in ques. So, we cannot calculate capital gain.

Hence, assuming total yield on stock = Dividend yield only.

- CAPM return = Rf + (Rm – Rf) x Beta
- Here, CAPM return = 11% + (19% - 11%) x Beta => 11% + 8% x Beta

 # Comparing actual yield vs CAPM yield

Stock	CAPM return	Actual return	Value, Strategy
D	11+ 8x1.16 = 20.28%	19.5%	Overvalued, Sell
E	11 + 8x2.28 = 29.24%	24%	Over-valued, Sell
F	11 + 8x0.9 = 18.20%	17.5%	Over-valued, Sell
G	11 + 8x1.50 = 23%	26%	Undervalued, Buy

👉 Using Risk-free securities to change portfolio beta

 # Ques 22 – Mazda {SM TYK, M19 Exam (Old), N20 RTP (New), N20 MTP 1 (New), Dec 21 RTP (Old)}

Mr. Mazda, A Portfolio Manager has the following four stocks in his portfolio:

Security	Quantity	MPS	β
VSL	10,000	50	0.9
CSL	5,000	20	1.0
SML	8,000	25	1.5
APL	2,000	200	1.2

(i) Calculate Portfolio beta

(ii) If the PM seeks to reduce the beta to 0.8, how much risk-free investment should he bring in?

(iii) If the PM seeks to increase the beta to 1.2, how much risk-free investment should he bring in?

Ans: **Calculate investment in each security**

Security	Amount Invested	Weight	Beta	Weight x Beta
VSL	10,000 x 50 = 5,00,000	5L / 12L = 0.41667	0.9	0.375
CSL	5,000 x 20 = 1,00,000	1L / 12L = 0.08333	1.0	0.08333
SML	8,000 x 25 = 2,00,000	2L / 12L = 0.16667	1.5	0.25
APL	2,000 x 200 = 4,00,000	4L / 12L = 0.33333	1.2	0.4
Total:	12,00,000		Portfolio Beta =	1.108

(ii) **New Required Beta = 0.8**

- Let the amount of new rf investment be X.
- Portfolio Beta = $1.108 \times \frac{12L}{12L + X} + 0$ (β of rf = 0)
- $0.8 = 1.108 \times \frac{12L}{12L + X} \Rightarrow 12L + X = 16.62L \Rightarrow X = 4.62$ Lacs

» Portfolio manager must bring in Risk-free investment of ₹4.62L to reduce portfolio Beta to 0.8.

(iii) **New required Beta = 1.2**

- $1.2 = 1.108 \times \frac{12L}{12L + X}$ => X = -0.92 Lacs

i.e. Portfolio manager must short ₹0.92 lacs worth of risk-free assets and should invest this amount in his portfolio (in this original ratio of 5 : 1 : 2 : 4. (alternate to shorting -> You can also understand it as "Borrow ₹0.92 lacs at risk-free rates)

Using Price & div. data to cal. Beta, CAPM etc.

Beta of stock when stock & market return has to be calculated using HPR

 # Ques 23 – Krishna {SM TYK, SM Illus, M22 Exam}

Following information are available with respect of Krishna Ltd. (KRL)

Year	KRL MPS	DPS	Market Index	Market div. yield	Rf
2012	245	20	2013	4%	7%
2013	253	22	2130	5%	6%
2014	310	25	2350	6%	6%
2015	330	30	2580	7%	6%

Compute Beta Value of the Krishna Ltd at the end of 2015 and state your observation.

Ans: **(i) Calculating return of Krishna Ltd stock (Rs)**

Year	Price	Dividend	CG	Total return	Return %
2012	245	20	-	-	-
2013	253	22	8	30	12.24%
2014	310	25	57	82	32.41%
2015	330	30	20	50	16.13%

(ii) **Calculating Market return (Rm)**

Year	Price	Div	Capital Gain %	Total %
2012	2013	4%	-	-
2013	2130	5%	(2130/2013) - 1 = 5.81%	10.81%
2014	2350	6%	(2350/2130) - 1 = 10.33%	16.33%
2015	2580	7%	(2580/2350) - 1 = 9.79%	16.79%

(iii) **Calculating Covariance(s,m) & Variance of market. Let Rs = x & Rm = y.**

Year	X (%)	Y (%)	$(x - \bar{x})$	$(y - \bar{y})$	$(y - \bar{y})^2$	$(x - \bar{x})(y - \bar{y})$
2013	12.24	10.81	-8.02	-3.833	14.69	30.74
2014	32.41	16.33	12.15	1.687	2.846	20.49
2015	16.13	16.79	-4.13	2.147	4.61	-8.87
Total	60.78	43.93	-	-	22.15	42.37
Avg:	20.26	14.643	-	-	7.38	14.12

- Covariance (stock, market) = $\Sigma(x - \bar{x})(y - \bar{y}) \div n$ = 42.37 / 3 = 14.12
- Variance of market (σ_m^2) = $\Sigma(y - \bar{y})^2 \div n$ = 22.15 / 3 = 7.38
- Beta of the stock (β) = Cov (s,m) / σ_m^2 = 13.89 / 7.38 = 1.913 times

(iv) **Observation**

Required return as per CAPM = 6% + (16.79% - 6%) x 1.913 = 26.64%

Actual return = 16.31%. Hence, we should sell the share as it is over-valued.

Rp for each year (when investment is held for 2 years) + SD in absolute terms

 # Ques 24 – Sukhoi **{SM TYK, N18 RTP (Old), M19 RTP (New), Dec 21 Exam (New)}**

Sukhoi Ltd invested on 1.4.2005 in few equities shares as below:

Company	No. of Shares	Cost (₹)
M Ltd	1,000 (₹100 each)	2,00,000
N Ltd	500 (₹10 each)	1,50,000

In Sept 2005, 10% dividend was paid out by M Ltd. and in Oct 2005 market quotation is ₹220 and ₹290 per share for M Ltd. and N Ltd. respectively. On 1.4.2006, investment advisors indicate:

(a) Dividends form M Ltd. and N Ltd. for the year ending 31.3.2007 are likely to be 20% and 35% respectively.

(b) The probabilities of market quotations on 31.3.2007 are as below:

Probability Factor	Price/Share of M Ltd	Price/Share of N Ltd
0.2	220	290
0.5	250	310
0.3	280	330

You are required to:

(i) Calculate the expected average return from the portfolio for the year ended 31.3.2006;

(ii) Calculated the expected average return from the portfolio for the year 2006-07; and

(iii) Advise Sukhoi Ltd of the comparative risk-taking absolute return figure in the two investments by calculating the standard deviation in the case for year 2006-07

Ans: **Return for year 2005-06**

Particulars	M Ltd.	N Ltd.
Purchase price (P0)	2,00,000 / 1000 = 200	1,50,000 / 500=300
Price at year end (P1)	220	290
Dividend (D1)	100 x 10% = 10	10 x 30% = 3
Total return = P1 – P0) + D1	30	-7
Return %	15%	-2.33%

Therefore, portfolio return for the year 2006-07 -

Rp = 15% x 2L/3.5L + (-2.33%) x 1.5L/3.5L = 7.57%

ii) **Return for year 2006 -07**

Expected price of M Ltd. = {220 x 0.2} + {250 x 0.5} + {280 x 0.3} = 253

Expected price of N Ltd. = {290 x 0.2} + {310 x 0.5} + {330 x 0.3} = 312

Particulars	M Ltd.	N Ltd.
Price at 1-4-2006 (P0)	220	290
Expected Price at year end (P1)	253	312
Dividend (D1)	100 x 20% = 20	10 x 35% = 3.5
Total return: (P1 – P0) + D1	53.00	25.5
Return %	24.09%	8.79%

Now, the weights (for cal. portfolio return) should be based on the price on 1-4-2006 (& not of 2005)

**As on 1-4-2006**

Value of investment in M ltd. = 220 x 1000 = 220,000

Value of investment in N ltd. = 290 x 500 = 145,000

Total : 365,000

∴ Portfolio return = {24.09% x 2.20L/3.65L} + {8.79% x 1.45L/3.65L} = 18.02%

iii) **# Calculating SD of M Ltd. for the year 2006-07**

Prob	P1	P0	DPS	CG (P1 – P0)	Total=Div + CG	$(x - \bar{x})$	$P(x - \bar{x})^2$
0.2	220	220	20	0	20	-33	217.8
0.5	250	220	20	30	50	-3	4.5
0.3	280	220	20	60	80	27	218.7
						Total i.e. Variance =	441

- Expected return = {20 x 0.2} + {50 x 0.5} + {80 x 0.3} = 53
- Variance = $\Sigma P(x - \bar{x})^2$ = 441
- SD = $\sqrt{441}$ = 21

Calculating SD of N Ltd. for the year 2006-07

Prob	P1	P0	DPS	CG (P1 – P0)	Total=Div + CG	$(x - \bar{x})$	$P(x - \bar{x})^2$
0.2	290	290	3.5	0	3.5	-22	96.8
0.5	310	290	3.5	20	23.5	-2	2
0.3	330	290	3.5	40	43.5	18	97.2
						Total i.e. Variance =	196

- Expected return = {3.5 x 0.2} + {23.5 x 0.5} + {43.5 x 0.3} = 25.5
- Variance = $\Sigma P(x - \bar{x})^2$ = 196
- Standard deviation = $\sqrt{196}$ = 14

» Since SD of M ltd is higher than N ltd., it is more-risky.

Total, Systematic & Unsystematic Risk

SR/USR of stock & portfolio (when r square is given)

 # Ques 25 – Nilgiri {SM Illus}

Nilgiri has collected the following details for X and Y companies' stocks and Bombay Sensex for a Period of one year:

(a) Calculate the systematic risk & Unsystematic risk for stock X and Y.

(b) If equal amount of money is allocated for the stocks what would be the portfolio risk.

	X-Stock	Y-Stock	Sensex
Average Return	0.15	0.25	0.06
Variance (SD square)	6.30	5.86	2.25
β	0.71	0.27	
R^2 i.e. $(.424)^2$	0.18		

Ans: Systematic Risk (SR) = $Beta_s^2 \times \sigma_m^2$

- SR of Stock X = $0.71^2 \times 2.25 = 1.134$
- SR of Stock Y = $0.27^2 \times 2.25 = 0.164$

» Unsystematic risk (USR) = Total risk (TR) – Systematic risk (SR)

- USR of X = 6.30 - 1.134 = 5.166
- USR of Y = 5.86 - 0.164 = 5.696

b) **Portfolio risk if equal amount is being invested in stock X & Y**

 # Method 1: Direct SD Formula

- Covariance(x,y) = $\beta_x \times \beta_y \times Variance_m$ = 0.71 x 0.27 x 2.25 = 0.4313

- $\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + 2\omega_a\omega_b(Covaraince)$
- σ_p^2 = {0.5^2 x 6.30} + {0.5^2 x 5.86} + {2×0.5×0.5×0.4313} = 3.256%^{2}
- σ_p = 1.80

 # Method 2: Using TR = SR + USR

» SR of Portfolio = (Beta of portfolio)^2 x Variance of market

- Beta of portfolio = {0.71 x 0.5} + {0.27 x 0.5} = 0.49
- SR of portfolio = 0.49^2 x 2.25 = 0.54%^{2}

- Portfolio USR = {$USR_x \times Wa^2$} + {$USR_y \times Wy^2$} = {5.166×0.5^2} + {5.696×0.5^2} = 2.7155%^{2}
- TR = SR + USR = 0.54 + 2.7155 = 3.256%^{2}

SR/USR when USR of each stock is given

 # Ques 26 – Astra **{SM TYK}**

Astra has a portfolio having following features:

Security	Beta	Random Error (σ)	Weight
L	1.60	7	0.25
M	1.15	11	0.30
N	1.40	3	0.25
K	1.00	9	0.20

You are required to find out the risk of the portfolio if σ_m = 18%

Ans: **V. Imp Note:** Here Unsystematic risk is not given in square form. But the Sharpe's Index model uses USR in square form. Hence, 1st take square.

- Beta(p) = Weighted average beta = {1.6 x 0.25} + {1.15 x 0.3} + {1.40 x 0.25} + {1 x 0.2} = 1.295

Total risk = SR + USR

- SR of Portfolio = Beta(p)^2 x variance of market = 1.2952 x (18%)^2 = 543.36%^{2}
- Portfolio USR = {USR_a x Wa^2} + {USR_b x Wb^2} + {USR_c x Wd^2} + {USR_d x Wd^2}
- Portfolio USR = {7^2 x 0.25^2} + {11^2x0.3^2} + {3^2x0.25^2} + {9^2x0.2^2} = 17.55%^{2}

» TR (σ_p^2) = 543.33%^{2} + 17.55%^{2} = 561.115%^{2}

SR/USR when 'Specific SD' (USR) of each stock is given

 # Ques 27 – Rati {N19 Exam (New)}

Rati traders ltd. has estimated following risk and return for two stocks:

Stock	Expected return (%)	Beta	Specific SD (%)
A	14	0.8	35
B	18	1.2	45

Market index Standard Deviation is 25% and risk-free is 6%.

(i) Calculate the standard deviation of expected returns on A and B.

(ii) Suppose a portfolio is to be constructed with the proportion of 25%, 40% and 35% in stock A, B and Treasury Bills respectively, what would be the expected return, standard deviation of expected return of the portfolio?

Ans:

	Stock A	Stock B
• Systematic risk (SR) = $Beta_s^2 \times \sigma_m^2$	0.8^2 x 25^2 = 400	1.2^2 x 25^2 = 900
• Unsystematic risk (USR) = Specific SD^2	35^2 = 1225	45^2 = 2025
• Total Risk (TR) i.e. Variance = SR + USR	400 + 1225 = 1625	900 + 2025 = 2925
• Standard deviation = √Variance	√1625 = 40.31%	√2925 = 54.08%

(ii) Expected return = weighted average return = {14 x 25%} + {18 x 40%} + {6 x 35%} = 12.8%

TR of portfolio = SR + USR

• Portfolio Beta	= Weighted average beta	= {0.8 x 25%} + {1.2 x 40%} + 0	= 0.68
• SR portfolio	= $B^2_P \times \sigma_m^2$	= 0.68^2 x 25^2	= 289
• USR of portfolio	= Weighted average USR	= {0.25^2 x 35^2} + {0.4^2 x 45^2} + 0	= 400.5625
• TR (i.e. Variance)	= SR + USR	= 289 + 400.5625	= 689.5625
• SD of portfolio	= √Variance	= √689.5625	= 26.259%

Portfolio risk, SR/USR master practice example

 # Ques 28 – Pingala {SM TYK, M18 RTP, M19 Exam, N24 MTP 2, Dec 21 MTP 2 (Old)}

Following are the details of Miss. Pingala's portfolio consisting of three shares:

Share	Weight	Beta	Expected return	Total variance
A	0.20	0.40	14%	0.015
B	0.50	0.50	15%	0.025
C	0.30	1.10	21%	0.100

Standard Deviation of Market Portfolio returns = 10%

Covariance (A, B) = 0.030

Covariance (A, C) = 0.020

Covariance (B, C) = 0.040

Calculate:

(i) Portfolio Beta

(ii) Residual Variance (Unsystematic Risk) of each of the three shares

(iii) Portfolio Variance using sharpe Index Model

or Part (iii) can be written as:

Calculate the Portfolio variance considering **Co-movement between securities due to change in the market index**.

(iv) Portfolio variance (based on modern portfolio theory given by Markowitz) i.e., σ_{a+b+c}^2 formula.

or part (iv) can be written as:

Calculate the Portfolio variance considering **Correlation between each pair of securities**.

Ans: i) Portfolio Beta = 0.4 x 0.2 + 0.5 x 0.5 + 1.1 x 0.3 = 0.66

ii) **USR = TR – SR, where SR = Beta² x σ_m^2**

- USR_a = 0.015 – $\{0.4^2 \times 0.1^2\}$ = 0.0134
- USR_b = 0.025 – $\{0.5^2 \times 0.1^2\}$ = 0.0225
- USR_c = 0.100 – $\{1.1^2 \times 0.1^2\}$ = 0.0879

iii. Portfolio variance (σ_p^2) as per sharpe index model => TR = SR + USR

- SR of portfolio = $Beta_p^2 \times \sigma_m^2$ = $0.66^2 \times 0.1^2$ = 0.004356
- USR portfolio = Weighted average USR = $0.0134 \times 0.2^2 + 0.0225 \times 0.5^2 + 0.0879 \times 0.3^2$ = 0.014072
- TR = 0.004356 + 0.014072 = 0.018428

iv. **Portfolio variance (σ^2) as per Markowitz model**

- $\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + (w_c\sigma_c)^2 + 2\omega_a\omega_b(Cov_{a,b}) + 2\omega_a\omega_c(Cov_{a,c}) + 2\omega_b\omega_c(Cov_{b,c})$
- σ_p^2 = $(0.015 \times 0.2^2) + (0.025 \times 0.5^2) + (0.1 \times 0.3^2) + \{2\times0.2\times0.5\times0.03\} + \{2\times0.2\times0.3\times0.02\}$

+ {2×0.5×0.3×0.04} = 0.0363

Note: Variance as per Sharpe's Index model and Markowitz model should be same. But we are getting different answers. Why so? Because the covariance given in ques are incorrect.

- For eg: Covariance(a,b) = $B_A \times B_B \times \sigma_m^2$ = $0.4 \times 0.5 \times 0.10^2 = 0.02$
- But covariance(a,b) given in ques = 0.03

Calculating CL, SR/USR of stock using raw historical data

 # Ques 29 – Asavari {SM TYK}

The returns on stock of Asavari ltd. and market portfolio for a period of 6 years are as follows:

Year	1	2	3	4	5	6
Return on stock (X)	12	15	11	2	10	-12
Market return (Y)	8	12	11	-4	9.5	-2

You are required to determine:

i) Characteristic line for the stock.

ii) The systematic and unsystematic risk of the stock.

Ans:

Year	X	Y	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$	$(x - \bar{x})(y - \bar{y})$
1	12	8	5.67	2.25	32.15	5.06	12.76
2	15	12	8.67	6.25	75.17	39.06	54.19
3	11	11	4.67	5.25	21.81	27.56	24.52
4	2	-4	-4.33	-9.75	18.75	95.06	42.22
5	10	9.5	3.67	3.75	13.47	14.06	13.76
6	-12	-2	-18.33	-7.75	335.99	60.06	142.06
Total	38	34.5			497.34	240.86	289.51
Avg:	6.33	5.75			82.89	40.14	48.25

- Covariance = $\Sigma(x - \bar{x})(y - \bar{y}) \div n$ = 289.51 / 6 = 48.25
- Variance of market (σ_m^2) = $\Sigma(y - \bar{y})^2 \div n$ = 240.86 / 6 = 40.14
- Beta = $Covariance_{s,m}$ / $Variance_{market}$ = 48.25 / 40.14 = 1.20

(ii) Characteristic line (CL) Equation → $R_s = \alpha + \beta.R_m$

- $6.33 = \alpha + 1.2 \times 5.75$ => $\alpha = -0.57$
- CL Equation → $R_s = -0.57 + 1.2R_m$

(iii) Total risk of stock (TR) is given by variance of stock (σ_s)

- Variance of stock σ^2 = $\Sigma(x - \bar{x})^2 \div n$ = 497.34 / 6 = 82.89
- Systematic risk (SR) = $Beta_s^2 \times \sigma_m^2$ = $1.2^2 \times 40.14$ = 57.80
- Unsystematic risk (USR) = TR – SR = 82.89 – 57.80 = 25.09

Efficient Frontier

Constructing Efficient frontier

 # Ques 30 – Shankh **{SM TYK}**

Following data is compiled by Mr. Shankh:

	A	B	C	D	E	F
Return (%)	8	8	12	4	9	8
Risk (S.D.)	4	5	12	4	5	6

(i) Assuming three will have to be selected, state which one will be picked. Use Modern portfolio Theory.

(ii) Assuming perfect correlation, whether it is preferable to invest 75% in A and 25% in C or invest 100% in E.

Ans:

Security	A	B	C	D	E	F
Return	8	8	12	4	9	8
Risk	4	5	12	4	5	6
Efficient?	Yes	No	Yes	No	Yes	No

Hence, only securities A,C,E are efficient.

ii) If 75% in A & 25% in C

- Return = {8 x 0.75} + {12 x 0.25} = 9%
- Risk = {4 x 0.75} + {12 x 0.25} = 6%

If 100% in E → then return = 9% & risk = 5%

» Its better to invest 100% in security E as risk is lower (but return is same)

Comment: If only "perfect correlation" is given in, then assume r = +1.

Minimum Variance portfolio

Calculating SD, Covariance etc. for construct Minimum Risk Portfolio

 # Ques 31 – Eeshwar {SM TYK, M19 RTP (New), M24 RTP, M24 Exam}

Mr. Eeshwar has decided to invest to invest ₹1 lac in the shares of two companies, namely, ABC and XYZ. The projections of returns from the shares of the two co. along with their probabilities are:

Probability	ABC (%)	XYZ (%)
0.20	12	16
0.25	14	10
0.25	-7	28
0.30	28	-2

i) Comment on return and risk of investment in individual shares.

ii) Compare the risk and return of these two shares with a Portfolio of these shares in equal proportions.

iii) Find out the proportion of each of the above shares to formulate a minimum risk portfolio.

Ans: i) Expected return = Σ Probability x Return

- ABC Ltd. = {12×0.2} + {14×0.25} + {-7×0.25} + {28×0.3} = 12.55%
- XYZ Ltd. = {16×0.2} + {10×0.25} + {28×0.25} + {-2×0.3} = 12.1%

# Prob.	A	X	$(A-\bar{A})$	$(X-\bar{X})$	$P(A-\bar{A})^2$	$P(X-\bar{X})^2$	$P(A-\bar{A})(X-\bar{X})$
0.20	12	16	-0.55	3.9	0.06	3.04	-0.429
0.25	14	10	1.45	-2.1	0.53	1.1	-0.761
0.25	-7	28	-19.55	15.9	95.55	63.2	-77.71
0.30	28	-2	15.45	-14.1	71.61	59.64	-65.35
				Total:	167.75	126.98	-144.25

# Details	ABC	XYZ
• Variance $(\sigma^2) = \Sigma P.(x-\bar{x})^2$	167.75	126.98
• SD = $\sqrt{\sigma}$	12.95	11.27

- Covariance $_{(A,X)} = \Sigma P(A-\bar{A})(X-\bar{X}) = -144.25\%^2$

 # Risk (SD) of portfolio with equal weight

- $\sigma^2_P = (0.5^2 \times 167.75) + (0.5^2 \times 126.98) + 2 \times (-144.25) \times 0.5 \times 0.5 = 1.5575$ or 1.56
- $\sigma_P = \sqrt{1.56} = 1.25\%$

- Expected return of portfolio (Rp) = (0.5 x 12.55) + (0.5 x 12.1) = 12.325%
- Hence, the return is 12.325% with the risk of 1.25% for the portfolio.
- Thus, the portfolio results in the reduction of risk by the combination of two shares.

iii) **Weight of stock A for minimum variance portfolio (W_A)**

- $W_A = \frac{Variance_B - Covariance(a,b)}{Variance_A + Variance_B - 2.Covariance(a,b)}$

- % ABC = $\frac{126.98 - (-144.25)}{126.98 + 167.75 - [2\times(-144.25)]} = \frac{271.23}{583.23} = 0.46$ or 46%

- Weight of ABC = 46%,
- Weight of XYZ = (1 – 0.46) = 0.54 or 54%

Arbitrage Pricing Theory (APT)

Basic APT return

 # Ques 32 – Xipil {SM Illus}

With the help of following data determine the return on the security Xipil:

Factor	Risk Premium associated with the Factor	βi
Market	4%	1.3
Growth Rate of GDP	1%	0.3
Inflation	-4%	0.2

Risk Free Rate of Return is 8%.

Ans: Expected Return = $Rf + \lambda_1\beta_1 + \lambda_2\beta_2 + \lambda_3\beta_3$ = 8% + {1.3 x 4%} + {0.3 x 1%} + {0.2 x -4%} = 12.7%

Basic APT return

 # Ques 33 – Tamarind {SM TYK}

Tamarind intends to invest in equity shares of a co. the parameters are:

Factor	Beta	Expected Value	Actual value
GNP	1.20	7.7%	7.7%
Inflation	1.75	5.5%	7.0%
Interest Rate	1.30	7.75%	9.0%
Stock Market Index	1.70	10.0%	12%
Industrial Production	1.00	7.0%	7.5%

If the Risk-free rate of interest is 9.25%. How much is the return on the share under APT?

A35b APT return = Rf + (Actual value – Expected value) x Beta for every risk factor

• APT return = 9.25 + 0×1.2 + (7 - 5.5)×1.75 + (9 - 7.75)×1.3 + (12-10)×1.7 + (7.5-7)×1 = 17.40%

Market return as per APT

 # Ques 34 - Nirmal Kumar {SM TYK, N19 RTP (Old)}

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

(i) Small cap growth stocks

(ii) Small cap value stocks

(iii) Large cap growth stock

(iv) Large cap value stocks

Mr Nirmal Kumar also estimated the weights of the categories of stocks in the market index. Furthermore, the sensitivity of returns on these categories of stocks to the three important factors are estimated to be:

Category	Weight in Market Index	Factor I	Factor II	Factor III
Small cap growth	25	0.80	1.39	1.35
Small cap value	10	0.90	0.75	1.25
Large Cap growth	50	1.165	2.75	8.65
Large cap growth	15	0.85	2.05	6.75
Risk Premium	-	6.85%	-3.5	0.65%

Where Factor I = Market's beta, Factor II = Price book's beta and Factor III = Inflation beta.

The Rate of return on treasury bond i.e risk free rate is 4.5%

(i) Using APT, determine the expected return on the market index taking all three factors

(ii) Using CAPM, determine the expected return on the market index.

(iii) An investor wants to construct a portfolio constituting only the 'Small cap value' and 'large cap growth stocks. If the target beta (factor 1) for the desired portfolio is 1, determine the composition (weights) of his portfolio.

Ans: **A) Method 1**

 # Stock's return = Rf + Risk premium$_n$ x Beta$_n$

Small cap growth = 4.5 + {6.85×0.80} + {-3.5×1.39} + {0.65×1.35} = 5.9925%

Small cap value = 4.5 + {6.85×0.90} + {-3.5×0.75} + {0.65×1.25} = 8.8525%

	Large cap growth = 4.5 + {6.85×1.165} + {-3.5×2.75} + {0.65×8.65} = 8.478%
	Large cap value = 4.5 + {6.85×0.85} + {-3.5×2.05} + {0.65×6.75} = 7.535%
•	Expected return of market = 0.25×5.9925 + 0.10×8.8525 + 0.50×8.478 + 0.15×7.535 = 7.7526%.
	B) Method 2
#	**Weighted average beta = Weight$_n$ x Beta$_n$**
•	Factor I = (0.8x0.25) + (0.9x0.1) + (1.165x0.5) + (0.85x0.15) = 1.00
•	Factor II = (1.39x0.25) + (0.75x0.1) + (2.75x0.5) + (2.05x0.15) = 2.105
•	Factor III = (1.35x0.25) + (1.25x0.1) + (8.65x0.5) + (6.75x0.15) = 5.80
#	**Market return = Rf + Risk premium$_n$ x Weighted average beta$_n$**
•	Rm = 4.5% + {6.85×1} + {-3.5×2.105} + {5.8×0.65} = 7.7525%
(ii)	**Using CAPM**
•	Small cap growth = 4.5 + 6.85 x 0.80 = 9.98%
•	Small cap value = 4.5 + 6.85 x 0.90 = 10.665%
•	Large cap growth = 4.5 + 6.85 x 1.165 = 12.48%
•	Large cap value = 4.5 + 6.85 x 0.85 = 10.3225%
•	Expected return on Market Index = 0.25×9.98 + 0.10×10.665 + 0.50×12.48 + 0.15×10.3225 = 11.33%
(c)	Let weight of small cap be X, then weight of large cap = 1-X
•	0.90X + 1.165 (1 – X) = 1
•	X = 0.623
•	Therefore, weight of small cap = 0.623
•	Weight of large cap = 1-X = 0.377
	Market return as per APT
#	**Ques 35 – Ahanu** **{N23 Exam}**
	Mrs. Ahanu has categorized all the available stock in the market into the following types and the estimated weights of the categories of stocks in the market index are given below. Further, the sensitivity of returns of these categories of stocks to two factors Inflation and Stock market are also given below:

			Factor 1			Factor 2		
	Category	Weight in market index	$Beta_1$	Exp Value	Actual Value	$Beta_2$	Exp Value	Actual Value
	Small cap	20%	1.20	6.7%	6.7%	0.80	10%	10.5%
	Mid cap	30%	1.75	4.5%	6%	0.90	7%	8%
	Large cap	15%	1.30	6.75%	8%	1.165	9%	10%
	Flexi cap	35%	1.70	7%	6.5%	0.85	8.85%	9.75%

- Rf = 7.50%. Round off to 2 decimals. **Required** -

(i) Expected return on the market index under Arbitrage Pricing Theory (Existing Scenario).

(ii) Expected return on the market index under Arbitrage Pricing Theory if the composition of the Portfolio is changed to 25% equally in all four categories.

(iii) Which alternative (Existing or Changed) will be more profitable?

(iv) Expected return on the market index for both the factors.

Ans: **WN 1 – Calculating return of each category as per APT**

APT return = Rf + (Actual– Expected value) x Beta of risk factor

- Small cap = 7.5% + 1.2 x 0 + 0.8 (10.5% – 10%) = 7.90%
- Mid cap = 7.5% + 1.75 (6% - 4.5%) + 0.9 (8% - 7%) = 11.025%
- Large cap = 7.5% + 1.3 (8% - 6.75%) + 1.165 (10% - 9%) = 10.29%
- Flexi cap = 7.5% + 1.7 (6.5% - 7%) + 0.85 (9.75% – 8.85%) = 7.415%

i) Market return (Rm) under existing scenario

- Rm = Expected return of category x Weight of category
- Rm = {7.9% x 0.2} + {11.025% x 0.3} + {10.29% x 0.15} + {7.415% x 0.35} = 9.03%

ii) Rm if equal composition

Rm = (7.9% x 0.25) + (11.025% x 0.25) + (10.29% x 0.25) + (7.415% x 0.25) = 9.16%

iii) Rm under changed composition > Rm under existing composition. So, the changed composition is more profitable.

(iv) Expected Return on Market Index for Both factors

- Factor 1 = {0.2 x 6.7%} + {0.3 x 4.5%} + {0.15 x 6.75%} + {0.35 x 7%} = 6.15%
- Factor 2 = {0.2 x 10%} + {0.3 x 7%} + {0.15 x 9%} + {0.35 x 8.85%} = 8.55%

Reverse calculation – Calculating risk premium of each factor

 # Ques 36 – Astrophysics {SM TYK, N18 Exam (New), M23 MTP 2, N24 MTP 1}

Mr. Astrophysics owns a portfolio with the following characteristics:

	Security A	Security B	Security C
Factor 1 Sensitivity (Beta)	0.80	1.50	0
Factor 2 Sensitivity (Beta)	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by two factor model.

(i) If Mr Astrophysics has ₹1,00,000 to invest and sells ₹50,000 of security B and purchases ₹1,50,000 of security A. What is the sensitivity (Beta) of Mr. Astrophysics's portfolio to the two factors?

(ii) Invest 3,00,000 in Security A by using 1,00,000 of own money, ₹1,00,000by borrowing at Risk free and ₹1,00,000 by selling Security B. What is the sensitivity of the portfolio to the factors?

---------- Or Part (ii) can also be written as: ----------

If Mr. Astrophysics borrows ₹1,00,000 at the risk free rate and invests the amount he borrowed along with the original amount of ₹100,000 in security X &Y in the same proportion as described in part (i), what is the sensitivity of the portfolio to the two factors.

(iii) What is the expected return premium of each factor?

Ans: Weight of Security A (Wa) = 150,000 / 100,000 = 1.5

- Weight of Security B (Wb) = (50,000) / 100,000 = -0.5

Sensitivity (Beta) of Mr. Astrophysics portfolio to the 2 portfolios is:

- Factor 1 = 1.50 x 0.80 + (-0.50 x 1.50) = 0.45
- Factor 2 = 1.50 x 0.60 + (-0.50 x 1.20) = 0.30

ii) Wa = 3L / 1L = 3

- Wb = (1L)/1L = -1
- Wrf = - 1L/1L = -1

- Factor 1 = 3.0 x 0.80 + (-1 x 1.50) + (-1 x 0) = 0.90
- Factor 2 = 3.0 x 0.60 + (-1 x 1.20) + (-1 x 0) = 0.60

iii) Expected Return = Risk Free rate of Return + Security Risk Premium

Let R_1 and R_2 be the value Factor 1 and Factor 2 respectively. Accordingly,

From Security A, we can say:

- $10 + 0.8R_1 + 0.6R_2 = 15$
- $0.8R_1 + 0.6R_2 = 5$
- $R_2 = \frac{5 - 0.8R_1}{0.6}$ ... (1)

From Security B, we can say:

- $10 + 1.5R_1 + 1.2R_2 = 20$
- $1.5R_1 + 1.2\left(\frac{5 - 0.8R_1}{0.6}\right) = 10$
- $1.5R_1 + 10 - 1.6R_1 = 10$
- $-0.1R_1 = 0$
- $R_1 = 0$

» Hence, value of R_1 is 0.

Putting this value in equation (1), we get

- $R_2 = \frac{5 - 0}{0.6} = 8.33$

» Risk premium value for Factor 1 is 0 and for Factor 2 is 8.33.

👉 **Co. Beta = Weighted avg beta of equity & debt**

Ques 37 – Himawari **{SM TYK, Dec 21 MTP 1 (Old), N22 MTP 1}**

Total market value of the equity share of Himawari ltd. is ₹60,00,000 and the total value of the debt is ₹40,00,000. The treasurer estimate that the beta of the stock is currently 1.5 and that the expected risk premium on the market is 10 per cent. The treasury bill rate is 8 per cent. Required:

(i) What is the beta of the Company's existing portfolio of assets?

(ii) Estimate the Co's Cost of capital and discount rate for an expansion of the co's present business.

Ans: i) Beta of co. (B_o) = $Beta_{equity} \times Weight_{equity} + Beta_{Debt} \times Weight_{Debt}$ = 1.5 x 60/100 + 0 = 0.9

Note: Since beta of debt is not given, assuming it to be 0.

ii) Ke as per CAPM = Rf + (Rm – Rf) x Beta = 8% + 10% x 0.9 = 17%

- Cost of capital (K_o) = $K_e.w_e + K_d.w_d$ = 17% x 0.6 + 8% x 0.4 = 13.40%

Note: Assumed Kd = 8% i.e. treasury bill rate as no other info is given in ques.

Note: For expanding the present business, the same cost of capital (Ko) of 13.4% shall be applicable. Assuming that risk of new investment is same as that current risk profile. However, if risk profile of new investment is different then required return shall change accordingly.

 # Alternate answer (of part ii)

- Ke = 8% + 10% x 1.5 = 23%
- Cost of capital (K_o) = $K_e.w_e + K_d.w_d$
- K_o = 23% x 0.6 + 8% x 0.4 = 17%

👉 Portfolio Rebalancing

Constant Proportion Insurance Policy

 # Ques 38 – Indira {M19 RTP (New), M23 MTP 2, N23 RTP, N24 RTP}

Indira has a fund of ₹3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. The present NIFTY is 5326. The minimum NIFTY within a month can at most be 4793.4. She wants to know as to how she should rebalance her portfolio under the following situations, according to the theory of Constant Proportion Insurance Policy, using '2' as the multiplier:

(1) Immediately to start with.

(2) 10 days later being the 1st day of rebalancing if NIFTY falls to 5122.96.

(3) 10 days further from the above date if the NIFTY touches 5539.4. For the sake of simplicity, assume that the value of her equity component will change in tandem with that of the NIFTY and the risk-free securities in which she is going to invest will have no Beta.

Ans: Maximum decline in one month = $\frac{5,326 - 4,793.40}{5,326} \times 100 = 10\%$

(1) **Immediately to start with**

- Investment in equity = Multiplier x (Portfolio value – Floor value) = 2(3L – 2.7L) = ₹60,000
- Indira may invest ₹60,000 in equity and balance in risk-free security.

(2) **After 10 days**

- Value of Equity = 60,000 x 5,122.96/5326 = ₹57,713
- Value of risk-free investment = ₹2,40,000
- Total value of Portfolio = ₹2,97,713

- Investment in Equity = 2 (2,97,713 – 2,70,000) = ₹55,426

Revised Portfolio

- Equity = ₹55,426
- Risk-free securities: ₹2,97,713 - ₹55,426 = ₹2,42,287
- i.e. Sell 2,287 worth of Equity and invest in Risk free securities.

(3) **After another 10 days**

- Value of Equity = 55,426 x 5,539.04/5122.96 = ₹59,928
- Value of risk-free investment = ₹2,42,287
- Total value of Portfolio = ₹3,02,215

- Investment in Equity = 2 (3,02,215 – 2,70,000) = ₹64,430

Revised Portfolio

- Equity = ₹64,430
- Risk-free securities = ₹3,02,215 – ₹64,430 = ₹2,37,785
- Investor should sell ₹4,502 of risk-free securities and invest it in equity.

Constant Ratio Plan

 # Ques 39 – Sunidhi **{SM TYK, Dec 21 MTP 1 (Old), N22 Exam}**

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund. She has constructed and compare the gain and losses from the technique with those from a passive buy and hold strategy. The fund consists of equities only and ending NAVs of the fund she constructed for the last 10 months are given below:

Month	Closing NAV	Month	Closing NAV
Dec,2008	40.00	May, 2009	37.00
Jan, 2009	25.00	Jun, 2009	42.00
Feb, 2009	36.00	July, 2009	43.00
Mar, 2009	32.00	Aug, 2009	50.00
Apr, 2009	38.00	Sep, 2009	52.00

Assume Sunidhi had invested a notional amount of ₹2 lacs equally in the fund and a conservative

portfolio (of bonds) in the beginning of Dec, 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%.

Determine the value of portfolio for each level of NAV following the Constant Ratio Plan.

Ans: Closing value of Buy and Hold strategy = 2L x 52/40 = ₹2,60,000.

 # Calculating closing value of constant ratio plan

	NAV	Equity Calculation	Equity Value	Bonds Value	Total Value	Trf from
•	40		1,00,000	1,00,000	2,00,000	
•	25	1L x 25/40	62,500	1,00,000	1,62,500	Bond to Eq.
			+18,750	(18,750)		
			81,250	81,250	1,62,500	
•	36	81,250x36/25	1,17,000	81,250	1,98,250	Eq. to Bond
			(17,875)	+17,875		
			99,125	99,125	1,98,250	
•	32	99,125 x 32/36	88,111	99,125	1,87,236	
•	38	88,111 x 38/32	1,04,632	99,125	2,03,757	Eq. to Bond
			(2,753.4)	+2753.4		
			1,01,878.5	1,01,878.5	2,03,757	
•	37	1,01,878.5 x 37/38	99,197.5	1,01,878.5	2,01,076	
•	42	99,197.5 x 42/37	1,12,602.5	1,01,878.5	2,14,481	
•	43	1,12,602.5 x 43/42	1,15,283.5	1,01,878.5	2,17,162	
•	50	1,15,283.5 x 50/43	1,34,050.5	1,01,878.5	2,35,929	Eq. to Bond
			(16,086)	+16,086		
			1,17,964.5	1,17,964.5	2,35,929	
•	52	1,17,964.5 x52/50	1,22,683	1,17,964.5	2,40,647.5	

• Hence, value of constant ratio plan in the end is ₹2,40,647.5 only.

Note: Ignore any minor difference due to decimals and rounding off.

Master practice example – Buy & Hold, Constant ratio, CPPI

 # Ques 40 – Achala **{N23 MTP 2}**

Achala has a fund of ₹3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. She has 3 close friends who have advised following different strategies:

(i)	Buy and Hold strategy	
(ii)	Constant ratio	
(iii)	CPPI	
	Suppose she immediately starts with investment in Bonds (non-fluctuating) and Equity and decides to rebalance her portfolio after each 10 days and to invest in Nifty as equity component changes in tandem with that of Nifty. Further, Bond has no Beta.	
•	As on date (i.e. month beginning) Nifty is 5326. Minimum Nifty within a month can at most be 4793.40.	
•	If she chooses CPPI she will use "2" as the multiplier.	
•	If she chooses Constant Ratio plan she will maintain the ratio of 60:40 in Equity & Bonds respectively.	
•	Further, portfolio will be rebalanced each time Nifty is changed by 5% as compared to previous Nifty.	
	You are required to evaluate Portfolio Position of Achala under each of the Strategies suggested by her friends and highlight the course of action to be taken if in the coming month after a gap of 10 days Nifty happened:	
(1)	10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.	
(2)	10 days further from the above date if the NIFTY touches 5539.04.	
A:	A) Buy and Hold strategy	
•	Maximum decline in one month = 5326 x {4793.40/5326} = 10%	
•	Floor Value = 3,00,000 × (1 - 0.10) = ₹ 2,70,000	
•	Under this strategy, investor invests floor value in bonds and rest in equity. So, investment in:	
	Bonds	2,70,000
	Equity = 300,000 – 2,70,000	30,000
	Total :	3,00,000
(2)	**After 10 days**	
	Value of equity = 30,000 × 5122.96/5326	28,856
	Value of Bonds	2,70,000
	Total value of portfolio	2,98,856
(3)	**After another 10 days**	
	Value of equity = 28,856 × 5539.04/5122.96	31,200
	Value of Bonds	2,70,000
	Total value of portfolio	3,01,200

	B) Under CPPI	
•	Investment in equity = Multiplier x (Portfolio value – Floor value) = 2×(3L – 2.7L) = ₹ 60,000	
•	Invest ₹ 60,000 in equity and balance in bonds.	
(2)	**After 10 days**	
	Value of equity = 60,000 x 5122.96/5326	57,713
	Value of bonds	2,40,000
	Total value of portfolio	2,97,713
•	Change in Investment (%) = (57,713 / 60,000) - 1 = - 3.81%	
•	No need to rebalance as change in investment is less than 5%.	
(3)	**After another 10 days**	
	Value of equity = 57,713 x 5539.04/5122.96	62,400
	Value of bonds	2,40,000
	Total value of portfolio	3,02,000
•	Change in Investment (%) = (62,400 / 57,713) - 1 = 8.12%	
•	Change in investment > 5%. So, Achala will rebalance the portfolio.	
#	**Revised portfolio**	
•	Equity = 2×(3,02,400 – 2,70,000)	64,800
•	Bonds = 3,02,400 – 64,800	2,37,600
	i.e. Sell 2400 of bonds and invest in equity.	
	C) Under Constant Ratio Strategy	
(1)	Ratio = 60:40. Invest 1,80,000 in equity and 1,20,000 in bonds.	
(2)	**After 10 days**	
	Value of equity = 1,80,000 × 5122.96/5326	1,73,138
	Value of Bonds	1,20,000
	Total value of portfolio	2,93,138
•	Change in Investment (%) = (1,73,138 / 1,80,000) - 1 = -3.81%	

•	Change is < 5%. So no rebalancing required.	
(3)	**After another 10 days**	
	Value of equity = 1,73,138 × 5539.04/5122.96	1,87,200
	Value of Bonds	1,20,000
	Total value of portfolio =	3,07,200
•	Change in Investment (%) = (1,87,200 / 1,73,138) - 1 = 8.12%	
•	Change > 5%. So rebalancing is required.	
#	**Revised portfolio**	
	Equity: 3,07,200 x 60%	1,84,320
	Bonds = 3,07,200 x 40%	1,22,880
	Action - Sell 2,880 of Equity and divert to Bonds	

👉 Corner Theorem

 # Ques 41 – Yamuna {SM Ques}

Mrs. Yamuna, an investor has two portfolios known to be on minimum variance set for a population of three securities A, B and C having below mentioned weights:

	WA	WB	WC
Portfolio X	0.30	0.40	0.30
Portfolio Y	0.20	0.50	0.30

It is supposed that there are no restrictions on short sales.

(i) What would be weight for each stock for a portfolio constructed by investing ₹5,000 in portfolio X and ₹3,000 in portfolio Y?

(ii) Suppose the investor invests ₹4,000 out of ₹8,000 in security A. How she will allocate the balance between security B & C to ensure that her portfolio is on minimum variance set?

Ans: (i) Investment committed to each security would be: -

	A	B	C	Total
Portfolio X	1,500	2,000	1,500	5,000
Portfolio Y	600	1,500	900	3,000
Combined Portfolio	2,100	3,500	2,400	8,000
Stock weights	0.26	0.44	0.30	

(ii) Critical line equation is given by → WB = a + bWA

- Substituting the values of WA & WB from portfolio X and Y in above equation:
- 0.40 = a + 0.30b
- 0.50 = a + 0.20b

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

» WB = 0.70 – WA

- WB if half fund is invested in security A = 0.70 – 0.50 = 0.20
- Therefore, WC = 1 – 0.50 – 0.20 = 0.30

- **Allocation of funds:**

Security B = 0.20 x 8,000 = ₹1,600

Security C = 0.30 x 8,000 = ₹2,400

Discrete Ques

Value of stock when inflation, growth rate & beta is changing

 # Ques 42 – Platinum **{SM TYK, M18 Exam (New), N23 MTP 1}**

The risk-free rate of return Rf is 9 percent. The expected rate of return on the market portfolio Rm is 13 percent. The expected rate of growth for the dividend of Platinum Ltd. is 7 percent. The last dividend paid on the equity stock of firm A was ₹ 2.00. The beta of Platinum Ltd. equity stock is 1.2.

i) What is the equilibrium price of the equity stock of Platinum Ltd.?

ii) How would the equilibrium price change when

- The inflation premium increases by 2 percent
- The expected growth rate increases by 3 percent in absolute terms
- The beta of Platinum Ltd. equity rises to 1.3 **and**
- Market return remains the same.

Ans: (i) Equilibrium price of Equity using CAPM

- Ke = 9% + 1.2(13% - 9%) = 13.8%

- $P = \frac{D_1}{Ke-g} = \frac{2.00(1.07)}{0.138-0.07} = \frac{2.14}{0.068}$ = ₹ 31.47

ii) New Equilibrium price of Equity using CAPM

- Ke = 9.18% + 1.3×(13% - 9.18%) = 14.146%

- $P = \frac{D1}{Ke-g} = \frac{2.00 \times 1.10}{0.14146 - 0.10} = ₹53.06$

Using fund's beta to cal. closing equity value (+ first using ratios to reverse cal. Beta)

 # Ques 43 – Damodara {SM TYK, M19 RTP, Dec 21 Exam, Dec 21 MTP 2 (Old), M23 MTP 2, M24 RTP}

There are two Mutual Finds viz. Damodara (D) mutual funds Ltd. and K mutual Funds Ltd. Each having close ended equity schemes. NAV as on 31- 12-2014 of equity schemes of D Mutual Fund Ltd. is ₹70.71 (consisting 99% equity and remaining cash balance) and that K mutual Fund is ₹62.50 (consisting 96% equity and balance in cash). Following is the other information:

Equity Schemes

Particular	D Mutual Fund Ltd.	K Mutual Fund Ltd
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard Deviation	11.25	5

- There is no charge in portfolios during next month. Monthly average cost is 0.25 per unit for the schemes of both the Mutual Funds.
- If share market goes down by 5% within a month, Calculate expected NAV after a month for the schemes of both the mutual funds. For calculation, consider 12 months in a year and ignore number of days for a month.

Ans: **Krack Chart** - i) Required "Closing NAV" → Closing NAV = Opening NAV +/- Changes

ii) We already have opening NAV. So all we need is "Changes during the month".

iii) Since market fell by 5% during the month. So, Δ equity position = Δ market x Beta.

iv) Hence, if we find beta, the entire ques will be solved like a cakewalk.

----- Ans Starts from here -----

- Sharpe's Ratio = $(Rp - Rf) / \sigma_p$
- Treynor ratio = $(Rp - Rf) / Beta_p$

Beta of D Ltd.

- Sharpe's ratio = 2
- (Rp – Rf) / 11.25 = 2 => Rp – Rf = 22.5

- Treynor ratio = 15
- 22.5 / Beta = 1.5 => Beta = 1.5
- Hence, Beta of D ltd. = 1.5

Beta of K Ltd.

- Sharpe's ratio = 3.3
- (Rp – Rf) / 5 = 3.3 => (Rp – Rf) = 16.5

- Treynor ratio = 15
- 16.5 / Beta = 1.5 => Beta = 1.1
- Hence, Beta of K ltd. = 1.1

If market goes down by 5%, then equity component of portfolio will fall by 5% x Beta.

D Ltd = 5% x 1.50 = 7.50%

K Ltd = 5% x 1.1 = 5.50%

Note: Cash is not impacted by market changes.

#

	Closing NAV of D ltd.	Closing NAV of K LTD.
• Equity	70.71 × 99% × (1-0.075) = 64.75	62.50 x 96% x (1-0.055) = 56.70
• Cash	70.71 x 1% - 0.25 = 0.457	62.50 x 4% - 0.25 = 2.25
• NAV After 1-month	65.21	58.95

Unique – Calculating expected return & SD when 'cum debenture price' of stock is given

Ques 44 – Kaveri **{SM TYK, M23 RTP}**

Following information is available in respect of dividend, market price of Kaveri Ltd. shares and market condition after one year.

Market Condition	Prob.	Market Price (₹)	Dividend /Share
Good	0.25	115	9
Medium	0.50	107	5
Bad	0.25	97	3

The existing market price of an equity share is ₹106 (F.V. Rs 1), which is cum debenture of ₹6 each per share with 10% rate of interest. The co. has offered the buy-back of debenture at face value.

i) Find out the expected return and Standard Deviation of equity of the equity shares.

ii) Also advise Whether to accept buyback offer?

Ans: **Faculty Note!!**

» Price of ₹106 given is cum-debenture price i.e., this price includes price of both equity shares as well as debenture. We need price of equity share only.

» BUT……. Since the company is buying back the debentures. (MPS after 1 year under different economic scenarios is ex- debenture price only.

• Price of equity share = Cum-debenture price – Price of debenture = 106 – 6 = 100

Prob.	Scenario	P1	Div	CG	Total Return % (x)	$(x - \bar{x})^2$	$P(x - \bar{x})^2$
0.25	Good	115	9	15	24 / 100 = 24%	144	36
0.5	Normal	107	5	7	12 / 100 = 12%	0	0
0.25	Bad	97	3	-3	0 / 100 = 0%	144	36
						Total i.e. Variance:	72

i) Calculating Expected return and SD

• Expected return = {24% x 0.25} + {12% 0.5} + 0 = 12%

• SD (σ_p) = $\sqrt{72}$ = 8.49%

Note: We have used ex-debenture price of ₹100 as P0 while calculating Capital gain.

ii) Should we accept buy-back?

- The rate of debenture is 10% and the company's stock is offering a 12% expected return, which is merely 2% more than the debentures. Considering the expected dividend, it seems like co. has surplus funds to pay dividends & hence should be able to honour its debt obligations as well. These factors favour the decision that the investor **should not accept** the buy-back offer.
- However, more information is required such as current yield on debt, maturity period, prevailing re-investment rate, probability of default etc. before reaching a conclusion.

Two stage DDM where beta is not given directly

 # Ques 45 – Britannia **{SM TYK, M24 Exam}**

Britannia Ltd. paid a dividend of ₹2 for the current year. The dividend is expected to grow at 40% for the next 5 years and at 15% per annum thereafter. The return on 182 days T-bills is 11% p.a.

and the market return is expected to be around 18% with a variance of 24%. The co-variance of XYZ's return with that of the market is 30%. You are required to calculate the required rate of return and intrinsic value of the stock.

Ans: Beta = Covariance (s,m) ÷ Variance (market) = 30/24 = 1.25

- Ke as per CAPM = $R_F + (R_M - R_F) \times$ Beta = 11 + (18 – 11) x 1.25 = 19.75%

-

Year	Growth	Dividend	PV @ 19.75%
1	0.4	2.8	2.3382
2	0.4	3.92	2.7336
3	0.4	5.488	3.1959
4	0.4	7.6832	3.7363
5	0.4	10.7565	4.3681
6	0.15	12.3700	TV = 105.7544 (WN 1)
		Total :	**122.1265**

- **WN 1 – Terminal value**

$$TV = \frac{DPS\ 6}{Ke - g} \times \frac{1}{(1+Ke)^5} = \frac{12.37}{0.1975 - 0.15} \times \frac{1}{1.1975^5} = ₹\ 105.7544$$

Additional Questions

Basic Questions

Constructing various possible portfolios from given stocks

 # Ques 1 – Soros {N22 Exam}

Mr. Soros collected the following info related to return on shares of three different companies:

Years	A Ltd.	B Ltd.	C Ltd.
2018	2%	3%	5%
2019	6%	8%	7%
2020	13%	14%	15%
2021	7%	9%	11%

Construct maximum number of portfolio and its return, if each portfolio consists of any two Company's shares in proportion of 65% and 35% and suggest which portfolio provides highest return.

Ans: **Calculating average return of each stock:**

A ltd = (2 + 6 + 13 + 7) / 4 = 7

B ltd = (3 + 8 + 14 + 9) / 4 = 8.5

C ltd = (5 + 7 + 15 + 11) / 4 = 9.5

 # Different combos of stocks:

(1) 65% in A Ltd. & 35% B Ltd.

Return = 7% x 0.65 + 8.50% x 0.35 = 7.525% or 7.53%

(2) 65% in B Ltd. & 35% in C Ltd.

Return = 8.50% x 0.65 + 9.50% x 0.35 = 8.85%

(3) 65% in C Ltd. & 35% in A Ltd.

Return = 0.65 x 9.5% + 0.35 x 7.00% = 8.625% or 8.63%

(4) 65% in A Ltd. & 35% in C Ltd.

Return = 0.65 x 7% + 0.35 x 9.50% = 7.875% or 7.88%

(5) **35% in A Ltd. & 65% in B Ltd.**

Return = 0.35% x 7% + 0.65 x 8.50% = 7.9755 or 7.98%

(6) **35% in B Ltd. & 65% in C Ltd.**

Return = 0.35 x 8.5% + 0.65 x 9.5% = 9.15%

» Since maximum return is under Combination 6 i.e. 65% investment in C Ltd. and 35% in B Ltd. Hence it should be opted for.

👉 ## CAPM, SML, CML Etc

Basic Over/under-valued using CML

 # Ques 2 – Nile

Suppose Rf = 8%, Rm = 18%, Standard Deviation of market 4%. The following portfolios are available to Mr. Nile who wants to know whether each is overvalued and correctly values. Use CML concept.

Security	Expected Return	Risk
A	18%	5%
B	30.5%	9%
C	14%	2%

Ans: CML Return = $Rf + \frac{(Rm - Rf)}{\sigma_m} \times \sigma_s = 8 + \frac{(18 - 8)}{4} \times \sigma_s = 8 + 2.5\sigma_s$

Share	SML return	Actual return	Value & Strategy
A	8 + 2.5 x 5 = 20.5%	18%	Overvalued -> Sell
B	8 + 2.5 x 9 = 30.5%	30.5%	Correct -> Hold
C	8 + 2.5 x 2 = 13%	14%	Undervalued- Buy

Portfolio Beta + Basic Over/under valued using CAPM

 # Ques 3 – Civic

Mr. Civic has short term investments in shares of the various companies. The detail are:

Name	Face Value	Quantity	Geared Beta	CMP	Div Yield %	Exp return %
T Ltd.	50	1000	1.55	280	6.8	21
U Ltd.	100	1550	0.65	340	3.6	12.5

	V Ltd.	20	2600	1.26	150	6.4	18
	W Ltd.	10	4300	1.14	95	7.2	18.5

Risk-free return and Market Return are 6% and 16% respectively. You are required to:

(i) Estimate the risk of Mr. Civic's portfolio relative to market.

(ii) Whether portfolio composition should be changed, if yes, then how.

Ans: (i) Risk of portfolio relative to market can be calculated using weighted beta of the portfolio:

Name	Geared β	Market Value (₹)	Weight (w)	(β)x(w)
T Ltd.	1.55	2,80,000	0.1744	0.2703
U Ltd.	0.65	5,27,000	0.3283	0.2135
V Ltd.	1.26	3,90,000	0.2429	0.3061
W Ltd.	1.14	4,08,500	0.2544	0.2900
				1.0799

Thus, the risk of portfolio relative to market is 1.08

(ii) Examining individual shares using CAPM to determine whether to change the portfolio.

- Ke as per CAPM = Rf + (Rm - Rf).β = 6 + (16 – 6).β = 6 + 10β

Name	Required return (Ke)	Expected Return	Alpha Value	Action
T	6 + 10×1.55 = 21.5%	21%	-0.50%	Sell
U	6 + 10×0.65 = 12.5%	12.5%	0%	Hold
V	6 + 10×1.26 = 18.6%	18%	-0.60%	Sell
W	6 + 10×1.14 = 17.4%	18.5%	1.1%	Buy

👉 Sharpe's, Treynor ratio, Jenson's Alpha

Basic portfolio risk & return + Impact on Sharpe ratio

 # Ques 4 – Angolia **{SM TYK, M24 MTP 2}**

Suppose economy of Angolia (Economy A) is growing rapidly and you are managing a global equity fund and so far you have invested only in developed-country stocks only. Now you have decided to add stocks of economy A to your portfolio. The table below shows the expected rates of return, SD, and correlation coefficients (all estimates are for aggregate stock market of developed countries and stock market of Economy A).

		Developed Country Stock	Stocks of Economy A
	Expected return p.a.	10%	15%
	Risk (Standard Deviation p.a.)	16%	30%
	Correlation Coefficient (ρ)	0.30	

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

(a) What percentage of your portfolio should you allocate to stocks of Economy A if you want to increase the expected rate of return on your portfolio by 0.5%?

(b) What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?

(c) Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio?

Ans: (a) Let weight of stocks of Economy A be 'w'

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

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

(b) $\sigma^2_p = \{0.9\times 16\}^2 + \{0.1\times 30\}^2 + 2(0.9\times 16)(0.1\times 30)0.3 = 242.3$

Standard deviation is $\sqrt{242.3} = 15.565\%$ or 15.6%.

(c) Sharpe ratio will improve by approximately 0.04, as shown below:

- Sharpe Ratio = (ER – Rf) ÷ Standard Deviation
- Investment only in developed countries: (10 – 3) ÷ 16 = 0.437
- With inclusion of Economy A stocks: (10.5 – 3) ÷ 15.6 = 0.481

* Alternatively, it can also be computed by using Weighted Average Method.

👉 Portfolio Rebalancing

Constant ratio plan

 # Ques 5 - Kiran

Ms. Kiran had a surplus fund of ₹2,00,000 on 31.03.2016. She is interested in constructing a portfolio of shares of the core sectors to be weighted equally in rupee value terms. Her friend Shaila based on her research advised her to purchase following shares:

Company:	O Ltd.	H Ltd.	A Ltd.	R Ltd.	T Ltd.
No. of shares:	100	1000	320	400	200

Price per share:	400	40	125	100	200

On April, 2016, the prices of these stocks were as follows:

Company	O Ltd	H Ltd.	A Ltd.	R Ltd.	T Ltd.
Price per share	300	60	120	150	125

You are required to exhibit how Kiran can rebalance her portfolio on 1.4.2016 so that her exposure to individual stock is maintained at original level in terms of rupee value.

Ans:

Co.	Original Qty	Amount Invested	Weight	New required Qty as per revised price	Buy (+) Sell (-)
O	100	100 x 400 = 40,000	1/5	(2,13,400 x 1/5)/300 = 142.27	+ 42.27
H	1000	1000 x 40 = 40,000	1/5	(2,13,400 x 1/5)/ 60 = 711.33	- 288.67
A	320	320 x 125 = 40,000	1/5	(2,13,400 x 1/5)/120 = 355.67	+ 35.67
R	400	400 x 100 = 40,000	1/5	(2,13,400 x 1/5)/150 = 284.53	- 115.47
T	200	200 x 200 = 40,000	1/5	(2,13,400 x 1/5)/125 = 341.44	+ 141.44

- **Working note: Value of portfolio as on 1.4.16**

{300×100} + {60×1000} + {120×320} + {150×400} + {125×200} = 213400

👉 **Master practice example**

 # Ques 6 – Abhishek **{SM TYK, M24 MTP 1}**

Mr Abhishek is interested in investing ₹2 lacs for which he is considering following 3 alternatives:

(i) Invest ₹2,00,000 in Mutual Fund X (MFX)

(ii) Invest ₹2,00,000 in Mutual Fund Y (MFY)

(iii) Invest ₹1,20,000 in Mutual Fund X (MFX) and ₹80,000 in Mutual Fund Y (MFY)

- Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%
- Covariance of return of MFX and MFY and market portfolio Mix are as follows:

	MFX	MFY	Market Mix
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
Market Mix	3.370	2.800	3.100

	You are required to Calculate:
(i)	variance of return form MFX, MFY and market return
(ii)	Portfolio return, portfolio beta, portfolio variance and portfolio standard deviation
(iii)	Expected return as per CAPM, systematic risk and unsystematic risk of each MFX, MFY and market return
(iv)	Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and portfolio Mix
Ans:	**i) Variance (directly given in variance-covariance matrix)**
	MFX = 4.800
	MFY = 4.250
	Market = 3.100
ii)	Return of portfolio (Rp) = Weighted average return
	Rp = 15 x 1.2/2 + 14 x 0.8/2 = 14.60%
-	**Beta of portfolio = Weighted average Beta**
•	Beta(s) = Covariance(s,m) / Variance
•	Beta MFX = 3.370 / 3.10 = 1.087
•	Beta MFY = 2.800 / 3.10 = 0.903
•	Beta(p) = {1.087 x 1.2/2} + {0.903 x 0.8/2} = 1.013
#	**VARIANCE OF PORTFOLIO**
•	$\sigma_P^2 = (w_a\sigma_a)^2 + (\omega_b\sigma_b)^2 + 2\omega_a\omega_b(\sigma_a\sigma_b r_{a,b})$
•	σ_p^2 = {0.60² x 4.800} + {0.40² x 4.250} + {2 x 0.6 x 0.4 x 4.3} = 4.472
•	SD (σ_p) = $\sqrt{4.472}$ = 2.115%
iii)	**Expected return as per CAPM**
	CAPM = Rf + (Rm – Rf) x Beta
	Portfolio = 10% + (12% - 10%) 1.013 = 12.03%
	MFX = 10% + (12% - 10%) 1.087 = 12.17%
	MFY = 10% + (12% - 10%) 0.903 = 11.81%
-	**Systematic risk = Beta² x σ_m^2**
	MFX = 1.087² x 3.1 = 3.663
	MFY = 0.903² x 3.1 = 2.528
	Portfolio = 1.013² x 3.1 = 3.181

-	**USR = TR – SR**
	MFX = 4.8 – 3.663 = 1.137
	MFY = 4.250 – 2.528 = 1.722
	Portfolio = 4.472 – 3.181 = 1.291
iv)	**Sharpe's Ratio = Rp – Rf**
	σ_p
	MFX = (15 – 10) ÷ √4.8 = 2.282
	MFY = (14 -10) ÷ √4.25 = 1.94
	Portfolio = (14.60 – 10) ÷ √2.115 = 2.175
#	**Treynor ratio = Rp – Rf**
	$Beta_p$
	MFX = (15 – 10) ÷ 1.087 = 4.60
	MFY = (14 – 10) ÷ 0.903 = 4.43
	Portfolio = (14.60 – 10) ÷ 1.0134 = 4.54
#	**Jenson's Alpha = Actual return – CAPM return**
	MFX = 15% - 12.17% = 2.83%
	MFX = 14% - 11.81% = 2.19%
	Portfolio = 14.6% - 12.03% = 2.57%
👉	**Low probability – Unique questions**
	When 2 different risk premiums are given in ques (Constant RP vs Historical RP)
#	**Ques 7 – Accord**
	Mr. Accord is analyzing that the market portfolio has a historically based expected return of 0.095
	and a S.D. of 0.035 during a period when risk free assets yielded 0.025. **The 0.06 risk premium is**
	thought to be constant through time. Riskless investments may now be purchased to yield 0.08. A
	security has a S.D. of 0.07 and a 0.75 correlation with the market portfolio. The market portfolio
	is now expected to have a S.D. of 0.035
(i)	Find the market's risk return trade-off using historical data

(ii) Find the security Beta

(iii) Find the equilibrium (fair) required expected return of the security using Current Data.

Ans: **i) Calculating Market risk return trade-off using historical data**

$= \frac{Rm - Rf}{\sigma_m} = \frac{9.5 - 2.5}{3.5} = 2:1$

(Here we are taking actual historical Rm & Rf figures.)

ii) Security Beta $= \frac{\sigma s \times Rs_{,m}}{\sigma_m} = \frac{7 \times 0.75}{3.5} = 1.5$ times

iii) Rs = Rf + Beta x Market risk premium

Rs = 8% + 1.5 x 6% = 17% **(Here we are taking constant Risk premium i.e., 6%.)**

Reverse calculation – SD of stock & market using given info

 # Ques 8 – Polo

Calculate SD of Market Return and Security Return from the following info about Stock of Polo ltd.

- Equilibrium Return 15%
- Market Return 15%
- 7% treasury Bond trading at $140
- Coefficient of Correlation 0.75
- Covariance of market return and Security Return = 225%

Ans: Since stock's equilibrium return = Market return.

- Therefore, Beta of stock = beta of market = 1
- Beta = $Covariance_{s,m} / Variance_m$
- $1 = 225 / Variance_m$
- Variance of market = 225

(i) SD of market (σ_m) = $\sqrt{225}$ = 15%

(ii) Beta = $\{\sigma_s \times r_{s,m}\} / \sigma_m$

- $1 = \frac{\sigma_s \times 0.75}{15}$ => σ_s = 20%

 # Author Note: Alternative way to calculate beta in this ques.

- Calculating Risk-free return (Rf):
- 7% treasury bond is trading at ₹140.
- Assuming bond life to be perpetual. (as life of bond is not given)

» Risk-free rate = Interest / Bond price = 7 / 140 = 5%

As per CAPM -> Return = Rf + (Rm – Rf) x Beta

- 15% = 5% + (15% - 5%) x Beta

» Beta = 1

Beta of equity when debt beta ≠ 0 & capital structure of the co. is changing

 # Ques 9 - Koala Gold field {M19 Exam (Old), N20 MTP 1 (New)}

Equity of Koala Gold field Ltd. (KGFL) is Rs. 410 Crores, its debt, is worth Rs. 170 Crores. Printer Division segments value is attributable to 74%, which has an Asset Beta (βp) of 1.45, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β sc) of 1.20 KGFL Debt beta (β D) is 0.24. You are required to calculate:

(i) Equity Beta (β E)

(ii) Ascertain Equity Beta (β E), if KGF Ltd. decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt Equity Ratio at 1.90. Assume that the present Debt Beta (β D1) is 0.35 and any further funds raised by way of Debt will have a Beta (β D2) of 0.40.

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

Ans: Asset beta of co. = 1.45 x 0.74 + 1.20 x 0.26 = 1.385

(i) $\text{Asset Beta} = \text{Beta}_{\text{Equity}} \times \frac{E}{E + D(1-t)} + \text{Beta}_{\text{Debt}} \frac{[D(1-\text{tax})]}{E + D(1-\text{tax})}$

- $1.385 = \text{Beta}_{\text{Equity}} \times 410/580 + 0.24 \times 170/580$
- Beta of equity = 1.86

(ii) Updated capital structure	₹ crores
• Total value of firm as of now = 410 + 170	580
• New total debt if debt ratio is 1.9 = 580 x 1.9 / (1.9 + 1)	380
• So, New debt to be raised = New total debt – Existing debt = 380 – 170	210
• New equity after repurchase = 410 – 210	200

Calculating new equity beta

- Asset beta = Weighted average beta
- $1.385 = \{\text{Beta}_{\text{Equity}} \times 200/580\} + \{0.35 \times 170/580\} + \{0.4 \times 210/580\}$
- $\text{Beta}_{\text{Equity}} = 3.299$

(iii) Yes, it justifies the increase as it leads to increase in the Value of Equity due to increase in Beta.

Beta of co. = Weighted avg beta of departments + Using proxy firm to cal. beta

 # Ques 10 – Rustom

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

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

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

(i) Beta of the co.

(ii) Cost of Equity of the co.

(iii) Assuming, that the co. wants to raise debt of an amount equal to half of its Market Value then determine equity beta, if yield of debt is 5%.

Ans: **(i) Calculating Beta**

- Beta = $(\sigma s \times Correlation) / \sigma m$
- Car AC = $(0.6 \times 0.30)/0.2$ = 0.9
- Window AC = $(0.35 \times 0.7)/0.2$ = 1.225
- Split AC = 3.025 (refer WN 1)

» Therefore, Beta of co = Weighted average beta = {0.9 x 60%} + {1.225 x 25%} + {3.025 x 15%} = 1.30

(ii) Cost of equity (Ke) = Rf + (Rm – Rf) x Beta = 4 + (10 – 4) 1.30 = 11.80%

(iii) Debt Beta = $\frac{Kd - Rf}{Rm - Rf} = \frac{5 - 4}{10 - 4} = 0.167$

- Accordingly, Equity Beta shall be: -
- 1.30 = {0.50 x 0.167} + {0.50 x Be}

• Be = 2.433

WN 1 – Beta of split AC using proxy firm

• Proxy firm beta = (0.85 x 0.50)/0.2 = 2.125

• Proxy firm constitutes of 50% Split AC & 50% window AC

=> Proxy firm Beta = 0.5% x Split AC Beta + 0.5 x window AC Beta

=> 2.125 = 0.5 x Split AC Beta + 0.5 x 1.225

=> Split AC Beta = 3.025

Sharpe Cut-off model

Ques 11 – Ganga **{SM TYK}**

Ganga wants to invest in stock market. He has got the following info about individual securities:

Security	Expected Return	Beta	σ_{ei}^2
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	09	1	10
E	08	1.2	20
F	14	1.5	30

Market index variance is 10% and the risk-free rate of return is 7%. What should be the optimum portfolio assuming no short sales?

Ans: Krack chart – Complete video solution is available on YouTube.

Search 'Sharpe cut off model Krivi Eduspace' on YouTube.

1) Step 1 – Rank securities based on Treynor ratio

Name	$(R_i - R_f)/\beta$	Rank
A	5.33	1
B	2.5	3
C	1.2	5
D	2	4
E	0.83	6
F	4.67	2

2) Step 2 – Calculating C_i and Deciding Cut off

For student learning:

$$Ci = \frac{\sigma_m^2 \times \Sigma (\text{Treynor ratio} \times A)}{1 + (\sigma_m^2 \times \Sigma A)}$$

where: $A = \beta^2 / \sigma_e^2$

For exam purpose:

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^{N} \frac{(R_i - R_f)\beta_i}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum_{i=1}^{N} \frac{\beta_i^2}{\sigma_{ei}^2}}$$

#	TR	Beta	USR	$A = \beta^2/\sigma_e^2$	$\Sigma\beta^2/\sigma_e^2$	TR×A	ΣTR×A	Ci
A	5.33	1.5	40	0.056	0.056	0.3	0.3	1.923
F	4.67	1.5	30	0.075	0.131	0.35	0.65	2.814
B	2.5	2	20	0.2	0.331	0.5	1.15	2.668
D	2	1	10	0.1	0.431	0.2	1.35	2.542
C	1.2	2.5	30	0.208	0.639	0.25	1.6	2.165
E	0.83	1.2	20	0.072	0.711	0.06	1.66	2.047

- Cut off point (C*) = Highest value of Ci = 2.814.
- Select stocks with **Treynor ratio** > C* i.e. Select stocks A & F.

3) Step 3 – Deciding weights

$$\text{Weight} = \frac{Z_i}{\Sigma Z_i} \quad \text{Where } Zi = \beta/\sigma_e^2 \times (\text{Treynor ratio} - C^*)$$

- $Z_A = (1.5/40) \times (5.33 - 2.814) = 0.09435$
- $Z_F = (1.5/30) \times (4.67 - 2.814) = 0.0928$
- $\Sigma Zi = Z_A + Z_F = 0.09435 + 0.0928 = 0.18715$
- Weight of A = $Z_A / \Sigma Z_i$ = 0.09435 / 0.18715 = 0.5041 or 50.41%
- Weight of F = $Z_F / \Sigma Z_i$ = 0.0928 / 0.18715 = 0.4959 or 49.59%

Bifurcating Active return into return due to higher risk & return due to skill

 # Ques 12 – Alaska **{N19 Exam (Old)}**

The returns of a portfolio Alaska (A) and market portfolio for the last 12 months are:

Month	Portfolio A (Ra)	Market Portfolio (Rm)
January	-0.52	0.82
February	2.20	0.04

	March	2.17	2.80
	April	4.17	1.72
	May	2.04	0.27
	June	3.00	0.39
	July	1.99	1.95
	August	4.00	0.64
	September	-1.38	1.53
	October	2.67	2.70
	November	3.99	2.52
	December	1.86	2.09
	Standard Deviation (σ)	1.6223	0.9498

Assume that the Risk-Free Rate of Return is 12% p.a. and the portfolio is fully diversified.

(i) Find out the monthly returns attributable to the sheer skill of the Portfolio Manager.

(ii) What part of the monthly return is attributable to the higher risk assumed by the Portfolio Manager?

Ans: Avg Rm = $\frac{0.82 + 0.04 + 2.8 + 1.72 + 0.27 + 0.39 + 1.95 + 0.64 + 1.53 + 2.70 + 2.5 + 2.09}{12}$ = 1.4558% pm

- Avg Ra = $\frac{-0.52 + 2.2 + 2.17 + 4.17 + 2.04 + 3 + 1.99 + 4 - 1.38 + 2.67 + 3.99 + 1.86}{12}$ = 2.1825% pm
- Excess return of portfolio A over market portfolio = 2.1825% - 1.4558% = 0.7267% pm

Calculating Beta of portfolio A (β_P)

- Since the portfolio is fully diversified.
- Total risk (σ^2_P) = Systematic risk of portfolio (SR) = $\beta_P^2 \times \sigma^2_M$
- $\sigma^2_P = \beta_P^2 \times \sigma^2_M$
- $1.6223^2 = \beta_P^2 \times 0.9498^2 \Rightarrow \beta_P = 1.708$

So, this portfolio is comparable with a portfolio with Beta = 1.708.

- Expected monthly return of such a portfolio = 1% + (1.4558% - 1%) x 1.708 = 1.7785%
- Note: Monthly Rf = 12%/12 = 1% p.m.

(i) Excess return due to skill of manager (this is same as Jenson's alpha)

Excess return = Rp – CAPM return = 2.1825% – 1.7785% = 0.404%

(ii) Balance excess return is due to higher risk = 0.7267% - 0.404% = 0.3227% p.m.

Beta of merged entity

Ques 13 - Bull Bear

Two companies Bull Ltd and Bear Ltd. recently have been merger. The merger initiative was taken by Bull Ltd. to achieve a lower risk profile for the combined firm despite fact that both companies belong to different industries and, also disclose a line co-movement in their earning streams. Through there is likely to earning synergy benefits to the tune of ₹7 crore from proposed merger. Further both companies are equity financed and other details are as follows:

	Market Capitalization	Beta
Bull Ltd.	₹1000 Crore	1.50
Bear Ltd.	₹500 Crore	0.60

Expected market return and risk-free rate of return are 13% and 8% respectively. Shares of merged entity have been distributed in the ratio of 2:1 i.e., Market Capitalization just before merger:

(a) Calculate cost of equity **(return on Shares)** of both companies before merger and after merger.

(b) Calculate the impact (gain or Loss) of merger on Mr X, a shareholder holding 4% share in Bull Ltd. and 2% share of Bear Ltd. Use Earning Yield Capitalization Method.

Ans: **a) Expected return before Merger as per CAPM.**

CAPM = Rf + (Rm – Rf) x Beta

Bull ltd = 8 + (13 – 8) x 1.50 = 15.5%

Bear ltd. = 8 + (13 – 8) x 0.6 = 11%

ii. **After merger**

Weight of Bull ltd in merged entity = 2/3

Weight of Bull ltd in merged entity = 1/3

» Beta of company after merger = 1.5 x 2/3 + 0.6 x 1/3 = 1.20

• Expected return of merged entity -> 8 + (13 – 8) x 1.20 = 14%

b) **Impact of Merger on Mr.X**

(i) **Total value before merger = Value of shares in Bull ltd. + Value of shares in Bear ltd.**

• Total value before merger = {1000 x 4%} + {500 x 2%} = 50 crores

(ii) **% share of Mr. X in merged entity** = {4% x 2/3} + {2% x 1/3} = 3.33%

(iii) **Total earning of merged entity = Earning of Bull + Earning of Bear + Synergy**

- Total earning of merged entity = {1000 x 15.5%} + {500 x 11%} + 7 = 217 crores

(iv) **Value of merged entity (as per Earning cap. Method) = Total earnings / Cost of equity**

- Value of merged entity = 217 / 0.14 = 1550 crores
- Value of Mr. X shares = 1550 x 3.33% = 51.67 crores
- Benefit to Mr. X = 51.67 – 50 = 1.67 crores

Ch 8 – Mutual Fund

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Calculating NAV	1 – 6
Investor return vs Mutual fund return	7 – 8
Reinvestment plan	9 – 10
Ques based on application	11 – 14
Dividend equalisation reserve	15
Diff. plans – Reinvestment, Bonus, Growth	16 – 18

Index - Additional Questions	**Ques Number**
Tiny Topics	1
Low Probability – Unique Questions	
- NAV Calculation (Vishnu Mutual fund)	2
- Using Target duration to calculate required earnings of fund	3

Main Questions

👉 Calculating NAV

 # Ques 1 – Cinderella **{SM TYK}**

Cinderella MF has the following assets in Scheme Rudolf at the close of business on 31/3/14.

Company	No. of Shares	Market Price Per Share
Nairobi Ltd.	25000	₹20
Dakar Ltd.	35000	₹300
Senegal Ltd.	29000	₹380
Cairo Ltd.	40000	₹500

The total number of units of Scheme Rudolf are 10 lacs. The Scheme Rudolf has accrued expenses of ₹2,50,000 and other liabilities of ₹2,00,000. Calculate the NAV per unit of the Scheme Rudolf.

Ans:

Calculation of NAV			Amount in ₹
• MV of Shares:			
Nairobi:	25,000 x 20 =	5,00,000	
Dakar:	35,000 x 300 =	1,05,00,000	
Senegal:	29,000 x 380 =	1,10,20,000	
Cairo:	40,000 x 500 =	2,00,00,000	4,20,20,000
(-) Accrued expenses			(2,50,000)
(-) Other Liabilities			(2,00,000)
= Total Net Assets:			4,15,70,000
÷ Number of units			10,00,000
= NAV per unit			**₹ 41.57 /-**

 # Ques 2 – Madhu **{SM TYK, N18 RTP (New)}**

Based on the following info determine the NAV per unit of a regular income scheme of Madhu Ltd.

Particulars	₹ Crores
• Listed shares at Cost (ex-dividend)	20
• Cash in hand	1.23
• Bonds and debentures at cost	4.3
• Of these, bonds not listed and quoted	1

•	Other fixed interest securities at cost	4.5
•	Dividend accrued	0.8
•	Amount payable on shares	6.32
•	Expenditure accrued	0.75
•	Number of units (₹ 10 face value)	20 lac
•	Current realizable Value of fixed income securities of face value of ₹ 100	106.5
•	The listed shares were purchased when Index was	1,000
•	Present index is	2,300
•	Value of listed bonds and debentures at NAV date	8
	There has been a diminution of 20% in unlisted bonds and debentures. Other fixed interest securities are at cost.	
Ans:	**Particulars**	**Adjusted Values ₹ crores**
•	Equity Shares (20 / 1000) x 2300	46.00
+	Cash in hand	1.23
+	Bonds and debentures not listed: (1 x 0.8)	0.80
+	Bonds and debentures listed	8.00
+	Dividends accrued	0.80
+	Fixed income securities	4.50
#	**Sub total assets (A)**	**61.33**
	Less: Liabilities	
•	Amount payable on shares	6.32
•	Expenditure accrued	0.75
#	**Sub total liabilities (B)**	**7.07**
=	**Net Assets Value (A) – (B)**	**54.26**
÷	No. of units	20,00,000
=	**Net Assets Value per unit**	**₹ 271.30**

HPR calculation

 # Ques 3 – Himalayas **{SM TYK, Jul 21 Exam (New), M23 MTP 1}**

Miss. Himalayas has invested in three mutual fund schemes as per detail given below:

Mutual Fund	A	B	C
Date of Investment	1.12.03	1.01.04	1.03.04

	Amount of Investment	₹50,000	₹1 lacs	₹50,000
	NAV at entry date	₹10.50	₹10.00	₹10.00
	Dividend received up to 31.3.04	₹950	₹1500	Nil
	NAV as on 31.03.04	₹10.40	₹10.10	₹9.80

What is the return **p.a.** in respect of each of the three schemes to Miss. Kiran up to 31.03.04?

Ans: **WN 1 - Calculating Dividend per unit for A & B*:**

		A	B
•	Amount invested	50,000	1,00,000
•	Opening NAV	10.50	10
•	Opening number of units	4761.90	10,000
•	Total dividend received	950	1500
•	Dividend per unit	0.1995	0.15

*Note: No dividend calculation is shown for Mutual fund C as it has paid Nil dividend.

WN 2: Period holding in each mutual fund till 31st March, 2004:

Mutual Fund	A	B	C
Date of Investment	1.12.03	1.01.04	1.03.04
Period of holding	4 months	3 months	1 month

**Calculating HPR of each fund:**

• $HPR = \frac{(NAV_1 - NAV_0) + Dividend}{NAV_0}$

• MF A $= \frac{(10.40 - 10.50) + 0.1995}{10.50} \times \frac{12}{4} = 2.843\%$ p.a.

• MF B $= \frac{(10.10 - 10) + 0.15}{10} \times \frac{12}{3} = 10\%$ p.a.

• MF C $= \frac{(9.80 - 10) + 0}{10} \times \frac{12}{1} = -24\%$ p.a.

Updated NAV when a new investor invests in MF (The "Cheque" ques)

 # Ques 4 – Aravalli **{SM TYK, M18 Exam (New), N19 RTP (New), N20 Exam (Old)}**

On 1st April 2009 Aravalli Mutual Fund has the following prices at 4.00 p.m.

Shares	No. Of Shares.	Market Price Per Share (₹)

	A Ltd.	10,000	19.70
	B Ltd.	50,000	482.60
	C Ltd.	10,000	264.40
	D Ltd.	1,00,000	674.90
	E Ltd.	30,000	25.90
		No. of units of fund:	8,00,000

(a) Calculate NAV of the fund.

(b) Assuming Mr. X, send a cheque of ₹50 lacs to the fund and Fund Manager purchases 18000 shares of C Ltd. and balance are held in bank. Then what will be the value of fund and Total No. of Units.

(c) Now suppose on 2 April 2009 at 4.00 p.m. the market price of shares is as A Ltd. ₹20.30, B Ltd. ₹513.70, C Ltd. ₹290.80, D Ltd. 671.90 & E Ltd. ₹44.20. Then what will be new NAV?

Ans: **(a) NAV on 01.4.2009**

- $\frac{\{10000 \times 9.7\} + \{50000 \times 482.6\} + \{10000 \times 64.4\} + \{1,00,000 \times 674.9\} + \{30000 \times 25.9\}}{8,00,000} = 119.0475$

(b)

New Units allotted to Mr. X	=	50,00,000 / 119.0475	=	42,000 Units
New Value of Fund	=	9,52,38,000 + 50,00,000	=	10,02,38,000
New Total no. of Units	=	8,00,000 + 42,000	=	8,42,000

(c) **NAV as on 02.4.2009**

- $\frac{\{10000 \times 20.3\} + \{50000 \times 513.7\} + \{28000 \times 290.8\} + \{1,00,000 \times 671.9\} + \{30,000 \times 44.2\} + 240800^*}{842,000}$

- NAV per unit = $\frac{10,27,87,200}{8,42,000} = 122.08$

 # *WN 1 – Calculating closing cash balance

- Amount used for purchasing shares of C ltd. = 18,000 x 264.40 = 47,59,200
- Balance cash remaining = 50,00,000 - 47,59,200 = ₹2,40,800

NAV when an investee co. declares Interim Dividend & Bonus Shares

 # Ques 5 – Templan {SM TYK, M22 Exam, N23 MTP 1}

Templan Mutual Fund had ₹10,00,00,000 as on Jan. 1, 07. The fund had issued 1,00,00,000 units of ₹10 each. It made following investments:

	5,00,000 Equity Shares of CHK ltd. of ₹100 each @ ₹160	8,00,00,000
	8% Central Government Securities	80,00,000
	9% Debenture (unlisted)	50,00,000
	10% Debenture (listed)	50,00,000
	Total:	9,80,00,000
	During the year, dividend of ₹1,20,00,000 were received on equity shares. Interest on all type of debt securities were received as and when due.	
	On 31st Dec, Equity shares were appreciated by 15% while listed debentures were quoted at 10% discount. CHK Ltd., on 15th December 2007 in its AGM declared the interim dividend of 10% and bonus shares at 1:10 with the record date of 28th December 2021.	
	Find out the NAV per unit given that operating expenses incurred during the year amounted to ₹50,00,000. Also find out the NAV, if the mutual fund had distributed a dividend of ₹0.80 per unit during the year to the unit holders. Assume that no load was charged.	
Ans:	**# Calculation of NAV (when no dividend is paid)**	**Amount in lacs**
	Equity shares: 5.5L* x 160 x 1.15	1012
+	8% Central Govt. Securities	80
+	9% Debentures:	50
+	10% listed debentures: 50L x 90%	45
+	Closing cash balance (WN 1)	155.9
	Total Net Assets:	1342.9
÷	Number of units	100
	NAV per unit:	13.429
#	**Working Note – Calculation of closing cash balance**	
	Cash in hand: Op Balance: (10 - 9.8) Crore =	20 L
+	Dividends	120 L
+	Interim dividend: 5L x 100 x 10%	50 L
+	Interest On CG securities: 80 L x 8%	6.4 L
+	Interest on 9% debentures: 50 L x 9%	4.5 L
+	Interest on 10% debentures: 50 L x 10%	5.0 L
(-)	Operating Expenses:	(50 L)
	-> Closing cash balance	155.9
•	NAV when dividend of ₹ 0.8 is paid = 13.429 – 0.80 = ₹ 12.629 per unit	

* WN 2 – Number of shares of CHK ltd. after bonus shares = 5L x 1.1 = 5.5 lacs shares

Calculating Closing cash balance to get closing NAV

 # Ques 6 – Vindhya {SM TYK, N18 Exam (Old), N20 MTP 1 (New), N20 RTP (Old), N22 RTP}

On 01.04.2012 Vindhya mutual Fund issued 20 lacs units at ₹10 per unit. Relevant initial expenses involved were ₹12 lacs. It invested the fund so raised in capital market instruments to build a portfolio of ₹185 Lacs. During the month of April,2012 it disposed- off some of the instrument's costing ₹60 lacs for ₹63 lacs and used the proceeds in purchasing securities for ₹56 lacs. Fund management expenses for the month of April, 2012 were ₹8 lacs of which 10% was in arrears. In April, 2012 the fund earned dividends amounting to ₹2 lacs and it distributed 80% of the realized earnings. On 30.04.2012 the market value of the portfolio was ₹198 lacs. Mr. Akash, an investor, subscribed to 100 units on 01.04.2012 and disposed-off the same at closing NAV on 30.4.2012. What was his annual rate of earning?

Ans:

	Calculation of Cash Balance	**₹ (in Lacs)**
	Opening Cash Balance: (20L x 10 – 12L – 185L)	3.00
+	Sales of Securities	63
+	Dividends received	2.00
(-)	Fund Management Expenses: 8L x 90%	(7.2)
(-)	Purchase of Securities	(56)
(-)	Distributed Capital Gain: (63 – 60) x 0.8	(2.4)
(-)	Distributed Dividend: (2 x 0.8)	(1.6)
	Closing Cash Balance:	0.8

#	**Calculation of NAV**	**₹ (in lacs)**
	MV of Securities	198
+	Cash Balance	0.8
-	Unpaid Management Expenses	(0.8)
	Total Net Assets =	198
÷	Number of units	20
	NAV per unit =	₹9.9

Fund Return = $\frac{(NAV_1 - NAV_0) + CG\ paid + Div\ paid}{NAV_0}$ = $\frac{(198-200) + 2.4 + 1.6}{200}$ x $\frac{12}{1}$ = 12% p.a.

- Return of Mr. Akash = 12% p.a.

👉 Investor return vs Mutual fund return

 # Ques 7 – Beluga **{SM TYK}**

Mr. Beluga can earn a return of 16% by investing in equity shares by his own. Now he is considering a recently announced equity based mutual fund scheme in which the initial expenses are 5.5% and annual recurring expenses are 1.5%. How much should the mutual fund earn to provide Mr. Beluga return of 16%?

Ans: **Alternate 1 – Conceptual method**

If Mr. Beluga invests ₹100 on his own:

Then return earn in one year = 100 x 16% = ₹16

 # If he invests ₹100 in Mutual Fund:

- Amount invested (net of initial expesnes) = 100 x (1 – 0.055) = 94.5
- Recurring expenses = 94.5 x 1.5% = ₹ 1.4175
- Required return (in ₹) = 16 + 1.4175 = ₹ 17.4175
- Required return (in %) = $\frac{17.4175 \times 100}{94.5}$ = 18.43% return

 # Alternate 2 - Formula Method

- Return of MF = $\frac{\text{Return earned by investor}}{1 - \text{Initial expenses}}$ + Recurring expenses = $\frac{16\%}{1 - 0.055}$ + 1.5% = 18.43%

 # Ques 8 – Alex **{N19 Exam (Old)}**

Mr. Alex, a practising Chartered Accountant, can earn a return of 15% by investing in equity shares on his own. He is considering a recently announced equity based mutual fund scheme in which initial expenses are 6% and annual recurring expenses are 2%.

(i) How much should the mutual fund earn to provide Mr. Alex a return of 15% p.a.?

(ii) Mr. Alex's current Annual Professional Income is ₹40 lacs. His portfolio value is ₹50 lacs and now he is spending 10% of his time to manage his portfolio. If he spends this time on profession, his professional income will go up in same proportion. He is thinking to invest his entire portfolio into a Multicap Fund, assuming the fund's NAV will grow at 13% p.a. (including dividend).You are requested to advise Mr. Alex, whether he can invest the portfolio into Multicap Funds? If so, what is the net financial benefit?

Ans: Return of MF = $\frac{\text{Return earned by investor}}{1 - \text{Initial expenses}}$ + Recurring expenses = $\frac{15\%}{1 - 0.06}$ + 2% = 17.96%

(ii)

	Particular	Current Income	Income if invested in Multi-cap fund
	Professional Income	40	40 x 1.1 = 44
+	Income on portfolio:	50L x 15% = 7.5	50L x 13% = 6.5
=	Total Income:	47.5	50.50

» It is advisable to invest in multi-cap fund as total income will increase by ₹3 lacs (50.50 – 47.50)

👉 **Reinvestment plan**

Ques 9 – Urchin **{SM TYK, N18 Exam (New), M20 RTP (Old), N22 MTP 1, N23 MTP 1}**

Urchin Mutual Fund having 300 units has a NAV of ₹8.75 and ₹9.45 at the beginning and at the end of the year respectively. The Mutual Fund has given two options:

(i) Pay ₹0.75 per unit as dividend and ₹0.60 per unit as a capital gain, or

(ii) Both the above distributions are to be reinvested at a NAV of ₹8.65 per unit.

What difference it would make in terms of HPR and which option is preferable?

Ans: **i) If amount is paid out to unitholders**

- HPR = $\frac{(9.45 - 8.75) + 0.75 + 0.60}{8.75}$ = 23.43%

ii) **If amount is reinvested:**

- Total amount to be reinvested = (0.75 + 0.60) x 300 = ₹ 405
- New units allotted = 405 / 8.65 = 46.82 units
- Total number of units = 300 + 46.82 = 346.82 units

- HPR = $\frac{(346.82 \times 9.45 - 300 \times 8.75) + 0 + 0}{300 \times 8.75}$ = 24.855%

» **Conclusion -** Option (ii) i.e. Re-investment option should be preferred.

Reverse cal. Opening NAV under DRP

Ques 10 – Arjun **{N18 Exam (Old), N22 MTP 2}**

During the year 2017 an investor invested in Arjun mutual fund. The capital gain and dividend for

the year was ₹3 per unit, which were reinvested at the year-end NAV of ₹23.75. The investor had total units of 26,750 as at the end of the year. The NAV had appreciated by 18.75% during the year and there was an entry load of ₹0.05 at the time when the investment was made. The investor lost his records and wants to find out the amount of investment made and the entry load in the MF.

Ans: NAV in the beginning of year = ₹ 23.75 x $\frac{100}{118.75}$ = 20

- No. of units after Bonus issue = 26,750
- Let X be the No. of units acquired then:
- X + $\frac{3X}{23.75}$ = 26,750
- X = 23750 units

- Investment amount = 23750 x (20 + 0.05) = ₹ 4,76,187.50
- Entry load = ₹1187.50 i.e. (23750 x 0.05)

👉 **Ques based on application**

Hedge fund fee calculation

 # Ques 11 – Jaguar **{SM TYK, N19 RTP (Old), M24 MTP 2}**

Jaguar Plan, a hedge fund currently has assets of ₹20 crore. Mr. X, the manager of fund charges fixed fee of 0.10% of portfolio asset. In addition to it he charges incentive/bonus fee of 2%. The bonus will be linked to gross value each year in excess of the portfolio maximum value since the start of fund. The maximum value the fund achieved so for since start of fund was ₹21 crore.

(i) You are required to compute the fee payable to CA X, if return on the fund this year turns out to be
(a) 29% (b) 4.5% (c) -1.8%

(ii) What is the Benchmark Return to make Mr. X eligible for incentive fee.

Ans: Fund charges of = 0.10% x 20 Crores = ₹2,00,000 will always be paid in all cases.

	Particulars	Return = 29%	Return = 4.5%	Return = -1.8% (₹ Crore)
A.	Fund value	20 x 1.29 = 25.8	20 x 1.045 = 20.9	19.64
B.	Bonus fee	(25.8-21)×2% = 0.096	Nil	Nil
C.	Fund charges	0.02	0.02	0.02
D.	Total: B+C	0.116	0.02	0.02

(ii) Benchmark Return = (21 crore - 20 crore) / 20 crore = 0.05 or 5%

Cal. Missing figures from given return data

 # Ques 12 – Wolf **{SM TYK, M19 RTP (Old), N20 RTP (New), N23 RTP}**

Mr. X on 01.07.2000, during the initial offer of Wolf Mutual Fund invested in 10,000 units having face value of ₹10 for each unit. On 31.03.2001 the dividend operated by the MF was 10% and Mr. X found that his annualized yield was 153.33%. On 31.12.2002, 20% dividend was given. On 31.03.2003 Mr. X redeemed all his balance of 11,296.11 units when his annualized yield till now from the beginning was 73.52%.What is the NAV on 31.03.2001, 31.12.2002 and 31.03.2003?

Ans: **(i) NAV as on 31.3.2001 (NAV_1)**

- Annualized Return = 153.33%
- Return (in amount) = 1,00,000 x 153.33% x 9/12 = ₹ 1,15,000
- Fund value on 31.3.2001 = 1,00,000 + 1,15,000 = ₹ 2,15,000

 # Number of additional units:

- Dividend amount = 1,00,000 x 10% = 10,000
- New Units = 10,000 / NAV_1
- (10,000 + $\frac{10,000}{NAV_1}$) x NAV_1 = 2,15,000
- NAV_1 = 20.5
- Number of new units = 10,000 / 20.5 = 487.80

(ii) NAV as on 31.3.2002 (NAV_2)

- Total units as on 31.12.2002 = 11,296.11
- New Units (Closing – Opening) = 11,296.11 - 10,487.80 = 808.31

- **NAV_2 Calculation:**
- Dividend as on 31.12.2002 = (10,487.80 x 10) x 20% = 20,975.60
- Additional Units = Dividend / NAV_2

=> 808.31 = $\frac{20,975.60}{NAV_2}$ => NAV_2 = 25.95

(iii) **Fund Value as on 31.3.2003:**

- Total value as on 31.3.03 = 1,00,000 + {1,00,000 x 73.52% x 33/12} = ₹ 3,02,180
- NAV_3 = 3,02,180 / 11,296.11 = ₹ 26.75

Cal. Investment period (No. of days) & Investment date

 # Ques 13 – Wallaby **{SM TYK, M18 Exam (Old), M22 Exam}**

Mr. Wallaby has invested in the three mutual funds (MF) as per the following detail:

Particulars	MF 'X'	MF 'Y'	MF'Z'
Investment amount	2 Lacs	4 Lacs	2 Lacs
NAV at the time of purchase	10.30	10.10	10
Dividend received up to 31.03.2018	6,000	0	5,000
NAV as on 31.03.2018	10.25	10	10.20
Effective yield p.a. as on 31.03.2018	9.66%	-11.66%	24.15%

Assume 1 year = 365 days

Mr. Wallaby has misplaced the documents of his investment. Held him in finding the date of his original investment after ascertaining the following:

(i) No. of units in each scheme (ii) Total NAV

(iii) Total yield and (iv) Number of days investment held and date of investment

(v) Assuming past performance of all three schemes will continue for next one year, what action the investor should take? What will be the expected return for the next one year after the above action?

(vi) Will your answer as above point no. (v) changes if the Mutual fund charges exit load of 5% if the investment is redeemed within 120 days? If so, advise the investor what and when the action to be taken to optimise the returns.

Ans: **(i) Number of Units in each scheme**

MF 'X'	2,00,000/10.30	= 19,417.48
MF 'Y'	4,00,000/10.10	= 39,603.96
MF 'Z'	2,00,000/10.00	= 20,000.00

(i) **Total NAV on 31.3.18** **(Amount in ₹)**

MF 'X' = 19,417.48 x ₹10.25	1,99,029.17
MF 'Y' = 39,603.96 x ₹ 10.00	3,96,039.60
MF 'Z' = 20,000.00 x ₹10.20	2,04,000.00
Total	7,99,068.77

(iii)

MF	Capital Yield		Dividend Yield	Total Yield
MF X	1,99,029.17 – 2,00,000	= -970.83	6000	5,029.17
MF Y	3,96,039.60 – 4,00,000	= -3,960.4	nil	3,960.40
MF Z	2,04,000 – 2,00,000	= 4,000	5,000	9,000.00
			Total:	10,068.77

- Total Yield % = (10,068.77 ÷ 8,00,000) x 100 = 1.2586%

(iv) **No. of Days Investment Held**

- Let number of days of investment in scheme in MF 'X', MF 'Y' & MF 'Z' be X, Y and Z respectively.
- Annualized yield = Yield x $\frac{365}{\text{No. of days}}$

- Date of investment = 31.3.18 – No. of days of original investment

MF X: $0.0966 = \frac{5029.17}{2L} \times \frac{365}{X}$ => X = 95 days

- Date of original investment in MF X = 26.12.17

MF Y: $-0.1166 = \frac{-3960.40}{4L} \times \frac{365}{Y}$ => Y = 31 days

- Date of original investment in MF Y = 28.2.18

MF Z: $0.2415 = \frac{9000}{2L} \times \frac{365}{Z}$ => Z = 68 days

- Date of original investment in MF X = 22.01.18

(v) If past of all three schemes will continue for next one year, the investor should redeem the units of MFs 'X' and 'Y' and invest the proceeds in MF 'Z'. The expected return next will be 24.15%.

(vi) If the Mutual funds are charging exit load of 5%, if investment is redeemed within 120 days, then investor should get redeemed units of MF 'Y' now and units of MF 'X' after 25 days.

ADDITIONAL NOTES: QUESTION VARIATIONS

- Sometimes ICAI may not provide dividend amount directly in ₹ but may rather provide dividend %.
- In such cases, Dividend amount in ₹ = Dividend % x Initial investment.
- Ex: Let us say that Dividend % of MF X = 3%, then dividend amount = 2L x 3% = 6,000.

Reverse calculating Investment amount using Yield

 # Ques 14 – Subahu {N23 Exam}

Mr. Subahu has invested in 3 different Mutual Fund Schemes. The following are its details:

Particulars	Scheme A	Scheme B	Scheme C
Date of Investment	1-06-2022	1-07-2022	1-08-2022
NAV at Entry Date	₹ 11.00	₹ 10.50	₹ 12.00
Dividend upto 31-03-23	₹ 12,500	₹ 17,000	₹ 4,000
NAV at 31-03-23	₹ 11.25	₹ 11.48	₹ 10.80
NAV Increase/ (Decrease)	₹ 22,727.27	₹ 93,333.33	(₹ 50,000)
Effective Yield p.a.	4.2296%	14.6978%	(-) 13.819%

Assume 365 days in a year. Round off the investment to nearest ₹100. You are required to calculate:

(i) The amount of investments made initially in these schemes.

(ii) Number of units invested in the three schemes by Mr. Subahu. Advise also whether he can continue to hold this investment or can he redeem now.

Ans: **WN 1 – Period of investment**

Scheme A = 304 days

Scheme B = 274 days

Scheme C = 243 days

(i) Calculation of Initial investment

- Let the amount initially invested in Scheme A, B and C be "a", "b" and "c" respectively.
- Annualized yield = $\frac{\text{Capital gain + Dividend}}{\text{Initial Investment}} \times \frac{365}{n}$

Scheme A

- $0.042296 = \frac{22,727.27 + 12,500}{a} \times \frac{365}{304}$ → a = 10 lacs

Scheme B

- $0.146978 = \frac{93,333.33 + 17,000}{b} \times \frac{365}{274}$ → b = 10 lacs

Scheme C

- $-0.13819 = \frac{-50,000 + 4,000}{c} \times \frac{365}{243}$ → c = 5 lacs

(ii) Calculation of opening No. of units

	Particulars	Scheme A	Scheme B	Scheme C
	Initial Investment	10,00,000	10,00,000	5,00,000
	Opening NAV	11.00	10.50	12.00
	Units of Investment	90,909.09	95,238.10	41,666.67

Advise: Continue to invest in Scheme B. Redeem both schemes A and C and invest its proceeds in Scheme B.

Dividend equalisation reserve

 # Q 15 – Komodo {SM TYK, M19 RTP (old), N19 RTP (old), M22 RTP, M23 MTP 1, N24 MTP 2}

On 1st April, an open-ended scheme of Komodo mutual fund had 300 Lac units outstanding with Net Asset Value of ₹18.75. At the end of April, it issued 6 lac units at opening NAV plus 2% load, and adjusted for dividend equalization. At the end of May, 3 lac units were repurchased at opening NAV less 2% exit load and adjusted for dividend equalization. At the end of June, 70% of its available income was distributed. In respect of April-June quarter, the following additional info is available:

	(₹ in Lacs)
Portfolio value appreciation	425.47
Income of April	22.95
Income of May	34.425
Income of June	45.45

You are required to calculate:

(i) Income available for distribution (ii) Issue price at the end of April

(iii) Re-purchase price at the end of May (iv) Net Asset Value as on 30th June

Ans: Author note - For better understanding 1st Refer Working note 1 given below.

(i) Income available for distribution as on 30th June, 04 = 102.717

(ii) **Issue price at the end of April**

	NAV as on 01-4-04	= 18.75
(+)	Entry load @ 2%	= 0.375
(+)	Income to be brought by new investors	= 0.0765
	Issue Price	= 19.2015

(iii) Redemption Price at the end of May

	NAV as on 01-4-04	= 18.75	
(-)	Exit load @ 2%	= (0.375)	
(+)	Income to be paid	= 0.189	
	Re-purchase Price	= 18.564	

(iv) Calculation of NAV as on 30th June, 2004

	NAV as on 01-4-04: 300 x 18.75 =		5625
+	Cash received on issue of 6L units: 6L x 19.2015 =		115.209
-	Cash paid on re-purchase of 3L units: 3L x 18.564 =		(55.692)
+	Income earned during Apr-Jun: 22.95 + 34.425 + 45.45 =		102.825
-	Income distributed 70% =		(71.9019)
+	Portfolio appreciation during April – June: =		425.47
		=> Total NAV =	6140.9101
÷	Total No. of units =		303
		=> NAV per Unit =	**20.267**

WN 1 - Calculation of Income available for distribution

	Particulars	Units	Income	Income/Unit
•	April Income	300	22.95	0.0765
(+)	New issue	6	6 x 0.0765 = 0.459	0.0765
		306	23.409	0.0765
(+)	May Income	---	34.425	-----
=>	Total income till May	306	57.834	0.189
(-)	Units Re-purchased	(3)	0.189 x 3 = (0.567)	0.189
		303	57.267	0.189
(+)	June Income	----	45.45	----
=>	Total income till June	303	102.717	0.339
(-)	Income distributed (70%)	303	102.717 × 0.7 = (71.9019)	0.2373
=>	Balance left	303	30.8151	0.1017

Diff. plans – Reinvestment, Bonus, Growth

Basic Return calculation under Dividend reinvestment plan & Bonus plan

 # Ques 16 – Cobra {SM TYK, M19 Exam (New), M19 Exam (Old), M24 MTP 2}

Cobra Mutual fund introduces two schemes i.e., Dividend Reinvestment Plan (Plan-D) and Bonus Plan (Plan-B). The face value of the unit is ₹10. On 01.04.2005 Mr. K invested ₹2,00,000 each in Plan-D & Plan-B when the NAV was ₹38.20 and ₹35.60 respectively. Both the Plans matured on 31.03.2010. Particular of dividend and bonus declared over the period are as follows:

			NAV (₹)	
Date	Dividend %	Bonus Ratio	Plan-D	Plan-B
30.09.05	10	1: 5	39.10	35.60
30.06.06	-	-	41.15	36.25
31.03.07	15	-	44.20	33.10
15.09.08	13	-	45.05	37.25
30.10.08	-	1: 8	42.70	38.30
27.03.09	16	-	44.80	39.10
11.04.09	-	1: 10	40.25	38.90
31.03.10	-	-	40.40	39.70

What is the return per annum in respect of the above two plans?

Author Note: ICAI repeated made the mistake of writing "Dividend reinvestment plan" as simply "Dividend plan" in the question. This mistake was repeated in several exam questions as well. But the answer was solved as per "Dividend reinvestment plan" only. Jai ho!! 🙏🏻🙂

Ans: Plan: Dividend re-investment Plan

Date	Op. Units (A)	NAV (B)	Dividend Amount C = (A × 10)×Div rate	Unit Issued D = C÷B	Cl. Units E = A+D
01.4.05	5235.60	38.2	---	---	5235.60
30.9.05	5235.60	39.10	5235 x 10% = 5235.60	133.9	5369.5
31.3.07	5369.5	44.20	53695 x 15% = 8054.25	182.22	5551.72
15.9.08	5551.72	45.05	55517.2 x 13% = 7217.24	160.21	5711.925
27.3.09	5711.925	44.80	57119.25 x 16% = 9139	203.99	5915.922

- Redemption Value: 5915.922 x 40.40 = 239003.25
- Annualized return: $\frac{(2,39,003.25 - 2,00,000)}{2,00,000} \times \frac{1}{5}$ = 3.90% p.a.

Plan B: Bonus Plan

Date	Op. Units	Bonus Units	Closing Units
01.4.05	5617.98	---	5617.98
30.6.06	5617.98	5617.98 x 1/5 = 1123.596	6741.576
30.10.08	6741.576	6741.576 x 1/8 = 842.697	7584.273
11.04.09	7584.273	7584.273 x 1/10 = 758.427	8342.70

- Redemption Value: 8342.70 x 39.70 = ₹ 331,205.20
- Annualized return: $\frac{(₹331,205.20 - 2,00,000)}{2,00,000} \times \frac{1}{5}$ = 13.12% p.a.

Return under DRP, Bonus plan and Growth plan when STCG & STCG Tax is given

 # Ques 17 – Chanakya {SM TYK, M18 RTP (New), N19 Exam (New)}

Moon Mutual Fund (an approved MF) sponsored open- ended equity-oriented scheme Chanakya Opportunity Fund. There were three plans viz. 'A'-Dividend Re-investment Plan, 'B'-Bonus Plan & 'C'-Growth Plan. At the time of Initial Public Offer on 1st April 1999, Mr. Anand, Mr. Bachan & Miss. Charu, three investors invested ₹1,00,000 each and opted 'B', 'C', & 'A' Plan respectively. The history of the fund is as follows:

			NAV per unit (Face value = ₹10 /-)		
Date	Dividend %	Bonus Ratio	Plan A	Plan B	Plan C
28.07.03	20	5:4	30.70	31.40	33.42
31.03.04	70	-	58.42	31.05	70.05
31.10.07	40	-	42.18	25.02	56.15
15.03.08	25	-	46.45	29.10	64.28
31.03.08	-	1:3	42.18	20.05	60.12
24.03.09	40	1:4	48.10	19.95	72.46
31.07.09	-	-	53.75	22.98	82.07

On 31st July all three investors redeemed all the balance units.

Calculate annual rate of return to each of the investors. Consider

1. Long-term Capital Gain is exempt from Income tax.
2. Short term Capital Gain is subject to 10% Income tax.
3. Security Transaction Tax 0.2% only on sale/redemption of units.

4. Ignore Education Cess.

Ans: Assuming face value and issue price of units = ₹10.

-> Number of units allotted on 1.4.99 = 100,000 ÷ 10 = 10,000

i) **Plan A: Dividend Reinvestment Plan (Miss. Charu)**

Date	Op. Units (A)	NAV (B)	Dividend Amount C = (A×10) x Div rate	Unit Issued D= C÷B	Cl. Units E=A+D
01.4.99	10000	10	---	---	10000
28.7.03	10000	30.70	100,000 x 20% = 20,000	651.46	10651.46
31.3.04	10651.46	58.42	106514.6 x 70% = 74560.22	1276.28	11927.74
31.10.07	11927.74	42.18	119277.4 x 40% = 47710.96	1131.13	13058.87
15.3.08	13058.87	46.45	130588.7 x 25% = 32647.18	702.85	13761.72
24.3.09	13761.72	48.10	137617.2 x 40% = 55046.88	1144.43	14906.15
31.7.09	14906.15	53.75	--- ---		14906.15

Amount (net of tax) received on 31.07.2009

	Sale proceed = 14,906.15 x 53.75	=	8,01,205.56
(-)	STT @ 2% = 8,01,205.56 x 0.2%	=	(1602.411)
(-)	STCG @ 10% = {(53.75 – 48.10) x 1144.43} x 10%	=	(646.603)
=	Net amount received	=	7,98,956.55

» Annual rate of return = $\frac{(798956.55 - 100000)}{1,00,000} \times \frac{12}{124}$ = 67.64% p.a.

Note: Holding period in months = 124 months (from 01.4.99 to 31.7.09)

ii) **Plan B: Bonus Plan (Mr. Anand)**

Date	Opening Units	Bonus Units	Closing Units
1.4.1999	10,000	---	10000
31.3.04	10,000	10,000 x 5/4 = 12500	22500
31.3.08	22,500	22,500 x 1/3 = 7500	30000
24.3.09	30,000	30,000 x 1/4 = 7500	37500

Amount (net of tax) received on 31.07.2009

	Sale proceed = 37,500 x 22.98	=	8,61,750
(-)	STT @ 2% = 8,61,750 x 0.2%	=	(1,723.5)

(-)	STCG @ 10% = {(22.98 – 19.95*) x 7500} x 10%	=	(2,272.5)	
=	Net amount received	=	8,57,754	
»	Annual rate of return = (8,57,754 – 1,00,000) x 12 = 73.33% p.a.			
	1,00,000 124			

Note 1: STCG is levied only if Period of holding < 12 months.

Note 2: Cost of bonus units could also have been taken as "0" as per Income tax act.

iii) **Plan C: Growth Plan (Mr. Bachan)**

•	Sale proceeds as on 31.07.09	=	10,000 x 82.07	=	8,20,700
(-)	STT @ 0.2% levied on sale	=	8,20,700 x 0.2%	=	(1641.4)
=	Net receipts (no STCG as all the units are long term)			=	8,19,058.6

» Annual rate of return = (8,19,058.6 – 10,00,000) x 12 = 69.59% p.a.
1,00,000 124

Reverse calculating opening NAV under DRP & Bonus plan

 # Ques 18 – Shark {N20 Exam (New), N22 MTP 2, M23 Exam, M23 RTP, N23 MTP 2}

M/S. Shark an AMC, on 1.04.2015 has floated two schemes viz. **Dividend Plan** and Bonus Plan. Mr. X, an investor has invested in both the schemes. The following details (except the issue price) are available:

Date	Dividend	Bonus ratio	Div Plan (NAV)	Bonus plan (NAV)
1.4.15			?	?
31.12.16		1:4	47	40
31.3.17	12%		48	42
31.3.18	10%		50	39
31.12.18		1:5	46	43
31.3.19	15%		45	42
31.3.20			49	44

Additional details:	Dividend plan	Bonus ratio
• Investment (₹)	₹9,20,000	₹10,00,000
• Average Profit (₹)	₹27,748.60	-
• Average Yield (%)	-	6.40%

Calculate the issue price of both the schemes as on 1.04.2015.

Faculty Note: The question mentioned "Dividend plan", but ICAI gave the solution as per "Dividend reinvestment plan". Jai Ho!!

Ans:

(i) Dividend reinvestment plan **(Amount in ₹)**

	Investment	9,20,000
(+)	Total profit of 5 years: 27748.6 x 5	1,38,743
=	Value of investment on 31.3.20	10,58,743

=> Closing number of units = Closing Investment Value / Closing NAV = 10,58,743 / 49 = 21,607 units

 # Calculating opening number of units

- Let opening number of units be "n".

Date	Op. Units	Units received as dividend	Cl. Units
31.3.17	n	(10n × 12%) ÷ 48 = 0.025n	1.025n
31.3.18	1.025n	(10.25n × 10%) ÷ 50 = 0.0205n	1.0455n
31.3.19	1.0455n	(10.455n × 15%) ÷ 45=0.03485n	1.08035n

- Closing Number of Units = 1.08035n
- 1.08035n = 21,607
- n i.e. opening number of units = 20,000 units

- Opening NAV = Opening Investment / Opening No. of units = 9,20,000 / 20,000 = ₹46 / unit

(ii) Bonus Plan **(Amount in ₹)**

	Investment	10,00,000
(+)	Total profit of 5 years: 10 L x 6.4% x 5	3,20,000
=	Value of investment on 31.3.20	13,20,000

» Closing number of units = Closing Investment Value / Closing NAV = 13,20,000 / 44 = 30,000 units

#	**Calculating opening number of units**
•	Let opening number of units be B.
•	Then, Closing number of units = B × 5/4 × 6/5 = 1.5B
•	1.5B = 30,000
•	B i.e. opening number of units = 20,000 units.
•	Opening NAV = Opening Investment / Opening No. of units = 10,00,000 / 20,000 = ₹ 50/unit

Additional Questions

Tiny Topics

Front-end & Back-end load calculation

 # Ques 1 – Stingray {SM TYK, M18 Exam (Old)}

The unit price of Equity Linked Savings Scheme (ELSS) of Stingray mutual fund is ₹10/-. The public offer price (POP) of the unit is ₹10.204and the redemption price is ₹9.80. **Calculate:**

(i) (i) Front-end Load (ii) Back-end Load

Ans: Public Offer Price = NAV/ (1 – Front end Load)

=> 10.204 = 10/(1 – F)

- F = 0.0199 say 2%

- Redemption Price = NAV/ (1 – Back End Load)

=> ₹9.80 = 10/ (1 – Back End Load)

- B = 0.0204 i.e. 2.04%

Alternative

(i) Front End Load = (10.204 - 10) / 10 = 0.0204 or 2.04%

(ii) Exit Load = (10 – 9.8) / 10 = 0.020 or 2.00%

Low Probability – Unique Questions

NAV Calculation

 # Ques 2 – Vishnu {M19 Exam (Old)}

The following particulars relating to Vishnu Fund Schemes:

	Particulars.	Value (₹ in crores)
1.	Investment in shares (at cost)	
	a. Pharmaceutical companies	79
	b. Construction Industries	31
	c. Service Sector Companies	56

	d. IT Companies	34
	e. Real Estate Companies	10
2.	**Investment in bonds (Fixed Income)**	
	a. Listed Bonds (8,000, 14% Bonds of ₹15,000 each)	**12**
	b. Unlisted Bonds	7
3.	No. of Units outstanding (crores)	4.2
4.	Expenses Payable	3.5
5.	Cash and Cash equivalents	1.5
6.	Market expectations on listed bonds	8.842%

 # Particulars relating to each sector are as follows:

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

 # The fund has incurred the following expenses:

Consultancy and Management fees	₹480 lacs
Office Expenses	₹150 lacs
Advertisement Expenses	₹38 lacs

 # You are required to calculate the following:

(i) Net Asset Value of the fund.

(ii) Net Asset Value per unit.

(iii) If the period of consideration is 2 years, and the fund has distributed ₹3/unit per year as cash dividend, ascertain the annualized net return.

(iv) Ascertain the expenses ratio.

Ans: (i) Calculation of NAV of the fund

	Value of Shares		₹ crore
a.	Pharmaceutical Co:	79 x 465/260	141.288
b.	Construction Co:	31 x 450/210	66.429
c.	Service Sector Co:	56 x 480/275	97.745
d.	IT Co:	34 x 495/240	70.125

e.	Pharmaceutical Co:	10 x 410/255	16.078
	Investment in Bonds		
a.	Listed Bonds	14 x 12/8.42	19
b.	Unlisted Bonds		7
	Cash & cash equivalent		1.5
			419.165
(-)	Expenses Payable		3.5
	NAV of the Fund		415.665

(ii) NAV per unit = NAV of fund / No. of units = ₹415.665 crore / 4.20 crore = ₹98.97

(iii)	**Calculating opening NAV per unit**		
	Shares (79 + 31 + 56 + 34 + 10)	₹210 crore	
+	Bonds (12 + 7)	₹19 crore	₹ 229 crore
÷	No. of Units		4.20 crore
=	Cost per Unit		₹ 54.52

#	**Calculation of return**		
•	Capital Gain: (₹98.97 – 54.52)		₹44.45
•	Dividend: ₹3 x 2		₹6.00
			₹50.45
»	Annualised Return =	50.45 / 54.52 x 1/2	= 46.27%

(iv) Expense Ratio = Expense per unit x 100 / NAV per unit = (480L + 150L + 38L) ÷ 420L / 98.97L = 1.590 x 100 / 98.97 = 1.607%

Find required earnings of a fixed income fund using fund's target duration

 # Ques 3 - Blue Tooth

Blue Tooth Mutual Fund is planning to float a fixed income fund at face value and issue price of ₹100 crore on 1 January 2015with a term of 7 years. If the target duration of fund is 5 year & six months and has expected rate of return of 8%, then determine the amount of interest (annual cash flow) it must earn annually on its investment after defraying management expenses of 10% of amount income earned.

Ans: **Slip ques!!**

Let annual Cf after Management Expenses be C.

- Duration = $\frac{1}{\text{Bond value}} \times \left[\frac{1 \times \text{Interest}}{(1+kd)^1} + \ldots\ldots + \frac{n \times (\text{Int} + RV)}{(1+kd)^n}\right]$

- $5.5 = \frac{1}{100} \times \left[\frac{1C}{1.08^1} + \frac{2C}{1.08^2} + \ldots\ldots + \frac{7(C+100)}{1.08^5}\right]$

- $5.5 = \frac{19.228C + 408.10}{100}$ => C = 0.0738 or 7.38%

- This is after management fees of 10%.
- Total earnings required = 7.38 /0.9 = 8.20%

» Annual required CF = 100 x 8.20% = ₹8.20 Crores

Ch 9A – Futures

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Basics of futures	1 – 2
Mark to Margin	3 – 4
Hedging using futures	5 – 9
Beta Management using Rf securities	10
Arbitrage using Futures	11 – 12
Hedge ratio	13
Discrete or Special Ques	14 – 15
Short Selling	16 – 17

Index - Additional Questions	**Ques Number**
Basic practice ques	1
Hedging using futures	2 – 3
Low Probability – Unique Questions	
- Reverse cal. No. of futures traded & Beta of stock from P&L figure	4
- Calculating Implied RF from Arbitrage profit	5
- Calculation of Open interest	6

Main Questions

👉 Basics of futures

 # Ques 1 – Rice trader **{M19 Exam (New), N20 MTP 1 (Old), M23 Exam}**

A rice trader has planned to sell 22,000 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. What the trader can do to mitigate its risk of reduced profit? If he decides to make use of future market, what would be the effective realized price for its sale when after 3 months, spot price is ₹57 per Kg. and future contract price for 3 months is ₹58 per Kg.?

Ans: The trader can short futures contract today at ₹59/kg.

- No. of contracts to be sold = $\frac{22000}{1000}$ = 22 contracts

(b) After 3 months

- Gain on futures: (59 – 58) x 1000 x 22 = 22000
- Sell 22000 kg rice at spot price: 22000 x 57 = 1254000

Net amount realised = 1276000

- Net realisation per kg = $\frac{1276000}{22000}$ = ₹58/kg

Using Average dividend yield to calculate Futures price

 # Ques 2 – Mrinal **{SM TYK}**

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

Month	Dividend paid p.a.	Month	Dividend paid p.a.
Jan	3%	Jul	3%
Feb	4%	Aug	4%
Mar	3%	Sep	3%
Apr	3%	Oct	3%

	May	4%	Nov	4%
	Jun	3%	Dec	3%

The interest is continuously compounded daily. Mr Mrinal wants to find out the future price of contract deliverable on 31-12-2011. Given: $e^{0.01583}$ = 1.01593.

Ans: Period of future contract = 31-08-2011 to 31-12-2011. That is → contract period = 4 months

- Average dividend yield during this period = $\frac{\{3\% + 3\% + 4\% + 3\%\}}{4}$ = 3.25%

- Fair future price (FFP) = SR $e^{(rf - y)t}$ = $2200.e^{(0.08-0.0325) \times 4/12}$ = 2235.05

Mark to Margin

 # Ques 3 – Pillai **{SM TYK, N18 RTP (Old), N19 RTP (New), N24 MTP 2}**

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

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

Mr. Pillai bought /purchased one Sensex futures contract on Feb 04 at closing rate. The average daily absolute change in the value of contract is ₹10,000 and SD of these changes is ₹2,000.

Maintenance margin is 75% of initial margin. You are required to determine the daily balances in margin account and payment on margin calls, if any taking closing Balance figure. Initial margin should by calculated by using Daily Absolute Changes + 3 x SD

Ans: Initial margin = $\mu + 3.sd = 10,000 + 3 \times 2000 = 16,000$

Maintenance margin = 16,000 x 75% = 12,000

Margin calculation of Abhishek (long at 3296.50)

Day	Op. Bal.	MTM (i.e. change in value)	Call Amount	Closing Bal.
5-2	16000	(3294.40 – 3296.50) x 50 = -105	-	15895
6-2	15895	(3230.40 - 3294.40) x 50 = -3200	-	12695
7-2	12695	(3212.30 – 3230.40) x 50 = -905	4210	16000
10-2	16000	(3267.50 – 3212.30) x 50 = 2760	-	18760
11-2	18760	(3263.80 – 3267.50) x 50 = -185	-	18575
12-2	18575	(3292.00 – 3263.80) x 50 = 1410	-	19985
14-2	19985	(3309.30 – 3292.00) x 50 = 865	-	20850
17-2	20850	(3257.80 – 3309.30) x 50 = -2575	-	18275
18-2	18275	(3102.60 – 3257.80) x 50 = -7760	5485	16000

 # Ques 4 – Shiva **{Dec 21 Exam (New), M23 MTP 1}**

The contract price of December Nifty futures contract on a particular-day was ₹1310. The minimum trading lot on Nifty futures is 100. The initial margin is 8% and the maintenance margin is 6%. The index closed at the following levels on the next five days.

Day	1	2	3	4	5
Closing Price	1340	1360	1300	1280	1305

1. Mr. Shiva has gone long on the Nifty futures at 1310. Calculate the mark to market cash flows and daily closing balances in his a/c. Also calculate the mark to market cash flows of the investor who has gone short at 1310.
2. Calculate the net profit or loss on each of the contracts.

Ans:

Lot value	=	1310 x 100	=	1,31,000
Initial margin	=	1,31,000 x 8%	=	10480
Maintenance margin	=	1,31,000 x 6%	=	7860

i) Long investor

Day	Opening Bal.	Mark to market	Margin call	Closing Bal.
1	10480	3000	-	13480
2	13480	2000	-	15480
3	15480	-6000	-	9480
4	9480	-2000	3000	10480
5	10480	2500	-	12980

ii) Short investor

Day	Opening Bal.	Mark to market	Margin call	Closing Bal.
1	10480	-3000	3000	10480
2	10480	-2000	-	8480
3	8480	6000	-	14480
4	14480	2000	-	16480
5	16480	-2500	-	13980

2. Calculation of Profit / (loss)

Long

Buy futures: 1310 x 100 = (1,31,000)

Sold futures: 1305 x 100 = 1,30,500

Loss: = (500)

Short

Sold futures: 1310 x 100 = 1,31,000

Buy futures: 1305 x 100 = (1,30,500)

Profit: = 500

👉 ## Hedging using futures

Hedging using Index futures

 # Ques 5 – Matangi **{SM TYK}**

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

Investments in diversified equity shares	90
Cash and Bank Balances	10
	100

- 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 that the Fund Manager's apprehension will materialize.

Ans: Number of Index futures to be traded = $\frac{V_h \times (T_B - C_B)}{I_{FP} \times \text{Lot size}}$

where, V_h = Value to be hedged T_B = Target beta

C_B = Current beta I_{FP} = Index futures price

- Number of index futures = $\frac{90 \text{ crores} \times (0 - 1.1)}{4300 \times 50}$ = -4604.65 or short 4605 contracts.

- **Justification – If market fell by 10%** **₹ in crores**

Fall in equity value: 90 crores x 1.1 = -9.9

Profit on futures: (4300 x 10%) x 50 x 4605 = +9.90075

Net Profit /loss: Nil (approx.)

Hence, shorting futures has lead to perfect hedging.

Hedging a portfolio of Cash + Equity

 # Ques 6 – Parvati

Details of portfolio of Mrs. Parvati is given below:

Equity ₹8,00,000; **Cash and Cash Equivalent ₹2,00,000**: Beta of **equity portfolio** = 0.69. Current NSE index future value is 930 with multiple of 200. If Mr. X wants to achieve an **overall portfolio beta** of 1.10 then how many numbers of futures contract he should so long?

Ans: Portfolio beta = {0.69 x 0.8} + 0 = 0.552

- Number of Index futures to be traded = $\frac{V_h \times (T_B - C_B)}{I_{FP} \times \text{Lot size}}$

where, V_h = Value to be hedged T_B = Target beta

C_B = Current beta I_{FP} = Index futures price

Number of index futures = $\frac{10 \text{ Lakhs} \times (1.1 - 0.552)}{930 \times 200}$ = 2.946 or Long 3 contracts

Hedging portfolio consisting of Long & Short positions

 # Ques 7 – Yayati **{SM TYK}**

Which position on the index future gives Mr. Yayati, 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.

Ans: Number of Nifty futures to hedge portfolio

Shares	value	Beta	Position	Nifty hedge
Right Ltd.	50 lacs	1.25	Long	62.5L Short
Wrong Ltd.	25 lacs	0.90	Short	22.5L Long
Fair Ltd.	20 lacs	0.75	Short	15L Long
				25L Short

-> Speculator should short 25 lacs of Nifty futures to obtain a complete hedge.

Hedging portfolio consisting of Long & Short positions

 # Ques 8 – Tara **{SM TYK, N18 RTP (New), N22 RTP}**

Tara buys 10,000 shares of X Ltd. at a price at ₹22 per share whose beta value is 1.5 and sell 5,000 shares at A Ltd, at a price of ₹40 per share having a beta value of 2. She obtains a hedge by Nifty futures at ₹1,000 each. She closes out her 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 of Tara?

Ans:

Shares	Value	Beta	Position	Nifty hedge
X ltd	10,000 x 22 = 2.2L	1.5	Long	3.3L short
A ltd	40 x 5,000 = 2L	2	Short	4L long
			Net position:	**70,000 long**

» Number of contracts required to hedge portfolio = 70,000/1000 = 70 contracts.

 # Calculation of profit / (loss)

Loss on X ltd: 2.2L x 2%=	4,400
Loss on A ltd: 2L x 3% =	6,000
Loss on Nifty: 70,000 x 1.5% =	1,050
Total loss:	11,450

Partial hedging using futures

 # Ques 9 – Shukracharya {SM TYK, M19 Exam (Old), N20 RTP (New), N23 MTP 2, N23 Exam}

On April 1, 2015, Shukracharya 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 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) Number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:

(A) His total portfolio (B) 50% of his portfolio (C) 120% of his portfolio

Ans:

Security	Market Price	No. of Shares	Value	β	Value x β
A	29.40	400	11,760	0.59	6,938.40
B	318.70	800	2,54,960	1.32	3,36,547.20
C	660.20	150	99,030	0.87	86,156.10

	D	5.20	300	1,560	0.35	546
	E	281.90	400	1,12,760	1.16	1,30,801.60
	F	275.40	750	2,06,550	1.24	2,56,122.00
	G	514.60	300	1,54,380	1.05	1,62,099.00
	H	170.50	900	1,53,450	0.76	1,16,622.00
				9,94,450		10,95,832.3

• Portfolio Beta = $\frac{10,95,832.30}{9,94,450}$ = 1.102

(ii) May future price (F) = S_e^{rt} = 8500 $e^{0.20 \times 2/12}$ = 8788

June future price (F) = S_e^{rt} = 8500 $e^{0.20 \times 3/12}$ = 8935.80

(iii) Number of Index futures to be traded = $\frac{V_h \times (T_B - C_B)}{I_{FP} \times \text{Lot size}}$

where, V_h = Value to be hedged T_B = Target beta

C_B = Current beta I_{FP} = Index futures price

(A) **Obtain complete hedge**

= $\frac{994450 \times (0 - 1.102)}{8850 \times 25}$ = -4.953 or -5 contracts i.e. short 5 contracts

(B) **Hedge only 50% of his portfolio**

= $\frac{994450 \times 50\% \times (0 - 1.102)}{8850 \times 25}$ = -2.47 or -3 contracts i.e. short 3 contracts.

(B) **Hedge only 120% of his portfolio**

= $\frac{994450 \times 120\% \times (0 - 1.102)}{8850 \times 25}$ = -5.94 or -6 contracts i.e. short 6 contracts.

👉 Beta Management using Rf securities

 # Ques 10 – Jaimini **{SM TYK, Dec 21 RTP (Old), N22 Exam, M23 MTP 2}**

Detail about portfolio of shares of Jaimini is as below:

	Shares	No. of shares	Price per share	Beta
	A Ltd.	3.0 lacs	₹500	1.40
	B Ltd.	4.0 lacs	₹750	1.20
	C Ltd.	2.0 lacs	₹250	1.60

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

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

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

Calculate:

(1) Portfolio beta

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

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

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

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

Ans: **i) Calculating Portfolio Beta**

- Total investment in portfolio = {3L x 500} + {4L x 750} + {2L x 250} = ₹5000 lacs.
- Portfolio Beta = Weighted average Beta = $1.4 \times \frac{1500}{5000} + 1.2 \times \frac{3000}{5000} + 1.6 \times \frac{500}{5000} = 1.3$

(ii) Required Beta = 0.91

- **Let the amount invested in existing portfolio be "a"**
- Portfolio Beta = 1.3a / 5000 + 0 (beta of rf securities =0)
- 0.91 = 1.3a / 5000
- a = ₹ 3500 lacs

» Portfolio manager should acquire risk-free securities worth ₹ 1500 lacs (5000 – 3500) by disposing off the same amount of existing portfolio.

(iii) Calculating Number of shares to be disposed-off:

#	New req. Investment	Required Qty (lacs)	Qty. to be disposed off
A	1500/5000 x 3500 = 1050	2.1	3 - 2.1 = 0.9 lacs
B	3000/5000 x 3500 = 2100	2.8	4 - 2.8 = 1.2 lacs
C	500/5000 x 3500 = 350	1.4	2 - 1.4 = 0.6 lacs

(iv) Number of Index futures = $\frac{V_h \times (T_B - C_B)}{I_{FP} \times \text{Lot size}}$ = $\frac{5000\ L \times (0.91 - 1.3)}{8125 \times 200}$ = -1200 contracts

i.e. short 1200 contracts.

(v) **If Nifty rises by 2%** **(₹ in lacs)**

- Change in share value = 5000 x (2% x 1.3) = 130
- Change in Nifty futures = (8125 x 2%) x 200 x (-120) (39)

Net Change = 91

- Net change in portfolio = i.e., 91/5000 = 1.82%
- Portfolio Beta = $\frac{\text{Change in portfolio value}}{\text{Change in Nifty value}}$ = $\frac{1.82\%}{2\%}$ = 0.91

Arbitrage using Futures

 # Ques 11 – Xavier **{SM TYK, N18 RTP (Old), N22 MTP 1}**

The share of Xavier 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 Xavier Ltd. will not pay any dividend in the next three months.

Ans: Fair Futures Price = 300×1.008^3 = ₹ 307.26

Since, prevailing futures price (312) ≠ fair futures price (307.26). So, arbitrage is possible.

(ii) **Constructing arbitrage:**

- **Step 1** - Arbitrageur will buy ABC Stock at ₹300 by borrowing for 3 months.
- So, total outflow after 3 months = 300×1.008^3 = ₹307.26
- **Step 2** - Arbitrageur will settle futures at ₹312. So, his inflows are ₹312.

» Arbitrage profit = 312 – 307.26 = ₹ 4.74

 # Ques 12 - Bottoms up **{SM TYK, N19 RTP (Old), N23 MTP 1, M24 RTP}**

Calculate the price of 3 months Bottoms up futures, if the co.' stock (FV ₹10) quotes ₹220 on NSE and the three months future price quotes at ₹230 and the one month borrowing rate is given as

15% p.a. and the expected annual dividend is 25%, payable before expiry. Also examine arbitrage opportunities.

Ans: Futures Price (F) = Spot + Cost of carry - Dividend

F = 220 + (220 x 0.15 x 3/12) – 0.25 x 10 = 225.75

(Entire dividend of ₹2.50 is payable before expiry.)

(ii) **Constructing arbitrage:**

\# **Step 1** - Arbitrageur will buy ABC Stock at ₹220 by borrowing at 15% for 3 months. So, outflows are:

Cost of Stock	220
Add: Interest @ 15 % for 3 months = 220 × 0.15 × 0.25	8.25
Total Outflows (A)	228.25

\# **Step 2** - Arbitrageur will settle futures at ₹230 and will receive dividend for his stock. So, inflows are:

Sale proceeds of futures	230
Dividend: 10 x 25%	2.50
Total inflows (B)	232.5

» Arbitrage profit = B – A = 232.5 – 228.25 = ₹ 4.25.

Hedge ratio

\# Ques 13 – Surya **{Dec 21 RTP (Old), N23 RTP}**

Surya Ltd. is long on 10MT of copper@ ₹474 per kg (spot) and intends to remain so for the ensuring quarter. The standard deviation of changes of its spot and future prices are 4% and 6% respectively, having correlation coefficient of 0.75. What is the hedge ratio? What is the amount of the copper future it should short to achieve a perfect hedge?

Ans: Hedge ratio $= \frac{\sigma_s \times r_{s,f}}{\sigma_f} = \frac{4\% \times 0.75}{6\%} = 0.5$

» Value of short futures = {(474 x 10) x 1000} x 0.5 = 23,70,000

Discrete or Special Ques

Beta of a portfolio consisting of both Equity + Futures position

\# Ques 14 – Vayu **{SM TYK, N20 RTP (Old), Jul 21 Exam (New), M24 MTP 1}**

Vayu is having in its portfolio shares worth ₹85 Lakhs at current price and cash ₹15 Lakhs. The beta of shares 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 trader on current date goes for long position on ₹100L Nifty futures.

Ans: (i) Portfolio beta = 0.85 x 1.6 + 0.15 x 0 = 1.36

ii) **Calculation of portfolio beta**

- value of shares after 3-months: = 85L x (1-0.032) = 82.28L

Value of long futures

- Shares having a beta of 1.6 fell by 3.2%.
- Beta = change in value of shares / change in value of market index
- 1.6 = -3.2% / Change in market index
- Change in market index = 2%
- Nifty futures value = 100 x (1-0.02) = 98L

» Portfolio beta = weighted average beta = $\frac{\{82.28L \times 1.6\} + \{15L \times 0\} + \{98L \times 1\}}{82.28L + 15L} = 2.36$

Note: No amount is paid for futures (unlike shares etc.). So, we do not take value of index in the denominator.

Calculating closing value of portfolio using CAPM

 # Ques 15 – Padma {SM TYK, M19 RTP Old, N20 Exam Old, Jul 21 Exam, M22 RTP, N22 MTP 1}

	BSE (cash market)	5000
Imp	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

Mrs. Padma assume that a future construct on the BSE index with four months maturity is used to hedge the value of portfolio. One future contract is for delivery of 50 times the index.

Based on the above information calculate:

(i) Fair price of 4 Months future contract.

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

(iii)	Value of portfolio after 3 months using CAPM	(a) without Hedging	(b) with Hedging
Ans:	Futures price = 500 x {1 + (0.09 – 0.06) x 4/12} =	5050	
•	Value of futures contract = 5050 x 50 =	2,52,500	
•	No. of futures contracts = (10,10,000 x 1.5) /252500 =	6 contracts	
ii.	**Value of future contract after 3 months should be**		
•	4500 x {1 + (0.09 – 0.06) x 1/12} =	4511.2512	
•	Gian = (5050 – 4511.2512) x 50 x 6 =	161624.64	
iii.	**Value of portfolio using CAPM**		
•	Market return (3 months) = Capital gain yield + Dividend yield		
	= (4500 – 5000) / 5000 + (6% x 3/12) = –8.5% for 3 months.		
•	Rf for 3-months = 9% x 3/12 = 2.25%		
•	CAPM return = Rf + (Rm – Rf).β = 2.25% + (-8.5% - 2.25%) x 1.50 = -13.875%		
a)	Value of portfolio without hedging = 10,10,000 x (1-0.13875) = 8,69,862.5		
b)	Value with hedging = Portfolio value + Gain on short futures = 869862.5 + 161624.64 = 1031487.14		

👉 Short Selling

P&L of Short seller

 # Ques 16 – Indra

Mr Indra decides to sell short 10,000 shares of ABC Ltd, which was selling a yearly high of £ 5.60. His broker requested him to deposit a margin requirement of 45% and commission of £1550. While Mr Indra. short the share, ABC ltd. paid dividend of £0.25 per share. At the end of one year he buys 10,000 shares of ABC Ltd. at £ 4.50 to close out position and was charged a commission of £ 1450. You are required to calculate his return on Investment taking opportunity cost of dividend loss.

Ans:	**Profit / (loss) on short sale**	**(£)**
	Sold shares: 5.60 x 10,000	56000
(-)	Bought shares: 4.50 x 10,000	(45000)
=		11000
(-)	Dividends re-imbursed by short: 0.25×10,000	(2,500)
(-)	Brokerage: 1550 + 1450	(3,000)
	Profit on short sale:	5,500

#	**Calculating of initial investment**		
	Margin money = {5.6 x 10,000} x 45%	25200	
+	Brokerage at the time of entering into contract	1550	
	Total:	26,750	

- Return on investment = Return / Investment = 5500/26750 = 20.56%

P&L of Stock lender

 # Ques 17 – Amazon {M22 RTP, M23 MTP 2, N24 RTP}

Mr. Amazon is holding 10,000 shares of face value of ₹100 each of M/s. XYZ Ltd. He wants to hold these shares for long term and have no intention to sell.

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

1. Shares to be borrowed for 3 months from 01-01-20 to 31-03-20.
2. Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange.
3. Bank Guarantee will be provided as collateral for the value as on 01-01-2020.

Other Information:

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

(b) On 29-02-2020 M/s XYZ Ltd., declared dividend of 25%,

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

Date	Share price in case 1 – Bullish	Share price in case 2 - Bearish
01-01-2020	1000	1000
31-01-2020	1020	980
29-02-2020	1040	960
31-03-2020	1050	940

You are required to find out:

(i) Earning of Mr. Amazon through Stock Lending Scheme in both the scenarios.

(ii) Total Earnings of Mr. Amazon during 01-01-2020 to 31-03-2020 in both the scenarios.

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

Ans: Earnings of Mr. Amazon through stock lending scheme

(i)	**Lending fee**	**Case 1**	**Case 2**
	31-01-20: 1020 x 1% and 980 x 1%	10.20	9.80
	29-02-20: 1040 x 1% and 960 x 1%	10.40	9.60
	31-03-20: 1050 x 1% and 940 x 1%	10.50	9.40
	Earnings from lending per Share (A)	31.10	28.80
	Total No. of Shares	10000	10000
	Total Earning from Lending	3,11,000	2,88,000
(ii)	**Total earnings of Mr. Amazon**		
	Dividend income per Share (B)	25	25
	Total earnings per share (A) + (B)	56.10	53.80
	Total No. of Shares	10000	10000
	Total Earning	5,61,000	5,38,000
(iii)	**Gain or loss on Short sales**		
	(1,050 - 1,000) and (1,000 - 940)	(50.00)	60.00
	Lending fees paid per share	(31.10)	(28.80)
	Bank guarantee charges @ 8% p.a.	(20.00)	(20.00)
	Gain Per Share	(101.10)	11.20
	Total No. of Shares	10000	10000
	Total Gain on shortening the shares	(10,11,000)	1,12,000

Additional Questions

👉 Basic practice ques

Basic P&L on futures position

 # Ques 1 – Ahalya **{N19 Exam (New)}**

A future contract is available on Ahalya 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 future contract of Ahalya Ltd. realizes a gain or loss? What will be the amount of gain or loss?

(Ignore margin and taxation, if any)

Ans: Futures price = Spot + Cost of carry – Dividend = 125 + (125 x 0.08) – 4 = ₹131

- Price of one futures contract = 131 x 1000 = ₹131,000

ii) Futures price if stock falls by 6% (stock price = 125 x 0.94 = ₹117.5)

- Futures price = 117.5 + (117.5 x 0.08) – 4 = 122.90
- Price of one futures contract = 122.90 x 1000 = ₹122,900

iii)

Calculation of profit / (loss)	₹
Long (bought) futures at:	(131,000)
Short (sold) futures at:	122,900
Loss:	8,100

👉 Hedging using futures

P&L in case of perfect hedging

 # Ques 2 – Pyaralal **{Dec 21 Exam (New)}**

Mr. Pyaralal bought 1000 equity shares of PL ltd. at ₹700 per share. Beta of PL ltd. is 1.25. He hedged his position by going short on Nifty futures contract which is currently quoted at 17,500 and has a

lot size of 50.

(i) Please advise the investor how to hedge his market exposure using the available data.

(ii) Calculate the profit / loss of Mr. Pyaralal in following situation:

(a) Nifty future rise by 10%

(b) PL ltd. falls by 5%.

(iii) Is it possible stock as well as nifty to raise or fall at the same percentage? Please state the reason.

Ans: (i) Investor can use Nifty futures to hedge his exposure.

- Number of Nifty futures = $\frac{700 \times 1000 \times (0 - 1.25)}{17{,}500 \times 50}$ = - 1 contract i.e. Short 1 contract.

(ii) P&L Calculation:

(a) **Case A – Nifty future rise by 10%**	₹
PL ltd: 1000 x 700 x (10% x 1.25)	87,500
Nifty future: -1 x 875,000 x 10%	(87,500)
Gain / (loss):	Nil

(b) **Case B – PL ltd. falls by 5%.**	₹
PL ltd: 1000 x 700 x -5%	(35,000)
Nifty future: -1 x 875,000 x -4%*	35,000
Gain / (loss):	Nil

Note: If PL ltd. falls by 5%, then Nifty should fall by = 5%/1.25 = 4%.

(iii) Normally it is not possible that Nifty to rise or fall by same percentage because of systematic risk i.e. Beta may not be the same as of market.

Reverse calculating Beta (using Hedging formula)

 # Ques 3 - Harsha

On 1-04-2015, Harsha was holding a portfolio of 10 securities whose value was ₹9,94,450. 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 contracts of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1st April.

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

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

Ans: Let overall portfolio Beta be β. then we can say that:

- Number of Index futures to be traded = $\frac{V_h \times (T_B - \beta)}{I_{FP} \times \text{Lot size}}$

- $-5 = \frac{994450 \times (0 - \beta)}{8767.07 \times 25}$ => β = 1.102 (approx.)

Portfolio Beta = weighted average Beta.

Let Beta of 10th security be 'a'

1.102 = 1.10 x 0.9 + 0.10a

a = 1.12

» Beta of 10th security = 1.12

(ii) The main reason for the profit in cash position might be due to reason that contrary to her expectation of fall in the value of cash position there may be increase in value of cash position.

👉 **Low Probability – Unique Questions**

Reverse cal. No. of futures traded & Beta of stock from P&L figure

Ques 4 – Baka consultant

Mr. Careless was employed with Baka Consultant. Mr. Ganchakkar their regular client purchased 1,00,000 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. Ganchakkar **to take a position*** in index future trading at $1,000 each contract. Though Mr. Careless noted the name & beta of A plc but forgot to record the beta value of X inc.

On next day Mr. Ganchakkar 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. Ganchakkar, informed Mr. Careless that he made a loss of $1,14,500 due to the position taken.

Since the records of Mr. Careless are incomplete, he has requested you to calculate the:

i) Number of futures contract he advised Mr. Ghanchakkar to trade.

ii) Beta of X Inc shares.

Note: ***The original ques of ICAI stated that Mr. Careless advised to take a short position in futures. Which is wrong. Because here in this ques a long futures position is required to obtain the hedge.***

Ans: **i) Let number of futures contracts traded be 'n'.**

#	Calculation of profit / (loss) after 1-day	Gain / (loss)
	X Inc: 100,000 x 22 x -2% =	(44,000)
	A Plc: -50,000 x 40 x 3% =	(60,000)
	Index futures: n x 1000 x -1.5% =	(15n)
	Total Gain / (loss):	(1,14,500)

Hence, => (44000) + (60,000) + (15n) = (114,500)

=> n = 700

- Number of futures contracts traded = 700 i.e. Long 700 contracts
- Therefore, total value of futures bought to hedge the position = 700 x 1000 = 7,00,000 ... (1)

ii) Beta of stock

Let Beta of X Inc stock be 'a'.

#	Shares	Value	Beta	Position	Index hedge
•	X Inc	100,000 x 22 = 22L	a	Long	22L*a short
•	A Plc	50,000 x 40 = 20L	2	Short	40L long
->	Net position (value of futures required to hedge):				40L – 22L*a ... (2)

From (1) and (2), we can say:

- 7,00,000 = 40,00,000 – 22,00,000*a
- 22,00,000*a = 33,00,000
- a = 33/22 => 1.5

Hence, Beta of shares is 1.5

Calculating Implied RF from Arbitrage profit

 # Ques 5 – Vaikuntha

Suppose current price of an index is ₹13,800 and yield on index is 4.8% (p.a.). A 6-month future contract on index is trading at ₹14,340. Assuming that Risk Free Rate of Interest is 12%, show how Mr. Vaikuntha (an arbitrageur) can earn an abnormal rate of return irrespective of outcome after 6

months. You can assume that after6 months index closes at ₹10,200 and ₹15,600. Also calculate implied risk-free rate of return on investment. **Do not incorporate borrowing point**.

Ans: Futures price = 13800 x {1 + (0.12 – 0.048) x 6/12} = 14,296.8

- Current futures price = 1430
- Arbitrage is possible.

Steps for arbitrage

1. Sell index futures at ₹14340.
2. Buy a portfolio of shares replicating the index at a cost of ₹13800 (i.e., spot rate).

i. If index closed at ₹10,200

	Profit from short position:	14340 – 10200	=	4140
(+)	Dividend on portfolio:	13800 x 4.8% x 6/12	=	331.2
(-)	Loss on portfolio:	10200 – 13800	=	(3600)
	Total arbitrage profit:		=	871.20

Note: Borrowing cost is ignored as it is explicitly mentioned in ques to ignore borrowing cost.

ii. If index closed at ₹15,600

	Loss on short position:	14340 – 15600	=	1260
	Dividend on portfolio:	13800 x 4.8% x 6/12	=	3312
(+)	Profit on portfolio:	15600 – 13800	=	1800
	Total arbitrage profit:		=	871.20

(Again, borrowing cost is to be ignored.)

 # Implied Rf calculation

- Implied Rf = Return / Investment = 871.20 / 13800 = 6.31% for 6-months ie. 12.63% p.a.

Calculation of Open interest

 # Ques 6 – Shizune {KE in-house}

M/s Shizune took following trades in Metal B Inc futures.

Date	Futures price	Action
4-May	1680	Long 15 Contracts
12-May	1740	Short 10 contracts

	14 May	1760	Short 7 contracts
	19 May	1815	Long 2 contracts

You are required to show the open interest (OI) of M/s Shizune for each of the above dates. Also calculate the net profit / loss from all the above trades. A commission of ₹30 is charged whenever a contract is bought or sold.

Ans:

Date	Action	Open Interest
4-May	Long 15 Contracts	15 lots – Long futures
12-May	Short 10 contracts	5 lots – Long futures
14 May	Short 7 contracts	2 lots – Short futures
19 May	Long 2 contracts	0 lots – No open interest

Calculating Profit / loss

	Short futures: (10 x 1740) + (7 x 1760)	29,720
(-)	Long futures: (15 x 1680) + (2 x 1815)	(28,830)
	Profit:	890
(-)	Commission: 34 x 30	(1020)
	Net Profit / (loss):	(130)

Ch 9B – Options

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Basic Questions	1 – 2
Expected value of option @ Maturity	3 – 4
Binomial Model	5 – 8
Two-Stage binomial model	9
BSM Model	10 – 11
Option strategies	12 – 14

Index - Additional Questions	**Ques Number**
Binomial Model – Risk Neutral approach	1
Low Probability – Unique Questions	
- Expiry day cash flow calculation	2
- P&L calculation on futures + Options trading when brokerage is given	3

Main Questions

👉 Basic Questions

Basic Option Payoff calculation

 # Ques 1 – Narada

A call option on Narada Ltd's stock has an exercise price of ₹20. The stock price **on expiry** ranges between 16 and 24 with interval of 2. Compute the **fair value premium of the call**.

Ans:

Market price	Payoff
16	0
18	0
20	0
22	2
24	4

Option Payoff & Break-even point calculation

 # Ques 2 – VCC {SM TYK, N18 Exam (New), N19 RTP (Old), N24 RTP}

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, 220, 230.

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

Ans:

ST	Call Gross payoff	Call Net payoff	Put Gross payoff	Put Net payoff
200	0	(6)	20	15
220	0	(6)	0	(5)
230	10	4	0	(5)

Note : Net Payoff = Gross payoff – Premium paid

(ii) Price range for gainfully exercising options

Call = Strike + Premium paid = 220 + 6 = 226

Put = Strike – Premium paid = 220 – 5 = 215

Expected value of option @ Maturity

Expected value of Put @ Maturity

 # Ques 3 – Pradyumna {SM TYK}

Equity share of Pradyumna 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).

Alternatively, ques can say **"Determine the premium at which trader will break even"**.

Ans:

Probability	Market Price	Put Payoff	Prob. X Payoff
0.1	180	120	12
0.2	260	40	8
0.5	280	20	10
0.1	320	0	-
0.1	400	0	-
		Expected value of option =	30

Expected value of Call @ Maturity

 # Ques 4 – Suprabha {SM TYK, N18 Exam (Old), M22 Exam, M24 MTP 2}

You as an investor had purchased a 4-month call option on the equity shares of Suprabha 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 Suprabha 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 the following:

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?

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.

Ans: (i) Expected Share Price = 120×0.05 + 140×0.20 + 160×0.50 + 180×0.10 + 190×0.15 = ₹160.50

(ii) **Value of Call Option if exercise price prevails** = ₹150 – ₹150 = Nil

(iii) If option is held till maturity the expected Value of Call:

Stock Price (S_T)	Call payoff	Probability (P)	Payoff x Probability
120	-	0.05	0
140	-	0.20	0
160	10	0.50	₹ 5
180	30	0.10	₹ 3
190	40	0.15	₹ 6
			₹ 14

* Call option payoff will be 0 if stock price < Strike price.

(iv) Price to be quoted at the stock exchange to get the value of the call option = 150 + 14 = 164

Binomial Model

Value of Call using Risk-neutral method

 # Ques 5 – Pinaka **{SM TYK, N22 MTP 1}**

The current market price of an equity share of Pinaka 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.

Ans: Let the probability of stock price going up be p.

- $p = \frac{S_0 e^{rt} - D}{U - D} = \frac{420e^{0.08 \times 3/12} - 400}{500 - 400} = 0.2848$

- Value of Call $= \frac{50 \times 0.2848 + 0}{e^{0.08 \times 3/12}} = \frac{14.24}{1.0202} = ₹ 13.96$

Value of Put using Risk-neutral method

 # Ques 6 – Tulsi

Find value of a 1-year put option with K = 2500. Tulsi Ltd. Stock is currently trading at ₹2400. It

may move 20% up to ₹2880 or fall 15% to ₹2040 in 1-year time frame. Rf = 6% p.a. Use risk-neutral approach.

Ans: Let probability of stock price going up in next 1 year = p

• $p = \frac{S_0 e^{rt} - Sd}{Su - Sd} = \frac{2400e^{0.06} - 2040}{2880 - 2040} = \frac{2548.32 - 2040}{840} = 60.5\%$

• 1 - p = probability of going down = 100% - 60.5% = 39.5%

» Value of put as on today = $\frac{0 + 460 \times 39.5\%}{e^{0.06}} = 171.125$

Value using Delta-hedge method (Master ex.)

Ques 7 – Dayal **{SM TYK, N19 Exam (New), N22 RTP, N22 MTP 2}**

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

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

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

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

iv) Calculate amount of borrowing.

v) What is the value of his holding (cashflow position)?

Ans: **i) Calculating hedge ratio**

• Hedge ratio = $\frac{\text{Change in call payoff}}{\text{Change in stock price}} = \frac{150 - 0}{780 - 480} = 0.5$

• To construct delta-hedge portfolio → Sell 100 call options & buy 50 shares (i.e. 100 x 0.5).

Illustrating identical position

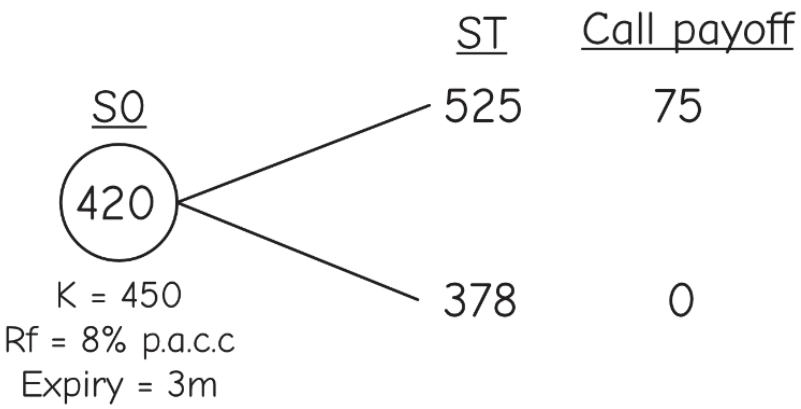
	ST = 780	**ST = 480**
Value of stock	780 x 50 = 39,000	480 x 50 = 24,000
Call Payoff	(100 x 150) = (15,000)	Nil
Net value	24,000	24,000

ii) Payoff on expiry is certain. So, value (cost) of portfolio today = PV of payoff discounted at Rf.

•	50 S_0 – 100 C_0 = 24,000 / 1.025
•	50 x 600 – 100 C_0 = 23415
•	C_0 = 6585 / 100 = ₹65.85
»	Therefore, value of option as on today = ₹65.85
iii)	Expected return = Expected profit from option = 150×0.6 + 0×0.4 = 36.67%
	cost of option 65.85
iv)	Amount borrowed = Cost to construct delta hedged portfolio = 50 x 600 – 100 x 65.85 = ₹23,415
v)	Value of holding on expiry will be ₹24,000 (calculated above).

Valuation using Risk neutral + Delta hedge method

#	**Ques 8 – Omni**	**{N23 Exam}**
	Following information is available related to shares of Omni Ltd:	
•	Current Market Price	₹ 420.00
•	Strike Price	₹ 450.00
•	Maximum Price expected in next 3 months' time	₹ 525.00
•	Minimum Price ₹ expected in next 3 months' time	₹ 378.00
•	Continuously Compounded Rate of Interest p.a.	8.00%
•	e^{rt}	1.0202
(i)	Calculate the 3 months call option by using Binomial Method and Risk Neutral Method.	
	Are the calculated values under both the models are same?	
(ii)	State also clearly the basis of Valuation of options under these models.	
Ans:	**Call Option value using Binomial Model:**	



- Δ = $\frac{525 - 378}{75 - 0}$ = 0.51
- Initial Investment = 0.51 x 420 = 214.20
- Value of Portfolio if Price goes down to ₹378 = 0.51 x 378 = 192.78
- Accordingly Let 'P' be the option price, then:

214.20 - P = 192.78/1.0202 = 188.96

P = 25.24

(2) **Value of Call Option using Risk Neutral Method**

- Let "P' be the probability of Price increase, then

p x 525 + (1 - p) x 378 = 420(1.0202)

147p = 50.48

p = 0.34

- Probability of Price increase (p) = 0.34
- Probability of Price decrease (1-p) = 0.66
- $\frac{0.34 \times 75 + 0.66 \times 0}{1.0202}$ = 25.24

Yes, the value of option under both Models is same.

(ii) **Basis of valuation of options :**

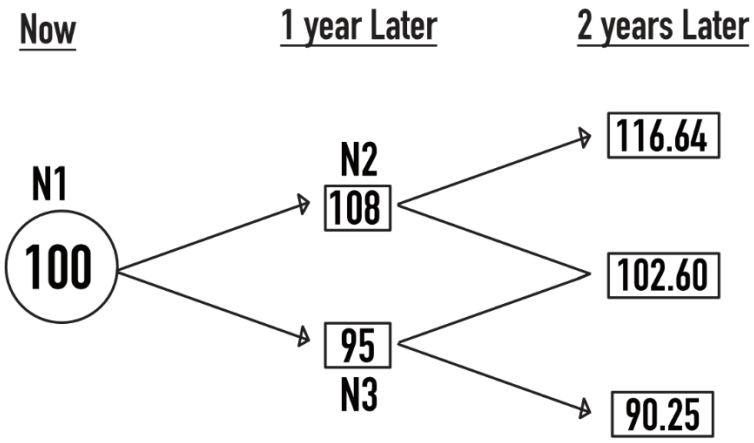
Binomial model uses an approach called " Risk less Hedge Approach" to find the price of the option, by creating a portfolio which will have same value at expiration irrespective of any price. - In Risk Neutral Model, valuation of options is based on arbitrage and is therefore independent of risk preferences; one should be able to value options assuming any set of risk preferences and get the same answer.

👉 Two-Stage binomial model

Two stage binomial model

 # Ques 9 – Moringa **{N20 Exam (New), M23 RTP}**

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



Consider a two years American call option on the stock of Moringa Ltd. with a strike price of ₹98. The current price of the stock is ₹100. Risk free return is 5% p.a. with a continuous compounding and $e^{0.05}$ = 1.05127. Assume two time periods of one year each.

Using the Binomial Model, calculate:

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

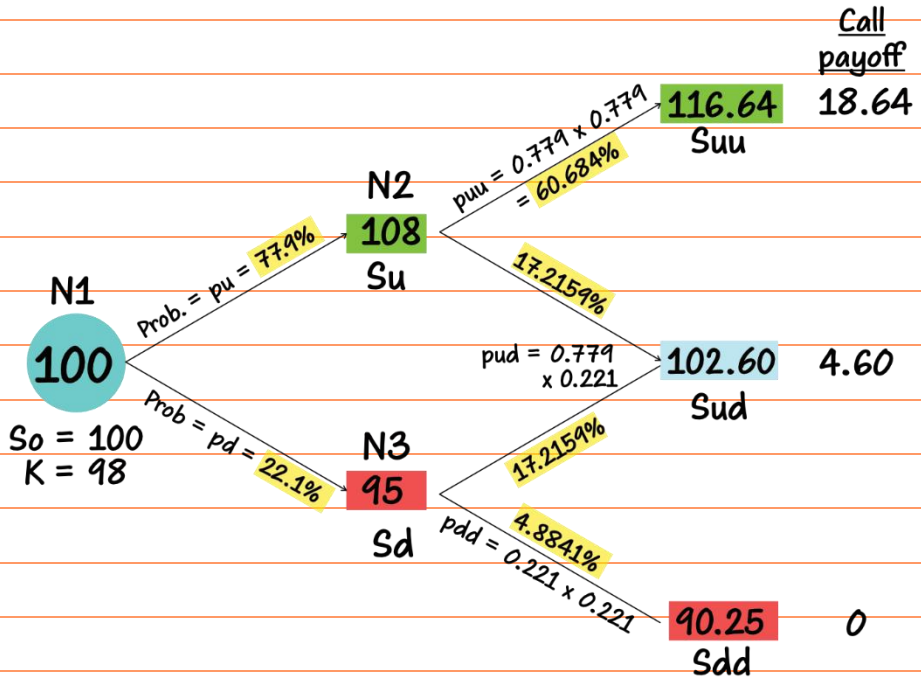
(ii) Expected pay offs at each node i.e., N1, N2 and N3.

Ans: The stock can move 8% up or 5% down at each step.

- Probability of up-move at each step = $\frac{e^{rt} - d}{u - d}$

Where d = down move factor (here 1 – 0.05 = 0.95)

and u = up move factor (here 1 + 0.08 = 1.08)



• Probability of up-move = $\frac{1.05127 - 0.95}{1.08 - 0.95}$ = 0.779 or 77.9%

Hence, Probability of down move = 1 – 0.779 = 0.221 or 22.1%

(ii) Calculating Call option Value

=> At N1: = $\frac{18.64 \times 60.6841\% + 4.60 \times (17.2159\% + 17.2159\%) + 0}{e^{0.05 \times 2}}$

= $\frac{12.90}{1.10517}$ = ₹11.67

=> At N 2 = $\frac{18.64 \times 0.779 + 4.60 \times 0.221}{1.05127}$ = ₹14.78

=> At N 3 = $\frac{4.60 \times 0.779 + 0}{1.05127}$ = ₹3.41

 # Checking value of option at each for American option exercise

Node	Value as per cal.	Payoff if immediately exercised	Final value (higher of 2)
N1	11.67	100 – 98 = 2	11.67
N2	14.78	108 – 98 = 10	14.78
N3	3.41	95 – 98 = 0*	3.41

*Option payoff cannot be negative. Hence, payoff at node 3 = 0.

BSM Model

Value of call using BSM (without dividend)

 # Ques 10 – Rosemary {SM TYK, N20 RTP (New), N20 MTP 1 (New), N20 RTP (Old)}

From the following data, find the value of a call option using BSM on Rosemary Ltd' stock:

Price of stock now	₹ 80
Exercise price	₹ 75
Standard Deviation of continuously compounded Annual return	0.40
Maturity period	6 months

Annual interest period 12%

You may use the following values from normal distribution table:

N(0.5817) = 0.7195

N(0.7011) = 0.7584

N(0.4183) = 0.6621

N(0.2989) = 0.6175

Ans: Value of Call = $S_0\ N(d_1) - Ke^{-rt}\ N(d_2)$ = $\{80 \times 71.95\%\} - \{75e^{-0.12x6/12} \times 61.75\%\}$ = 13.94

WN 1: $d1 = \frac{Ln\ (S_0\ /\ K) + (rf + \sigma^2/2).t}{\sigma\sqrt{t}} = \frac{Ln\ (80/75) + (0.12 + 0.40^2/2)0.5}{0.40\ \sqrt{0.5}} = 0.5817$

WN 2: $d2 = d1 - \sigma\sqrt{t} = 0.5817 - 0.40\ \sqrt{0.5} = 0.2989$

WN 3: **Calculating N(d1) & N(d2)**

N(d1) = N (0.5817) = 71.95%

N(d2) = N (0.2989) = 61.75%

ADDITIONAL NOTES: QUESTION VARIATIONS

Sometimes ques may not provide value of N(d1) and N(d2) directly. Rather it may give values as:

No. 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

In such cases, we will have to use interpolation to get our desired value:

Calculating N(d1) i.e. N(0.5817)

- Value at 0.55 = 1 - 0.2912 = 0.7088
- Value at 0.60 = 1 - 0.2743 = 0.7257
- Value at 0.5817 = 0.7088 + $\frac{(0.7257 - 0.7088)}{0.05} \times 0.0317$ = 0.7195 or 71.95%

Similarly, value of N(d2) i.e. N(0.2989) = 61.75%

Value of Call using BSM + Value of put using PCP (with dividends) [Master ques]

**Ques 11 – TIC** **{SM Illus, N22 MTP 2}**

i) The shares of TIC Ltd. are currently priced at ₹415 and call option exercisable in three months' time has an exercise rate of ₹400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of share price is 22%. Based on the assumption that TIC Ltd. is not going to declare any dividend over the next three months, is the option worth buying for ₹ 25?

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

iii) What would be the worth of put option if current price is ₹ 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, then, calculate value of the call option.

Ln & e Values	Cumulative probability Under Normal distribution	
Ln (0.95) = -0.05129	z = 0.29 → 61.41%	z = 0.125 → 54.98%
Ln (0.9952) = -0.00481	z = 0.30 → 61.79%	z = 0.015 → 50.60%
Ln (1.0375) = 0.03681	z = 0.40 → 65.54%	z = 0.5033 → 69.26%
$e^{0.008333}$ = 1.0084	z = 0.41 → 65.91%	z = 0.3933 → 65.29%

You can use the above values for your calculation.

Ans: <u>Part 1 - Value of call when S0 = 415</u>

i) Value of Call = $S_0N(d_1) - Ke^{-rt}N(d_2)$

= $\{415 \times 69.26\%\} - \{400e^{-0.05x3/12} \times 65.29\%\}$ = ₹ 29.52

WN 1: $d1 = \frac{Ln(S_0/K) + (rf + \sigma^2/2)t}{\sigma\sqrt{t}} = \frac{Ln(415/400) + (0.05 + 0.22^2/2)0.25}{0.22\sqrt{0.25}} = 0.5033$

WN 2: $d2 = d1 - \sigma\sqrt{t} = 0.5033 - 0.22\sqrt{0.25} = 0.3933$

WN 3: N(d1) = N(0.5033) = 69.26%

- N(d2) = N(0.3933) = 65.29%

ii) <u>Part 2 - Value of call when S0 = 380</u>

Value of call if current stock price is ₹380

Call option value = $\{380 \times 0.3830\} - \{400e^{-0.05x3/12} \times 0.3418\}$ = ₹ 10.52

WN 4: $d1 = \frac{Ln(380/400) + (0.05 + 0.22^2/2)0.25}{0.22\sqrt{0.25}} = -0.297636$

WN 5: $d2 = d1 - \sigma\sqrt{t} = -0.297636 - 0.22\sqrt{0.25} = -0.407636$

WN 6: **Calculating N(d1) i.e. N(-0.297636)**

- Value at 0.29 = 61.41%
- Value at 0.30 = 61.79%
- Value at 0.297636 = 61.41% + $\frac{(61.79\% - 61.41\%)}{0.01} \times 0.007636$ = 61.70%
- Therefore, value at N(-0.297636) = 1 – 0.6170 = 0.3830

WN 7: **Calculating N(d2) i.e. N(-0.407636)**

- Value at 0.40 = 65.54%
- Value at 0.41 = 65.91%
- Value at 0.407636 = 65.54% + $\frac{(65.91\% - 65.54\%)}{0.01} \times 0.007636$ = 65.82%
- Therefore, value at N(-0.407636) = 1 – 0.6582 = 0.3418

iii) *Part 3 - Value of Put when S0 = 380 (using PCP)*

AS PER PUT-CALL PARITY (PCP):

S_0 + Value of put = Value of call + PV of strike price

$380 + \text{Value of put} = 10.52 + 400e^{-0.05 \times 3/12}$

Value of put = 10.52 + 395.03 – 380 = ₹ 25.55

iv) *Part 4 - Value of call option when dividend is expected*

- Call value = $S^* \times N(d1) - Ke^{-rt} N(d2)$

  $= \{398.083 \times 0.5498\} - \{400e^{-0.05 \times 3/12} \times 0.5060\}$ = ₹ 18.98

- where S* = Stock price as on today – PV of expected dividends

  $= 408 - 10e^{-0.05 \times 2/12} = 408 - 9.917$ = ₹398.083

- $d1 = \frac{Ln(S^*/K) + (rf + \sigma^2/2)t}{\sigma\sqrt{t}} = \frac{Ln\ (398.083/400) + (0.05 + 0.22^2/2)0.25}{0.22\sqrt{0.25}} = 0.125$

- $d2 = d1 - \sigma\sqrt{t} = 0.125 - 0.22\ \sqrt{0.25} = 0.015$

- $N(d1) = N(0.125) = 0.5498$

  $N(d2) = N(0.015) = 0.5060$

Option strategies

 # Ques 12 – Sumukhi **{SM TYK, M18 Exam (New)}**

Mr. Sumukhi 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. Sumukhi'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.

Ans: **Cal. Of premium paid**

- Call premium = 30 x 100 = 3000
- Put premium = 5 x 100 = 500

Stock Price	Call payoff K = 550	Put payoff K = 450	Total Payoff	Premium Paid	Net Gain
350	0	100 x 100 = 10000	1000	3500	6500

 # Ques 13 – Harper **{SM TYK, N18 RTP (Old), M19 RTP (New), M24 Exam}**

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

She 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. **Determine the Investor's position if:**

i) The tie up offer bids the price of stock up to ₹ 43 in 3 months.

ii) The tie up programme fails and the price of the stocks falls to ₹ 36 in 3 months.

Ans: **Cal. Of premium paid**

Call premium = 2 x 100 = 200

Put Premium = 1 x 100 = 100

300

Stock Price	Call payoff K = 42	Put payoff K = 40	Total Payoff	Premium Paid	Net Gain
43	100	0	100	300	-200
36	0	400	400	300	100

 # Ques 14 – Chitrasena {SM TYK, M19 Exam, N20 Exam (Old), M22 RTP, M24 MTP 1, M24 RTP}

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

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

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

Delta Corporation's stock is currently selling at ₹500. Determine profit or loss, if the stock price:

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.

Ans: **Calculation of premium paid**

Call of premium	=	30 x 100 =	3000	
Put premium	=	5 x 100 =	500	
			3500	

Stock Price	Call payoff K = 550	Put payoff K = 450	Total Payoff	Premium Paid	Net Gain
500	0	0	0	3500	-3500
350	0	100x100 = 10,000	10,000	3500	6500
600	50 x 100 =5,000	0	5000	3500	1500

Additional Questions

👉 Binomial Model – Risk Neutral approach

V. Basic Risk-neutral probability calculation

 # Ques 1 – Sumana {SM TYK}

Sumana wanted to buy shares of EIL which has a range of ₹411 to ₹592 a month later. The present price of share is ₹421. Her broker informs her that the price of this share can soar 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.

Advise her. Take the risk-free interest to be 3.60% and $e^{0.036}$ = 1.037.

Ans: Let probability of stock price going up in next 1 year = p

- $p = \frac{S_0e^{rt} - S_d}{S_u - S_d} = \frac{421e^{0.036} - 411}{592 - 411} = \frac{436.577 - 411}{592 - 411} = 0.14$ or 14%

👉 Low Probability – Unique Questions

Expiry day cash flow calculation

 # Ques 2 – Kapila

A call and put exist on Kapila ltd.'s stock each of which has EP of ₹60. They now trade for:

Market price of Stock or stock index	₹55
Market price or premium of call	₹9
Market price or premium of put	₹1

Calculate the expiration date cash flow of contract (in case of physical delivery), Gross Profit and net profit for expiration date stock prices of ₹55, ₹60, ₹70 from:

(i) Buy 1 call (ii) Write 1 call

(iii) Buy 1 put (iv) Write 1 put

Ans: **# Gross profit = Payoff**

Case	S_T	C+	C-	P+	P-
1	55	0	0	5	(5)
2	60	0	0	0	0
3	70	10	(10)	0	0

Net profit = Gross profit (i.e. Payoff) – premium paid

Case	S_T	C+	C-	P+	P-
1	55	(9)	9	4	(4)
2	60	(9)	9	(1)	1
3	70	1	(1)	(1)	1

Expiry date cash flow (EDCF) in case of call option

Case	ST	Call exercised	EDCF of C+	EDCF of C-
1	55	No	-	-
2	60	No	-	-
3	70	Yes	(60)	60

Expiry date cash flow (EDCF) in case of put option

Case	ST	Put exercised	EDCF of P+	EDCF of P-
1	55	Yes	60	(60)
2	60	No	-	-
3	70	No	-	-

P&L calculation on futures + Options trading when brokerage is given

Ques 3 – Willow

Willow purchased Reliance November Future (600 shares Tick size/lot size) at ₹542 and write a ₹580 November call options at a premium of ₹6 (600 shares Tick size/lot size). As on November 20spot price rises and so the future price and the call premium. Future price rises to ₹575 and call premium rises to ₹12 Find out profit/loss of the investor, if he/she settles the transaction on the date and at stated price. **Brokerage is 0.05% for the transaction value of future and strike price net of call premium for option.**

Ans: **(A) Futures:**

Buy price: 600 x 542	325200
Sell price: 600 x 575	345000

		Gross profit:	19800
	Less: Brokerage		
	Buying brokerage: 0.05% x 325200		(162.6)
	Selling brokerage: 0.05% x 325200		(172.5)
		Net profit:	19464.9
	(B) Options:		
	Selling price: 600 x 6		3600
	Buy price: 600 x 12		(7200)
		Gross profit / (Loss):	(3600)
	Less: Brokerage		
	Selling brokerage: 0.05% of (580 – 6) x 600		(172.20)
	Buying brokerage: 0.05% of (580 – 12) x 600		(170.40)
		Net profit / (loss) :	(3942.60)
»	Overall profit / (loss) = 19464.90 – 3942.60		15,522.30

Ch 9C – Real Options

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Real Options in Risk Neutral world	1 – 3
Real Options – BSM Model	4

Index - Additional Questions	**Ques Number**
Real Options – BSM Model	1
Low Probability Unique Questions	
- Timing option (using real word probabilities)	2

Main Questions

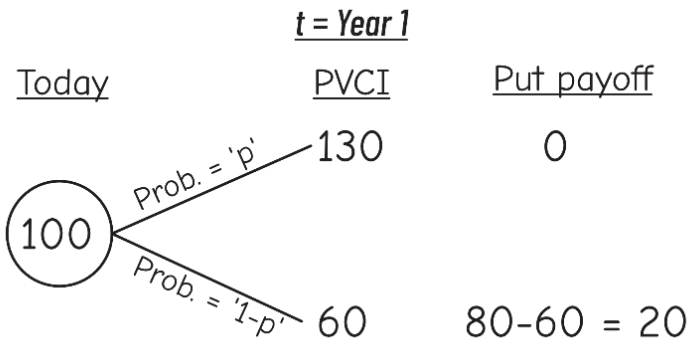
Real Options in Risk Neutral world

Abandonment option (using Risk-Neutral method)

 # Ques 1 – IPL Fertilizers {SM Illus, N24 MTP 1}

IPL fertilizers ltd. is considering a proposal of building a new plant to produce pesticides. The new plant will cost ₹115 crores. The PV of proposal is ₹100 crore without the abandonment option. However, if pesticide market turns out to be favourable **after 1 year**, the PV of proposal shall increase by 30%. On the other hand, if market **after 1-year** is sluggish the PV of the proposal shall be reduced by 40%. In case company is not interested in continuation of the project it can be disposed of for ₹80 crore **after 1 year**. If the risk-free rate of interest is 8% then what will be value of abandonment option.

Ans: **Author Notes:** Period of option (1-year) was not given in original ICAI ques. Author has corrected this mistake in the above ques.



- $S_0 \times (1 + Rf)^n = p.Su + (1-p).Sd$
- $p = \frac{S_0(1+r) - D}{U - D} = \frac{100(1.08) - 60}{130 - 60} = 0.686$
- $1-p = 1 - 0.686 = 0.314$

- Value of abandonment option = PV of expected payoff
- Value = $\frac{0 + 20 \times 0.314}{1.08}$ = ₹ 5.815 crores

Timing option (using Risk-Neutral method)

 # Ques 2 - MIS ltd {ICAI Illus}

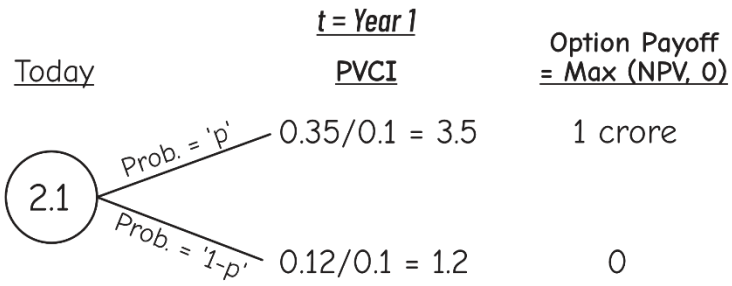
Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹21 lakh per year forever.

However, with change in State Government, the rate of electricity is subject to change **after 1 year**. Accordingly, the saving in electricity can be ₹12 lakh or ₹35 lakh p.a. and forever. Assuming WACC of MIS Ltd. is 10% and risk-free rate is 8%. Decide whether MIS Ltd. should accept the project or wait and see.

Ans: **As on today**

- PVCI = 0.21 / 0.1 = 2.1 crores
- NPV = 2.1 – 2.5 = –0.4 crores
- NPV is negative if project is started today. So, do not start today.

After 1-year



- $S_0 \times (1 + Rf)^n = p.Su + (1-p).Sd$
- $p = \frac{S0\,(1+r) - D}{U - D} = \frac{2.1\,(1.08) - 1.2}{3.5 - 1.2} = 0.4643$
- 1-p = 1 – 0.4643 = 0.5357
- Value of Timing option = PV of expected payoff
- Value = $\frac{1 \text{ crore} \times 0.4643 + 0}{1.08^1}$ = 42.99 Lacs
- Since Value of timing option is positive, so it is advisable to wait & watch as the project may become feasible after 1 year.

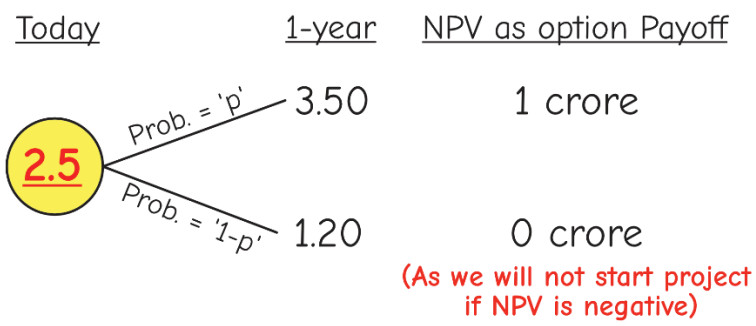
Author Note – Mistakes in Ques

Mistake 1 – Period of option was not mentioned in ques

(This mistake is corrected by author in the ques. Chillax 😀)

Mistake 2 – Wrong probability calculation

ICAI did the following probability calculation:



- $p = \frac{S0\,(1+r) - D}{U - D} = \frac{2.5\,(1.08) - 1.2}{3.5 - 1.2} = 0.652$

This is wrong as we need to take PV of asset / Project as on today as starting point. Not the initial investment.

Value of land as an option (using Risk-Neutral probability)

 # Ques 3 - Cheetah **{ICAI Past Ques}**

Mr. Cheetah owns a plot of land on which he intends to construct apartment for sale. No. of apartment units to be constructed may be either 10 or 15. Total construction costs for these alternatives are estimated to be ₹600 lakhs or ₹1025 lakhs respectively. Current market price for each apartment unit is ₹80 lakhs.

The market price after a year for apartment units will depend upon the conditions of market. If the market is buoyant, each apartment unit will be sold for ₹91 lakhs, if it is sluggish, the sale price for the same will be ₹ 75 lakhs.

Determine the current value of vacant plot of land. Should Ramesh start construction now or keep the land vacant? The yearly rental per apartment unit is ₹7 lakhs and risk-free interest rate is 10% p.a. Assume that the construction cost will remain unchanged.

Ans: **Profit if apartments are constructed today**

- 10 Apartments = 10 x 80 – 600 = ₹ 200 Lacs

- 15 Apartments = 15 x 80 – 1025 = ₹ 175 Lacs

Decision – Construct only 10 apartments today. Value = ₹200L

(ii) **NPV if construction is done after 1 year**

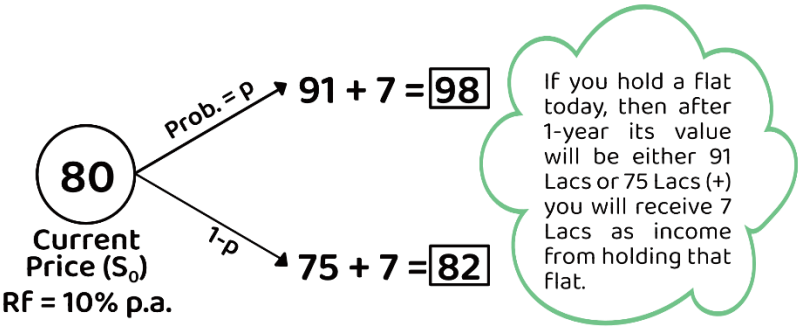
No. of flats	Buoyant market (Sale price = 91L)	Sluggish market (Sale price = 75L)
10 Flats	10×91 – 600 = 310	10×75 – 600 = 150
15 Flats	15×91 – 1025 = 340	15×75 – 1025 = 100
Decision	15 Flats ✓ (profit = 340L)	10 Flats ✓ (Profit = 150L)

(ii) Value of land today = PV of Expected payoff

- Expected value = $\frac{CF_{Buoyant} \times Prob._{Buoyant} + CF_{Sluggish} \times Prob._{Sluggish}}{(1 + Rf)^n}$

- Expected value = $\frac{340 \times 37.5\% + 150 \times 62.5\%}{1.10}$ = 201.136 Lacs

WN 1 – Risk Neutral Prob. of Buoyant & Sluggish market



- $S_0 \times (1 + Rf)^n = p.Su + (1-p).Sd$
- $p = \frac{S0\ (1+r) - D}{U - D} = \frac{80\ (1.1) - 82}{98 - 82} = 37.5\%$
- 1 – p = 62.5%

👉 **Real Options – BSM Model**

Using BSM to value a drug

 # Ques 4 – Aidrex **{ICAI Illus}**

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. ABC Ltd. holds the right of production of drugs and its marketing. Find value of this patent.

- Period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula.
- Co. will incur $12.5 million for development & marketing of the drug.
- Expected present value of cashflows from the sale of drug during the period of 15 years shall be $16.7 million.
- Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cashflows.
- Yield on T-Bonds of similar duration (15 years) is 7.8%.

**Some Further Information is as follows:**

Z-score:	1.3896	0.5472	1.2315	-0.7735
Cumulative Prob:	0.9177	0.7079	0.891	0.2196

 # Logs & e: ln(1.336) = 0.2897, $e^{-1.0005}$ = 0.3677, $e^{-1.17}$ = 0.3104

Ans: **Valuing Patent as a real option**

- S0 = PVCI = 16.7
- K = PVCO = 12.5
- σ = SD = √0.268 = 0.5177
- t = Time to expiry = 15 years
- Rf = 0.078
- **y = cost of delay = 1/15 = 0.0667**

i. **Calculating d1 & d2**

- $d1 = \frac{\text{Ln } (S_0 / K) + (rf - y + \sigma^2/2).t}{\sigma\sqrt{t}}$

$$= \frac{\text{Ln } (16.7 \div 12.5) + (0.078 - 0.0667 + 0.268/2) \times 15}{0.5177\ \sqrt{15}}$$

= $\frac{\text{Ln } (1.336) + 2.1795}{2.005}$ = $\frac{0.2897 + 2.1795}{2.005}$ = 1.2315

- $d2 = d1 - \sigma\sqrt{t} = 1.2315 - 2.005 = -0.7735$

ii. **Calculating N(d1) & N(d2)**

N(d1) = N (1.2315) = 0.8910

N(d2) = N (−0.7735) = 0.2196

iii. **Value of Project as a call option**

Value = $S_0 e^{-yt} N(d_1) - Ke^{-rt} N(d_2)$

= $[16.7 \times e^{(-0.0667 \times 15)} \times 0.8910] - [12.5\ e^{-0.078 \times 15} \times 0.2196]$

= $4.6192 Million

Additional Questions

👉 Real options - BSM model

Valuing rights using BSM

 # Ques 1 - Chatur **{ICAI}**

Chatur ltd., an advertisement agency intends to purchase adv. rights from GOI for National Highways. These adv. rights will provide the co. exclusive rights to run & manage advertisement on banners & digital boards alongside the national highways. Right if purchased will be valid for next 5 years. The govt. has demanded $20 Mn for these rights.

- Initial investment required to set up adv. infrastructure = $500 Mn
- Annual CFAT = $100 Mn p.a.
- Discount rate of the project = 15%
- Risk-free rate (Rf) = 5%
- Some Z-score and cumulative probability are:

Z-score:	-0.7549	-1.6939	0.6432	0.8997
Cumulative prob:	0.2252	0.0451	0.74	0.8159

i) Determine the Static Net present value of the project.

ii) A simulation of the projects cash flows yields a standard deviation of 42% in the present value of the cash flows. Dividend yield on project is 20% p.a. Determine the value of Real Option.

Ans: (i) Static NPV of project = PVCI – PVCO

= 100 x PVAF(15%, 5) – 500 = 335.22 – 500 = –164.78

(ii) Value of Adv. rights (as per real option)

S_0 = PVCI = 335.22

K = Initial Investment = 500

σ = SD of PVCI = 0.42

rf = 5%,

t = 5 years

y = 20%

i. **Calculating d1 & d2**

- $d1 = \frac{Ln (S_0 / K) + (rf - y + \sigma^2/2)t}{\sigma\sqrt{t}}$

$= \frac{Ln (335.22 \div 500) + (0.05 - 0.2 + 0.42^2/2)5}{0.42 \sqrt{5}}$

- $d1 = -0.7549$
- $d2 = d1 - \sigma\sqrt{t} = -0.7549 - 0.939 = -1.6939$

ii. **Calculating N(d1) & N(d2)**

$N(d1) = N(-0.7549) = 22.52\%$

$N(d2) = N(-1.6939) = 4.51\%$

iii. **Value of Project as a call option**

$Value = S_0 e^{-yt} N(d_1) - Ke^{-rt} N(d_2)$

$= [335.22 e^{(-0.2 \times 5)} 22.52\%] - [500e^{-0.05 \times 5} \times 4.51\%]$

$= 27.768 - 17.562 = \$ 10.206$ Million

👉 **Low Probability – Unique Questions**

Timing option (using real word probabilities)

\# **Ques 2 - Bhuloka** **{ICAI}**

Oil has been found in Bhuloka region. Indian Oil Corporation owns a lease to extract crude oil and is considering the construction of a deep-sea oil rig.

Construction cost is ₹20 crores and these costs are expected to grow at a constant rate of 10% per year. The risk-free rate of interest is also 10%, so the cost of the well is constant at ₹20 crores in present value terms, regardless of when construction begins.

The current price of oil is @ ₹200/barrel. Once a well is set up, the Corporation's variable production costs to extract and refine the crude oil is @ ₹80 per barrel. Assuming there is no maintenance or other fixed production costs, the well is expected to produce 2,00,000 barrels per year in perpetuity. All cash flows are assumed to occur at the end of the year. Production is expected to start immediately, in which case the first cash flow will occur at the end of the first year.

Currently, OPEC countries are deliberating oil output and prices. If OPEC members take unanimous decision, then production will be limited and oil prices will rise to ₹300 per barrel in perpetuity. If the cartel breaks up, production will rise and prices will fall to ₹100 per barrel in perpetuity. This negotiation will be settled within one year. Once the new price is established, it is expected to remain at that level (either ₹300/ barrel or ₹100/barrel) in perpetuity. The corporation estimates that an oil price rise and an oil price fall are equally likely.

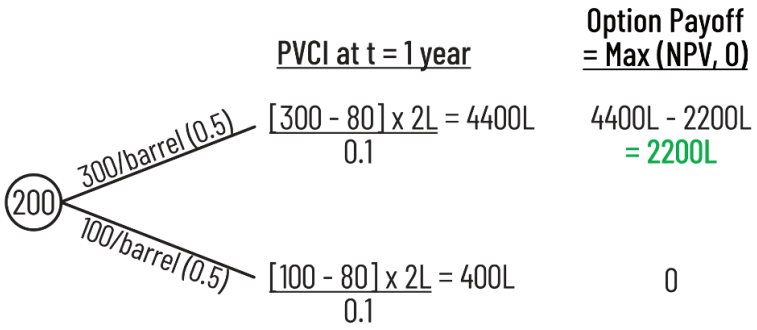
You are required to advise whether to invest immediately or wait for one year? You are also advised to calculate the value of the option to invest in one year period and suggest accordingly?

Ans: **Case A – If construction is started today**

- PVCI = $\frac{(200 - 80) \times 2L}{0.10}$ = 2,400 Lacs

- NPV = 2,400 – 2,000 = 400 Lacs i.e. 4 crores

Case B – Wait for 1 year



- Expected NPV (Value of timing option) = PV of expected NPV

= $\frac{2,200L \times 0.5 + 0}{1.10^1}$ = ₹1000 Lacs i.e. ₹10 crores

☞ **Advice**

- Expected NPV is higher if the firm waits for 1 year.
- So, the firm should wait for 1 year before starting production.

 # Working Notes:

- WN 1 – Project cost after 1 year = 2000L x 1.10 = 2200L

- WN 2 – Expected NPV if oil price after 1 year = 300

NPV = $\frac{(300 - 80) \times 2L}{0.10} - 2200L = 2{,}200$ Lacs

- WN 2 – Expected NPV if oil price after 1 year = 100

NPV = $\frac{(100 - 80) \times 2L}{0.10} - 2200L = -1800$ Lacs

The co. won't start project in this case. So, expected NPV = 0.

Ch 10A - Forex

Index - Main Questions	Ques Number
Cross rates & application of cross rates	1 – 5
Foreign investment	6
Arbitrage (Triangular arbitrage and Covered Interest Arbitrage)	7 – 8
Forward premium & Discount	9 – 10
Hedging using forward Contact	11 – 15
Should you avail credit or Not?	16 – 18
Leading and Lagging	19
Money Market operations (MMO)	20 – 21
Fate of forward contracts	22 – 26
Nostro, Vostro, Loro	27
Exposure calculation	28 – 30
International Cash Management	31 – 33
Discrete Questions	34 – 35

Index - Additional Questions	Ques Number
Basics	1
Arbitrage (Triangular arbitrage and Covered Interest Arbitrage)	2 – 4
Forward premium & Discount	5 – 7
Should you avail credit or Not?	8
Fate of forward contracts	9
Nostro, Vostro, Loro	10 – 11
Discrete Questions	12
Low Probability Unique Questions	
- Geographical arbitrage when rates of different locations are given	13
- Cost under FR vs MMO vs Unhedged "when Tax rate is given"	14
- Bifurcating difference due to time factor vs currency fluctuation	15
- Calculating Cash inflow when "Transit and usance" period is given	16

Main Questions

👉 Cross rates & application of cross rates

Squaring off existing trade using Cross rate

 # Ques 1 – Trigarta {SM TYK}

Trigarta ltd. had entered into a cross currency deal and had sold US$ 10 Lacs against € at US $ = € 1.4400 for spot delivery. However, during the day the market became volatile and Trigarta in compliance with the managements' guidelines had to square up the position when quotes were:

Spot US$ 1 INR 31.4300 / 4500

Spot US$ 1 € 1.4400 / 4450

What will be the gain or loss in the transaction in terms of ₹?

Ans:

Step 1: calculating profit/loss in Euro	€
Sold $10 L: 10 L x 1.440 =	14,40,000
Bought $10 L: 10 L x 1.4450 =	14,45,000
Gain/(loss) =	(€5,000)

- Loss in ₹ terms = € 5.000 x 21.8403 (WN 1) = ₹1,09,201.5

WN 1: ₹/€ = ₹/$ x $/€ = 31.43 x 1/1.4450 – 31.45 x 1/1.440 = 21.7509 – 21.8403

Squaring off existing trade using Cross rate

 # Ques 2 – Tripura {SM TYK, N20 Exam (Old), N24 MTP 1}

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

- US$ 1 = H.K.$ 7.5880 - 7.5920
- Local inter-bank market rates for US$ were → Spot US$ 1 = ₹ 42.70 - 42.85

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

Ans: Bank (Dealer) covers itself by buying from inter-bank market at market Ask rate.

Rupee – Dollar selling rate	₹ 42.85
Dollar – Hong Kong Dollar	HK $ 7.5880

	Rupee – Hong Kong cross rate = ₹ 42.85 / 7.5880	₹ 5.6471
	Profit / Loss to the Bank	
	Amount received from customer (1 crore × 5.70) =	₹ 5,70,00,000
(-)	Amount paid on cover deal (1 crore × 5.6471) =	₹ 5,64,71,000
=	Profit to Bank =	₹ 5,29,000

Comparing cross rates on 2 diff. dates to calculate P&L

 # Ques 3 – Sarayu {SM TYK, N18 RTP (New), N19 RTP (Old), M24 MTP 2}

On Jan.28, 2005 Sarayu requested a bank to remit Singapore Dollar SGD 25,00,000 under an irrevocable LC. However, due to bank strikes, the bank could effect's the remittance only on Feb.4, 2005. The inter-bank market rates were as follows:

	28th Jan.	4th Feb.
Bombay US 1	₹ 45.85 /45.90	45.91 / 45.97
London Pound 1	$ 1.7840 / 1.7850	1.7765 /1.7775
London Pound 1	SG $ 3.1575 / 3.1590	3.1380 /3.1390

The bank wants to retain an exchange margin of 0.125%. How much does the customer stand to gain or loss due to the delay? (Calculate rate in multiples of 0.001).

Ans: ₹ = ₹ × $ × £

SGD $ £ SGD

- Ask rate on 28th Jan. = 45.90 x 1.7850 x 1 /3.1575 = ₹25.8931/SGD
- Effective rate = 25.8931 + 0.125% = ₹25.9806 / SGD

- Ask rate on 4th Feb. = 45.97 x 1.7775 x 1/3.1380 = ₹26.0394 / SGD
- Effective rate = 26.0394 + 0.125% = ₹26.0719 / SGD

- Loss to customer = (26.0719 – 25.9806) x 25 lacs = ₹228250

Selecting Optimum cross rate to square off existing trade

 # Ques 4 – Parikshit {SM TYK, N20 RTP (Old), N20 MTP 1 (Old)}

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

	under:		
	Mumbai – London	₹74.3000 – ₹74.3200	
	Mumbai – New York	₹49.2500 – ₹49.2625	
	London – Copenhagen	DKK 11.4200 – DKK 11.4350	
	New York – Copenhagen	DKK 07.5670 – DKK 07.5840	
	In which market will you cover the transaction, London, or New York, and what will be the exchange profit or loss on the transaction? Ignore brokerages.		
Ans:	Amount realized on DKK sale @ ₹6.515 =		₹ 65,15,000
#	**Option 1 – Cover in London**		
•	Buy DKK at London = 10,00,000/11.42 =		£ 87,565.67
•	Buy $ at 1$ = ₹74.32 = 87,565.67 x 74.32 =		₹ 65,07,881
»	Profit = ₹65,15,000 – 65,07,881 =		₹ 7,119
#	**Option 2 – Cover in New York**		
•	Buy DKK at New York = 10,00,000/7.567 =		$ 1,32,152.77
•	Buy $ at 1$ = ₹49.2625 = 1,32,152.77 x 49.2625 =		₹ 65,10,176
»	Profit = ₹65,15,000 – ₹65,10,176 =		₹ 4,824
	Decision :- Buy from London as it leads to higher profit.		

Calculating Forward rate using Cross rate + Swap points + exchange margin

 # Ques 5 – Nitya **{SM TYK, M18 Exam (Old), N20 RTP (Old)}**

An Importer customer of Nitya Bank wishes to book a forward contract with your bank on 3rd Sep for sale to him of SGD5,00,000 to be delivered on 30th October. The spot rate on 3rd Sep are: USD/INR = 49.3700/3800 and USD/SGD = 1.7058/68.

The swap points are:

	USD/₹		USD/SGD
Spot/Sep.	0300/0400	1st month forward	48/49
Spot/Oct.	1100/1300	2nd month forward	96/97
Spot/Nov.	1900/2200	3rd month forward	138/140
Spot/Dec.	2700/3100		
Spot/Jan.	3500/4000		

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

Ans: ₹/SGD Forward ask rate = ₹ x $ = 49.56 / 1.7154 = 28.8912
$ SGD

- Hence, applicable forward rate for Importer = ₹28.8912/SGD

WN 1: ₹/$ Oct FR (ask) = SR + Swap points + ₹ commission
= 49.3800 + 0.1300 + 0.05 = ₹49.56/$

WN 2: SGD/$ Oct. FR = SR + Swap points
= (1.7058 + 0.0096) – (1.7068 + 0.0097)
= 1.7154 – 1.7165

- $/SGD Oct. FR = 1/1.7165 – 1/1.7154

👉 **Foreign investment**

Finding Indifferent return (b/w HC & FC)

 # Ques 6 – Nandi

With the relaxation of investment norms in India in international market up to $ 2,50,000, Mr. Nandi wants to hedge himself against the risk of declining Indian economy and weakening of Indian Rupee during last few years decided to diversify into international market. Accordingly, he invested a sum of ₹1.58 crore on 1.1.2001 in Standard & Poor Index. On 1.1.2002 he sold his investment.

The other relevant data is given below:

	1.1.2001	1.1.2002
Index of Stock Market in India	7395	?
Standard & Poor Index	2028	1919
Exchange Rate	62.00/62.25	67.25/67.50

(i) Determine the return for a US investor.

(ii) Determine return of Mr. Nandi of holding period.

(iii) Determine the value of Index of Stock Market in India as on 1.1.2002 at which Mr. Nandi would be indifferent between investment in Standard & Poor Index & Indian Stok Market.

Ans: Return on S&P = 1919 – 2028 = –5.375%
2028

- Return on $ = 67.25 – 62.25 = 8.032%
62.25

•	Effective return = (1 + S&P return) (1 + $ return) – 1	
	= (1 – 0.05375) (1 + 0.08032) – 1 = 0.02225 or 2.225%	
(i)	Return for US investor = S&P return = -5.375%	
(ii)	Return of Mr. Nandi = Effective return = 2.225%	
(iii)	For Indifference → Nifty return should be equal to Effective return on foreign investment i.e. 2.225%	
•	Hence, Closing value of Nifty = 7395 + 2.225% = 7560 approx.	

👉 Triangular Arbitrage

Basic Triangular Arbitrage (No bid-ask rates / commission etc.)

#	**Ques 7 – Maharathi** {SM TYK, N20 Exam (New), N20 RTP (New), N24 MTP 2}	
	Following are the spot exchange rates quoted at three different forex markets:	
	USD/INR 48.30 in Mumbai	
	GBP/INR 77.52 in London	
	GBP/USD 1.6231 in New York	
	Maharathi has USD 1,00,000 assuming that there is no transaction cost, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.	
Ans:	*Rough Analysis (Show in exam "Only if time allows")*	
•	£ Price in Direct market	$ 1.6231
•	£ Price in Indirect market: $/£ = ₹/£ x $/₹ = 77.52 x 1/48.30	$ 1.605
•	**Decision:** Buy £ indirectly **($ → ₹ → £)** and then sell it in Direct market **(£ → $)**	
»	*Main Answer:*	
	Step 1 – Buy £ Indirectly ($ → ₹ → £)	
•	Sell $ 1,00,000 to get ₹ = 1,00,000 x 48.30	₹ 48,30,000
•	Sell ₹ 48.30 Lacs to get £ = 48,30,000 x 1/77.52	£ 62,306.50
	Step 2 – Sell £ Directly (£ → $)	
•	Sell £ to get $ = 62,306.50 x 1.6231	$ 1,01,130
»	Arbitrage profit = $1,01,130 – $1,00,000	$ 1,130

Covered Interest Arbitrage (CIA)

Basic CIA (No bid-ask rates / No Separate deposit – borrowing rates)

 # Ques 8 – Sushumna {SM TYK, M18 Exam (New), N18 Exam (Old)}

₹ / $	Spot rate	=	₹48.0123
	180 days Forward rate	=	₹48.8190
Annualised interest rate for 6 months- ₹		=	12%
Annualised interest rate for 6 months- US $		=	8%

Is there any arbitrage possibility? If yes then how Mrs. Sushumna an arbitrageur can take advantage of the situation, if she is willing to borrow ₹40,00,000 or US $83,312. Further should arbitrageur go for Covered Interest Rate Arbitrage if she has forecasted the spot rates 180 days hence as:

Future rate for 1 US $	Probability
₹48.7600	25%
₹48.8000	60%
₹48.8200	15%

Ans: **Today**

- Borrow $88,312 from US and Invest in India. ₹ Invested today = 83,312 x 48.013 = ₹40 lacs

After 3-months

A	₹ investment value	= 40 L (1 + 0.12 x6/12)	=	₹ 42,40,000
B	$ repayment	= 83,312 (1 + 0.08 x 6/12)	=	$ 86,644.48
C	₹ at forward rate	= 86,644.48 x 48.819	=	₹ 42,29,897
D	₹ at Expected spot rate	= 86,644.48 x 48.793	=	₹ 42,27,644

E Arbitrage profit

- at forward rate = A – C = ₹ 10,103
- at Expected rate = A – D = ₹ 12,356

Decision - It is better to go for "Uncovered arbitrage" as it leads to higher arbitrage profit. However, unlike covered arbitrage it may lead to significant risk of exchange rate fluctuation.

WN 1: Expected spot rate = {48.76 x 0.25} + {48.8 x 0.6} + {48.82 x 0.15} = 48.793

Forward premium & Discount

Selecting Optimum invoicing currency for Export & Import

 # Ques 9 – XP Pharma {Jul 21 Exam (New), N23 MTP 2}

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

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

Advice the co. about invoicing in which currency. Calculation should be up to three decimal places.

Ans: (i) Proceeds of Exports in INR = ₹ 10 Million

Position of Inflow under three currencies will be as follows:

#	Invoice at SR	Expected rate after 3m	Conversion in INR after 3m
$	100L / 67.10 = $149031.297	67.10 (1 + 0.07/4) = ₹68.27	68.27 x 149031.297 = ₹1,01,74,367
€	100L / 63.15 = €1,58,353.127	63.15 (1 + 0.06/4) = ₹64.10	64.10 x 158353.127 = ₹1,01,50,435
£	100L/88.65 = £1,12,803.158	88.65 (1 + 0.05/4) = ₹89.76	89.76 x 112803.158 = ₹1,01,25,211

(ii) Payment of Import in INR = ₹ 5 Million

Position of outflow under three currencies will be as follows:

#	Invoice at SR	Expected rate after 6m	INR after 6 months
$	50L / 67.20 = $74404.762	67.20 (1 + 0.07/2) = ₹69.55	69.55 x 74404.762 = ₹51,74,851
€	50L/ 63.20 = €79,113.924	₹63.20 (1 + 0.06/2) = ₹65.10	65.10 x 79,113.924 = ₹51,50,316
£	50L/88.75 = £56,338.028	₹88.75 (1 + 0.05/2) = ₹90.97	90.97 x 56,338.028 = ₹51,25,070

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

Effective cost of loan = Interest cost (after TDS adjustment) + Currency Premium

 # Ques 10 – Chalo Chalo {N19 Exam (Old)}

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

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

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

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

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

Ans: Net Cost under each of the Options is as follows:

(i) **Loan from German Bank** = 5% + 0.25% = 5.25%

(ii) **Loan from US Parent Bank**

- Effective Rate of Interest = 4% / (1 – 0.08) 4.35%
- Premium on US$: (1.05 / 1.04) – 1 0.96%
- » Net cost: 5.31%

(iii) **Loan from Swiss Bank**

- Effective Rate of Interest = 3% / (1 – 0.08) 3.26%
- Premium on US$: (1.05 / 1.03) – 1 1.94%
- » Net cost: 5.20%

Comment - Thus, loan from Swiss Bank is the best option as the Total Outflow including Interest is Less i.e. €105200

👉 ## Hedging using forward Contact

V. Basic – Using FR to hedge outflow

Ques 11 – Anahita {SM TYK, M23 RTP}

Anahita Co have taken a 6-month loan from their foreign collaboration for $ 2 million, interest payable on maturity is at LIBOR plus 1.0%. Current 6-month LIBOR for USD is 2% p.a. and for INR is 6% p.a. Enquiries regarding Exchange rate with their bank elicit the following data:

- Spot USD 1 ₹ 48.5275
- 6 Months forward ₹ 48.4575

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

(ii) Will you advise the company to enter, into a forward contract? Explain giving Reasons.

Ans: Effective Interest rate = USD LIBOR + 1% = 2% + 1% = 3% p.a.

Amount payable after 6-months = 2 Mn x (1 + 0.03 x 6/12) = $ 2.03 million

(i) ₹ outflow under forward contract = 2.03 million x 48.4575 = ₹ 9,83,68,725

(ii) Since, Forward rate (48.4575) < Spot rate (48.5275), ∴ it is advisable to enter, into a forward contract.

Covering Trnx @ FR vs Expected SR

 # Ques 12 - Suger Pine {SM TYK, Dec 21 Exam (New)}

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

Ans: Calculation of rates

- ¥/₹ Spot rate (SR) = ¥108L / ₹30L — ¥ 3.6 / ₹
- Expected SR after 3 months = 3.6 x 0.9 — ¥ 3.24 / ₹
- 3 months Forward rate (FR) — ¥ 3.3 / ₹

Particulars	Without Forward	With Forward contract
Present cost of 108 lakhs yen	₹ 30L	₹ 30L
Cost after 3 months:	₹ 33.33L (108L / 3.24)	₹ 32.73L (108L / 3.3)
Expected exchange loss	₹ 3.33L	₹ 2.73L

» Loss under forward < Loss under expected rate. Hence, taking forward contract is suggested.

Net cost of Forward contract = FR + FV of Premium charged by bank

 # Ques 13 – Kalyani {SM TYK, N20 Exam (New), Dec 21 Exam (New), M23 MTP 1, N24 RTP}

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

(i) Compute the profit/loss the co. will make if it hedges its foreign exchange risk with the exchange rate on 31st Dec, 2016 as: (a) ₹ 68 per US $ (b) ₹ 62 per US $

(ii) Should the co. hedge its exposure if the probability distribution of expected USD Spot rate for 31 Dec, 16 is as follows:

Exchange rate	61	64	66	68
Probability	0.25	0.4	0.15	0.2

Alternatively, part (ii) can also be written as:

Advise the co. a suitable cover for its risk, if it can hedge its position with the following expected rate of USD in foreign exchange market on 1st July 2020:

Exchange rate	61	64	66	68
Probability	0.25	0.4	0.15	0.2

A:	**Calculating cost of hedging**	**Amount ₹**
A.	Forward premium = $60,000 x 64 x 2%	76,800
B.	Interest for 6 months = 76,800 x 12% x 6/12	4,608
C.	Total hedging cost = A + B	81,408
D.	Amount to be paid for US$ 60,000 @ ₹ 64	38,40,000
E.	Total cost under forward cover = C + D	39,21,408

(i)	**Net P&L if forward cover is taken**	**(i) ₹68/$**	**(ii) ₹62/$**
A.	Cost @ Spot rate = 60,000 x SR	40,80,000	37,20,000
B.	Cost under forward cover	(39,21,408)	(39,21,408)
C.	Net gain = B – A	1,58,592	(2,01,408)

(ii) Unhedged vs Hedged position

- Total expected outflow if exposure is not hedged = 60,000 x 64.35 (WN 1) ₹ 38,61,000
- Cost under forward cover ₹ 39,21,408
- Since expected cashflow is less in case of unhedged position company should opt for the same.

WN 1: Expected SR on 31 Dec, 2016 = {61×0.25} + {64×0.4} + {66×0.15} + {68×0.2} = ₹ 64.35 / $

Expected loss @ FR vs Expected SR vs Actual SR

 # Ques 14 – Nalini **{SM TYK, N18 RTP (Old), M24 RTP}**

Nalini Ltd., an Indian company has an export exposure of JPY 10,000,000 receivable August 31, 2014.

	Japanese Yen (JPY) is not directly quoted against Indian Rupee.		
	Current spot rates	**Forward rates for August 2014**	
	INR/US $ = ₹ 62.22	INR/US $ = ₹ 66.50	
	JPY/US$ = JPY 102.34	JPY/US$ = JPY 110.35	
	It is estimated that Japanese Yen will depreciate to 124 level and Indian Rupee to depreciate against US $ to ₹ 65. Required:		
i)	Calculate the expected loss, if the hedging is not done. How the position will change, if the firm takes forward cover?		
ii)	Is the decision to take forward cover justified if the spot rates on August 31, 2014 are:		
	INR/US $ = ₹ 66.25		
	JPY/US$ = JPY 110.85		
Ans:	₹/¥ SR on date of export = ₹/$ x $/¥ = 62.22/102.34 = ¥0.6080		
	Expected Rate of ¥ for Aug = ₹ 0.5242 (₹65/¥124)		
	Forward Rate of ¥ for Aug = ₹ 0.6026 (₹ 66.50/¥110.35)		
i)	**Calculation of expected loss @ Expected SR & @ Forward rate**		
A.	Export value as on today = ₹0.608 × ¥10Mn		₹ 60,80,000
B.	Receivable at expected SR (₹0.5242 × ¥10Mn)		₹ 52,42,000
C.	Loss at expected rate (C = A – B)		₹ 8,38,000
D.	Receivable under Forward (₹0.6026 × ¥10Mn)		₹ 60,26,000
E.	Loss under forward contract (E = A – D)		₹ 54,000
	By taking forward cover loss is reduced to ₹ 54,000.		
ii)	**Actual Rate of ¥ on August 2014 = ₹ 0.5977 (₹66.25/¥110.85)**		
A.	Export value as on today = ₹0.608 × ¥10Mn		₹ 60,80,000
B.	Amount at SR as on 31 Aug = ₹0.5977 × ¥10Mn =		₹ 59,77,000
C.	Loss (C = A – B)		₹ 1,03,000
	The decision to take forward cover is still justified.		
	Calculating Contribution to sales ratio to decide on "Forward vs Expected SR"		
#	**Ques 15 – Shikhandi**		**{SM TYK, N19 Exam (New)}**
	Following information relates to Shikhandi Ltd. Which manufactures some parts of an Electronics		

device which are exported to USA, Japan & Europe on 90 days credit terms.

	Cost and Sales Information:	**Japan**	**USA**	**Europe**
	Variable cost per unit	₹ 225	₹ 395	₹ 510
	Export sale price per unit	¥ 650	$ 10.23	€ 11.99
	Sale Receipts due in 3 months	¥ 78,00,000	$ 1,02,300	€ 95,920

	Other Info:	**¥/₹**	**US $/₹**	**€/₹**
	Spot market	2.417-2.437	0.0214–0.0217	0.0177-0.0180
	3-m forward	2.397-2.427	0.0213–0.0216	0.0176–0.0178
	3-m expected SR	2.423-2.459	0.02144 – 0.02156	0.0177 – 0.0179

Advice by calculating **contribution to sales ratio** whether the co. should take forward contract or not.

Ans:	**Total contribution**	**(I) When risk is hedged**	**(II) When risk is not hedged**
A.	Total receipts (WN 1 & 2)	1,33,38,719	1,32,75,578
B.	Total variable cost (WN 3)	1,07,30,000	1,07,30,000
C.	Contribution = A - B	26,08,719	25,45,578
D.	Contribution ratio = C/A x 100	19.56%	19.17%

WN 1: **Total receipt when risk is hedged**

•	Sum due	¥ 78,00,000	$ 1,02,300	€95,920
•	3-m Forward ask rate	2.427	0.0216	0.0178
»	Rupee value of receipts	₹ 32,13,844	₹ 47,36,111	₹ 53,88,764

• Total receipts = 32,13,844 + 47,36,111 + 53,88,764 = ₹1,33,38,719

WN 2: **Total receipt when risk is not hedged**

•	Sum due	¥ 78,00,000	$ 1,02,300	€ 95,920
•	3-m Forward ask rate	2.427	0.0216	0.0178
»	Rupee value of receipts	₹ 31,72,021	₹ 47,44,898	₹ 53,58,659

• Total receipts = 31,72,021 + 47,44,898 + 53,58,659 = ₹ 1,32,75,578

WN 3: **Calculating total variable cost**

•	Sum due	¥ 78,00,000	$ 1,02,300	€ 95,920
÷	Unit input price	¥ 650	$ 10.23	€ 11.99

=	Unit sold	12,000	10,000	8,000
×	Variable cost PU	₹ 225	₹ 395	₹ 510
»	Variable cost	₹ 27 Lacs	₹ 39.5 Lacs	₹ 40.80 Lacs

• Total cost = 27,00,000 + 39,50,000 + 40,80,000 = ₹ 1,07,30,000

Decision – Co. should hedge its foreign currency exchange risk as it leads to higher contribution to sales ratio.

👉 Should you avail credit or Not?

Avail credit from Supplier vs Loan from bank

 # Ques 16 – Ramya **{SM TYK, N22 MTP 1}**

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

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

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

Which one of the following options would be better?

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

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

Ans: **(i) Option 1 - Pay the supplier in 60 days**

	Outflow in ₹ = $1 crore x ₹63.15/$	₹ 63.15 crore
(+)	Interest for 30 days = 63.15(1+ 0.095×30/360)	₹ 0.50 crore
=	Total Outflow in ₹	₹ 63.65 crore

ii) Option 2 - Availing supplier's offer of 90 days credit

	Amount Payable	$ 1.0000 crore
(+)	Interest for 30 days @ 7.75% p.a.	$ 0.00646 crore
=	Total Outflow in USD	$ 1.00646 crore
	₹ Outflow @ FR = 1.00646 crore × 63.45	₹ 63.86 crore

Outflow under Option 1 (63.65) < Outflow under option 2.

Hence, supplier should be paid in 60 days by availing bank loan.

Loan from Local bank vs Loan from Foreign bank using LC (by paying commission for LC)

 # Ques 17 – Alert **{SM TYK, N19 RTP (Old), M22 Exam, M23 RTP}**

Alert ltd. Is planning to import a multi-purpose machine (asset) from Japan at a cost 3,400 Lakhs YEN. The company can avail loans at 18% interest per annum with quarterly rests or compounding, with which it can import the machine (asset), from India. However, there is an offer from Tokyo branch of an India Based bank extending credit of 180 days at 2% p.a. in Tokyo itself against opening of an irrevocable letter of credit.

Other information:

- Present Exchange rate ₹ 100 = 340 YEN
- 180 day's forward rate ₹ 100 = 335 YEN
- Commission charges for letter of credit is 2% per 12 months in INDIA to be payable today.

(i) Advise whether the offer from the foreign branch should be accepted? Take 365 Days in a year.

(ii) Based on the present market condition company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expense of ₹25 lacs. If so, what is your advice to the company?

Ans: Calculation total cost under each of the options

#	**Option 1 – Take loan from India**	**(in Lacs)**
•	Loan amount = ¥ 3400L x 1/3.4	₹ 1000
•	Repayment amount = 1000L x $(1 + 0.18/4)^2$	₹ 1092.025

#	**Option 2 – Take loan of ¥3400 Lacs from Tokyo**	**(in Lacs)**
A.	¥ Repayable after 6 months = 3400 (1 + 0.02 × 180/365)	¥ 3433.53
B.	Equivalent amount in ₹ = 3433.53 / 3.35	₹ 1025
C.	Future value of commission paid (WN 1)	₹ 10.92
D.	Total ₹ payable = B + C	₹ 1035.92

(i) Decision -> Loan from Tokyo is preferred due to lower outflow.

(ii) Loss due to forward rate (as compared to spot rate) = 1025 – 1000 = ₹ 25 lacs

•	Hence, if an alternative hedging option is available at an additional cost of 25 lacs, then the co. can select that option. Because forward contract is also resulting in increased outflow by same amount.	
#	**WN 1: Future value of commision**	
•	Commission payable on LC = (3400 x 1/3.4) x 2% x 6/12	₹ 10 Lacs
•	FV of commission payable = 10 L x $(1 + 0.18/4)^2$	₹ 10.92 Lacs
•	LC will be taken in terms of HC i.e. ₹ in this case. ₹ equivalent of ¥3400 = ₹1000 L. (i.e., 3400 x 1/3.4).	
•	Since commission is paid today (whereas all other payments are after 6-m), ∴ we'll calculate the FV of commission after 6-m.	
	Pay Immediately vs later when "Surplus cash" is available with the co.	
#	**Ques 18 – Radha**	**{Dec 21 RTP (Old)}**
	Radha Ltd. has imported goods to the extent of US$ 8 Million. The payment terms are as under:	
i)	1% discount if full amount is paid immediately or	
ii)	60 days interest free credit. However, in case of a further delay up to 30 days, interest at the rate of 8% p.a. will be charged for additional days after 60 days. The Co. has ₹25 Lakh available and for remaining it has an offer from bank for a loan up to 90 days @ 9.0% p.a.	
	The quotes for ₹/$ are as follows:	
	Spot Rate (buying)	₹ 66.98
	60 days Forward Rate (buying)	₹67.16
	90 days Forward Rate (buying)	₹68.03
	Advise which of the following options would be better for the Co.	
i)	Pay immediately after utilizing cash available and for balance amount take 90 days loan from bank.	
ii)	Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.	
iii)	Avail supplier offer of 90 days credit and utilize cash available.	
	Further presume that the cash available with the Co. will fetch a return of 4% p.a. in India till it is utilized. Assume year has 360 days. Ignore Taxation.	
Ans:	**Pay immediately**	**(in Lacs)**
	$ to be paid = 80 x 0.99	$ 79.2
•	₹ required today = 79.2 x 66.98	₹ 5304.816
(-)	Available cash balance	(₹ 25)

=	₹ borrowing required today	₹ 5279.816
(+)	Interest on ₹ borrowing for 90 days @ 9% p.a.	₹ 118.80
	Total ₹ outflow after 90 days	₹ 5398.616
ii)	**Pay in 60 days**	**(in lacs)**
	$ to be paid	$80
•	₹ required = 80 x 67.16	₹ 5372.8
(-)	Available cash balance = 25 (1 + 0.04 x 60/360)	(₹ 25.167)
=	₹ borrowing required today	₹ 5347.633
(+)	Interest on ₹ borrowing for 30 days @ 9% p.a.	₹ 40.107
	Total ₹ outflow after 90 days =	₹ 5387.74
iii)	**Pay in 90 days**	**(in lacs)**
	$ to be paid = 80(1 + 0.08 x 30/360)	$ 80.533
•	₹ required = 80.533 x 68.03	₹ 5478.66
(-)	Available cash balance = 25 (1 + 0.04 x 90/360)	(₹ 25.25)
	Total ₹ outflow after 90 days	₹ 5453.41

👉 Leading and Lagging

Netting off exposure (via Leading / Lagging) vs Covering them separately

 # Ques 19 - NP and Co **{SM TYK}**

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

The market rates for Rupee and Dollar are as under:

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

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

(I) To cover payables in the forward market and

(II) To lag the receivables by one month and cover the risk only for the net amount. No interest for delaying the receivables is earned.

» Evaluate both the options if the cost of Rupee Funds is 12%. Which option is preferable?

Ans:	**(I) Cover payable and receivable in forward Market**	
•	Amount payable after 3 months	$7,00,000
•	Forward Rate	₹ 48.45
(A)	Payable Amount (₹)	₹ 3,39,15,000
•	Amount receivable after 2 months	$ 4,50,000
•	Forward Rate	₹ 48.90
(B)	Receivable Amount (₹)	₹ 2,20,05,000
(C)	Interest @ 12% p.a. for 1 month	₹ 2,20,050
»	Net Amount Payable in (₹) (A)–(B)–(C)	₹ 1,16,89,950
(II)	The forward contract for receivable was already booked. It shall be cancelled if we lag the receivables. Accordingly, profit/ loss on cancellation of contract shall also be adjusted.	
•	Amount Payable ($)	$7,00,000
•	Amount receivable after 3 months	$ 4,50,000
•	Net Amount payable	$2,50,000
•	Applicable Rate	₹ 48.45
(A)	Amount payable in (₹)	₹ 1,21,12,500
(B)	Profit on cancellation of Forward contract = (48.90 – 48.30) × 4,50,000	₹ 2,70,000
(C)	Net amount payable in (₹) = (A) + (B)	₹ 1,18,42,500
	Conclusion - Cover payable and receivables in forward market as it leads to lower outflow.	
	Note: In the question it has not been clearly mentioned that whether quotes given for 2 and 3 months (in points terms) are premium points or direct quotes. Although above solution is based on the assumption that these are direct quotes, but students can also consider them as premium points and solve the question accordingly.	
👉🏻	**Money Market operations (MMO)**	
	MMO with separate Bid-ask rates & Deposit-Loan rates	
#	**Ques 20 – Nirjalla**	**{SM TYK, M19 RTP (New), N19 Exam (Old), M24 RTP}**
	Nirjalla ltd is a UK based company. Invoice amount is $350000. Credit period is three months. Some additional info is as below:	

$/£ Exchange rates in London	Deposit rate	Loan rate
Spot Rate = 1.5865 – 1.5905	$ = 7%	$ = 9%

	3m Forward Rate = 1.6100 – 1.6140	£ = 5%	£ = 8%
	Compute and show how a money market hedge can be put in place. Compare and contrast the outcome with a forward contract.		
Ans:	(a) £ inflow under forward = $ 350000 x $\frac{1}{1.6140}$ = £ 2,16,852.54		
(b)	**Under money market operation (MMO)**		
•	Borrow PV of receivable = $\frac{\$\ 350000}{1 + 0.09\times3/12}$		$ 3,42,298.29
•	Convert in £ today = 342298.29 x 1.5905		£ 2,15,214.27
•	Future value of £ = 2,15,214.27 x (1 + 0.05×3/12)		£ 2,17,904,45
→	**Note – Settlement of $ Loan**		
•	Repayment of $ loan = $3,42,298.29 x (1 + 0.09×3/12)		$ 3,50,000
•	This will be settled using $3,50,000 receivable after 3-months.		
#	Conclusion – receivable under MMO (£ 2,17,904.45) > receivable under forward contract (£ 2,16,852.54). So, prefer MMO.		
	MMO for Payable & receivable vs Forward cover		
#	**Ques 21 - Columbus Surgical**		**{SM TYK}**
	Columbus Surgical Inc. is based in US, has recently imported surgical raw materials from the UK and has been invoiced for £4,80,000, payable in 3 months. It has also exported surgical goods to India and France.		
	The Indian customer has been invoiced for £1,38,000, payable in 3 months, and the French customer has been invoiced for €5,90,000,payable in 4-months.		
	Current spot and forward rates are as follows :		
	£/$ Spot	0.9830 – 0.9850	
	£/$ Three months forward	0.9520 – 0.9545	
	$/€ Spot	1.8890 – 1.8920	
	$/€ Four months forward	1.9510 – 1.9540	

	Current money market rates are as follows :	
	UK : 10.0% - 12.0% p.a.	
	France : 14.0% - 16.0% p.a.	
	USA : 11.5% - 13.0% p.a.	
	You as are required to show how the company can hedge its foreign exchange exposure using	
	Forward markets and Money markets hedge and suggest which is the best hedging technique	
Ans:	Net payable in 3-months = £4,80,000 – £1,38,000	£ 3,42,000
-	Net receivable in 4-months	€ 5,90,000
→	**Using Forward rates**	
•	3-months payable = £ 3,42,000/0.952	$ 3,59,244
•	4-months receivable = € 5,90,000 x 1.9510	$ 11,51,090
→	**Using Money market operations (MMO) for payable**	
•	Invest PV of payable = £3,42,000 / (1 + 0.10 x 3/12)	£ 3,33,659
•	Borrow equivalent $ today = 3,39,659/0.983	$ 3,39,429
•	Repay $ borrowing = 3,39,429 x (1+0.13 x3/12)	$ 3,50,460
	Note: The payable of £ 3,42,000 will be settled using the investment proceeds after 3 months.	
→	**Using MMO for receivable**	
•	Borrow PV of receivable = €5,90,000 / (1 + 0.16 x4/12)	€ 5,60,127
•	Convert in $ and invest = 5,60,127 x 1.8890	$ 10,58,080
•	Investment value after 4-m = 10,58,080 × (1 + 0.115 x 4/12)	$ 10,98,640
	Note: The receivable of € 5,90,000 will be used to settle the borrowing after 4 months.	
→	**Conclusion**	
•	For payable -> Use MMO (as outflow is less under MMO)	
•	For receivable -> Use forward (as inflow is more under forward)	

👉 Fate of forward contracts – Delivery, Cancellation, Extension etc.

Cancellation before Due date [using Cross rates + Swap points + Ex margin]

 # Ques 22 – Balarama **{SM TYK, N23 MTP 2}**

Balarama bank enters, into a forward purchase TT covering an export bill of Swiss francs 1,00,000 at ₹32.4000 due 25th April and covered itself for same delivery in the local inter- bank market at ₹32.4200. However, on 25th March exporter sought for cancellation of the contract as the tenor of the bill is changed. In Singapore market, Swiss Francs were quoted against dollars as under:

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

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

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

Cal. cancellation charges payable by customer if exchange margin is 0.10% on buying and selling.

Ans: Customer has earlier sold forward. Now, to cancel he must purchase forward, i.e., Bank's ask rate for April forward shall apply.

(i)	₹ / $ Forward rate for April	
	Spot Selling Rate	₹ 49.4455
(+)	Premium for April	₹ 00.4200
		₹ 49.8655
(+)	**Exchange Margin @ 0.10%***	**₹ 00.0499**
		₹ 49.9154
(ii)	₹ / SF forward rate = ₹/$ x $/SF = 49.9154 x 1/1.5150	₹ 32.9474
	Rounded off to:	₹ 32.9475
(iii)	**Gain/(loss) to customer**	
•	Sold forward : 1,00,000 x 32.4	₹ 32,40,000

•	Bought forward : 1,00,000 x 32.9475	₹ 32,94,750
•	Gain/(loss)	(₹ 54,750)
	Hence, Cancellation charges of ₹54,750 shall be paid by the customer.	

Cancellation on Due date [with Ex margin]

 # Ques 23 – Saraswati bank {SM Illus}

On the 15 Jan 2015 you as a banker of Saraswati bank booked a forward contract for US $ 250,000 for your import customer deliverable on 15 March 2015 at ₹65.3450. On due date customer request, you to cancel the contract. On this date quotation of US$ in the Inter-bank market is as follows:

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

Cancellation Charges = ₹100. Exchange margin = 0.10%.

Calculate cancellation charges payable by customer.

	Gain/(loss) to Bank	**(Amount in ₹)**
A.	Sold forward : 2,50,000 x 65.3450	1,63,36,250
B.	Bought forward : 2,50,000 x 65.2250	1,63,06,250
C.	Gain/(loss) = A – B	30,000
D.	Flat cancellation charges	100
E.	Total charges to be paid by customer = C + D	30,100

WN 1: Rate applicable to customer = Spot Bid rate – 0.1% margin = 65.29 – 0.1% = 65.2247
rounded off to = 65.2250

Extension On due date [with Ex margin]

 # Ques 24 – Satyaki {SM TYK}

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

Contracted Rule – US$ 1 = ₹ 42.32

The US Dollar quoted on 30-10-2010: spot = 41.5000/41.5200

3 months' $ premium = 0.87% / 0.93%

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

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

(ii) The rate of new forward contract

Ans: Existing contract cannot be extended. It must be 1st squared off and a new contract will be entered.

i) **Squaring off existing contract**

A.	Sold forward = 20,000 x 41.4700 (WN 1)	₹ 8,29,400
B.	Buy forward = 20,000 x 42.3200	₹ 8,46,400
C.	Gain/(loss) on cancellation	(₹ 17,000)

WN 1: Rate at which contract is sold = Bank's bid rate – Commission = 41.50 – 0.075% = 41.4689 rounded off to 41.4700.

ii) Rate at which new forward contract will be purchased = (Spot ask rate + premium) + Commission

= (41.52 + 0.93%) + 0.2% = ₹ 41.9900 / $

Early delivery

 # Ques 25 – BNP Bank {SM Illus, N18 Exam (New), M19 Exam (New), N23 MTP 1}

On 1 Oct, 2015 Mr. X an exporter enters a forward contract with a BNP bank to sell US $1 Lac on 31 Dec, 2015 at ₹65.40/$. However, due to the request of the importer, Mr. X received amount on 28 Nov, 2015. Mr. X requested the bank take delivery of the remittance on 30 Nov, 2015 i.e. before due date. The inter- banking rates on 28 Nov, 2015 was as follows:

Spot	₹65.22/65.27
1 Month Premium	10/15

If the bank agrees to take early delivery, then what will be net inflow to Mr. X assuming, that the prevailing Prime lending rate is 18%. Take 365 days in a year.

Ans:

	Amount payable on 30 Nov	**(Amount in ₹)**
•	Buy $1,00,000 at agreed rate of ₹65.40	65,40,000
(-)	Swap loss (WN 1)	(20,000)
(-)	Interest on outlay of funds (WN 2)	(275)
»	Net amount paid to customer	65,19,725

WN 1: Swap loss calculation

•	Sell $ at SR today	₹ 65.22
•	Buy Forward today	₹ 65.42
•	Swap loss	₹ 00.20

•	Total swap loss = 0.20 x 1,00,000	(20,000)
WN 2:	**Interest on outlay of funds**	
	Bank outflow today = 1,00,000 x 65.40	65,40,000
	Bank inflow today = 1,00,000 x 65.22	65,22,000
	Bank's Net outflow	18,000
•	Interest charged = 18,000 x 18% x 31/365	₹275

Late delivery / Cancellation / Extension

 # Ques 26 – Eklavya {SM Illus, M18 RTP (New), M18 Exam (Old), N20 Exam (Old), Dec 21 MTP 1 (Old), M23 MTP 1, N23 Exam}

An **Importer** booked a forward contract with Eklavya bank on 10th,April for US $ 2,00,000 due on 10th June @ ₹64.4000. The bank covered its position in the market at ₹64.2800. The exchange rate for Dollar in the inter-bank market on 10th June & 13th June were:

		10th June	13th June
Spot US $ 1 =		₹ 63.8000 / 8200	₹ 63.6800 / 7200
Forward Rates: June		₹ 63.9200 / 9500	₹ 63.8000 / 8500
	July	₹ 64.0500 / 0900	₹ 63.9300 / 9900
	August	₹ 64.3000 / 3500	₹ 64.1800 / 2500
	Sept.	₹ 64.6000 / 6600	₹ 64.4800 / 5600

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

Rates rounded to 4 decimals in multiples of 0.0025. Take 360 days. On 10th June, Bank Swaps by selling spot & buying one month forward.

Calculate how the bank will react if on 14th June:

(a) Customer requests to Cancel the contract. Calculate

(i) Cancellation rate

(iii) Total cancellation charges / Total cost of customer

(b) Customer requests to execute the contract

(c) Customer requests to extend the contract with due date to fall on 10th August.

Ans: **(a) Customer Requests cancellation**

i) Cancellation rate (rate @ which customer will sell) = 63.6800 – 0.1% = 63.6163

• Rounded off: **61.6175**

(ii)	**Amount payable by customer as per FEDAI rules**	**(amount in ₹)**
	Loss on Squaring off i.e. Exchange difference (WN 1)	156,500
	Swap loss (WN 2)	30,000
	Interest on outlay of funds (WN 3)	96
»	Net amount paid by customer	**₹1,86,596**
WN 1:	**Exchange difference i.e. Squaring off the contract**	
•	Customer bought future at	64.4000
•	Customer sold spot at	63.6175
»	Total loss to customer = 0.7825 x 200,000	₹156,500
	Customer selling rate = 63.5800 – 0.1% = 63.6163. Rounded off to 63.6175.	
WN 2:	**Swap loss**	
	Bank sell spot at	63.80
	Bank Buy 1-m forward	63.95
»	Total Swap loss = 0.15 x 200,000	₹30,000
WN 3:	**Interest on outlay of funds**	
	Bank outflow today (buy $ from interbank market)	64.28
	Bank inflow today = Sold $ at spot rate	63.80
»	Bank's Net outflow = (64.28 – 63.80) x 200,000	₹96,000
•	Interest charged for 3 days = 96,000 x 12% x 3/360	₹96
	(b) Customer requests to execute the contract	
•	Cancellation charges of ₹1,86,596 as computed above will be recovered.	
•	The contract will be executed at the spot TT selling rate calculated as follows:	
»	₹ / $ interbank spot selling rate + Exchange margin = 63.7200 + 0.10% = 63.7837 r/o to 63.7850.	
	(c) Customer requests to extend the contract	
•	Cancellation charges of ₹1,86,596 as computed above will be recovered.	
•	A new contract for August can be entered at following rate:	
»	₹ / $ FR for August + Exchange margin = 64.2500 + 0.1% = 64.3143 r/o to ₹ 64.3150 / $.	

ADDITIONAL NOTES: QUESTION VARIATIONS

Sometimes ques may give some additional rates as well, like "Rates as on 15th June are as follows..."

These unrequired rates are given to confuse students. Ignore them like your crush ignores you :p

👉 Nostro, Vostro, Loro

Meeting required closing balance in Nostro A/c and Exchange position A/c

 # Ques 27 – Shridhara {SM TYK, SM Illus, N18 Exam (New), N24 RTP}

Shridhara as a dealer in foreign exchange have following position in Swiss Francs on 31 Oct, 2009:

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

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

Ans:

Particulars	Nostro A/c	Exchange position A/c (CHF)
Opening Balance	1,00,000	50,000
Purchase Bill on Zurich	-	80,000
Sold forward TT	-	(60,000)
Forward purchase Cancelled	-	(30,000)
Remitted by TT	(75,000)	(75,000)
Draft on Zurich Cancelled	-	30,000
Closing balance before adjustments	25,000	(5,000)
# Adjustments		
Buy Spot	5,000	Nil
Buy forward		10,000
Closing Balance	30,000	10,000

» Thus buying 5,000 CHF spot and selling 10,000 CHF forward will maintain the req. closing balance.

Exposure calculation

Calculating Transaction Exposure

 # Ques 28 – Shanti **{Dec 21 MTP 1 (Old)}**

Shanti exported 200 piece of designer jewellery to USA at $200 each. To manufacture and design this jewellery she imported raw material for Japan of the Cost JP¥ 6000 For each piece. The labour cost and variable overhead incurred in producing each piece of jewellery is ₹1,300 and ₹650 respectively. Suppose spot rates are:

INR/US$ ₹65.00 – ₹66.00

JP¥/US$ JP¥ 115 – JP¥ 120

Shanti is expecting that by the time the export remittance is recovered and payment of export is made the expected spot rates are likely to be as follows:

INR/US$ ₹68.90 – ₹69.25

JP¥/US$ JP¥105 - JP¥ 112

You are required to calculate the resultant transaction exposure.

Ans:

	Particulars	At spot rate	At expected rate
	Sale price	200 x 65 = 13,000	200 x 68.9 = 13780
(-)	Material (WN 2)	(3443.46)	(3957.12)
(-)	Labour	(1300)	(1300)
(-)	Variable o/hs	(650)	(650)
=	Profit per unit	7606.54	7872.88
×	No. of units	200	200
»	Total Profit	15,21,308	15,74,576

» Transaction exposure = Profit @ spot rate - Profit at changed rates = 15,74,576 – 15,21,308 = ₹53,268

WN1: **Calculating ₹/¥ Ask rate**

Before: ₹/¥ = ₹ x $ = 66 x 1 = 0.57391
$ ¥ 115

After: ₹/¥ = 69.25 x 1 = 0.65952
105

WN 2: Material cost

Before = 6000 x 0.57391 = 3443.46

After = 6000 x 0.65952 = 3957.12

Calculating Transaction exposure + Operating Exposure

 # Ques 29 - Omega Electronics {SM TYK}

M/S Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The Co. is exporting 2,400 units at a price of Euro 500 per unit. The cost of imported components is $800 per unit. The fixed cost and other variables cost per unit are ₹1,000 and ₹1,500 respectively. The cash flow in foreign currencies is due in six months.

Current exchange rates: ₹/Euro = 51.50/55 ₹/S$ = 27.20/25

After six months the exchange rates turn out as: ₹/Euro = 52.00/05 ₹/S$ = 27.70/75

(1) You are required to calculate loss/gain due to transaction exposure.

(2) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioner is ₹25,000: The current exchange rate changes to → ₹/Euro = 51.75/80 ₹/S$ = 27.10/15

- Price elasticity of demand is estimated to be 1.5
- Payments and receipts are to be settled at the end of six months.

Ans:

	(i) Particulars	Current rates	New rate (₹ lacs)
	Revenue : 500 x 2400 x (51.50 / 52)	618	624
(-)	Material : 800 x 2400 x (27.25 / 27.5)	(523.2)	(532.8)
(-)	Fixed cost: 1000 x 2400	(24)	(24)
(-)	Variable cost : 1500 x 2400	(36)	(36)
»	Total Profit	0.348	0.312

- Loss due to transaction exposure = 0.348 – 0.312 = ₹0.036 crore i.e ₹3,60,000.

(2)

			New rates	
	Particulars (₹)	**Current rates**	**(a) 2400units**	**(b) 2417*units**
	Revenue : 25,000 x (2400 / 2400 / 2417)	600L	600L	604.25L
(-)	Material : 800 x 27.15 x 2400	(521.28L)		
	800 x 27.75 x 2400		(532.8L)	
	800 x 27.75 x 2417			(536.574L)
(-)	Fixed cost: 1000 x 2400	(24L)	(24L)	(24L)
(-)	Variable cost: 1500 x 2400	(36L)	(36L)	
	1500 x 2417			(36.255L)
»	Total profit:	18.72L	7.2L	7.421L

- Loss due to transaction exposure = Profit at spot rates (-) profit at changed rates
  = 18.72 – 7.2 = ₹11.52 lacs.

- Loss due to operating exposure = Profit @ SR (-) Profit @ changed rate after changed demand
  = 18.72 – 7.421 = ₹11.299 lacs.

WN 1: **Calculating new demand due to change in price (for customer)**

•	Earlier price/unit in € = 25000/51.50	€ 485.437
•	New price/unit in € = 25000/51.75	€ 483.092
•	% Decrease in price = {485.437 – 483.092} / 485.437	0.483%
»	% Increase in demand = % fall in price x Price elasticity = 0.483% x 1.5 =	0.7245%
»	New units demand = 2400 + 0.7245%	~2417 units

Calculating Exposure using Swap points

 # Ques 30 – Kunti **{SM TYK, N19 RTP (Old)}**

Following are details of cash inflows and outflows in foreign currency of Kunti Co. an Indian export firm:

Currency	Inflow	Outflow	Spot Rate	Forward rate
US$	4 crore	2 crore	48.01	48.82
French Franc	2 crore	0.8 crore	7.450	8.120
UK£	3 crore	2 crore	75.57	75.98
Japanese YEN	1.5 crore	2.5 crore	3.200	2.400

(i) Determine the net exposure of each foreign currency in terms of ₹.

(ii) Are any of the exposure positions offsetting to some extent?

Ans:

Currency	Inflow	Outflow	Net Inflow	Swap points	Net Exposure (in crores)
US $	4	2	2	0.81	1.62
FF	2	0.8	1.2	0.67	0.804
UK £	3	2	1	0.41	0.41
¥	1.5	2.5	-1	-0.80	0.80

ii) Japanese yen exposure is being offset by better forward rate.

Note 1: Swap points = Forward rate – Spot rate

Note 2: Net Exposure = Net inflow x Swap points

International Cash Management

Selecting ideal investment currency for maximum gains

 # Ques 31 – Manvantar {SM TYK, M18 RTP (New), M19 Exam (Old), Dec 21 RTP (Old), N23 MTP 1}

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

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

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

	London on New York	London on Frankfurt
Spot	1.5350/90	1.8260/90
1 month	15/18	60/55
2 months	30/35	95/90
3 months	80/85	145/140

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

Ans: *Faculty Note 1: London on New York means => $/£*

London on Frankfurt means => €/£

Faculty Note 2: Question mentioned that "London office" has surplus funds. But these funds are lying in "US$" and not "£".

 # WN 1 – Spot rates

- $/£ = 1.5350 – 1.5390 £/$ = 1/1.5390 – 1/1.5350
- €/£ = 1.8260 – 1.8290 £/€ = 1/1.8290 – 1/1.8260

- €/$ = £/$ x €/£ = {1/1.5390 x 1.8260} – {1/1.5350 x 1.8290} = 1.1865 – 1.1915
- $/€ = 1/1.1915 – 1.1865

 # WN 2 - Three months Forward rates

- $/£ FR = {1.5350 + 0.0080} - {1.5390 + 0.0085} = 1.5430 – 1.5475

- £/$ FR = 1/1.5475 – 1/1.5430

- €/£ FR = {1.8260 – 0.0145} - {1.8290 – 0.0140} = 1.8115 – 1.8150
- £/€ FR = 1/1.8150 – 1/1.8115

WN 3 –Cost of funds to the bank = 4%

- Initial Amount + Interest thereon = $5L + $5,000 $ 5,05,000
- Equivalent amount of £ required to pay the above sum ($ 5,05,000/1.5430*) £ 3,27,285

* Due to conservative outlook.

(i) If investment is made at New York

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

(ii)

	Particulars	London	Frankfurt
A.	Invest today	$ 5,00,000	$5,00,000
B.	in local Currency (using SR)	5L/1.5390 = £ 3,24,886	5L x 1.1865 = € 5,93,250
C.	Interest rate in local currency	5%	3%
D.	3 months Interest	£ 4,061	€ 4,449
E.	Balance after 3 months	£ 3,28,947	€ 5,97,699
F.	Equivalent £	£ 3,28,947	5,97,699 x 1/1.8150 = £ 3,29,332
G.	Less: Outflow in £ (WN 3)	£ 3,27,285	£ 3,27,285
H.	Arbitrage profit	£ 1,662	£ 2,047

Maximum profit is earned if investment is made in New York. Hence it should be opted.

Acting Independently vs Immediate Cash pooling

 # Ques 32 – Ambalika {N18 RTP (Old), N23 RTP}

Suppose you are a treasure of Ambalika plc in the UK. It has two overseas subsidiaries, one based in Amsterdam and one in Switzerland. The Dutch subsidiaries has surplus Euros in the amount of 7,25,000 which it does not need for the next three months but which will be needed at the end of that period (91 days). The Swiss subsidiaries has a surplus of Swiss Francs in the amount of 9,98,077 that, again, it will need on day 91. The Ambalika plc.in UK has a net balance of £75,000 that is not needed for the foreseeable future .Given the rates below, what is the advantage of swapping Euros and Swiss Franc into Sterling?

	Spot rate (€)	£0.6858 – 0.6869		
	91 days Pts.	0.0037 – 0.0040		
	Spot rate (£)	CHF2.3295 – 2.3326		
	91 days Pts	0.0242 – 0.0228		
	Interest ates for the deposits:			
	Amount of currency	**91 days Interest rate % p.a.**		
		£	**€**	**CHF**
	0 – 1,00,000	1	¼	0
	1,00,001 – 5,00,000	2	1.5	¼
	5,00,001 – 10,00,000	4	2	1/2
	Over 10,00,000	5.375	3	1
	Note: - Assume 360 days a year.			
Ans:	Amount after 91-days when acting Independently (i.e., w/o Swapping)			
#	**In Local Currency**			**in £**
€	7,25,000(1 + 0.02 x 91/360) = €7,28,665			5,02,415
CHF	9,98,077(1 + 0.005 x 91/360) = CHF9,99,338			4,32,651
£	75,000(1 + 0.01 x 91/360) = £75,190			75,190
			Total :	10,10,256
(b)	Immediate Cash pooling i.e. Swap to Sterling			
	£ amount today			**in £**
	€ : 7.25 x 0.6858			4,97,205
	CHF : 9.98077/2.3326			4,27,882
	£ :			75,000
			Total :	10,00,087
(+)	1-m £ Interest : 10,00,087 x 5.375% x 91/360			13,588
				10,13,675
*	Net gain due to sterling swap = 10,13,675 – 10,10,256 = £3,419			
WN 1:	Forward rate = Spot rate ± Swap Points = 0.6858 + 0.0037 – 0.6869 + 0.0040 = 0.6895 – 0.6909			
•	CHF/£ FR = (2.3295 – 0.0242) – (2.3326 – 0.0228) = 2.3053 – 2.3098			

Investment in Risky index vs Investment in Safe Govt. securities

 # Ques 33 – Amba {N18 Exam (Old), N20 Exam (New), N20 MTP 1 (New), M23 Exam}

Amba Ltd. an Indian MNC is executing a plant in Sri Lanka. It has raised ₹400 billion. Half of the amount will be required after 6months' time. It is looking an opportunity to invest this amount on 1st April 2020 for a period of six months. It is considering two underlying proposals:

Market	Japan	USA
Nature of investment	Index Fund (JPY)	Treasury Bill (USD)
Dividend (in billions)	25	-
Income from Stock lending (in billions)	11.9276	-
Discount on initial investment at the end	2%	-
Interest	-	5% p.a.
Exchange Rate (1st April 2020)	JPY/INR 1.58	USD/INR 0.014
Exchange Rate (30th Sep. 2020)	JPY/INR 1.57	USD/INR 0.013

You, as an Investment Manager, is required to suggest the best course of option.

Ans:

	(i) Investing ₹200 Billions in Japan (Option 1)	JPY (Billions)
	JPY invested = 200 x 1.58	316
+	Dividend	25
+	Income from Stock lending	11.9276
(-)	Discount on initial investment: 316 x 2%	(6.32)
»	JPY after 6-months	346.6076
•	Equivalent ₹ = 346.6076/1.57	₹ 220.769

(ii)	Investing ₹200 Billion in US (Option 2)	($ Billions)
	USD Investment : 200 x 0.014	2.8
(+)	Interest : 2.8 x 5% x 6/12	0.07
	Total $ receivable after 6- months	2.87
•	Equivalent ₹ = 2.87 x 1/0.013	₹ 220.769

Decision - The gain amount is same in both the cases so the company is indifferent. However, Treasury Bills are risk free, so investment in Treasury Bills (USA) is suggested.

Discrete Questions

Competitive Quote selection

 # Ques 34 – Vyasa {SM TYK, M23 MTP 2}

You have following quotes from Bank Vyasa & Bank Vipasa

		Bank Vyasa	Bank Vipasa
	SPOT	USD / CHF 1.4650 /55	USD / CHF 1.4653 /60
	3 months	5/10	
	6 months	10/15	
	SPOT	GBP / USD 1.7645 /60	GBP / USD 1.7640 /50
	3 months	25/20	
	6 months	35/25	

(i) How much min. CHF amount you have to pay for 1 million GBP spot?

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

Ans: Quote selection → We will obviously select the bank more competitive rate.

- For USD/CHF → Bank Vyasa @ 1.4650/55.
- For GBP/USD → Bank Vipasa @ 1.7640/50.

- GBP/CHF SR (i.e. $\frac{CHF}{£}$) = $\frac{CHF}{\$} \times \frac{\$}{£}$ = 1.4650 x 1.7640 – 1.4655 x 1.7650 = 2.58426 – 2.58661

(i) 1 million GBP = CHF 2.58661 x 1 million = CHF 25,86,610.

(ii) **Considering quotes from bank Vyasa only**

- Spot CHF/£ = 1.4650 x 1.7645 – 1.4655 x 1.7660 = 2.5850 - 2.5881
- 3-m FR CHF/£ = 1.4655 x 1.7620 – 1.4665 x 1.7640 = 2.5822 - 2.5869

* **Swap points**

Spot rate = 2.5850 - 2.5881

3-m FR = 2.5822 - 2.5869

= 0.0028 - 0.0012

∴ Swap points are = 28/12.

Finding rate of "Indifference" between ₹ & $ borrowing + Calculating Forward rates

 # Ques 35 – Ashwatthama **{N18 Exam (New), N20 MTP 1 (Old)}**

Ashwatthama Ltd. obtains the following quotes (₹/$)

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

The co. needs $ funds for 6 months. Determine whether the company should borrow in $ or ₹.

Interest rates are :

3-Month's interest rate :	₹ = 12%	$ = 6%
6-Month's interest rate :	₹ = 11.50%	$ = 5.5%

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

(i) ₹ borrowing (ii) $ borrowing

Ans: Let amount of funds required be $1000. (Faculty Note: You can assume any amount)

(i) $ Borrowing

$ outflow after 6-m = $1000 x (1 + 0.055×6/12)	$ 1027.5
Equivalent ₹ outflow = 1027.5 x 36.40	₹ 37,401

(ii) ₹ borrowing

Required ₹ borrowing today = $1000 x 36.10	₹ 36,100
₹ outflow after 6-m = 36,100 x (1 + 0.1150×6/12)	₹ 38,175.75

- **Decision**: Prefer $ borrowing and enter in 6-m forward contract.

(iii) Calculating 3 x 6 Forward rate (i.e. 3-m forward rate after 3-m).

a. **$ Forward rate**

- (1 + 0.05 x 3/12) (1 + $ FR) = (1 + 0.055 x 6/12)
- $ FR = 1.2315% for 3-months or 4.926% p.a.

b. **₹ Forward rate**

- (1 + 0.12 x 3/12) (1 + ₹ FR) = (1 + 0.1150 x 6/12)
- ₹ FR = 2.67% for 3-months or 10.68% p.a.

Additional Questions

👉 Basics

V. Basic currency conversion + Decision: Convert today or later

 # Ques 1 – Ugrasena {SM TYK, M19 RTP (Old), N22 Exam}

The following two ways quotes appear in Foreign Exchange Market:

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

Required:

(i) How many $ should Ugrasena sell to get ₹25 Lakhs after 2 months?

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

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

Ans: (i) $ Required to get ₹25 lacs = 25L x 1/47 $ 53,191.4893

(ii) ₹ required to get $2L = $2L x 46.25 ₹ 92,50,000

(iii) Lag receivable or encash now

A. If $ are converted today

- ₹ received today: 69,000 x 46 ₹ 31,74,000
- 2 months interest: 31,74,000 x 10% x 2/12 ₹ 52,900

» Total: ₹ 32,26,900

B. If $ are converted after 2-months

₹ received after 2-months: 69,000 x 47 = ₹ 32,43,000

Decision – The firm should lag and should encash after 2 months.

👉 Triangular Arbitrage

Triangular arbitrage under Bid-ask spread + Exchange commision

 # Ques 2 – Mahamaya

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

	USD/INR 59.25 / 59.35 in Mumbai	
	GBP/INR 102.50 / 103.00 in London	
	GBP/USD 1.70 / 1.72 in New York	
	Mahamaya has USD 1,00,00,000. The bank wishes to retain an exchange margin of 0.125%.	
	Explain whether there is any arbitrage gain possible from the quoted spot exchanges rates.	
Ans:	Rough (No need to show in exam) - Write down all the quotes for easy reference	
	₹/$ = 59.25 - 59.35 $/₹ = 1/59.35 - 1/59.25	
	₹/£ = 102.50 - 103 £/₹ = 1/103 - 1/102.50	
	$/£ = 1.70 - 1.72 £/$ = 1/1.72 - 1/1.70	
•	Cross rate of $/£ = ₹/$ x $/₹ = 102.50 x 1/59.35 – 103 x 1/59.25 = 1.7270 - 1.734	
»	Rough Analysis (Show in exam "Only if time allows")	
•	£ Price in Direct market	$ 1.70 - 1.72
•	£ Price in Indirect market (cross market)	$ 1.7270 - 1.7384
•	**Decision:** Buy £ directly **($ → £)** and then sell it in indirect market **(£ → ₹ → $)**	
»	Main Answer:	
	Step 1 – Buy £ Directly ($ → £)	
	Sell $ to buy £ = $ 1 crore x {1/1.72 – 0.125%}	£ 58,06,686
	Step 2 – Sell £ Indirectly (£ → ₹ → $)	
•	Sell £ 58,06,686 to get ₹ = 58,06,686 x {102.50 - 0.125%}	₹ 59,44,42,060
•	Sell ₹ 59,44,42,060 to get $ = 59,44,42,060 x {1/59.35 – 0.125%}	$ 1,00,03,353
»	**Hence arbitrage profit = $1,00,03,353 - $1,00,00,000 = $3353.**	
	Notes: -	
1.	Students answer may differ due to rounding off.	
2.	Here, we use exploited the mispricing between $/£. Student may choose to exploit any other pair.	
3.	The above answer is sufficient for 4-5 marks questions. However, in case the question is asked for 6 marks or more, then also show effective rate of each transaction separately.	
	Ex: Rate applicable when selling $1 crore = 1/1.72 – 0.125% = £ 0.5806686 / $	

Covered Interest Arbitrage (CIA)

CIA under Bid-ask spread + Separate deposit-borrowing rates

 # Ques 3 – Choka

Spot Rate	1$= ₹45.36 - ₹45.45	
3 Month Forward Rate	1$= ₹46.00 - ₹46.10	
Interest Rate:	**India**	**USA**
Borrowing	8%	5%
Deposit	6%	4%

Mr. Choka, an arbitrageur, wants to construct an arbitrager using above information. Calculate Covered Interest Arbitrage Profit?

Ans: **ROUGH ANALYSIS (NO NEED TO SHOW IN EXAM)**

- $ Forward premium = {46.10 / 45.45 – 1} x 12/3 — 5.72%
- Return if invested in India — 6%
- Return if invested in US = $Rf_{\$}$ + $ Premium = 4% + 5.72% — 9.72%
- Return in US > Return in India. So borrow from India & Invest in US.

IN EXAM START FROM HERE:

Today

Borrow ₹10,000 from India & invest in US.

$ Invested today	= ₹10,000/45.45	$ 220.022

- **After 3-months**

$ Investment value = 220.022(1 + 0.04x3/12)		$ 222.22
₹ at forward rate	= 222.22 x 46	₹ 10,222.12
Repay ₹ borrowing = 10,000 (1 + 0.08 x3/12)		(₹ 10,200)
	=> Arbitrage profit	₹ 22.12

CIA when continuously compounded rate is given

 # Ques 4 – Gandharv

The risk-free rate of interest rate in USA is 8% p.a. and in UK is 5% p.a. The spot exchange rate between US $ and UK £ is 1$ = £0.75. Assuming that interest is compounded on daily basis then at which forward rate of 2 year there will be no opportunity for arbitrage. Further, show how Gandharv, an investor could make risk-less profit, if two year forward price is 1$ = 0.85 £.

Given $e^{-0.06}$ = 0.9413 & $e^{-0.16}$ = 0852, $e^{0.16}$ = 1.1735, $e^{-0.1}$ = 0.9051

Ans: £/$ 2-year forward rate = $\frac{SR\ e^{UKrf \times 2}}{e^{USrf \times 2}}$

$= SR\ e^{(UKrf - Usrf) \times 2}$

$= 0.75\ e^{(0.05 - 0.08) \times 2} = 0.75\ e^{-0.06} =$ £0.706/$

- **Arbitrage if prevailing $ forward rate = £0.85**
- Sell 2-year $ forward at £0.85/$.
- Invest 1$ today for two-years.
- Borrow equivalent £ for $ investment = 0.75 £

- **After 2-years**
- $ investment value = $1\ e^{0.08 \times 2} = 1 \times e^{0.16} =$ $1.1735
- Sell $ at forward rate & get £ = 1.1735 x 0.85 = £0.997475
- £ loan repayment = $0.75 \times e^{0.05 \times 2} = 0.75 \times e^{0.10}$

$= 0.75 \times \frac{1}{e^{-0.10}} = 0.75 \times \frac{1}{0.9051} =$ £0.828638

- Arbitrage profit = £0.997475 – £0.828638 = £0.168837 per $

Forward premium & Discount

Finding missing entries using Forward rate concepts

 # Ques 5 – Savitri **{N23 RTP}**

The following table reflect interest rates for the US $ & French Francs. The spot exchange rate is 7.05 francs per dollars. Miss Savitri has requested you to complete the missing entries.

	3-m	6-m	1-year
$ Interest Rate (effective rate)	11.5%	12.25%	?
Franc Interest Rate (effective rate)	19.5%	?	20%
Forward Franc per Dollar	?	?	7.5200
Forward discount per Franc % per year	?	-6.3	?

Ans: FR (3-months) = $\frac{SR\ (1 + rf\ FF)^{1/4}}{(1 + rf\ \$)^{1/4}} = \frac{7.05\ (1.195)^{1/4}}{(1.115)^{1/4}} \rightarrow$ 1$ = FF 7.173

(ii) $/FF = 1/7.05 = 0.14184 $/FF

FR = 1/7.173 = 0.13941 $/FF

∴ Discount = $\frac{0.13941 - 0.14184}{0.14184} \times \frac{12}{3}$ = -6.853% p.a.

(iii) FR (1-year) = $\frac{SR\ (1 + rf\ FF)}{(1 + rf\ \$)}$

- $7.52 = \frac{7.05\ (1.20)}{(1 + rf\ \$)}$
- 1 + rf $ = 1.125
- rf $ = 0.125 or 12.5% p.a.

iii) Discount = 6.3% p.a. i.e., 3.15% for 6-months.

- $ = FF 7.05

» FR ($ after 6-m) = 7.05 + 3.15% = FF 7.272075

iv) FR (6m) = $\frac{SR\ (1 + rf\ FF)^{1/2}}{(1 + rf\ \$)^{1/2}}$

- $7.272075 = \frac{7.05\ (1 + rf\ FF)^{1/2}}{(1.1225)^{1/2}}$
- $7.272075 \times (1.1225)^{1/2} = 7.05\ (1 + rf\ FF)^{1/2}$
- $1.0928546 = (1 + rf\ FF)^{1/2}$

Squaring both side

- $(1.0928546)^2 = [(1 + rf\ FF)^{1/2}]^2$
- 1.9433 = 1 + rf FF
- 0.19433 = rf FF → 19.433%

Calculating Forward premium + Using IRPT to calculate Fair FR

 # Ques 6 – True Blue Cosmetics

True Blue Cosmetics Ltd.is an old-line producer of cosmetics products made up of herbals. Their products are popular in India and all over the world but are more popular in Europe. The company invoice in Indian Rupee when it exports to guard itself against the fluctuation in exchange rate.

	As the company is enjoying monopoly position, the buyer normally never objected to such invoices.
	However, recently, an order has been received from a whole-seller of France for FFr 80,00,000. The
	other conditions of the order are as follows:
(a)	The delivery shall be made within 3 months;
(b)	The invoice should be FF_r
	Since, Company is not interesting in losing this contract only because of practice of invoicing in
	Indian Rupee. The Export Manager Mr. E approached the banker of Company seeking their guidance
	and further course of action. The banker provided following information to Mr. E
(a)	Spot rate $1FF_r$ = ₹6.60;
(b)	Forward of (90 days) of 1 FF_r = ₹6.50
(c)	Interest rate in India is 9% p.a. and in France 12% p.a. Mr. E entered in forward contract with
	banker for 90 days to sell FFr at above mentioned rate. When the matter came for consideration
	before Mr. A Accounts Manager of company, he approaches you.
	You as a Forex Consultant is required to comment on:
(i)	Whether an arbitrage opportunity exist or not.
(ii)	Whether the action taken by Mr. E is correct and if bank agrees for negotiation of rate, then at what
	forward rate company should sell FF_r to Bank.
Ans:	(i) Calculating premium /discount of FF
	$= \frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{\text{months}}$
	$= \frac{6.50 - 6.60}{6.60} \times \frac{12}{3} = -6.06\%$
•	Interest rate differential between 2 countries = 12% - 9% = 3% p.a.
•	Implied discount (6.06%) ≠ Interest differential (3%). Therefore, arbitrage opportunity exists.
(ii)	Correct forward rate as per IRPT
	₹/FF forward rate = $SR \frac{(1 + ₹ \text{ interest})}{(1 + FF \text{ interest})}$
	$= 6.60 \times \frac{(1 + 0.09 \times 3/12)}{(1 + 0.12 \times 3/12)} = ₹6.552/FF$

P&L using FR vs Expected SR

 # Ques 7 – Indraprastha {SM TYK}

Indraprastha Ltd. of U.K. has exported goods with Can $5,00,000 receivable in 6-months.The exporter wants to hedge the receipt in the forward market. The following information is available:

Spot Exchange Rate	Can $2.5/£
Interest rate in U.K.	12%
Interest rate in Canada	15%

The forward rates truly reflect the interest rates differential. Find out the gain/loss to U.K. exporter if Can $ spot rates: (i) Declines 2% (ii) Gains 4%

Ans: Cad$/£ FR = $\frac{\text{SR } (1 + \text{Cad. Interest rate} \times 6/12)}{(1 + \text{UK Interest rate} \times 6/12)} = \frac{2.5\ (1 + 0.15 \times 6/12)}{(1 + 0.12 \times 6/12)}$ = Cad $2.535/£

Calculating Gain/(Loss)	(i) £ = Cad $2.55 (i.e., 2.5 x 1.02)	(ii) £ = Cad $2.4 (2.5 x 0.96)
• Receipt at FR: 5,00,000 ÷ 2.535	£1,97,239	£1,97,239
• Receipt at SR: 5,00,000 ÷ 2.55 or 2.4	£1,96,078	£2,08,333
Gain/(Loss):	£1,161	(£11,094)

👉 **Should you avail credit or Not?**

Avail credit from Supplier vs Loan from bank

 # Ques 8 – Gibraltar {SM TYK, N19 RTP (New), N20 MTP 1 (New)}

Gibraltar ltd has imported 5,000 bottles of shampoo at landed cost in Mumbai of US$ 20 each. The company has the choice for paying for the goods immediately or in 3-month time. Has a clean overdraft limited where 14% p.a. rate of interest is charged calculate which of the following method would be cheaper to Gibraltar Ltd.

(i) Pay in 3 months with the interest @ 10% and cover risk forward for 3 months

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

The rates are as follows

Mumbai ₹/$ Spot	60.25-60.55
3 Month Swap	35/25

Ans: Amount payable = 5,000 x $ 20 = $1,00,000

• Forward rate (FR) = SR ± Swap points = {60.25 – 0.35} – {60.55 – 0.25} = 59.90 – 60.30

(i)	**Pay in 3-months:**	**₹ in Lacs**
	Payment to supplier: $1L (1 + 0.1 x 3/12) x 60.3	61.8075
(ii)	**Settle now:**	**₹ in Lacs**
	Payment to supplier: $ 1 L x 60.55	60.55
+	Interest @ 14% p.a.: 60.55 x 14% x 3/12	2.11925
	Total =	62.66925
-	**Clearly, paying supplier in 3-months is a better option.**	

👉 Fate of forward contracts

Extension on Due date (Cancel existing + Enter into new contract)

 # Ques 9 – Uttara **{SM Illus}**

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

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

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

Note: In this ques the Ask rate (67.68) < Bid rate (67.72). This is technically impossible. It is simply a typing mistake in the ques. Students MUST consider the correct quote while attempting ques.

Ans: **For Extension**

- A contract cannot be extended as such. For extension, the customer must cancel the existing contract and enter a new 1-m Forward.

=> **Gain/(loss) to customer**

Sold forward: 1,00,000 x 62.52	₹ 62,52,000
Bought forward: 1,00,000 x 62.7825 (WN 1)	₹ 62,78,250
Gain/(loss) =	₹ 26,250

Hence, cancellation charges of ₹26,250 shall be paid by the customer.

WN 1: Applicable rate = Spot ask rate + 0.1% = 62.72 + 0.1% = 62.7827 rounded off to ₹62.7825.

(ii) Applicable rate for new contact = 1- month forward bid rate – 0.1% margin

= 62.64 - 0.1% x 62.64 = 62.5774, rounded off to ₹62.5775

Nostro, Vostro, Loro

V. Basic cross rate calculation

 # Ques 10 – Xover **{SM TYK, M19 RTP (Old)}**

Xover Bank, Amsterdam, wants to purchase Rupee 25 million against £ for funding their Nostro A/c. Calculate the amount of £,s credited. Ongoing inter-bank rates per $, ₹61.3625/3700 & per £ is $ 1.5260/70.

Ans: ₹/£ = ₹/$ x $/£ = 61.3625 x 1.5260 - 61.3700 x 1.5270 = 93.6392 – 93.7120

£ required = 25 million / 93.6392 = £2,66,982.20

V.V. Basic currency conversion

 # Ques 11 – ABN Amro **{SM TYK}**

ABN-Amro bank, Amsterdam, wants to purchase ₹15 million against US $ for funding their Vostro account with Canara Bank, New Delhi. Assuming the inter-bank rates of US $ is ₹51.3625/3700, what would be the rate Canara Bank would quote to ABN-Amro bank? Further, if the deal is struck, what would be the equivalent US $ amount.

Ans: Applicable rate = ₹51.3625/$

Equivalent $ amount = ₹15 million x 1 / 51.3625 = $292,041.86

Discrete Questions

Broken swap points

 # Ques 12 – Atulya **{SM TYK, N22 RTP}**

On April 3, 2016, Atulya bank quotes the following:

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

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

Assume spot date is April 5, 2016.

Assume 1 swap point = 0.0001.

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

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

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

Ans: Swap point for 2-m 15 days

Bid = $70 + \frac{(160 - 70)}{30} \times 15 = 115$

Ask = $90 + \frac{(186 - 90)}{30} \times 15 = 138$

∴ Swap points for 2 months 15 days = 115/138

ii) FR for 20th June, 2016.

SR	66.2525	67.5945
Swap points	115	138
Forward rate	66.2640	67.6083

iii)

Spot Rate	66.2525	67.5945
2.5 M FR	66.2640	67.6083
Average	66.2583	66.6014
Premium (Swap points)	0.0115	0.0138

∴ Premium (%) p.a. $\frac{0.0115}{66.2583} \times \frac{12}{2.5} = 0.083\%$ $\frac{0.0138}{66.6014} \times \frac{12}{2.5} = 0.098\%$

Alternate view

Average spot rate = (66.2525 + 67.5945) / 2 = 66.9235

Average 2.5 m FR =(66.2640 + 67.6083) / 2 = 66.9362

∴ Premium = $\frac{66.9362 - 66.9235}{66.9235} \times \frac{12}{2.5}$ = 0.091% p.a.

Low Probability Unique Questions

Geographical arbitrage when rates of different locations are given

 # Ques 13 - Bharat Silk

Bharat Silk Ltd., an established exporter of silk materials, has a surplus of US$20 million as on 31st May, 2015. The banker of the company informs the following exchange rates that are quoted at three different forex markets:

GBP/INR	99.10 at London
INR/GBP	0.01 at London
USD/INR	64.10 at Mumbai
INR/USD	0.02 at Mumbai
USD/GBP	0.65 at New York
GBP/USD	1.5530 at New York

Assuming that there are no transaction costs, advice the company how to avail the arbitrage gain from the above quoted spot exchange rates.

Ans: Krack chart – We have $20 million surplus. We have "rotate" it in a manner to generate arbitrage gain. How to do it?

Simple → Whenever selling any currency, sell at highest possible rate.

Whenever buying --> Buy at lowest rate.

2 Also, it will be better to first write ratio in standard form. (You can do this step in rough).

- London : ₹/£ = 99.10

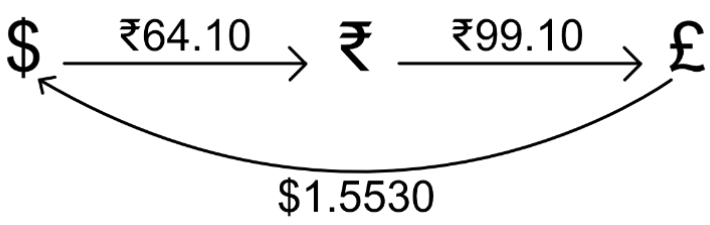
  £/₹ = 0.01 i.e. ₹/£ = 1/0.01 = ₹100/£

- Mumbai : ₹/$ = 64.10

  $/₹ = 0.02 i.e. ₹/$ = 1/0.02 = 50

- New York: £/$ = 0.65 i.e. $/£ = 1/0.65 = 1.5384

  $/£ = 1.5530



	In exam start from here -	
•	Sell $ at Mumbai : $20 Mn x 64.10	₹ 1282 Mn
•	Sell ₹ at London : ₹1282 /99.10	£ 12.93643 Mn
•	Sell £ at New York :£12.93643 x 1.5530	$ 20.0027 Mn
•	Profit = $20.09027 Mn - $20 Mn	$ 0.09027 Mn i.e., $90,270
	Cost under Forward cover vs MMO vs Unhedged 'when Tax rate is given'	
#	**Ques 14 – Dhrishtadyumna**	
	On 1/3/1979, Dhrishtadyumna. bought from a foreign firm electronic equipment that will require the payment of LC 9,00,000 on May 31,1979. The spot rate on March 1, 1979, is LC 10 per $, the expected future spot rate is LC 8 per $, and the ninety days forward rate is LC 9 per $. The US interest rate is 12%, and the foreign interest rate is 8%. Tax rate for both countries is 40%. The Co. is considering three alternatives to deal with the risk of exchange rate fluctuations.	
(a)	To enter forward market to buy LC 9,00,000 at the 90 days forward rate in effect on May 31, 1979.	
(b)	To borrow an amount in $ to buy the LC at the current spot rate. This money is to be invested in government Securities of the foreign country; with the interest income, it will equal LC 9,00,000 on 31 May, 1979.	
(c)	To wait until May 31, 1979, and buy LCs at whatever spot rate prevails at that time.	
	Which alternative should the Co. Follow in order to minimise its cost of meeting the future payment in LCs? Explain.	
Ans:	**Forward Cover**	
•	$ if paid today = 9,00,000/10	$ 90,000
•	$ if paid under forward cover = 9,00,000/9	$ 1,00,000
=	Extra exp. incurred under forward cover = 100000 – 90000	$ 10,000
(-)	Tax saving on this $10,000 = 10,000 x 40%	$ 4,000
=	Cost (net of tax) = $1,00,000 - $4,000	$ 96,000
(b)	**Cost under MMO**	
•	Interest rate on investment (net of tax) = 8% x (1 – 0.4) = 4.8%	
•	Invest PV of LC 9,00,000 for 3m = 9,00,000 / (1 + 0.048×3/12)	LC 8,89,328
#	**Borrow in $ an amount equivalent to LC 8,89,328 today.**	
•	Borrow $ for 3m @ 12% p.a. = 8,89,328 / 10	$ 88,932.8
•	$ Repaid = 88,932.8 + 88,932.8 x 12%(1 – 0.4) x 3/12	$ 90,534

c)	**If Uncovered (i.e. pay at SR after 3-months)**	
•	$ if paid today = 9,00,000/9	$ 90,000
•	$ if paid at expected spot rate = 9,00,000/8	$ 1,12,500
»	Extra exp. incurred under forward cover = 1,12,500 – 90,000	$ 22,500
•	Tax saving on this $22,500 = 22500 x 40%	$ 9,000
»	Cost (Net of tax) = $1,12,500 - $9,000	$ 1,03,500

Bifurcating difference due to time factor vs currency fluctuation

 # Ques 15 – Satyavati

Satyavati Ltd. purchased 1 lacs Mark's worth of machines (asset) from a firm in Dortmund, Germany. The value of the dollar in terms of the mark has been decreasing. The firm in Dortmund offers 2/10, net 90 terms. The spot rate prevailing for 10 days for the mark is Dollar 0.55. the 90 days forward rate is dollar 0.56.

(a) Compute the $ cost of paying the account within 10 days.

(b) Compute the $ cost of buying a forward contract to liquidate the account in 90 days.

(c) The differential between part (a) and part (b) is the result of the time value of money (the discount for --prepayment) and protection from currency value fluctuation. Determine the magnitude of each of these components.

Ans:	(i) If paid within 10 days = (1,00,000 x 0.98) x 0.55	$53,900
(ii)	Pay in 90 days = 1,00,000 x 0.56	$56,000
(iii)	Difference between (i) and (ii) = 56,000 – 53,900 =	$2,100.
•	Difference due to discount i.e. time factor = (1,00,000 – 98,000) x 0.56	$1,120
•	Balance difference is due to currency fluctuation = 2,100 – 1,120	$980

Calculating Cash inflow when "Transit and usance" period is given

 # Ques 16 - Sky products

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

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

	3 months forward	32/33 Paise	0.70/0.75 Cents
	Transit Period is 20 days. Interest on post shipment credit is 8% p.a. Exchange Margin is 0.1%.		
	Assume 365 days in a year.		
	You are required to calculate:		
(i)	Exchange rate quoted to the company		
(ii)	Cash inflow to the company		
(iii)	Interest amount to be paid to bank by the company.		
Ans:	Note: Transit and usance period is 80 days. **It will be rounded off to the lower of months** and @		
	months forward bid rate is to be taken:		
(i)	**Exchange rate quoted = 2 months (60 days) Forward Bid rate of ₹ / EUR**		
•	₹ Forward rate = ₹ × $ = 67.9420 x 1.0815 = 73.4793 ...(refer WN 1 & WN 2)		
	€ $ €		
(ii)	**Cash inflow**		
•	Amount of Export Bill		EUR 5,00,000
	Less: EEFC		EUR 2,50,000
			EUR 2,50,000
•	Cash inflow in ₹ = 2,50,000 x 73.4793		₹ 1,83,69,825
(iii)	Interest for 80 days @ 8% = 1,83,69,825 x 8% x 80/365		₹ 3,22,101
#	**WN 1 – ₹ / $ forward bid rate**		
•	₹/USD		₹ 67.8000
+	Premium for 2 months		₹ 0.2100
			₹ 68.0100
(-)	Exchange margin @ 0.1%		₹ 0.0680
=	Bid rate for USD		₹ 67.9420
#	**WN 2 - $ / € Forward bid rate**		
•	USD/EUR		USD 1.0775
+	Add: Premium		USD 0.0040
			USD 1.0815

Ch 10B – Currency F&O

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Currency Futures	1 – 3
Currency Options	4 – 5
Currency Options & MMO	6 – 7
Discrete Questions (Buy call & sell put both having same strike)	8

Index - Additional Questions	**Ques Number**
-- None --	--

Main Questions

👉 Currency futures

 # Ques 1 – Vidura **{SM TYK}**

Vidura Technology is expecting to receive a sum of US$ 4 Lacs after three months. The co. decided to go for future contract to hedge against the risk. The standard size of future contract available in market is $1,000. As on date spot & futures $ contracts are quoting at ₹44.00 and ₹45.00 respectively. Suppose after 3 months the company closes out its position futures are quoting at ₹44.50 and spot rate is also quoting at ₹44.50. You are required to calculate effective realization for the company while selling the receivable. Also calculate how company has been benefitted by using the future option.

Ans: Short futures (F-) at prevailing rate = ₹45/$.

- No. of contracts = $4,00,000 / $ 1000 = 400 contracts.

 # <u>After 3-months</u>

•	Sell $ at spot rate = $4,00,000 × 44.5	1,78,00,000
(+)	Gain on future square off = (45 – 44.5) × $1,000 × 400	<u>2,00,000</u>
	Total =	<u>1,80,00,000</u>

- Effective realization per $ = 1,80,00,000/4,00,000 ₹45 / $
- Clearly, futures hedging was beneficial. Otherwise, realization per $ would have been ₹44.50(i.e. SR).

 # Ques 2 – Zaz **{SM TYK, N20 RTP (New), N20 RTP (Old)}**

Zaz plc, a UK Company is in the process of negotiating an order amounting €2.8 million with a large German retailer on 6 months' credits. If successful, this will be first time for Zaz has exported goods into the highly competitive German Market. The Zaz is considering following 3 alternatives for managing the transaction risk before the order is finalized.

(a) Mr. Peter the Marketing head has suggested that in order to remove transaction risk completely Zaz should invoice the German firm in Sterling using the current €/£ average spot rate to calculate the invoice amount.

(b) Mr. Wilson, CE is doubtful about Mr. Peter's proposal and suggested an alternative of invoicing the

	German firm in € and using a forward exchange contract to hedge the transaction risk.		
(c)	Ms. Karen, CFO is agreed with the proposal of Mr. Wilson to invoice the German first in €, but she is of opinion that Zaz should use sufficient 6-month sterling further contracts (to the nearest whole number) to hedge the transaction risk.		
	Following data is available :		
	Spot Rate	€ 1.1960 - €1.1970/£	
	6 months forward points	0.60 – 0.55 Euro Cents.	
	6-month further contract is currently trading at	€ 1.1943 / £	
	6-month future contract size is	£ 62,500	
	After 6-month Spot rate and future rate	€ 1.1873 / £	
	You are required to:		
(a)	Calculate (to the nearest £) the £ receipt for Zaz plc, under each of 3 above proposals.		
(b)	In your opinion which alternative you consider to be most appropriate.		
Ans:	(i) Average spot rate = (1.1960 + 1.1970) / 2		€ 1.1965 / £
	Invoice at average spot rate = € 2.8 Mn /1.1965		£ 2.34 Million
(ii)	**Under Forward contract**		
•	6-months FR = Spot rates ± Swap points = 1.1970 - 0.0055		1.1900 – 1.1915
•	€ 2.8mn. using forward rate = €2.8mn/1.1915		£ 2.35 Million
(iii)	**Using futures**		
•	Convert €2.8 Mn into £ at futures rate = €2.8 Mn / 1.1943		£ 23,44,470
•	No. of contracts (nearest whole number) = 23,44,470 / 62,500		37 contracts
•	Long 37 futures contracts on £.		
•	Gain / (loss) on Futures after 6m = (1.1873 - 1.1943) x 37 x 62500		(€ 16,187.5)
•	Net £ realization = € received – Loss on futures = 28,00,000 - 16,187.5		€ 27,83,812.5
•	Equivalent £ (using SR after 6m) = 27,83,812.5 / 1.1873		£ 2.3447 Million
»	**Decision** - Hence, it is best to use forward contract as proposed by Mr. Wilson.		
#	**Ques 3 – Navika** **{SM TYK M19 RTP (New), M19 Exam (Old), M23 Exam, N24 MTP 1}**		
	Navika Ltd. is an export business house. The company prepares invoice in customers' currency. Its		

debtors of US$ 10,000,000 is due on April 1, 2015. On April 1, 2015 the spot rate US$/INR is 0.016136 and currency future rate is 0.016134.

Market information as at January 1, 2015 is:

Exchange rates	US$/INR	Futures US$/ INR	
Spot	0.016667	Contract size:	₹24,816,975
1-month forward	0.016529	1-month	0.016519
3-months forward	0.016129	3-month	0.016118

Tenure	Initial Margin	Interest rates in India
1-Month	₹ 17,500	6.5%
3-Months	₹ 22,500	7%

Which of the following would be most advantageous to EFD Ltd?

i) Using forward contract

ii) Using currency futures

iii) Not hedging the currency risk

Ans: (i) Receipt under forward contract = 10 Million / 0.016129 ₹ 62,00,01,240

(ii) **Using futured contracts:**

- No of contracts = $\frac{\text{10 million / 0.016118}}{\text{₹ 24,816,975}}$ 25 contracts
- Initial Margin paid = 25 x 22500 ₹ 5,62,500
- Interest on initial margin = 562500 x 7% x 3/12 ₹ 9844
- Variation margin = (0.016134 - 0.016118) x 25 x 24,816,975 $ 9927
- Net $ realization = $ received + Gain on futures = 10,000,000 + 9927 $ 10,009,927
- Equivalent ₹ (using SR) = 10,009,927 / 0.016136 ₹ 62,03,47,484
- Less: Interest on initial margin = (₹ 8,844)

» Net ₹ receipt = ₹ 62,03,37,640

(iii) **Unhedged** - ₹ receipt at spot rate = 10Mn/0.016136 = ₹ 61,97,32,276

Comment → Using futures is the most beneficial.

Currency Options

 # Ques 4 – Nakula **{SM TYK, Dec 21 MTP 2 (Old), M24 MTP 1}**

Nakula Ltd. an Indian firm, will need to pay Japanese Yen (JY) 5,00,000 on 30th June. In order to hedge the risk involved in foreign currency transaction, the firm is considering two alternative methods i.e., forward market cover and currency option contract.

On 1st April, following quotations (JY/INR) are made available:

Spot	3-month forward
1.9516/1.9711	1.9726/1.9923

The prices for forex currency option on purchase are as follows:

Strike Price	JY 2.125
Call Option (June)	JY 0.047
Put Option (June)	JY 0.098

For excess or balance of JY covered, the firm would use forward rate as future spot rate. You are required to recommend cheaper hedging alternative for Nakula Ltd.

Ans:	(i) Using forward = 5,00,000/1.9726	₹ 2,53,473
(ii)	**Using options :**	
a.	Long put option on ₹ at strike price	¥ 2.125
b.	At max. amt payable under put = 5,00,000 / 2.125	₹ 2,35,294
c.	Put premium paid today = 2,35,294 x ¥0.098	¥ 23,058.8
d.	Premium in ₹ = 23,058.8 / 1.9516	₹ 11,815
»	Total ₹ outflow (b + d)	₹ 2,47,109

**Comment** - Use options as outflow is lower in case of options. Also, the outflow may further reduce in case of a favourable movement in currency.

 # Ques 5 – Inframix **{SM TYK, Dec 21 MTP 2 (Old), N22 MTP 1}**

Inframix Plc is under obligation to pay interests of Can $10,10,000 and Can $7,05,000 on 31st July and 30th September respectively. The firm is risk averse and its policy is to hedge the risks involved in all foreign currency transactions. The finance manager of the firm is thinking of hedging the risk considering two methods i.e., fixed forward or option contracts. It is now June 30. Following Quotations regarding rates of exchange, US $ per Can $, from the firm's bank were obtained:

Spot rate	1-month forward	3-months forward
0.9284 – 0.9288	0.9301	0.9356

Price for Can $/US $ option on a U.S. stock exchange (cents per Can$) payable on purchase of the option (contract size Can $50,000) are as follows:

Strike Price	Calls		Puts	
(US$/Can$)	July	Sept.	July	Sept.
0.93	1.56	2.56	0.88	1.75
0.94	1.02	NA	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of finance manager if options are to be used, one month option should be bought at a strike price of 94 cents and three-month option at a strike price of 95 cents and for the remainder uncovered by the options the firm would bear the risk itself. For this, it would use forward rate as the best estimate of spot. Transaction costs are ignored.

Recommend which of the above two methods would be appropriate for the American firm to hedge its foreign exchange risk on the two interest payments.

Ans: **(i) Forward cover :**

July = 10,10,000 x 0.9301	US $ 9,39,401
Sep = 7,05,000 x 0.9356	US $ 6,59,598

(ii)	Options :	July	Sep
•	No. of contracts (rounded off)	20 (10.1L / 50,000)	14 (7.05 / 50,000)
A.	Bought under options	$9,40,000 (20×50,000×0.94)	$6,65,000 (14×50,000×0.95)
B.	Bal. bought at Spot rate	$9301 (10,000×0.9301)	$4,678 (5,000×0.9356)
C.	Option premium	$10,200 (20×50,000×0.0102)	$11,480 (14×50,000×0.0164)
	Total (A + B + C)	$9,59,501	$6,81,158

Comment - Use option as outflow is lower in case of options. Also, this outflow may further reduce in case of a favourable movement in currency.

👉 Currency Options and MMO

 # Ques 6 - Rock Sand **{SM TYK, M19 Exam (New)}**

Rock Sand Ltd. a US firm will need £3,00,000 in 180 days. In this connection, the following information is available :

Spot Rate 1 £ = $ 2.00

180 days forward rate of £ as of today = $1.96

Interest rates are as follows:

	UK	US
180 days deposit rate	4.5%	5%
180 days borrowing rate	5%	5.5%

- A call option on £ that expires in 180 das has an exercise price of $1.97 and a premium of $0.04.
- The co. has forecasted the spot rates 180 days hence as below:

Future rate	Probability
$1.91	25%
$1.95	60%
$2.05	15%

The company has following four choices. Recommend the alternative that would be best for the co.

(i) A forward contract (ii) A Money Market hedge;

(iii) An Option Contract (iv) No Hedging.

Ans: (i) Forward Contract = £3,00,000 x 1.96 $ 5,88,000

(ii) Money Market Operation (MMO)

- Invest PV of £ 3,00,000 today = £ 3,00,000 / 1.045 £ 2,87,082
- Borrow equivalent today = £ 2,87,082 x $2 $ 5,74,164
- Loan repayment i.e. Cost under MMO = $ 5,74,164 x 1.055 $ 6,05,743

(iii) Cost under Call option:

Expected SR (1)	Call Payoff (2)	Cost per $ (3 = 1 - 2)	Probability (4)	Expected Cost (5 = 3 x 4)
1.91	-	1.91	0.25	0.4775
1.95	-	1.95	0.60	1.17
2.05	0.08	1.97	0.15	0.2955
				$ 1.943

- Gross total expected cost = 3,00,000 x 1.943 $ 5,82,900
(+) Option premium paid = 3,00,000 x 0.04 $ 12,000
(+) Interest cost of premium = $12,000 x 5.5% $ 660
» Total Expected cost $ 5,95,560

(iv)	**No Hedge:**	
•	Expected Spot rate = (1.91 x 0.25) + (1.95 x 0.6) + (2.05 x 0.15)	$ 1.955/£
•	Expected total cost = 3,00,000 x 1.955	$ 5,86,500
#	**Recommendation** -> No hedging should be preferred as it is leading to lowest $ outflow.	

#	**Ques 7 – Agastya**	**{SM TYK, N22 RTP}**
	Agastya Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the US suppliers.	
	The amount is payable in six months-time. The relevant spot and forward rates are:	
	Spot rate USD 1.5617 – 1.5673	
	6 month's forward rate USD 1.5455 – 1.5609	
	Borrowing rates in U.K. and U.S. are 7% and 6% resp. and Deposit rates are 5.5% and 4.5% respectively.	
	Currency options are available under which one option contract is for GBP12,500. Option premium for GBP at a strike price of USD1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for six months period. The company has three choices:	
	(i) Forward Cover (ii) Money Market Cover (iii) Currency option	
	Recommend which of the alternatives is preferable by the company?	
Ans:	(i) Forward Contract = 3,64,897/1.5455	£ 2,36,103
(ii)	**Money Market Operation (MMO)**	
•	Invest PV of $3,64,897 today = $ 3,64,897 / (1 + 0.045×6/12)	$ 3,56,867
•	Borrow equivalent today = $ 3,56,867 / 1.5617	£ 2,28,512
•	Loan repayment (i.e. Cost under MMO) = £ 2,28,512 x 1.035	£ 2,36,510
(iii)	**Long put options**	
•	No. of contracts = 3,64,897/1.70 / 12,500	17 contracts
•	Option premium = (17 x 12,500) x $0.096	$ 20,400
•	Option premium in GBP = $20,400/1.5617	£ 13,063
•	£ outflow under options contract (WN 1)	£ 2,25,563
•	£ outflow under forward (WN 2)	£ 2,360
»	Total £ outflow	£ 2,27,923

WN 1:	**£ outflow under options**	
•	$ bought under options = 17 x 12,500 x 1.70	$ 3,61,250
•	£ outflow under options Contracts = $3,61,250/1.70	£ 2,12,500
(+)	Option premium paid	£ 13,063
»	Total £ outflow under options	£ 2,25,563
WN 2:	Amount not covered under options = $3,64,897 - $3,61,250	$ 3,647
•	£ outflow under forward = $3,647 / 1.5455	£ 2,360

👉 Discrete Questions

 # Ques 8 – Phantom **{N23 Exam}**

A Japanese co. named Phantom ltd. imports hi-tech printer cartridges from US worth $1 million. The chief financial officer of the company wishes to know the best strategy for protection against uncertainty, for the payment that has to be made at the end of 3 months. Financial team of the company has collected the following options for evaluation:

 # Exchange rates quoted in FOREX Market:

¥/$ Quotations	Bid Price	Offer/Ask Price
Spot Rates	146.03	146.63
3M – Forward Rates	144.03	145.00
6M – Forward Rates	146.35	146.70

 # Options Market rates for European options with 3 months expiry :

Type of Option	Strike Price (X) (¥/$)	Premium (%) for Call & Put Options
Call & Put	145.20	1.6766% (Call) & 1.7414% (Put)
Call & Put	146.00	1.3505% (Call) & 2.1006% (Put)

- The expected spot price at expiry is ¥/$: 144.90/145.05
- Suggest the best strategy for CFO of the Japanese Co. to protect against uncertainty, with respect to the following alternatives:

(i) Forward Hedge

(ii) Buy 3 months call, X = 145.20

(iii) Sell 3 months put, X = 145.20

(iv) Buy call & sell put both having X = 146.00

Ans:	**(i) Forward Hedge**	
	Amount payable after 3 months	$ 1000000
	3 months applicable buying rate	¥ 145/$
	Amt. payable in Yen	¥ 145 million
(ii)	**Buy 3 month call option at X = ¥ 145.20**	
	If expected spot price after 3 month is ¥ 145.05 then co. would not exercise its option. So, the cost of import will be:	
•	Buying Yen in spot Market after 3 month	¥ 145.05 Mn
(+)	Premium paid ¥ 145.20 x 1.6766% x $ 1 million	¥ 2.43 Mn
		¥ 147.48 Mn
(iii)	**Selling 3 month Put at X = ¥ 145.20**	
	If expected SR after 3 month ¥ 144.90, then Put Option buyer will exercise his /her option. Then import Bill will be:	
•	Buying Yen in under option after 3 month	¥ 145.20 Mn
(-)	Premium Receipt ¥ 145.20 x 1.7414%x $ 1 Mn	¥ 2.53 Mn
		¥ 142.67 Mn
(iv)	**Buying Call and selling Put at X = ¥ 146**	
#	Net Premium receipt:	
	Premium Receipt on Put = ¥ 146.00 x 2.1006%	¥ 3.0669 Mn
(-)	Premium paid on call = ¥ 146.00 x 1.3505%	¥ 1.9717 Mn
		¥ 1.0952 Mn
	If expected spot Rate expiry happens to be ¥ 144.90/145.05, then call option will be lapsed and put option by buyer will be exercised. Accordingly, the import bill will be:	
•	Buying US$ under Put Option	¥ 146.00 Mn
(-)	Receipt of Net Premium	¥ 1.09520 Mn
		¥ 144.905 Mn
	Decision: Expected outflow is least in case of selling Put option, the same strategy is recommended.	

Ch 11 – IFM

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
IFM Basics, GDRs	1 – 4
NPV Calculation – Medium type questions	5 – 9
Discrete / Different Ques	10

Index - Additional Questions	**Ques Number**
NPV Calculation – Medium type questions	1 – 3
Long ques (relatively less imp)	4 – 6
Low Probability Unique Questions	
- Foreign borrowing cost (with hedging)	7

Main Questions

IFM Basics, GDRs

NPV using Real CFs and Nominal CFs

 # Ques 1 - Pine electro

Pine electro ltd. is considering a new project with following expected cash flows:

Year :	1	2	3
Real Cash flow :	(200)	108	120

Find NPV if the required return in nominal terms is 12% p.a. Inflation rate is 4% p.a.

Ans: **Method 1: Convert Real cash flow to Nominal cash flows.**

Year	Real CFs	Nominal CFs
1	(200)	(200)
2	108	$108 \times (1.04)^1 = 112.32$
3	120	$120 \times (1.04)^2 = 129.792$

» $NPV = (200) + \frac{112.32}{1.12} + \frac{129.792}{1.12^2} = +3.755$

 # Method 2: Convert nominal rate to real rate and use real rate to directly discount real CFs.

- (1 + real rate) (1 + Inflation) = (1 + Nominal rate)
- (1 + real rate) x 1.04 = 1.12
- Real rate = 7.6923%

» $NPV = (200) + \frac{108}{1.076923} + \frac{120}{1.076923^2} = +3.755$

Calculating Risk-Adjusted return

 # Ques 2 – Atri {SM TYK, N19 RTP (New)}

Atri Ltd. is considering a project in US, which will involve an initial investment of US $ 1,10,00,000. The project will have 5 years of life. Current spot exchange rate is ₹48 per US $. The risk-free rate in US is 8% and the same in India is 12%. Project cash flows are:

	Year	**1**	**2**	**3**	**4**	**5**
	Cash flow (in $ Million)	**2**	**2.5**	**3**	**4**	**5**

i) Calculate project NPV using foreign currency approach. Required return on this project is 14%.

ii) What will be the impact if withholding tax of 10% is applicable.

Ans: (1 + ₹rf) × (1 + Risk premium) = (1 + ₹ Req. return)

(1 + 0.12) × (1 + Risk premium) = (1 + 0.14)

or, 1 + Risk premium = 1.14/1.12 = 1.0179

Therefore, Risk adjusted $ rate is = {1.0179 x 1.08 – 1} = {1.099 – 1} = 0.099

- NPV = PVCI – PVCO

$$\frac{2}{1.099} + \frac{2.5}{1.099^2} + \frac{3}{1.099^3} + \frac{4}{1.099^4} + \frac{5}{1.099^5} - 11 = 12.013 - 11 = \$\ 1.013m$$

- NPV in ₹ terms = 1.103 x 48 = ₹48.624 million

ii) **If withholding tax of 10% is applicable** **($ Million)**

	Total PV of cash inflows	12.013
(-)	Withholding tax @ 10%	(1.2013)
=	PV of cash flows after withholding tax	10.8117
(-)	Initial investment (PVCO)	(11)
=	NPV in $	($0.1883)

- NPV in ₹ = -0.1883 x 48 = -₹9.0384 Million
- Hence, the project is no longer viable if withholding tax is applicable

Cost of GDR + No. of GDRs to be issued

 # Q3– Bharadwaja {SM Illus, M18 Exam, N20 RTP (O), M22 Exam, M22 RTP, N23 RTP, M24 Exam}

Bharadwaja ltd. is interested in expanding its operation and planning to install manufacturing plant at US. For the proposed project it requires a fund of $ 10 million (net of issue expenses/ floatation cost). The estimated floatation cost is 2%. To finance this project it proposes to issue GDR.

Following additional information is given:

- Expected market price of share at the time of issue of GDR is ₹250 (Face Value ₹100)
- 2 Shares shall underly each GDR and shall be priced at 10% discount to market price.
- Expected exchange rate ₹60/$.

•	Dividend expected to be paid is 20% with growth rate 12%.	
(i)	You are required to compute the number of GDRs to be issued.	
(ii)	Calculate the cost of the GDR.	
(iii)	If the company is able to raise the funds in US at the rate of 4% p.a. and the company is able to repay the loan along with interest from revenues generated from the operations of US, what is your advise to the company?	
Ans:	**i) Calculating Number of GDRs to be issued**	
•	Net Issue Size =	$ 10 million
•	Gross Issue = $10million / 0.98	$ 10.204 million
•	Issue Price per GDR in ₹ = 250 x 2 x 90%	₹ 450
•	Issue Price per GDR in $ = ₹450 / ₹60	$ 7.5
•	Number of GDRs to be issued = $10.204 Million / 7.5	1.3605 Million
ii)	Cost of GDR = Total next year dividend / Net proceeds + Growth rate = (2 x 20) / 441 + 0.12 = 21.07%	
	* GDR net proceeds (in ₹) = 450(1 – 0.02) = ₹441	
iii)	If the company receives an offer from US Bank willing to provide an equivalent amount of loan with interest rate of 4%, it should accept the offer.	

Basic NPV calculation (Software development ques)

#	**Ques 4 – Gautama**	**{SM Ques}**
	Gautama ltd. is planning to set up a software development unit in India. Software developed at the Indian unit will be bought back by the US parent at a transfer price of US $10 million. The unit will remain in existence in India for one year; the software is expected to get developed within this time frame.	
	The US based company will be subject to corporate tax of 30 per cent and a withholding tax of 10 per cent in India and will not be eligible for tax credit in the US. The software developed will be sold in the US market for US $ 12.0 million.	
	Other estimates are as follows:	
•	Man power cost (80 software professional will work for 10 hours each day)	₹ 400 / man hour
•	Rent with necessary hardware in India	₹ 15,00,000
•	Administrative and other costs	₹ 12,00,000
	Advise the US Company on the financial viability of the project.	

The rupee-dollar rate is ₹48/$. Take 365 days in a year.

Ans: Profit & loss account of the Indian software development unit:

	Particular's		Amount in ₹
	Revenue		48,00,00,000
(-)	Costs: Rent	15,00,000	
	Manpower (₹400 x 80 x 10 x365)	11,68,00,000	
	Administrative & other costs	12,00,000	11,95,00,000
	Earnings before tax		36,05,00,000
(-)	Tax		10,81,50,000
	Earnings after tax		25,23,50,000
(-)	Withholding tax (TDS)		2,52,35,000
	Repatriation amount (in ₹)		22,71,15,000
	Repatriation amount (in $)		$4.7 million

Advise: The cost of development software in India for the US based company is $5.268 million. As the USA based company is expected to sell the software in the USA at $12.0 million, it is advised to develop the software in India.

👉 ## Invest in Foreign country – Medium ques

(More important from exam point of view)

NPV using Home currency approach (+ MIRR)

 # Ques 5 – Markandeya **{SM TYK, N20 RTP (New), N22 Exam}**

Markandeya ltd., a company based in India, manufactures very high- quality modern furniture, and sells to a small number of retail outlets in India and Nepal. It is facing tough competition. Recent studies on marketability of products has clearly indicated that the customers are now more interested in variety and choice rather than exclusivity and exceptional quality. Since the cost of quality wood in India is very high, the co. is reviewing the proposal for import of woods in bulk from Nepalese supplier. The estimate of net Indian (₹) and Nepalese Currency (NC) cash flows in Nominal terms for this proposal is shown below:

Net Cash Flow (in millions)

Year	0	1	2	3
NC	-25.000	2.600	3.800	4.100
Indian (₹)	0	2.869	4.200	4.600

The following information is relevant:

(i) Markandeya Ltd. evaluates all investments by using a discount rate of 9% p.a. All Nepalese customers are invoiced in NC. NC cash flows are converted to Indian (₹) at the forward rate and discounted at the Indian rate.

(ii) Inflation rates in Nepal and India are expected to be 9% and 8% p.a. respectively. The current exchange rate is ₹1= NC 1.6 Assuming that you are the finance manager of Markandeya Ltd., calculate the NPV and (MIRR) of the proposal.

Ans: Forward rate of ₹ = $\frac{SR\ (1 + NC\ inflation)^n}{(1 + ₹\ inflation)^n}$

Year 1 = $1.6 \times 1.09 / 1.08$ = 1.615

Year 2 = $1.6 \times 1.09^2 / 1.08^2$ = 1.630

Year 3 = $1.6 \times 1.09^3 / 1.08^3$ = 1.645

	CF p.a.	Yr 0	Yr 1	Yr 2	Yr 3 (₹ Million)
a)	CF in INR	0	2.869	4.2	4.6
b)	CF in NC	-25	2.6	3.8	4.1
c)	Equivalent ₹	-15.625	1.6099	2.3313	2.4924
		[-25/1.6]	[2.6/1.615]	[3.8/1.630]	[4.1/1.645]
d)	Total ₹ CF	-15.625	4.4789	6.5313	7.0924

- NPV = PVCI – PVCO
- NPV = $(15.625) + \frac{4.4789}{1.09} + \frac{6.5313}{1.09^2} + \frac{7.0924}{1.09^3}$ = - ₹0.542 million

 # Calculating Modified Internal rate of return (MIRR)

Year	CF	Value at year 3 end
1	4.4789	4.4789×1.09^2 = 5.3214
2	6.5313	6.5313×1.09^1 = 7.119
3	7.0924	7.0924×1.09^0 = 7.0924
		19.533

- MIRR -> Rate at which PVCO = PVCI
- $15.625 = \frac{19.533}{(1+IRR)^3}$
- $(1+IRR)^3 = 19.533 / 15.625$
- $MIRR = (1.250112)^{1/3} - 1$

- MIRR = 7.725%

NPV using HC approach when real CFs are given

 # Ques 6 – Vasishtha **{SM TYK, N23 MTP 1}**

Vasishtha Ltd. is engaged in large retail business in India. It is contemplating for expansion into a country of Africa by acquiring a group of stores having the same line of operation as that of India. The exchange rate for the currency of the proposed African country is extremely volatile. Rate of inflation is presently 40% a year. Inflation in India is currently 10% a year. Management of Vasishtha Limited expects these rates likely to continue for the foreseeable future.

Estimated projected cash flows, in real terms, in India as well as African country for the first three years of the project are as follows:

	Year 0	Year 1	Year 2	Year 3
CF in Indian ₹ (000)	-50,000	-1,500	-2,000	-2,500
CF in African rands (000)	-2,00,000	50,000	70,000	90,000

Vasishtha Ltd. assumes the year 3 nominal cash flows will continue to be earned each year indefinitely. It evaluates all investments using nominal cash flows and a nominal discounting rate. The present exchange rate is African Rand 6 to ₹ 1.

Calculate the NPV of the proposed investment considering the following:

(i) African Rand cash flows are converted into rupees and discounted at a risk adjusted rate.

(ii) All cash flows for these projects will be discounted at a rate of 20% to reflect its high risk.

(iii) Ignore taxation.

Ans: Exchange rate as per PPPT $= \frac{SR \times 1 + \text{Rand inflation}}{1 + ₹ \text{ inflation}}$

- Year 1 = $6 \times 1.40 / 1.10 =$ 7.6364
- Year 2 = $6 \times 1.40^2 / 1.10^2 =$ 9.7190
- Year 3 = $6 \times 1.40^3 / 1.10^3 =$ 12.3696

#	Cal. Nominal CFs	Year 0	Year 1	Year 2	Year 3
A.	Real INR CFs	(50,000)	(1,500)	(2,000)	(2,500)
B.	₹ Inflation factor	1	1.1^1	1.1^2	1.1^3
C.	Nominal ₹ CF (A×B)	(5,000)	(1,650)	(2,420)	(3,327.5)
D.	Real Rand CFs	(2,00,000)	50,000	70,000	90,000

E.	Rand Inflation factor	1	1.4^1	1.4^2	1.4^3
F.	Nominal Rand CFs (D×E)	(2,00,000)	70,000	1,37,200	2,46,960
G.	Applicable rate / ₹	6	7.6364	9.7190	12.3696
H.	Equivalent INR: F/G	(33,333)	9,167	14,117	19,965
I.	Total ₹ CF (C + H)	(83,333)	7,517	11,697	16,637.5

- NPV = $(83,333) + \frac{7,517}{1.2} + \frac{11,697}{1.2^2} + \frac{16,637.5}{0.20} \times \frac{1}{1.2^2}$ = (₹ 11,177)
- NPV is negative. Project should not be accepted.

NPV of setting up a new plant

 # Ques 7 – IRCTC {SM TYK, N18 RTP (New), N19 Exam (New), N19 RTP (Old), N20 MTP 1 (New), N20 MTP 1 (Old), Jul 21 Exam (New), N22 MTP 2, M23 RTP, N24 MTP 2}

IRCTC Ltd is planning to set up a subsidiary company in India (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The initial project cost (consisting of Plant and Machinery including installation) is estimated to be US$ 500 million. The net working capital requirements are estimated at US$ 50 million. The company follows straight line method of depreciation. Presently, the company is exporting two million units every year at a unit price of US$ 80, its variable cost per unit being US$ 40.

The CFO has estimated the following operating cost and other data in respect of proposed project:

(i) Variable operating cost will be US $ 20 per unit of production

(ii) Additional cash fixed cost will be US $ 30 million p.a. and project's share of allocated fixed cost will be US $ 3 million p.a. based on principle of ability to share.

(iii) Production capacity of the proposed project in India will be 5 million units

(iv) Expected useful life of the proposed plant is five years with no salvage value

(v) Existing working capital investment for production & sale of two million units through exports was US $ 15 million.

(vi) Export of the product in the coming year will decrease to 1.5 million units in case the company does not open subsidiary company in India, in view of the presence of competing MNCs that are in the process of setting up their subsidiaries in India;

(vii) Applicable Corporate Income Tax rate is 35%, and

(viii) Required rate of return for such project is 12%.

Assuming that there will be no variation in the exchange rate of two currencies and all profits will be repatriated, as there will be no withholding tax, estimate Net Present Value (NPV) of the

	proposed project in India.	
Ans:	**Calculation of Annual CFs**	**$ million**
	Annual Revenue = 5 x 80	400
(-)	Variable cost = 5 x 20	(100)
(-)	additional fixed cost	(30)
(-)	Depreciation = 500/5	(100)
(-)	**Opportunity cost (Current CF by exports): 1.5 x (80 – 40)**	**(60)**
=	EBT	110
	EAT = EBT (1 - 0.35)	71.5
(+)	Depreciation	100
=	Cash flow p.a. for 5 years =	171.5
#	**Calculating NPV (PVCI – PVCO)**	
•	PV of CFs of 5years: 171.5 x PVAF (12%,5)	618.219
•	PV of WC released at end of 5th year: $35/112^5$	19.86
		638.08
(-)	Initial investment =	(535)
	=> NPV	103.08
WN 1:	Initial Investment = Investment in fixed capital + Increase in working capital	
	Initial Investment = 500 + (50 – 15) = $ 535 Million	

NPV when cost can change as per different scenarios

 # Ques 8 - Dell Technologies {M23 MTP 1}

Dell Technologies is considering a foreign investment that involves creation of a plant with an annual output of 1 million units. The entire production will be exported at a selling price of USD 10 per unit. At the current rate of exchange dollar cost of local production equals to USD 6 per unit. Dollar is expected to decline by 10% or 15%. The change in local cost of production and probability from the expected current level will be as follows:

Decline in $ value (%)	Reduction in local cost of production ($/unit)	Probability
0	-	0.4
10	0.30	0.4
15	0.15 Additional reduction	0.2

The plant at the current rate of exchange will have a depreciation of USD 1 million annually. Assume

local Tax rate as 30%. You are required to find out:

(i) Annual Cash Flow After Tax (CFAT) under all the different scenarios of exchange rate.

(ii) Expected value of CFAT assuming no repatriation of profits.

(iii) Viability of the investment proposal assuming an initial investment of USD 25 million on plant and working capital with a required rate of return of 11% on investment and on the basis of CFAT arrived under option (ii). The CFAT will grow @ 3% per annum in perpetuity.

Ans:	**(i) Cal. of Annual CFAT**	**Scenario 1**	**Scenario 1**	**Scenario 1**
A.	**Annual Sales**	**10,00,000**	**10,00,000**	**10,00,000**
		US $	US $	US $
	Selling price p.u.	10.00	10.00	10.00
	Cost p.u	6.00	5.70	5.55
B.	Profit p.u.	4.00	4.30	4.45
	Total Profit (A x B)	40,00,000	43,00,000	44,50,000
(-)	Depreciation	10,00,000	9,00,000	8,50,000
	PBT	30,00,000	34,00,000	36,00,000
(-)	Tax @30%	9,00,000	10,20,000	10,80,000
	PAT	21,00,000	23,80,000	25,20,000
(+)	Depreciation	10,00,000	9,00,000	8,50,000
	CFAT (US$)	31,00,000	32,80,000	33,70,000

(ii) **Expected Value of CFAT** = (31,00,000 x 0.4) + (32,80,000 x 0.4) + (33,70,000x0.2) = $ 32,26,000

iii) NPV = PVCI – PVCO = $\frac{32,26,000 \times 1.03}{0.11 - 0.03}$ - 2,50,00,000 = $ 1,65,34,750

Since NPV is positive, project is viable.

NPV when income is taxed both in foreign country as well as home country

 # Ques 9 - Vamsi Krishna **{N23 MTP 2}**

Vamsi Krishna (VK Ltd) is an Indian co. which is planning to set up a manufacturing plant through its subsidiary in the small country Farland, (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The currency of Farland is the Farroh (Fr.).

An initial investment of Fr. 80 million in plant and machinery would be required. In addition to that the initial investment in working capital of Fr. 6 million would be also required which shall be financed through a loan from a local bank of Farland, at interest rate of 10% p.a. **The working**

capital shall also be subject to inflation. At the end of 5 years, the subsidiary would be taken over by the Govt. of Farland for a price of Fr. 2 million. The part of the proceeds would be used to pay off the bank loan.

It is expected that subsidiary shall produce Net Cash Flows from Operations of Fr. 30 million per year at current price level over the five-year period, before allowing for Farland inflation of 8% p.a. Depreciation on Plant and Machinery shall be charged at 20% per year on straight line basis. As a result of setting up the subsidiary, VK Ltd. expects to lose after-tax export income from Farland of INR 8,00,000 per year in current price terms, before allowing for India inflation of 3%. Profits in Farland are taxed at a rate of 20% after allowing deduction for interest and depreciation.

All after-tax cash profits are remitted to the India at the end of each year. Indian tax @ 30% is charged on profit earned, but due to tax treaty between Farland and the India the tax paid in Farland is allowed to be set off against any India Tax liability. Taxation is paid in the year in which the liability arises.

VK Ltd. requires foreign investments to be discounted at 12%. The current exchange rate is Fr.2.5/INR and the Farroh is expected to depreciate against INR by 5% per year.

Advise should VK Ltd. undertake the investment in Farland or not.

Notes:- 1. Present Figures in thousands multiple.

2. Round off all calculations.

You can use the below mentioned PV factors in your calculations:

Year	1	2	3	4	5
PVF @ 12%	0.893	0.797	0.712	0.636	0.567

Ans: Note: Below solution is as per ICAI.

Author does not fully agree with the solution.

 # Cal. PV of CFs ('000) **[Amounts in Fr, unless specifically mentioned ₹]**

Year	**1**	**2**	**3**	**4**	**5**
CF from Operations	32400	34992	37791	40815	44080
Depreciation	16000	16000	16000	16000	16000
Interest	600	600	600	600	600
PBT	15800	18392	21191	24215	27480
Farland tax	3160	3678	4238	4843	5496

	PAT	12640	14714	16953	19372	21984
(+)	Depreciation	16000	16000	16000	16000	16000
(-)	Increase in W.C.	(480)	(518)	(560)	(605)	(653)
(-)	Loan repay	-	-	-	-	(6000)
(+)	Sale of subsidiary	-	-	-	-	2000
	Farland CF	28160	30196	32393	34767	33331
	Fx rate (Fr./₹)	2.63	2.76	2.89	3.04	3.19
	₹ CF	10707	10941	11209	11437	10449
	Tax in India (₹)	**(601)**	**(666)**	**(733)**	**(797)**	**(861)**
	Exports lost (₹)	(824)	(849)	(874)	(900)	(927)
	CF (in ₹)	9282	9426	9602	9740	8661
	PVF @ 12%	0.893	0.797	0.712	0.636	0.567
	PVCI (₹)	8289	7513	6837	6195	4911

NPV calculation **(₹ '000)**

- Initial investment (in ₹) = 80,000 x 1/2.50 = ₹ 32,000
- Total PVCI = 8289 + 7513 + 6837 + 6195 + 4911 = ₹ 33,745
- NPV = 33,745 – 32,000 = ₹ 1,745

WN 1 – Exchange rate calculation

0	2.50
1	2.50 x 1.05 = 2.63
2	2.50 x $(1.05)^2$ = 2.76
3	2.50 x $(1.05)^3$ = 2.89
4	2.50 x $(1.05)^4$ = 3.04
5	2.50 x $(1.05)^5$ = 3.19

WN 2 - Calculation of Tax paid in India **(Amount in '000)**

Year	**1**	**2**	**3**	**4**	**5**
PBT (Fr)	15800	18392	21191	24215	27480
Tax @ 10%	1580	1839	2119	2422	2748
Exchange rate	2.63	2.76	2.89	3.04	3.19
Tax in India (₹)	601	666	733	797	861

Discrete / Different Ques

Adjusted NPV method

 # Ques 10 – Dattatreya {N20 Exam (New), M23 MTP 2, N24 RTP}

The Management of an MNC Dattatreya ltd. is engaged in construction of Infrastructure Project. A proposal to construct a Toll Road in Nepal is under consideration of the management.

The following information is available:

- The initial investment will be in purchase of equipment costing USD 250 lakhs. The economic life of the equipment is 10 years. The depreciation on the equipment will be charged on straight line method.
- EBIDTA to be collected from the Toll Road is projected to be $33 lakhs p.a. for a period of 20 years.
- To encourage investment Nepalese government is offering a 15 year term loan of USD 150 lakhs at an interest rate of 6 per cent per annum. The interest is to be paid annually. The loan will be repaid at the end of 15 year in one tranche.
- The required rate of return for the project under all equity financing is 12 per cent per annum.
- Post tax cost of debt is 5.6 per cent per annum.
- Corporate Tax Rate is 30 per cent. All cash Flows will be in USD. Ignore inflation.

-> Advise the management on the viability of the proposal by using Adjusted NPV method.

Given: PVIFA (12%, 10) = 5.650, PVIFA 12%,20) = 7.469, PVIFA(8%,15) = 8.559, PVIF (8%, 15) = 0.315.

Ans: (i) Net Present Value (All Equity Financed) – Base NPV

Particular's	Period	US$	PVF @ 12%	PV (US$)	($ in Lacs)
Initial Investment	0	(250.00)	1.000	(250.000)	
EBIDTA	1 to 20	33.00	7.469	246.477	
Tax	1 to 20	(9.90)	7.469	(73.943)	
Depreciation	1 to 10	(25.00)			
Tax saving on Dep.	1 to 10	7.50	5.650	42.375	
NPV				(35.091)	

(ii) Present Value of Impact of Financing by Debt

Particular's	Period	US$	PVF @ 8%	PV (US$)
Loan	0	150	1.000	150.000
Interest	1 to 15	(9.00)	8.559	(77.031)
Tax Saving on Int.	1 to 15	2.70	8.559	23.109
Repayment of Principal	15	(150)	0.315	(47.250)
NPV				48.828

- Adjusted NPV = Base NPV + PV of Impact of Financing = –35.091 + 48.828 = US$ 13.737 Lacs

Advise: Since APV is positive, TL Ltd. should accept the project.

Alternatively, if instead of PV of overall impact of Financing the PV of impact of tax shield on Interest is considered then APV shall be computed as follows:

- Adjusted NPV = Base NPV + PV of Tax Shield on Interest = –35.091 + 23.109 = – $ 11.982 Lacs
- Advise: Since APV is negative, TL Ltd. should not accept the project.

Additional Questions

👉 NPV Calculation – Medium type questions

NPV under Home currency and Foreign currency approach

 # Ques 1 - Dhun Kun {M24 MTP 1}

Dhun Kun Ltd. (DK ltd) is considering an investment proposal in Sri Lanka involving an initial investment of LKR 25 billion. Current spot exchange rate is INR/LKR 0.370. The risk-free rate in India is 6% and the same in Sri Lanka is 5.02%.

The project will generate a cash flow of LKR 5 billion in the first year. The cash flow will increase by LKR 1 billion each year for the next 4 years. The project will wind up on completion of 5 years with no salvage value. Required rate of return for the project is 8%

(i) You are required to find out the investment worth of the project by using :

a) Home Currency Approach b) Foreign Currency Approach

(ii) Compare the outcome under both the approaches.

Ans: **# Home currency approach**

WN 1 - Calculation of forward exchange rates

Year 1 → 0.37 x 1.06 / 1.0502 = 0.373

Year 2 → 0.373 x 1.06 / 1.0502 = 0.376

Year 3 → 0.376 x 1.06 / 1.0502 = 0.379

Year 4 → 0.379 x 1.06 / 1.0502 = 0.382

Year 5 → 0.382 x 1.06 / 1.0502 = 0.385

#	Year	CF Billion (Lkr)	₹ / LKR	CF Billion (₹)	PVF @ 8%	PV Billion (₹)
	1	5	0.373	1.865	0.92593	1.7269
	2	6	0.376	2.256	0.85734	1.9342
	3	7	0.379	2.653	0.79383	2.1060
	4	8	0.382	3.056	0.73503	2.2463
	5	9	0.385	3.465	0.68058	2.3582
	Total :					10.3716
	Less: Investment = 25 x 0.37					(9.2500)
	NPV :					1.1216

(2) **Foreign Currency Approach**

- (1 + 0.06) (1+ Risk Premium) = 1.08
- 1 + Risk Premium = 1.08/1.06 = 1.01887

☞ Risk adjusted LKR Rate = 1.01887 × 1.0502 – 1 = 0.07 i.e. 7%

Calculating NPV

Year	Cash Flow (Billion LKR)	PVF @ 7%	PV (Billion LKR)
1	5	0.93457	4.6729
2	6	0.87344	5.2406
3	7	0.81630	5.7141
4	8	0.76290	6.1032
5	9	0.71299	6.4169
Total :			28.1477
Less: Investment: 25			(25)
NPV in Lkr :			3.1477

☞ Thus, Rupee NPV of the Project = 0.37 × 3.1477= ₹ 1.1646 billion

- Decision :- NPV is positive. Accept the project.

NPV when opportunity cost is given

Ques 2 – Bhrigu {Dec 21 Exam (New)}

Bhrigu ltd. a company based in India manufactures good quality of leather bags and sells to retail outlets in India and USA. The cost of quality leather in India is very high, the company is reviewing the proposal of importing of leather in bulk from USA supplier. The estimate of net US $ and Indian ₹ Currency Cash Flows in nominal terms for this proposal is given below:

	Net Cash Flow (in Lakh)			
Year	**0**	**1**	**2**	**3**
• In US $	(25)	5	7	8
• In ₹	0	60	80	90
• If not imported cost of leather to be purchased in India (in ₹)	400	450	500	600

Other information:

(i) Bhrigu Ltd. evaluates all investments by using discount rate of 9% p.a.

(ii) All US customers are invoiced in US $. US $ Cash flows converted into ₹ at the forward rate and discounted at Indian Rate.

(iii) Inflation in USA and India are expected to be 9% and 8% respectively.

(iv) The current exchange rate 1 US $ = ₹ 74

Calculate NPV and recommend the decision.

Ans: **Expected Forward Exchange Rates**

Year 1 = $74 (1.08) / 1.09$ = 73.32

Year 2 = $73.32 (1.08)^2 / 1.09^2$ = 72.65

Year 3 = $72.65 (1.08)^3 / 1.09^3$ = 71.98

#	NPV if leather is imported from US	Yr 0	Yr 1	Yr 2	Yr 3
•	Cash Flow in $ Lacs	(25)	5	7	8
•	Forward Rates (₹/$)	74	73.32	72.65	71.98
•	Cash Flows in ₹ Lakh	(1850)	366.6	508.55	575.84
•	Cost If leather not imported	(400)	(450)	(500)	(600)
•	Cash Flows in ₹ Lakh	--	60	80	90
»	Total Cash Flow ₹ Lakh	(2250)	(23.4)	88.55	65.84

• $NPV = (2250) + \frac{(23.4)}{1.09} + \frac{88.55}{1.09^2} + \frac{65.84}{1.09^3}$ = - ₹2146.09 lacs

• Decision: Proposal should not be accepted as NPV is negative.

NPV when all revenue, costs, working capital etc. are given in real terms

 # Ques 3 – Vishwas {M24 RTP}

Mr. Vishwas, a friend of Mr. Pramod who is one of the Directors of Ashirwad Limited, is a citizen of Mauritius. He along with Mr. Pramod incorporated a company "Aerious Private Ltd." in Mumbai. It is estimated that in equivalent terms the business shall require an initial investment of MUR 100 Million and thereafter MUR 2 Million each year will be needed as working capital fund.

• Info related to exchange rate and inflation rate is as follows:

• Spot Rate for 1 Mauritian Dollar (MUR) = 1.88 Indian Rupee (INR)

• The inflation in India is 6% and in Mauritius is 5%.

• It is expected that this inflation rate will remain unchanged for the next 4 years.

INR 8 Crore out of initial investment shall be required for setting up a plant. The useful life of

the plant is 4 years. At the end of 4th year estimated salvage value of this plant shall be INR 80 lakhs. Depreciation of the plant shall be charged on the basis of straight-line method.

40 % of the investment shall be through debt funds from Mauritius at the cost of 10% (post tax) while remaining funds shall be arranged by him and his friends. They expect a rate of return of 12% on their funds.

Expected revenues & costs (excluding depreciation) in real term are: (₹ crores)

Year:	1	2	3	4
Revenue:	6	7	8	8
Cost:	3	4	4	4

Assume that applicable tax rate in India is 30%. Since there is Double tax avoidance agreement between India and Mauritius, the company is not required to pay tax in Mauritius if tax has been paid in India.

The applicable inflation rates for revenues & costs are as follows:

Year	Revenues	Costs
1	10%	12%
2	9%	10%
3	8%	9%
4	7%	8%

Demonstrate whether this project is viable or not.

Notes: (1) Round off calculations upto 4 decimal points.

(2) Show INR calculations in Crore and MUR calculations in Million.

Ans: **WN 1 - Expected exchange rates**

Year 1 → 1.88 x 1.06 / 1.05 = 1.8979

Year 2 → 1.8979 x 1.06 / 1.05 = 1.9160

Year 3 → 1.9160 x 1.06 / 1.05 = 1.9342

Year 4 → 1.9342 x 1.06 / 1.05 = 1.9526

- **WN 2 – Nominal revenue (₹ crores)**

Year	Revenue	Revenue (Inflation Adjusted)
1	6	6 x 1.10 = 6.60
2	7	7 x 1.10 x 1.09 = 8.393

	3	8	8 x 1.10 x 1.09 x 1.08 = 10.3594
	4	8	8 x 1.10 x 1.09 x 1.08 x 1.07 = 11.0845

- **WN 3 – Nominal cost (₹ crores)**

Year	Cost	Cost (Inflation Adjusted)
1	3	3 x 1.12 = 3.3600
2	4	4 x 1.12 x 1.10 = 4.9280
3	4	4 x 1.12 x 1.10 x 1.09 = 5.3715
4	4	4 x 1.12 x 1.10 x 1.09 x 1.08 = 5.8012

- **WN 4 –** WACC = 40% x 10% + 60% x 12% = 11.20%

- **WN 5 – Working capital calculation**

Year	Amount in MUR	Amount in ₹
1	2 Mn	0.3796 crore
2	2 Mn	0.3832 crore
3	2 Mn	0.3868 crore
4	2 Mn	0.3905 crore

 # Annual CFs calculation (Amount in ₹ Crores, unless specified)

	Year	1	2	3	4
	Revenue	6.600	8.393	10.3594	11.0845
(-)	Cost	3.360	4.928	5.3715	5.8012
(-)	Depreciation	1.800	1.800	1.800	1.800
	PBT	1.440	1.665	3.1879	3.4833
	PAT = PBT x 0.7	1.008	1.1655	2.2315	2.4383
(+)	Depreciation	1.800	1.800	1.800	1.800
(-)	Working capital	(0.3796)	(0.3832)	(0.3868)	(0.3905)
(+)	Scrap value of m/c	-	-	-	0.8
(+)	WC released	-	-	-	1.5401
	CF (₹ crores)	2.4284	2.5823	3.6447	6.1879
	Exchange rate	1.8979	1.9160	1.9342	1.9526
	CF (Million MUR)	12.7952	13.4776	18.8434	31.6906
	PVF@11.20%	0.8993	0.8087	0.7273	0.6540
	PV (Million MUR)	11.5067	10.8993	13.7048	20.7257

- NPV = [11.5067 + 10.8993 + 13.7048 + 20.7257] – 100 = –MUR 43.1635 Million
- Decision -> NPV is negative. The proposal is not viable.

Long ques (relatively less imp)

 # Ques 4 - Its Entertainment {SM Illus}

Its Entertainment Ltd., an Indian Amusement Company is happy with the success of its Water Park in India. The company wants to repeat its success in Nepal also where it is planning to establish a Grand Water Park with world class amenities. The company is also encouraged by a marketing research report on which it has just spent ₹20,00,000 lacs.

Estimated cost of construction would be Nepali Rupee (NPR) 450 crores and it would be completed in one year time. Half of the construction cost will be paid in the beginning and rest at the end of year. In addition, working capital requirement would be NPR 65 crores from the year 1 end. The after-tax realizable value of fixed assets after four years of operation is expected to be NPR 250 crores. Under the Foreign Capital Encouragement Policy of Nepal, company is allowed to claim 20% depreciation allowance per year on reducing balance basis subject to maximum capital limit of NPR 200 crore. The company can raise loan for theme park in Nepal @ 9%.

The water park will have a maximum capacity of 20,000 visitors per day. On an average, it is expected to achieve 70% capacity for first operational four years. The entry ticket is expected to be NPR 220per person. In addition to entry tickets revenue, the company could earn revenue from sale of food and beverages and fancy gift items. The average sales expected to be NPR 150 per visitor for food and beverages and NPR 50 per visitor for fancy gift items. The sales margin on food and beverages and fancy gift items is 20% and 50% respectively. The Park would open for 360 days a year.

Annual staffing cost would be NPR 65 crores per annum. The annual insurance cost would be NPR 5 crores. The other running and maintenance costs are expected to be NPR 25 crores in the first year of operation which is expected to increase NPR 4 crores every year. The company would apportion existing overheads to the tune of NPR 5 crores to the park.

All costs and receipts (excluding construction costs, assets realizable value and other running and maintenance costs) mentioned above are at current prices (i.e., 0 point of time) which are expected

to increase by 5% per year.

The current spot rate is NPR 1.60 per rupee. The tax rate in India is 30% and in Nepal it is 20%.

The average market return is 11% and interest rate on treasury bond is 8%. The company's current equity beta is 0.45. The company's funding ratio for the Water Park would be 55% equity and 45% debt. Being a tourist Place, the amusement industry in Nepal is competitive and very different from its Indian counterpart. The company has gathered the relevant information about its nearest competitor in Nepal. The competitor's market value of the equity is NPR 1850 crores and the debt is NPR 510 crores and the equity beta is 1.35.State whether Its Entertainment Ltd. should undertake Water Park project in Nepal or not.

Ans:

	Calculating Cash flow p.a.	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**
	Total revenue (WN 1)	152.81	160.45	168.47	176.89
(-)	Annual staffing cost	71.66	75.25	79.01	82.96
(-)	Annual insurance cost	5..51	5.79	6.08	6.38
(-)	Other running costs	25	29	33	37
(-)	Depreciation (WN 2)	40	32	25.60	20.48
=	PBT	10.64	18.41	24.78	30.07
	PAT = PBT x (1-0.2)	8.51	14.73	19.82	24.06
(+)	Depreciation	40	32	25.60	20.48
(±)	Working capital adjustment	(3.25)	(3.41)	(3.58)	75.25
(+)	**After tax asset value**				**250**
=>	**Net cash flow**	**45.26**	**43.32**	**41.84**	**369.79**

- NPV = PVCI – PVCO = $\frac{45.26}{1.1051} + \frac{43.32}{1.1051^2} + \frac{41.84}{1.1051^3} + \frac{369.79}{1.1051^4} - 487.45 = -165.79$

- The project has a negative NPV of -NPR 165.79 crores. It is financially not feasible.

WN 1:	**Total revenue per year**	**Year 2**	**Year 3**	**Year 4**	**Year 5 (in NPR)**
	Entry price/visitor	242.55	254.68	267.41	280.78
	Profit on food sale	33.08	34.73	36.47	38.29
	Profit on fancy items	27.56	28.94	30.39	31.91
»	Total revenue/visitor	303.19	318.35	334.27	350.98
x	Annual visitors (lacs)	50.40	50.40	50.40	50.40
»	Total revenue (crores)	152.81	160.45	168.47	176.89

WN 2:	**Year**	**Opening Bal.**	**Depreciation**	**Closing Bal.** **(NPR Crores)**
	1	200	40	160
	2	160	32	128
	3	128	25.60	102.40
	4	102.40	20.48	81.92

WN 3: **Cost of Capital**

Step i – Calculate Bu using competing (proxy) firm.

$B_L = Bu [1 + \frac{Debt (1 - tax)}{Equity}]$

Where B_L = Levered beta & Bu = unlevered beta

$1.35 = Bu [1 + \frac{510 (1 - 0.2)}{1850}]$ => Bu = 1.106

Step ii – Calculate Levered beta

$B_L = 1.106 [1 + \frac{45 (1 - 0.3)}{55}] = 1.74$

Step iii – Cost of Equity = $R_F + (R_M - R_F) \times Beta = 8 + (11 - 8)\ 1.74 = 13.22\%$

Step iv – WACC =13.22% x 0.55 + 9% (1 – 0.2) x 0.45 = 10.51%

WN 4: PV of cash outflow i.e. PVCO (in NPR crores)

Year 0 = 225

Year 1 = 225 + 65 = 290

PVCO = 225 + 290/1.1051 = 487.45

 # Ques 5 - Perfect Inc **{SM Illus, Dec 21 MTP 2 (Old)}**

Perfect Inc., a U.S. based Pharmaceutical Company has received an offer from Aidscure Ltd., a company engaged in manufacturing of drugs to cure Dengue, to set up a manufacturing unit in Baddi (H.P.), India in a joint venture.

As per the Joint Venture agreement, Perfect Inc. will receive 55% share of revenues plus a royalty @ US $0.01 per bottle. The initial investment will be ₹200 crores for machinery and factory. The

scrap value of machinery and factory is estimated at the end of five years to be ₹5 crores. The machinery is depreciable @ 20% on the value net of salvage value using Straight Line Method. An initial working capital to the tune of ₹50 crores shall be required and thereafter ₹5 crores each year.

As per GOI directions, it is estimated that the price per bottle will be ₹7.50 and production will be 24 crores bottles per year. The price **in addition to inflation** of respective years shall be increased by ₹1 each year. The production cost shall be 40% of the revenues. The applicable tax rate in India is 30% and 35% in US and there is Double Taxation Avoidance Agreement between India and US. According to the agreement tax credit shall be given in US for the tax paid in India. **In both the countries, taxes shall be paid in the FOLLOWING YEAR in which profit have arisen/ remittance received**. The Spot rate of $ is ₹57. The inflation in India is 6% (expected to decrease by 0.50% every year) and 5% in US.

As per the policy of GOI, only 50% of the share can be remitted in the year in which they are realised and remaining in the following year.

Though WACC of Perfect Inc. is 13% but due to risky nature of the project it expects a return of 15%. Determine whether Perfect Inc. should invest in the project or not (From subsidiary point of view).

Ans: Initial Cash outflow = Investment in PPE + Working cap requirements = 200 + 50 = ₹250 crores

- Amount in $ = 250 crores / 57 = $4.386 crores or $43.86 Mn

#	**Net Cash flows remitted to parent (in ₹ crores, unless specifically mentioned otherwise)**						
	Year	**1**	**2**	**3**	**4**	**5**	**6**
A.	Total Income (WN 5)	118.75	132.28	145.61	158.61	171.55	-
B.	Prod Cost (WN 5)	(41.98)	(47.36)	(52.69)	(57.2)	(63.15)	-
C.	Working Capital	(5)	(5)	(5)	(5)	**70**	-
D.	Scrap Value	-	-	-	-	5	-
E.	Tax paid (WN 5)	-	(11.33)	(13.78)	(16.18)	(18.51)	(20.82)
F.	Free CF	71.77	68.59	74.15	79.51	164.89	(20.82)
G.	Remit: CY 50%	35.89	34.29	37.07	39.76	82.45	-
H.	Remit: PY 50%	-	35.88	34.30	37.08	39.75	82.44
I.	Total Remittance	35.88	70.17	71.37	76.84	122.20	61.62
J.	Exchange Rate (WN 1)	57.54	57.82	57.82	57.54	56.99	56.18
K.	Remittance: $Mn	6.24	12.14	12.34	13.35	21.44	10.97
L.	US tax (WN 6)	-	(0.22)	(1.87)	(1.51)	(1.42)	(3.79)
M.	Net CF ($ Mn)	6.24	11.92	10.47	11.84	20.02	7.18

PVCI = $\frac{6.24}{1.15^1} + \frac{11.92}{1.15^2} + \frac{10.47}{1.15^3} + \frac{11.84}{1.15^4} + \frac{20.02}{1.15^5} + \frac{7.18}{1.15^6} + \frac{\textbf{-3.84*}}{1.15^7}$ = $ 39.71 Mn

*Tax of 6th year's remittance is paid in 7th year.

NPV = PVCI – PVCO = 39.71 - 43.86 = –$4.15 Mn

- Since NPV is negative, project should not be accepted.

WN 1: Estimated Exchange Rates (Using PPP Theory)

- ₹/$ Forward rate = Spot rate x $\frac{(1 + ₹ \text{ Inflation})}{(1 + \$ \text{ Inflation})}$

Year	0	1	2	3	4	5	6
Price Inflation Rate	-	6%	5.5%	5%	4.5%	4%	3.5%
Exchange rate	57	57.54	57.82	57.82	57.54	56.99	56.18

WN 2: Calculating Sales share

	Year	1	2	3	4	5
A.	Annual Units in crores	24	24	24	24	24
B.	Price per bottle w/o inflation (₹)	7.50	8.50	9.50	10.50	11.50
C.	Inflation	6%	5.5%	5%	4.5%	4%
D.	Inflated Price per bottle (₹)	7.95	8.97	9.98	10.97	11.96
E.	Total Revenue (₹ Crores)	190.80	215.28	239.52	263.28	287.04
F.	Sales share @ 55%	104.94	118.40	131.74	144.80	157.87

WN 3: Calculating Royalty

	Year	1	2	3	4	5
A.	Royalty = $0.01 x 24 ($ crores)	0.24	0.24	0.24	0.24	0.24
B.	Exchange Rate (WN 1)	57.54	57.82	57.82	57.54	56.99
C.	Total Royalty (₹ Crore) : E×F	13.81	13.88	13.88	13.81	13.68

WN 4: Tax Liability in India (All amounts are in ₹ Crore, unless specifically mentioned otherwise)

	Year	1	2	3	4	5	6
A.	Sales share (WN 3)	104.94	118.40	131.74	144.80	157.87	-
B.	Royalty (WN 4)	13.81	13.88	13.88	13.81	13.68	-

C.	Total Income: A+B	118.75	132.28	145.61	158.61	171.55	-
D.	Prod. Cost: A×0.4	41.98	47.36	52.69	57.2	63.15	-
E.	Dep. (195 x 20%)	39.00	39.00	39.00	39.00	39.00	-
F.	PBT = C – D – E	37.77	45.92	53.92	61.69	69.40	-
G.	Tax @ 30%	11.33	13.78	16.18	18.51	20.82	-
H.	**Tax cash outflow**	**-**	**11.33**	**13.78**	**16.18**	**18.51**	**20.82**
I.	Exchange rate	57.54	57.82	57.82	57.54	56.99	56.18
J.	Tax amount ($ Mn)	-	(1.96)	(2.38)	(2.82)	(3.25)	(3.71)

WN 5: Calculation of Tax paid in US **(Amounts in $ Mn)**

Year	1	2	3	4	5	6	7
Remittance	6.24	12.14	12.34	13.35	21.44	10.97	-
US Tax @ 35%	-	2.18	4.25	4.32	4.67	7.50	3.84
Indian Tax (WN 5)	-	(1.96)	(2.38)	(2.82)	(3.25)	(3.71)	-
Net Tax	-	0.22	1.87	1.51	1.42	3.79	**3.84**

 # Ques 6 - Opus Technologies **{SM Illus}**

Opus Technologies Ltd., an Indian IT company is planning to make an investment through a wholly owned subsidiary in a software project in China with a shelf life of two years. The inflation in China is estimated as 8 percent. Operating cash flows are received at the year end.

For the project an initial investment of Chinese Yuan (CN¥) 30,00,000will be in land. The land will be sold after the completion of project at estimated value of CN¥ 35,00,000. The project also requires an office complex at cost of CN¥ 15,00,000 payables at the beginning of project. The complex will be depreciated on straight-line basis over two years to a zero-salvage value. This complex is expected to fetch CN¥ 5,00,000 at the end of project. The company is planning to raise the required funds through GDR issue in Mauritius. Each GDR will have 5 common equity shares of the co. as underlying security which are currently trading at ₹200per share (Face Value = ₹10) in the domestic market. The company has currently paid the dividend of 25% which is expected to grow at 10% p.a. The total issue cost is estimated to be 1 percent of issue size.

The annual sales are expected to be 10,000 units at the rate of CN¥ 500 per unit. The price of unit is expected to rise at the rate of inflation. Variable operating costs are 40% of sales. Fixed operating costs will be CN¥ 22,00,000 per year and expected to rise at the rate of inflation.

The tax rate applicable in China for income and capital gain is 25% and as per GOI Policy no further tax shall be payable in India. The current spot rate of CN¥ 1 is ₹9.50. The nominal interest rate in India and China is 12% and 10% respectively and the international parity conditions hold.

You are required to

(a) Identify expected future cash flows in China and determine NPV of the project in CN¥.

(b) Determine whether Opus Technologies should go for the project or not assuming that there neither there is restriction on the transfer of funds from China to India nor any charges/taxes payable on the transfer of funds.

Ans: Working Notes:

1. **Calculation of Cost of Capital (GDR) (Ke)**

$K_e = \frac{(2.50 \times 1.10)}{200 \times 0.99} + 0.10 = 0.1139$ i.e., 11.39%

2. **Calculation of Expected Exchange Rate as per Interest Rate Parity**

Year 1 = $9.50 \times 1.12/1.10 = 9.67$

Year 2 = $9.5 \times 1.12^2/1.10^2 = 9.85$

3.	**CF from sale of Land & Office**	**CN ¥**
A.	**Net CF from sale of Land**	
•	Sale value at the end of project	35,00,000
•	Capital gain tax = (35,00,000 – 30,00,000) x 25%	(1,25,000)
»	Amount net of tax (A)	33,75,000
B.	**Net CF from sale of office**	
•	Sale value at the end of project	5,00,000
•	Capital gain tax = (5,00,000 – 0) x 25%	(1,25,000)
»	Amount net of tax (A)	3,75,000
C.	**Total CF from sale of land & office = A + B**	**37,50,000**

Note: Capital gain tax = (Sale value – WDV) x Tax %

4. **Computation of Annual Cash Inflows**

Year	**1**	**2**

	Annual Units	10000	10000
	Price per bottle (CN¥)	540.00	583.20
	Annual Revenue (CN¥)	5400000	5832000
(-)	Expenses		
	Variable operating cost (CN¥)	2160000	2332800
	Depreciation (CN¥)	750000	750000
	Fixed Cost per annum (CN¥)	2376000	2566080
	PBT (CN¥)	114000	183120
	Tax on Profit (CN¥)	28500	45780
	Net Profit (CN¥)	85500	137340
	Add: Depreciation (CN¥)	750000	750000
	Cash Flow from operations	835500	887340
(+)	Disposal of land & office complex (net of tax)	-	37,50,000
»	Net Cash flow	8,35,500	46,37,340

(a)	**Computation of NPV of the project in CN¥** **(CN¥)**	
A.	Initial investment (PVCO)	(45,00,000)
B.	PVCI = {8,35,500 x 0.898} + {46,37,340 x 0.806}	44,87,975
C.	NPV = B – A	(12,025)

(b) **Evaluation of Project from Opus Point of View**

(i) Assuming that funds are transferred in the year in which same are generated i.e., 1st yr and 2nd yr.

Year	**0**	**1**	**2**
Cash Flows (CN¥)	-45,00,000	8,35,500	46,37,340
Exchange Rate (₹/ CN¥)	9.50	9.67	9.85
Cash Flows (₹)	-4,27,50,000	80,79,285	4,56,77,799
PVF @ 12%	1.00	0.893	0.797
	-4,27,50,000	72,14,802	3,64,05,206
NPV			8,70,008

(ii) Assuming that inflow funds are transferred at the end of the project i.e., second year.

Year	**0**	**2**
Cash Flows (CN¥)	-45,00,000	54,72,840
Exchange Rate (₹/ CN¥)	9.50	9.85
Cash Flows (₹)	-4,27,50,000	5,39,07,474

	PVF	1.00	0.797
		-4,27,50,000	4,29,64,257
	NPV		2,14,257

Though in terms of CN¥ the NPV of the project is negative but in ₹ it has positive NPV due to weakening of ₹ in comparison of CN¥. Thus, Opus can accept the project.

👉 Low Probability Unique Questions

Foreign borrowing cost (with hedging)

 # Ques 7 – Shuka {M19 Exam (New)}

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

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

Shuka Ltd. also entered into a GBP-INR hedge at 1 GBP = INR 90 to cover the exposure on account of the above ECB Loan and the cost of the hedge is coming to 4.00% p.a. As a Finance Manager, given the above information and taking the 1 GBP = INR 90:

i) Calculate the overall cost both in percentage and rupee terms on an annual basis.

ii) What is the cost of hedging in rupee terms?

iii) If Shuka Ltd. wants to pursue an aggressive approach, what would be the net gain/loss for Shuka Ltd. if the INR depreciates/appreciates against GBP by 10% at the end of the 5 years assuming that the loan is repaid in GBP at the end of 5 years?

Ans: **(i) Calculating annual cost p.a.**

•	Upfront fee paid = 10 Mn x 1.2%	£ 1,20,000
•	Interest cost = 10 Mn x (2.5 + 1.05)% x 3.4	£ 12,07,000
•	Hedging cost = 10 Mn x 4% x 3.4	£ 13,60,000
»	Total cost of loan in GBP	£ 26,87,000

»	Cost p.a. = Total cost/Avg. loan life = 26,87,000/3.4				£ 7,90,294
•	Annual cost in ₹ = £7,90,294 x 90				₹ 7,11,26,460
•	Annual cost % (in ₹ terms) = 7,11,26,460 / 90 crores				7.903% p.a
Note:	Alternatively, Annual cost % =	Interest cost p.a.	=	7,11,26,460	= 8% p.a.
		Net loan proceeds		90 crores x (1 – 0.012)	
(ii)	**Total cost of hedging**				
•	In £				£ 13,60,000
•	In ₹ = 13,60,000 x 90				₹ 12,24,00,000
•	Annual hedging cost = 12.24 crores/3.4				₹ 3,60,00,000

(iii)	Particulars	Hedged	No Hedge	
	(Amt. in crores)	@ ₹90/£	₹99/£	₹81/£
•	Repay loan	₹ 90	₹99	₹81
		(£ 1 x 90)	(£ 1 x 99)	(£ 1 x 81)
•	Hedging cost*	₹3.6	-	-
•	Total out flows	₹93.6	₹99	₹81

#	**Impact of not hedging**
•	If ₹ depreciates = 99 – 93.6 = ₹5.4 crores additional outflow.
•	If ₹ appreciates = 81 – 93.6 = ₹12.6 crores of savings.

Ch 12 - IRRM

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	***Ques Number***
Forward Rate Agreement (FRA)	1 – 2
Interest rate options / Guarantees (IRG)	3 – 7
Swaps	8 – 11
Comparative Advantage Theory (CAT)	12
Swap Valuation	13
Interest rate futures (IRF)	14
Currency Swaps	15 – 16

Index - Additional Questions	***Ques Number***
Forward Rate Agreement (FRA)	1
Interest rate options / Guarantees (IRG)	2
Swaps	3
Interest Rate futures	4 – 5
Currency Swaps	6
Low Probability – Unique Questions	
- Converting floating rate to fixed rate using "Hybrid instrument"	7
- Calculating PV of savings from Swap	8
- Using swap to hedge in case of Floating rate "Assets"	9
- Calculating value of swap in case of counterparty default	10
- Using IRF to hedge borrowing cost	11

Main Questions

👉 Forward Rate Agreement (FRA)

Hedging borrowing cost using FRA

 # Ques 1 - Parker & Co {SM TYK, N18 RTP (New), N19 Exam (New), N22 MTP 2}

Parker & Co. is contemplating to borrow an amount of ₹60 crores for a period of 3 months in the coming 6 months from now. Current interest rate is 9% p.a., but it may go up in 6 months. The co. wants to hedge itself against any increase in interest rate. Bankers have quoted an FRA at 9.30% p.a. What will be the effect of FRA and rate of interest cost incurred by the co. if: Actual interest rate after 6 months happens to be (i) 9.60% p.a. (ii) 8.80% p.a.?

Ans:

Particular's	(i) Int = 9.6% p.a.	(ii) Int = 8.80% p.a.
• Interest on Loan (60 x Int % x 3/12)	(1.44)	(1.32)
• FRA Settlement [60 x (Int % - 9.30%) x 3/12]	0.045	(0.075)
• Net Interest payable	(1.395)	(1.395)

∴ Interest cost incurred by Co. = (1.395 / 60) x 12/3 = 9.30% p.a.

WN 1 - Long FRA Settlement (in arrears) = Principal x (Ref. rate – FRA rate) x months/12

Calculating FRA rate + Arbitrage opportunity

 # Ques 2 – Eicher {M18 RTP (New)}

The following market data is providing by Eicher bank

Deposit rates p.a.	USD	JYP
3 months	4.50%	0.25%
6 months	5.00%	0.25%

Forward Rate Agreement for Yen is nil.

i) What should be the 3 months FRA at 3 months forward for USD?

ii) The 6 & 12-month's LIBOR are 5% & 6.50% respectively. A bank is quoting 6x12 USD FRA at 6.50% - 6.75%. Is any arbitrage opportunity available? Calculate profit in such cases.

Ans: Forward rate = $\left(\frac{\text{Longer effective yield}}{\text{Shorter effective yield}} - 1\right) \times \frac{12}{\text{Period of FRA}}$

(i) **3x6 FRA rate** = $\left[\frac{(1 + 0.05 \times 6/12)}{(1 + 0.045 \times 3/12)} - 1\right] \times \frac{12}{3}$ = 5.4388% p.a.

(ii) **Calculating price of 6/12 FRA**

Forward rate = $\left[\frac{(1 + 0.065 \times 12/12)}{(1 + 0.05 \times 6/12)} - 1\right] \times \frac{12}{6}$ = 7.80% p.a.

FRA quote by bank is 6.50-6.75%, so there is an arbitrage opportunity.

Constructing arbitrage (assuming notional principal = $10,000)

Today:

- Borrow $10,000 for 6 months (@ 5% p.a.) and Long 6x12 FRA (@ 6.75% p.a.).
- Invest this $10,000 for 1 year (@ 6.5% p.a.)

After 1 year:

• Total inflow: $10,000 x (1 + 0.065)	10,650
• Total outflow: $10,000 x (1 + 0.05×6/12) (1 + 0.0675×6/12)	(10,596)
• Net inflow i.e., arbitrage profit	54

» An arbitrage profit of $54 can be earned (on a notional of $10,000).

» or we can say profit / $ = 54/10,000 = $0.0054

AUTHOR NOTE 1 : WRONG QUESTION

- This line written in question is wrong → "Forward Rate Agreement for Yen is nil."
- Logic → FRA rate of yen should be == $\left[\frac{(1 + 0.0025 \times 6/12)}{(1 + 0.0025 \times 3/12)} - 1\right] \times \frac{12}{3}$ = 0.25% p.a.
- But since this does not affect the question, so our above answer is (where we calculated FRA rate of $ and constructed arbitrage) is completely correct. No changes required there.

BIG BUMMER!!

In one variation of ques (asked in some MTP/RTP), ICAI asked "Whether forward rate of Yen should be Nil". And in Answer it wrote "Yes, Forward rate of Yen should be Nil". Jai Ho!! 🙏

Interest rate options / Guarantees (IRG)

Hedging borrowing cost using IRG

 # Ques 3 – Vasishta {SM TYK, N20 MTP 1 (New), N20 MTP 1 (Old), N22 RTP}

Vasishta Ltd. borrows £ 15 million of 6 months LIBOR + 10% for a period of 24 months. The company anticipates a rise in LIBOR, hence it proposes to buy a Cap Option from its Banker at the strike rate of 8%. The lump sum premium is 1.00% for the entire reset periods and the fixed rate of interest is 7% p.a. The actual position of LIBOR during the forthcoming reset period is as under:

Reset Period -	1	2	3
Libor -	9.00%	9.50%	10.00%

You are required to show how far interest rate risk is hedged through Cap Option.

Ans: **(i) Calculating premium per period**

- Lumpsum option premium quoted = 15 Mn x 1% £ 150,000
- Option premium per period = £150,000 ÷ PVAF (**3.5%**, 4) £ 40,838
- Imp!! Discount rate used is 6-monthly rate = 7%/2 = 3.5%

Period	Interest paid	Cap Payoff	Option premium	Net profit from cap
1	(14,25,000)	75,000	(40838)	34,162
2	(14,62,500)	1,12,500	(40838)	71,662
3	(15,00,000)	1,50,000	(40838)	1,09,162
		£ 3,37,500	£ 122514	£ 214,986

- Total savings due to cap option = £ 214,986

(Extra Note for knowledge – Had the co. not taken the cap option, it would have to pay an additional interest of £337,500)

Hedging borrowing cost using IRG

 # Ques 4 – Devapi {SM TYK, Dec 21 MTP 2 (Old), M22 RTP, M23 MTP 2, N23 MTP 1, M24 Exam}

Devapi, A textile manufacturer has taken floating interest rate loan of 40,00,000 on 1st April, 2012. The rate of interest at the inception of loan is 8.5% p.a. Interest is to be paid every year on 31st March and the duration of loan is 4 years. In October 2012, RBI released the following projections about the interest rates likely to prevail in future as:

Date:	31/3/13	31/3/14	31/3/15	31/3/16
Interest:	8.75%	10%	10.5%	7.75%

(i) Show how the borrower can hedge the risk arising out of expected rise in the rate of interest when he wants to peg his interest cost at 8.5% p.a.

(ii) Assume the premium negotiated by both the parties is 0.75% to be paid on 1st Oct,2012. The actual interest rates happen to be as:

Date:	**31/3/13**	**31/3/14**	**31/3/15**	**31/3/16**
Interest:	**10.2%**	**11.5%**	**9.25%**	**8.25%**

Show how settlement will be executed on the respective due dates.

(iii) State whether this option is advantageous when compared to Interest Rate Collar option. Explain

Ans: (i) The Borrower can hedge his interest rate risk by entering into an interest rate cap with following parameters:

- Strike rate = 8.5%
- Notional amount = 40 lacs
- Settlement = Yearly settlement on 31st March every year.
- Reference rate = Rate applicable to this loan.
- Duration = Till 31st March, 2016

(ii) Premium paid today (lumpsum) = 40 lacs x 0.75% = 30,000

Payoff = Max {Notional x (Reference rate - Cap rate) x months /12, 0}

Date	Interest paid	Cap payoff	Net interest cost
31-3-13	40L x 10.2% = 4.08L	40L x (10.2 – 8.5)% = 68,000	3,40,000
31-3-14	40L x 11.5% = 4.6L	40L x (11.5 – 8.5)% = 120,000	3,40,000
31-3-15	40L x 9.25% = 3.7L	40L x (9.25 – 8.5)% = 30,000	3,40,000
31-3-16	40L x 8.25% = 3.3L	Nil (as reference rate < Cap rate)	3,30,000

- Clearly, entering into cap helps to peg the interest cost as the maximum cost under any scenario is ₹3,40,000 i.e. 3.4L / 40L = 8.5% p.a. So the cost is pegged at 8.5% p.a.

(iii) Comparing to Interest Rate Collar, Cap Option appears to be better because even though Collar may not involve initial outflow of cash on account of Premium but selling Put Option at 8.5% can lead to cash outflow if interest rate goes below 8.5%.

Hedging borrowing cost using IRG + Calculating FRA rate

 # Ques 5 – Janaka **{M19 RTP (Old), N19 RTP (New), Dec 21 MTP 1 (Old)}**

Two companies ABC ltd. and XYZ ltd. approach the Janaka bank for FRA. They want to borrow a sum

of ₹100 crores after 2 years for 1 year. Bank has calculated yield curve of both the Co.'s as:

Year	XYZ ltd.	ABC ltd.
1	3.86%	4.12%
2	4.20%	5.48%
3	4.48%	5.78%

Difference in yield curve is due to lower credit rating of ABC ltd. as compared to XYZ ltd.

i) Calculate 2x3FRA rate that will be quoted to the two companies.

ii) Suppose bank offers interest rate guarantee for a premium of 0.1% of the amount of loan, you are required to calculate the interest payable by XYZ ltd. if interest after 2 years turn out to be:

(a) 4.50% (b) 5.50%

Ans: Forward rate = $\left(\frac{\text{Longer effective yield}}{\text{Shorter effective yield}} - 1\right) \times \frac{12}{\text{Period of FRA}}$

i) 2x3 FRA for XYZ = $\frac{(1 + 0.0448)^3}{(1 + 0.0420)^2} - 1 = 5.042\%$ p.a.

2x3 FRA for ABC = $\frac{(1 + 0.0578)^3}{(1 + 0.0548)^2} - 1 = 6.382\%$ p.a.

(ii) Interest rate guarantee (IRG) in case of XYZ ltd.

Strike price of IRG is not given. Assuming it = FRA rate quoted by bank. i.e., strike price = 5.04%

Particulars	4.50%	5.50%
Interest cost	100 x 4.5% = (4.5)	100 x 5.5% = (5.5)
Cap payoff	Nil	100 x (5.5-5.04)% = 0.46
Option Premium	100 x 0.1% = (0.1)	100 x 0.1% = (0.1)
Net Interest cost	4.60 crores	5.14 crores

Using Cap vs Collar vs Unhedged in case of Floating rate borrowing

 # Ques 6 - Fast Strike

Fast Strike ltd. has a floating rate loan raised at LIBOR + 30 bps. It is now afraid of an increase in interest rates and wants to hedge its exposure. It has been offered 2 alternatives by its bankers.

a) Buy Cap option against LIBOR with strike=6%. Premium=0.4% p.a.

b) Buy a zero-cost collar with cap of 6.2% and floor of 4.8%.

The treasury department of the co. forecasts the following interest rates (LIBOR) in the next 4 years.

Date:	1/1/23	1/1/24	1/1/25	1/1/26
LIBOR:	6.1%	6.5%	5.4%	4.7%

You are required to advice company as to whether it should keep the exposure unhedged or buy cap option or the collar. For this purpose calculate the average cost under each of the alternate.

Ans: **Slip point: compare option strike rate with LIBOR only (not L + 0.3%)**

Case I – When Cap is purchased

LIBOR	LIBRO + 30 bps	Cap payoff	Cap premium	Net Interest cost
6.1%	6.4%	(0.1%)	0.4%	6.7%
6.5%	6.8%	(0.5%)	0.4%	6.7%
5.4%	5.7%	Nil	0.4%	6.1%
4.7%	5%	Nil	0.4%	5.4%
			Average cost =	6.225%

Case II – When Collar is purchased

LIBOR	LIBRO + 30 bps	Cap payoff	Floor payoff	Net Interest cost
6.1%	6.4%	Nil	Nil	6.4%
6.5%	6.8%	(0.3%)	Nil	6.5%
5.4%	5.7%	Nil	Nil	5.7%
4.7%	5%	Nil	0.1%	5.1%
			Average cost =	5.925%

Case III – If exposure is left unhedged

Average cost = (6.4% + 6.8% + 5.7% + 5%) ÷ 4 = 5.975%

Calculating Net interest cost under Collar strategy

 # Ques 7 - Mega Petro Diesel {M19 RTP (New), May 22 Exam}

Mega Petro Diesel (MPD) Ltd. issues a ₹50 Million Floating Rate Loan on July 1, 2018 with resetting of coupon rate every 6 Months equal to LIBOR + 50 bps.

MPD is interested in an Interest rate Collar Strategy of selling a Floor and buying a cap. MPD buys the 3 years cap and sell 3 years Floor as per the following details on July 1, 2018:

Principal Amount	₹ 50 Million
Strike Rate	5% for Floor & 8% for Cap

	Reference Rate	6 months LIBOR					
	Premium	NIL, since premium paid for cap = premium received for Floor					
	The Reset dates & Interest rates p.a., on that dates are:						
	Reset Date	31/12/2018	30/06/2019	31/12/2019	30/06/2020	31/12/2020	30/06/2021
	LIBOR (%)	7.00	8.00	6.00	4.75	4.25	5.25

Using the above data, you are required to determine:

(i) Effective Interest paid out at each six reset dates, (Round off to the nearest rupee)

(ii) Average overall effective rate of interest p.a. (round off to 2 decimals)

A: (i) The pay-off of each leg shall be computed as follows:

Call payoff = Max {Notional(Reference rate - Cap rate) x n/365, 0}

Floor payoff = Max {Notional x (Floor rate - Ref. rate) x n/365, 0}

Statement showing effective interest on each payment date

Reset date	LIBOR (%)	Payment date	Days	Interest paid (₹)	Cap payoff	Floor pay-off	Effective Interest
31-12-18	7	30-06-19	181	18,59,589	0	0	18,59,589
30-06-19	8	31-12-19	184	21,42,466	0	0	21,42,466
31-12-19	6	30-06-20	**182**	16,16,120	0	0	16,16,120
30-06-20	4.75	31-12-20	184	13,19,672	0	62,842	13,82,514
31-12-20	4.25	30-06-21	181	11,77,740	0	1,85,959	13,63,699
30-06-21	5.25	31-12-21	184	14,49,315	0	0	14,49,315
Total:			**1096**				**98,13,703**

- Average Annual Effective Interest Rate = $\frac{98,13,703}{5,00,00,000} \times \frac{365}{1096} \times 100 = 6.54\%$

Swaps

Using IRS for converting Floating rate into Fixed rate

 # Ques 8 – Shinewood

Shinewood ltd (SWL) can borrow at either fixed rate of 8.2% or at floating rate of Libor + 1.5%.

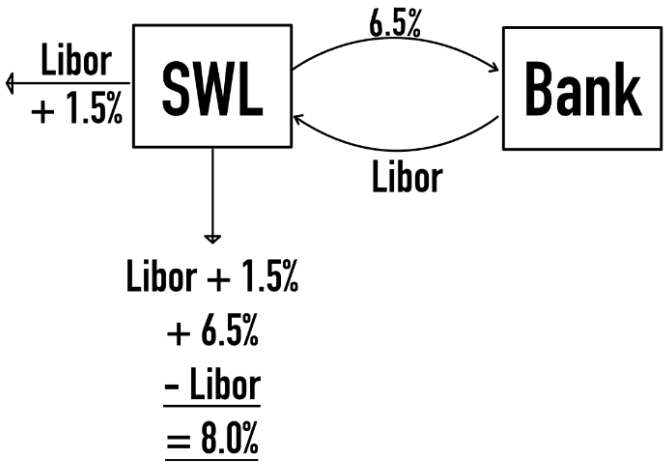
The co. wants to borrow at fixed rate only. An Interest rate swap (IRS) against Libor is available with a price of 6.5%. Can it be used to reduce the borrowing cost of the co.

Ans: **Option 1**: Borrow at fixed rate of 8.2% p.a.

Option 2: Borrow at floating rate & use IRS to convert it into fixed.

Effective rate = Libor + 1.5% + 6.5% - Libor = 8% p.a.

Hence, we can use IRS to reduce the borrowing cost.



Generic – Fixed for floating swap

 # Ques 9 – Nagato {SM TYK, N18 Exam (New), Jul 21 Exam (New), M23 RTP, M24 MTP 1}

Suppose a dealer Mr. Nagato quotes 'All in cost' for a generic swap at 8% against 6m LIBOR flat. If the notional principal amount of swap is ₹5,00,000, Calculate:

(i) Calculate semi-annual fixed payment using 180 days.

(ii) Calculate floating rate payment LIBOR was 6% using 181 days.

(iii) Calculate amount of net settlement and how much the fixed rate payer would pay to the floating rate payer? Assume 360 days.

Ans: (i) Fixed leg payment = 500,000 x 8% x 180/360 = ₹20,000

(Note – Day count convention for fixed leg is 30/360)

(ii) Floating leg payment = 500,000 x 6% x 181/360 = ₹15,083.33

(Note – Day count convention for floating leg is Actual/360)

(iii) Net payment of fixed payer = Fixed leg payment – Floating = 20,000 – 15,083.33 = ₹ 4916.67

Overnight Index Swap

 # Ques 10 - Derivative Bank {SM TYK, M18 Exam, N22 MTP1, N23 MTP2, M24 MTP2, N24 RTP}

Derivative Bank entered in to a swap through on OIS (Overnight Index Swap) on a principal of ₹ 10 crores and agree to receive MIBOR floating rate for a fixed payment on the principal. The swap was entered on Monday, 2nd August, 2010 and run for a period of 7 days.

- Respective MIBOR rates for Tuesday to Monday were: 7.75%, 8.15% ,8.12%,7.95%, 7.98%, 8.15%.

If Derivative Bank received ₹317 net on settlement, calculate Fixed rate and interest under both legs.

- Notes: (i) Sunday is Holiday.
  (ii) Work in rounded rupees and avoid decimal working.

Ans: **Calculating amount receivable under floating leg**

Day	Principal (₹)	MIBOR (%)	Interest (₹)
Tuesday	10,00,00,000	7.75%	21,233
Wednesday	10,00,21,233	8.15%	22,334
Thursday	10,00,43,567	8.12%	22,256
Friday	10,00,65,823	7.95%	21,795
Sat & Sun	10,00,87,618	7.98%	43,764
Monday	10,01,31,382	8.15%	22,358
Total interest receivable under floating leg:			**1,53,740**

- Since, the bank received ₹317 on net settlement, this implies that total fixed interest for the period was = 1,53,740 - 317 = 1,53,423
- Fixed interest rate = $\frac{1,53,423}{10 \text{ crore}} \times \frac{365}{7}$ = 8.0% p.a.

Notes:

- Since Sunday is a holiday. So, interest for 2 days (Sat & Sun) is charged on Saturday itself.
- Ans is calculated based on 365 days in a year. Alternatively, it be calculated with 360 days as base.

Total return swap - TRS

 # Ques 11 - TMC Holding {M18 RTP (New), Dec 21 MTP 1 (Old)}

TMC Holding ltd. has a portfolio of shares of diversified companies valued at ₹400 crore enters in to a swap arrangement with None Bank on the terms that it will get 1.15% quarterly on notional principal of₹400 crore in exchange of return on portfolio which exactly tracking the Sensex which is presently 21,600. You are required to determine the net payment to be received/paid if Sensex turns out to be 21,860 21,780, 22,080 & 21,960 at the end of each quarter.

Ans:

Qtr	Sensex return	Net CF = (1.15% - Sensex return) x 400 crores
1	21860/21600 – 1 = 1.204%	(1.15 - 1.204)% x 400 = (0.216 crores)
2	21780/21860 - 1 = (0.366%)	(1.15 - (0.366))% x 400 = 6.064 crores
3	22080/21780 - 1 = 1.377%	(1.15 - 1.377)% x 400 = (0.908 crores)
4	21960/22080 - 1 = (0.543%)	(1.15 – (0.543))% x 400 = 6.772 crores

👉 Comparative Advantage Theory (CAT)

CAT with Intermediary (& non-standard quote format in question)

 # Ques 12 – Zaki {M19 Exam (Old), N20 Exam (New), Dec 21 MTP 1 (Old), M23 Exam, M23 MTP 1}

IB an Indian firm has its subsidiary in Japan and Zaki a Japanese firm has its subsidiary in India and face the following interest rates:

	IB	Zaki
INR Floating rate	BPLR + 0.5%	BPLR + 2.5%
JPY Fixed rate	2%	2.25%

Zaki wishes to borrow Rupee Loan at a floating rate and IB wishes to borrow JPY at a fixed rate. The amount of loan required by both the firms is same at the current exchange rate. A financial institution may arrange a swap and requires 25 basis points as its commission. Gain, if any, is to be shared by the firms equally.

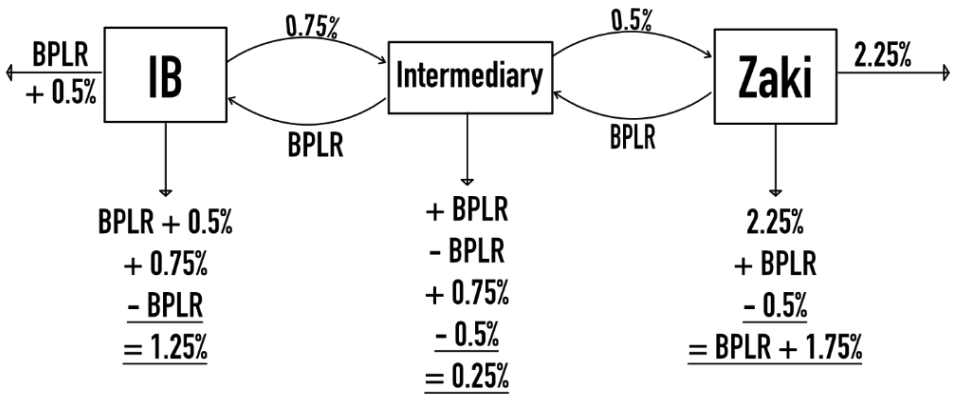
You are required to find out:

i. Whether the beneficial swap can be arranged?

ii) What rate of interest will the firms end up paying?

Ans: Krack Chart: Ques is easy. But some students may find it a little confusing because of slightly different presentation of question. So, it's better to make our own presentation style table.

	INR Floating rate	JPY Fixed rate
IB	BPLR + 0.50%	2%
Zaki	BPLR + 2.50%	2.25%
Int. rate differential	2%	0.25%



- IB has comparative advantage in ₹ floating market but wants to borrow at JPY fixed rate whereas Zaki wants floating INR rate. Therefore, the two co. can enter an IRS.
- Potential gain under swap = Difference in Interest rate differential = 2% - 0.25% - 0.25% = 1.5%
  (Note: Intermediary commission is 0.25%)
- Gain to each party = 1.5% / 2 = 0.75%

i) Yes, a beneficial swap can be arranged.

ii) Effective rate: For IB = 2% - 0.75% = 1.25%
For Zaki = BPLR + 2.5% - 0.75% = BPLR + 1.75%

ADDITIONAL NOTES: QUESTION VARIATIONS

- Sometimes question may mention that parties required at least "x %" of benefit and that bank may have to forgo a part of its commission to ensure that parties get their desired benefit.
- Ex: Let us say that in the above question, it is said that both IB and Zaki wants at least 85 bps and 80 bps of benefit respectively. In such case, bank will have to forgo some of its commission.
- Then, benefit of 175 bps is to be distributed as:
  - Benefit to IB = 85 bps, Effective rate = 2% - 0.85% = 1.15%
  - Benefit to Zaki = 80 bps, Effective rate = BPLR + 2.5% - 0.8% = BPLR + 1.7%
  - Bank's commission = 10 bps only.

👉 Swap Valuation

Basic Swap valuation

 # Ques 13 - Grey matter

2 years ago, Mind ltd. entered into a 5-years Interest rate swap (IRS) against LIBOR at a price of 5.5% with Grey matter ltd. The notional amount was decided to be ₹50 lacs. Settlement will happen

every 6-month. The fourth payment is yet to be exchanged by the 2 parties.

Currently, an interest rate of 6% p.a. prevails in the market for all the maturities. 6-months ago, LIBOR was at 5.8%. You are required to find the value of swap for both the parties.

Ans: Swap was entered 2 years ago for 5 years. So, Remaining period = 3 years.

Value for Mind ltd. (floating receiver)

Value = Value of floating leg – Value of fixed leg

Value = 51.45 – 50.698 = ₹0.752 L

Value for Grey Matter (Fixed receiver)

Value for Fixed receiver = Value of fixed leg – Value of floating leg

Value = 50.698 – 51.45 = –₹0.752 L

- WN 1 - Value of floating bond (leg) on reset date

Par value + Accrued interest = 50 + {50 x 5.8% x 6/12} = 50 + 1.45 = ₹51.45 Lacs

- WN 2 - Value of fixed leg = Value of bond + Accrued Interest

Bond value = 1.375 x PVAF(3%, 6) + 50 x PVF(3%, 6)	49.323
Accrued interest = 50 x 5.5% x 6/12	1.375
Value of fixed leg =	₹ 50.698 L

Interest rate futures (IRF)

Finding Cheapest to Deliver (CTD) bond

 # Ques 14 – Nimi **{N23 Exam}**

Following bonds and its conversion factors (CF) are given. Miss. Nimi has a short position. Futures price = ₹98.

- Which bond should the short deliver?
- Or alternatively, find the 'Cheapest to Deliver' Bond (CTD bond).

Bond	Price of bond	CF
1	106	1.10
2	115	1.18
3	92	0.95

Ans: **Method 1 – Full calculation**

Bond	Amount received by short (F x CF)	Price of Bond	Gain / (loss) to short
1	98 x 1.10 = 1078	106	1.8
2	98 x 1.18 = 115.64	115	0.64
3	98 x 0.95 = 93.10	92	1.1

Hence, short must deliver bond 1. Or we can say that Bond 1 is the Cheapest to deliver (CTD) bond.

Method 2 – Adjusted spot rate (SR) method

Bond	Adjusted spot rate = SR/CF
1	106/1.10 = 96.36
2	115/1.18 = 97.46
3	92/0.95 = 96.84

∴ Bond 1 is CTD bond as it has lowest Adjusted spot rate

Note:

- For MCQ, use → "Adjusted SR" method (as it is faster).
- For Subjective ques, use → Full calculation method (as ICAI may require proper presentation)

👉 ## Currency Swaps

Basic Currency Swap

 # Ques 15 – Ankle **{SM TYK, N20 RTP (New), N20 RTP (Old), M24 RTP}**

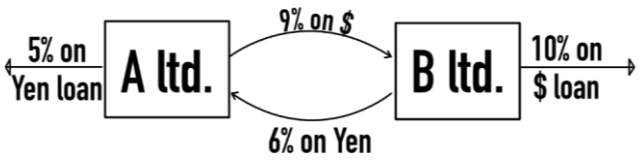
Ankle Inc (A Inc) & Bone Inc (B Inc) intend to borrow $200,000 & $200,000 in ¥ respectively for a time, horizon of one year. The prevalent interest rates are:

Company	¥ Loan	$ Loan
A Inc.	5%	9%
B Inc.	8%	10%

The prevalent exchange rate is $1 = ¥ 120.

They entered in a currency swap under which it is agreed that B Inc. will pay A Inc. @ 1% over the ¥ Loan interest rate which the later will have to pay a result of the agreed currency swap whereas A Inc. will reimburse interest to B Inc. only to the extent of 9%. Keeping the exchange rate invariant, quantify the opportunity gain or loss component of the ultimate outcome, resulting from the designed currency swap.

Ans:



#	Calculating benefit for A Inc	Amount in $
»	Part A – outflow with Swap	
•	Pay 5% Interest on ¥ 240 lacs loan = ¥12,00,000 eq. to	$ 10,000
•	Receive 6% Interest on ¥240L from B = (¥14,00,000) eq. to	($ 12,000)
•	Pay 9% Interest on $200,000 to B	$ 18,000
(A)	Net Interest paid with swap	$ 16,000
(B)	Interest without swap = $200,000 x 9%	$ 18,000
(C)	Hence, benefit due to swap to A Inc (B – A)	$ 2,000

#	Calculating benefit for B Inc	Amount in ¥
»	Part A – outflow with Swap	
•	Pay 10% interest on $2L loan = $20,000 eq. to	¥ 24,00,000
•	Receive 9% Interest on $2L from A = ($18,000) eq. to	(¥ 21,60,000)
•	Pay 6% interest on ¥ 240L to A	¥ 14,40,000
(A)	Net Interest paid under swap	¥ 16,80,000
(B)	Interest without swap = ¥240L x 8%	¥ 19,20,000
(C)	Hence, benefit due to swap to A Inc (B – A)	¥ 2,40,000
	or Benefit due to swap for B Inc in $	$ 2,000

Note: We have used the conversion rate 1$ = ¥120 (given in ques)

Impact of Swap on project's NPV

 # Ques 16 – Drillip **{SM TYK, M19 RTP (Old)}**

Drillip Ltd. a US based co. has won a contract in India for drilling oil field. The project will require an initial investment of ₹500 crore. The oil field along with equipments will be sold to Indian Govt. for ₹740 crore in one-year time. Since the Indian Government will pay for the amount in INR. The company is worried about exposure due exchange rate volatility. Construct a swap that will help the Drillip Ltd. to minimize the exchange rate risk. Assuming, that Indian Gov. offers a swap at spot rate which is 1 US$ = ₹50 in one year on amount of investment, then should the company opt for this option or it just do nothing. The spot rate after one year is expected to be 1 US$ is equal to ₹54. Further you may also assume that the Drillip Ltd. can also take a US $ loan at 8%

Ans: Constructing swap: A 1-year swap can be entered with Indian govt. for ₹500 crores at 1$ = ₹50.

	CF in $ Million after 1 year	A) With Swap	B) No Swap
A.	Convert ₹740 crores after 1 year into $		
	• With swap = {₹500 cr @ ₹50/$} + {₹240 cr @ ₹54/$}	$ 14.44	
	• Without swap = ₹740 cr @ ₹54/$		$ 13.704
B.	Interest on US Loan: 10 x 8%	($ 0.8)	($ 0.8)
C.	Net cash inflow in $ after 1 year = A – B	$ 13.644	$ 12.904
D.	Initial investment = ₹500 cr @ ₹50/$	$ 10.00	$ 10.00
E.	Net gain = C – D	$ 3.644	$ 2.904

Decision - Clearly it is better to enter swap as net gain with swap is higher.

Additional Questions

👉 Forward Rate Agreement (FRA)

Using FRA to hedge borrowing cost

 # Ques 1 - Balaji

Balaji ltd. Presently had a term loan of ₹500 Lakhs The loan is priced at 5% over 3 months-MIBOR, Interest is re-fixed on a quarterly basis, and is payable quarterly. Balaji apprehends that 3 months MIBOR Is likely to increase in future. They enter an FRA (Forward Rate Agreements) with Bank Madhurai agreeing to pay, for 12 months, fixed rate of interest of 12% p.a. Compute Balaji's loss or gain under FRA If on each interest date MIBOR moves as under:

Quarter 1	Quarter 2	Quarter 3	Quarter 4
8.00%	8.50%	8.25%	6.75%

Ans:

Particulars (amount in ₹ Lacs)	Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4
A. Interest payable under FRA [500 L x 12% x 3/12]	15	15	15	15
B. Int. receivable under FRA [500L x 3/12 x (Mibor + 5%)]	16.25	16.875	16.5625	14.6875
→ Net receivable (B-A)	1.25	1.875	1.5625	(0.3125)

👉 Interest rate options / Guarantees (IRG)

Calculating effective cost under IRG (when entire premium is paid upfront)

 # Ques 2 - Orange

Orange ltd. wants to borrow ₹250 lakhs after 3 months for 6months. It wants to hedge its exposure to any increase in interest rates by buying a cap option at a strike price of 8% p.a. The call is available at on upfront premium of ₹2 lakhs. Cost of capital of Co. = 7% p.a.

Calculate Effective Interest cost of orange ltd. in each of the case.

Case 1 → Rate after 3 months = 6% p.a.

Case 2 → Rate after 3 months = 10% p.a.

Ans: **Note -> Option premium is always paid upfront (even if ques is silent)**

	Particulars	(i) Int = 6% p.a.	(ii) Int = 10% p.a.
A.	Interest on loan [250 x Int % x 6/12]	7.5L	12.5L
B.	Call payoff (WN 1)	Nil	(2.5L)
C.	Future Value of Call Premium (WN 2)	2.105L	2.105L
D.	Total cost	9.605L	12.105L
E.	Effective interest % [E = D/250 x 12/6]	7.684%	9.684%

WN 1 → Cap Payoff

- When Interest rate is 6% = Nil
- When interest is 10% = (10-8)% x 250 x 6/12 = 2.5 Lacs

WN 2 → Future value of Call premium = 2L x (1 + 0.07 x 9/12) = 2.105 Lacs

👉 SWAPS

Generic Fixed to floating swap

 # Ques 3 – Big Swapper **{N23 Exam}**

Big swapper, a dealer bank quotes for a generic swap "AIC 8%/8.20% vs. 6M LIBOR Flat". Notional principal amount of swap is ₹ 1 Million, and the same is for a period of three years, reset after every six months.

In this context, answer the following questions:

(1) Interpret the dealer bank quote.

(2) If a firm is buying a swap, what is the nature of cash flows?

(3) If a firm is selling a swap, what is the nature of cash flows?

(4) Calculate semi-annual fixed payment for the buyer of swap at the end of every six months.

(5) If the six-month period from the effective date of swap to the settlement date comprises of 181 days and that the corresponding LIBOR was 5% on the effective date of swap, then what will be the first floating rate payment for the buyer?

(6) If the settlement is on "Net Basis", how much the buyer of swap has to pay or receive at the end of first six months?

Ans: **(i) Interpretation of dealer bank quote:**

- AIC in the dealer bank quote refers to 'All in cost' i.e. cost of swap all inclusive.
- First part of the quote i.e. "8% / 8.20%" refers to the fixed leg part and the second part of the quote i. e. '6m LIBOR Flat' refers to the floating leg part.
- The difference in the fixed rates i.e. 20 bps refers to the margin charged by the Bank on the

fixed leg of transactions.

- The term 'flat' on the floating leg quote, indicates that the Bank does not charge any commission on the floating leg. Therefore, bank charges 20 bps for transacting swap as a whole.

(ii) A buyer of swap pays 'Fixed' cash flows and receives 'Floating'. As per the quote, the buyer would pay 8.2% (higher of 8%, 8.2%) to the Bank and would receive '6M LIBOR' against it.

(iii) A seller of swap pays 'floating' cash flows and receives 'fixed'. As per the quote, the seller would pay '6M LIBOR' to the bank and would receive 8% (lower of 8%, 8.2%) against it.

(iv) Semi-annual Payment every 6-month for buyer of Swap: ₹ 10,00,000 x 8.20% x ½ = ₹ 41,000

Note – Day count convention for fixed leg is 30/360.

(v) Floating Rate Payment = 10,00,000 × 0.05 × 181/360 = ₹ 25,140

Note – Day count convention for floating leg is Actual/360.

(vi) Net Settlement = ₹41,000 - ₹25,140 = ₹15,860

👉 Interest Rate futures

Arbitrage using Interest rate futures

 # Ques 4 - Oversmart

3 months futures price = ₹95. A bond deliverable under the futures contract is trading at ₹100. Conversion factor of this bond is 1.1. One of your clients, Mr. Oversmart wants to construct arbitrage. You are required to construct the arbitrage if Rf = 8% p.a.

Ans: Purchase bond at ₹100 by borrowing at 8% p.a. Short futures at ₹95.

Cash flow on Maturity (i.e., after 3 months)

Cash inflow = Deliver bond and receive = 95 x 1.1	104.5
Cash outflow = Repay loan = 100 x (1 + 0.08×3/12)	(102)
Net CF i.e. Arbitrage profit =	₹ 2.5

Mark to market (MTM) in case of IRF

 # Ques 5 - Sucharu

Mr. Sucharu sold 500 contracts when Interest rate futures price was ₹95.3. Calculate the Mark to

Market (MTM) position if settlement price is as follows:

Day:	1	2	3	4
Price:	95.2	95.35	95.40	95.10

Ans:

Day	Daily Change	Closing MTM
1	(95.3 – 95.2) x 500 x 2000 = ₹1,00,000	1,00,000
2	(95.2 – 95.35) x 500 x2000 = ₹(1,50,000)	(50,000)
3	(95.35 – 95.4) x 500 x2000 = ₹(50,000)	(1,00,000)
4	(95.4 – 95.1) x 500 x2000 = ₹3,00,000	2,00,000

👉 Currency Swaps

Calculation of Amount paid/received under Currency swap

 # Ques 6 - McDonalds Hamburger

McDonalds Hamburger Co wishes to lend its Japanese subsidiary. At the same time, Yasufuku Heavy Industries is interested in making a medium-term loan of approximately the same amount to its US Subsidiary. The two parties are brought together by an investment bank for purpose of making Parallel loans. McDonalds will lend $5L to US subsidiary of Yasufuku for 4 years at 13% compounding annually. Yasufuku will lend the Japanese subsidiary of McDonalds 70 Million YEN for 4 Years at 10%. Again, principal and interest (annual compounding) are payable at the end.

- Current exchange rate = ¥ 140/$
- Dollar is expected to decline ¥ 5/$ per year over the next 4 years.

(i) What total dollars will McDonalds receive at the end of 4 years?

(ii) What dollar Equivalent will Yasufuku receive at the end of 4 years?

(iii) Which party is better of with the parallel loan arrangement?

(iv) What would happen if Yen did not change in value? Which party will now be in a better position?

Ans: **Expected exchange rate (if $ decline by 5¥ per year)**

Year 1 = ¥135

Year 2 = ¥130

Year 3 = ¥125

Year 4 = ¥120

(i) Amount receivable by McDonalds = 0.5 Mn x $(1.13)^4$ = $ 815,236

(ii) Amt receivable by Yasufuku (in $) = $\frac{70 \text{ Mn} \times (1.10)^4}{}$ = $ 854,058

(iii) Clearly, Yasufuku is in better position as it is receiving $854,058 whereas McDonalds will receive only $815,236.

(iv) **If Spot rate remains same at year 4 end (1$ = Yen 140)**

- Amt receivable by Yasufuku (in $) = $\frac{70 \text{ Mn} \times (1.10)^4}{140}$ = $732,050
- Clearly, McDonalds is in better position now as it is receiving $815,236 whereas Yasufuku will receive only $732,050.

👉 Low Probability – Unique Questions

Converting floating rate to fixed rate using "Hybrid instrument"

 # Ques 7 – Itachi

Itachi ltd. wants to borrow at fixed rate for 5 years. It has the following 3 options:

Option 1 -> Borrow at fixed rate at 9.5% p.a.

Option 2 -> Borrow at floating rate @ LIBOR + 0.2% and enter, into an Interest rate swap against LIBOR at a price of 9%.

Option 3 -> Issue a hybrid instrument that would pay 8.5% for 1st 3 years and then Libor - 0.1% for next 2 years. A 3-year IRS against Libor is available at a price of 8.7%.

You are required to calculate the effective cost in each of the 3 alternatives and recommend the alternate with minimum cost.

Ans: **Option 1 ->** Fixed interest rate for 5 years = 9.5% p.a.

Option 2 -> Borrow at Libor + 0.2% and enter, into an IRS to pay 9% and receive Libor.

Effective cost = Libor + 0.2% + 9% - Libor = 9.2% p.a.

Option 3 -> Issue hybrid instrument and enter, into a 5-year IRS to convert the floating rate of last 2 years to a fixed rate. This will result in:

- For 1st 3 years => 8.5% + 9% - Libor = 17.5% - Libor
- For last 2 years => Libor - 0.1% + 9% - Libor = 8.9% p.a.

- Using this arrangement, the interest cost of last 2 years in now fixed at 8.9% p.a. But now the first 3 years have a floating component. We can use the 3-year IRS to convert this floating rate to fixed

rate Enter, into 3-year IRS to receive Libor and pay fixed.

• **This will lead to:** - For 1st 3 years => 17.5% - Libor + Libor - 8.7% = 8.8% p.a.

- Last 2 years = 8.9% p.a. (as calculated above)

☞ Option 3 should be preferred as it is leading to least interest cost.

Calculating PV of savings from Swap

 # Ques 8 – Shantanu

A Ltd. is considering a ₹50 crore 3-year interest rate swap. The company is interested in borrowing floating rate however, due to its good credit rating. It has a comparative over lower rated companies in fixed rate market. It can borrow at fixed rate of 6.25% or floating rate MIBOR + 0.75%.

Presently, MIBOR is 5.25% but is expected to change after 6 months due to political situation in the country. Shantanu Ltd. an intermediary bank agreed to arrange a swap. The bank will offset the swap risk with a counter party (B Ltd.) a comparative lower credit rated company, which could borrow at a fixed rate of 7.25% & floating rate of MIBOR + 1.25%. Shantanu Ltd. would charge ₹12,00,000 per year as its fee from each party. Mr. Fin the CFO of A Ltd. desires that A Ltd. should receive 60% of any arbitrage saving (before payment of fees) from the swap as A Ltd. enjoying high credit rating. Any fees paid to the bank are. tax deductible. The applicable tax rate is 30%.

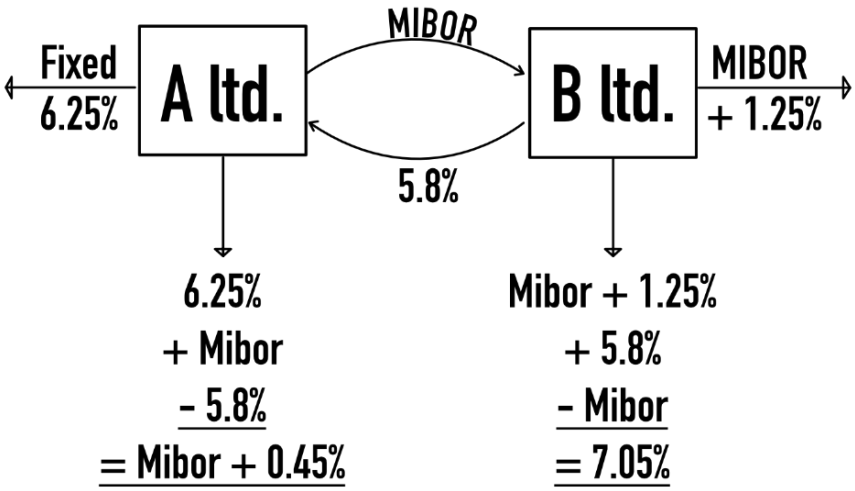
You are required to:

(a) Evaluate whether the proposal is beneficial for both parties or not.

(b) Assuming that MIBOR was to increase to 5.75% after 6 months immediately after political crisis over and shall remain constant for the period of swap. Evaluate the present value of savings from the swap for A Ltd., assuming that interest payment is made semi-annually ignoring the charges made to Shantanu Ltd. & also tax paid.

Ans:

	Fixed Rate	Floating Rate
A ltd.	6.25%	MIBOR + 0.75%
B ltd.	7.25%	MIBOR + 1.25%
Interest rate differential	1%	0.5%



- A ltd. has comparative advantage in fixed market but wants to borrow at floating rate whereas B ltd. wants fixed rate. Therefore, the two companies can enter, into an IRS.

- Potential gain under swap = Difference in Interest rate differential = 1% - 0.5% = 0.5%
- Savings in ₹ = 0.5% x 50 crores = 25 Lacs

i) **Savings for A ltd.** **(₹ in lacs)**

Arbitrage profit from swap: 25 x 60%	15
less: Intermediary bank fees	(12)
Net Savings (before tax)	3
=> Net savings after tax: 3 x 0.7	2.1

- **Savings for B ltd.** **(₹ in lacs)**

Arbitrage profit from swap: 25 x 40%	10
less: Intermediary bank fees	(12)
Net Savings (before tax)	(2)
=> Net savings after tax: (2) x 0.7	(1.4) i.e. loss

☞ **Hence, the proposal is beneficial for A ltd. but is not beneficial for B.**

ii) Krack chart: All we need to calculate is PV of savings from swap (to A ltd). For this, we need:

a) Savings in every period = 15/2 = 7.5 lacs per 6 months

b) Appropriate discount rate for A ltd. -> Prevailing MIBOR + 0.45%.

For 1st period, it will be => 5.25% + 0.45% = 5.7% p.a. or 2.85% per 6m

For balance periods => 5.75% + 0.45% = 6.2% p.a. or 3.1% per 6m.

∴ PV of savings = $\frac{7.5}{1.0285^1} + \frac{7.5}{1.031^2} + \frac{7.5}{1.031^3} + \frac{7.5}{1.031^4} + \frac{7.5}{1.031^5} + \frac{7.5}{1.031^6}$ = ₹ 40.5123 Lacs

Using swap to hedge in case of Floating rate "Assets"

 # Ques 9 - Euroloan

Euroloan Bank wants to issue variable-rate loans, but wants to receive Fixed Rate. Currently has a portfolio €25,000,000 loan with PLR + 150 bps, reset monthly PLR is currently 4%. IB an investment bank has arranged for Euroloan to swap into a fixed interest payment of 6.5% on notional amount of loan for its variable interest income.

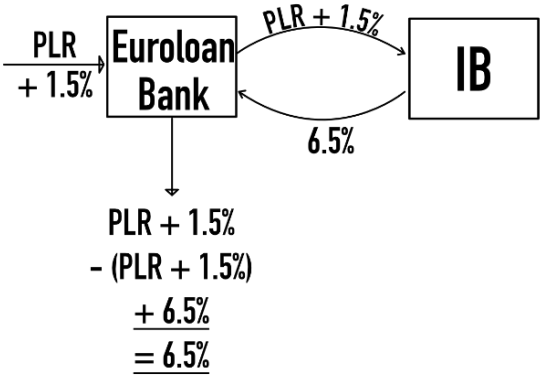
i) What amount of interest is received and given in the first month between Euroloan Bank & IB? Calculate gain/loss for Eurobank.

ii) Next, If PLR increased by 200bp then what will be the gain or loss.

Ans:

Case (i) – If PLR is 4%	**€ Millions**
Interest received on loans: 25 x 5.5% x 1/12	114,583
This is swapped in exchange of: 25 x 6.5% x 1/12	135,417
Net gain / (loss) to Eurobank due to swap =	€20,834

Case (ii) - PLR jumps by 200 bps i.e. PLR = 6%	**€ Millions**
Interest received on loans: 25 x 7.5% x 1/12	156,250
This is swapped in exchange of: 25 x 6.5% x 1/12	135,417
Net gain / (loss) to Eurobank due to swap =	-€20,833



Calculating value of swap in case of counterparty default

 # Ques 10 - Samba

Samba, A Financial Institution has entered in to an IRS with company X. Under the terms of the swap, it receives 10% per annum and pays six-month LIBOR on a principal of $10 million for five years. Payments are made every, six months. Suppose co. X defaults on the sixth payment date (end of year 3) when the interest rate (with semi-annual compounding) is 8% p.a. for all maturities. What is the loss to the Financial Institution? Assume the six-month LIBOR was 9% p.a. halfway through year 3.

Ans: Krack chart: Question may seem quite unique (or maybe alien) at 1st sight. But let's break it down easily. Ques asks for -> Loss of FI due to default. What will this be? Ans: Value of swap to FI at the time of default. (All we need to do it is to calculate value of swap (EASY!!!)

i) **Value of Swap for FI (Fixed receiver)**

- Swap value for FI = Value of fixed leg – Value of floating leg = 10.863 – 10.45 = $0.413 Mn
- Hence, loss to FI due to default of Company X = $413,000

WNI I - Value of fixed leg = Value of bond + Accrued Interest

Bond value = 05 x PVAF(4%, 4) + 10 x PVF(4%, 4)	10.363
Accrued interest = 10 x 10% x 6/12	0.5
Value of fixed leg =	$10.863 Mn

WN II – Value of floating bond (leg) on reset date

Par value + Accrued interest = 10 + {10 x 9% x 6/12} = 10 + 0.45 = $10.45 Mn

Using IRF to hedge borrowing cost

 # Ques 11 – Electraspace **{M18 RTP (New), N19 RTP (Old)}**

Electraspace is consumer electronics wholesaler. The business of the firm is highly seasonal in nature. In 6 months of a year, firm has a huge cash deposits and especially near Christmas time and other 6 months firm cash crunch, leading to borrowing of money to cover up its exposures for running the business. It is expected that firm shall borrow a sum of €50 million for the entire period of slack season in about 3 months.

- **Bank has given the following quotations for FRA:**

3 × 6 FRA	5.59% - 5.82%
3 × 9 FRA	5.64% - 5.94%

- 3-month €50,000 Interest rate future (IRF) contract maturing in 3 months is quoted at 94.15.

a) How FRA shall be useful if interest rate after 3 months turns out to be: (i) 4.5% (ii) 6.5%

b) Should the firm instead use IRF? What will be in net cost in this case?

Ans: **ALTERNATE 1 – USE FRA**

The firm requires money after 3 months for 6 months. Use 3x9 FRA.

#	Particular's (Amounts in € Million)	(i) Int = 4.5% p.a.	(ii) Int = 6.5% p.a.
•	Interest on Loan (50 x Int % x 6/12)	(1.125)	(1.625)
•	FRA Settlement [50 x (Int % - 5.94%) x 6/12]	(0.36)	0.14
•	Net Interest payable	(1.485)	(1.485)

» Interest cost incurred by Co. = (1.485 / 50) x 12/6 = 5.94% p.a.

ii) **ALTERNATE 2 – USE IRF**

Number of Contracts to be shorted

• No. of contracts = $\frac{\text{Exposure to be hedged}}{\text{Value of 1 lot}} \times \frac{\text{Period of borrowing/Investment}}{\text{Maturity of futures}}$

• No. of contracts = $\frac{50 \text{ million}}{50{,}000} \times \frac{6}{3}$ = 2000 contracts i.e. short 2000 contracts of IRF.

#	Particular's (Amounts in € Million)	(i) Int = 4.5% p.a.	(ii) Int = 6.5% p.a.
•	Interest on Loan (50 x Int % x 6/12)	(1.125)	(1.625)
•	IRF settlement (WN 1)	(0.3375)	0.1625
•	Net Interest payable	(1.4625)	(1.4625)

» Interest cost incurred by Co. = (1.4625 / 50) x 12/6 = 5.85% p.a.

Conclusion: Cost under IRF (5.85%) < Cost under FRA (5.94%). So, IRF is preferred.

WN 1: Amount paid on Settlement of IRF

When rate is 4.5% = 50,000 (94.15 – 95.5)% x 2000 x 3/12 = (0.3375)

When rate is 6.5% = 50,000 (94.15 – 93.5)% x 2000 x 3/12 = 0.1625

Ch 13 – Business Val.

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
DCF valuation – when CFs are directly given	1
Two stage DCF / Value of new strategy	2 – 4
Profit Capitalisation method	5
NAV and Dividend discount Method	6
CF (for equity) per share method	7
Chop-Shop Method	8
Relative valuation - Comparables Method	9
Using EBIDTA multiple to calculate value of firm	10
Discrete Questions	11 – 14
Economic Value Added	15 – 19
Market Value added (MVA)	20 – 21
Enterprise value	22
Valuation of Start-ups	23

Index - Additional Questions	**Ques Number**
Basic questions on Valuation	1 – 2
EVA	3 – 4
Low Probability Unique Questions	
- Impact of debenture conversion on Equity & Debenture holders	5
- Value of equity using FCFF	6
- Calculating FCFF (long question)	7

Main Questions

👉 DCF valuation – when CFs are directly given

Basic DCF + Allocation of new shares when fully & party paid shares exists

 # Ques 1 – Gaussian {SM TYK, Dec 21 MTP 1 (Old), N23 MTP 2}

A ltd. is planning to acquire and absorb the running business B Ltd. The valuation is to be based on the recommendations of Gaussian merchant bankers and the consideration is to be discharged in the form of equity shares to be issued by A Ltd. As on 31.03.2006, the paid-up capital of A Ltd. consists of ₹80 Lakhs share of ₹10 each. The highest and the lowest market quotation during the last 6 months were ₹570 and ₹430. For the purpose of exchange, the price per share is to be reckoned as the average of highest and lowest market price during the last 6 months ended on 31.03.2006.

B Ltd.'s balance sheet as at 31.03.2006 is summarized below:

Sources	(₹in Lakhs)
Share Capital	
20L Equity Shares of ₹10 each, fully paid	200
10L Equity shares of ₹10 each, ₹5 paid	50
Loans	100
TOTAL	350

Uses	(₹in Lakhs)
Fixed Assets (Net)	150
Net current assets	200
TOTAL	350

An independent firm have produced the following estimates of cash flows from the business of B Ltd.

Year Ended	By way of	(₹ in Lakhs)
31.03.2007	after tax-earning for equity	105
31.03.2008	"	120
31.03.2009	"	125
31.03.2010	"	120

	31.03.2011	"	100
	31.03.2011	Terminal Value Estimate	200

It is the recommendation of the merchant bankers that the business of B Ltd. may be valued on the basis of the average of (i) Aggregate of discounted cash flows at 8% and (ii) Net asset Value

PVF at 8% for years 1 to 5: 0.93 0.86 0.79 0.74 0.68

You are required to:

(i) Calculate the total value of the business of B Ltd.

(ii) The number of shares to be issued by A Ltd.

(iii) The basis of allocation of the shares among the shareholders of B Ltd.

Ans: Total Value as per NAV = Total assets – Loans = 350 – 100 = ₹250 Lacs

- Value as per PVCI = {105×0.93} + {120×0.86} + {125×0.79} + {120×0.74} + (100+200)×0.68 = ₹592.4L

(i) Total Value of B Ltd. = Average Value = (250 + 592.4) / 2 = ₹ 421.2 lacs

(ii) Value of A's share for exchange = (570 + 430) / 2 = ₹ 500 per share

- Number of shares to be issued = 421.2L / 500 = 0.8424 Lacs or 84,240 shares

(iii) 20 Lacs fully paid ESH's will get = 84,240 x 200/250 = 67,392 shares.

& Partly paid SH's will get = 84,240 – 67,392 = 16,848 shares.

👉 Two stage DCF / Value of new strategy

Basic 2 stage DCF

 # Ques 2 – Clayton **{SM TYK, M22 Exam, N22 Exam, M24 MTP 1}**

Following information are available in respect of Clayton Ltd which is expected to grow at higher rate for 4 years after which growth rate will stabilize at a lower level:

Base year information:	Value in Crores
Revenue	₹2,000
EBIT	₹300
Capital Expenditure	₹280
Depreciation	₹200

	Info for High growth & stable growth period:	High Growth	Stable Growth
	Growth in revenue & EBIT	20%	10%
	Growth in capex & dep.	20%	Capex offset by dep.
	Risk free rate	10%	9%
	Equity beta	1.15%	1%
	Market risk premium	6%	5%
	Pre-tax cost of debt	13%	12.86%
	Debt equity ratio	1 : 1	2 : 3

For all time, working capital is 25% of revenue and tax rate is 30%. What is the value of Firm?

Ans:	Calculation Of K_e	High Growth	Stable Growth
•	Cost of Debt = Interest x (1 - tax)	13% x (1 - 0.3) = 9.1%	12.86 x (1 - 0.3) = 9%
•	Cost of Equity (Rf + β×Risk Prem)	10% + 1.15×6% = 16.9%	9% + 1×5% = 14%
•	Debt Equity Ratio	1 : 1	2 : 3
»	Cost of capital (K_o)	$\frac{1\times9.1 + 1\times16.9\%}{2}$ = 13%	$\frac{2\times9\% + 3\times14\%}{5}$ = 12%

Calculation of Cash Flow per year

Year	1	2	3	4	5
Revenue	2,400	2,880	3,456	4,147.2	4,562
EBIT	360	432	518.4	622	684.3
EAT = EBIT×0.7	252	302.4	362.88	435.4	479
Capex over dep^n	96	115.2	138.24	165.88	-
Increase in WC	(100)	(120)	(144)	(172.8)	(103.7)
CF per yr.	56	67.2	80.64	96.72	375.24

» Firm Value = $\frac{56}{1.13} + \frac{67.2}{(1.13)^2} + \frac{80.64}{(1.13)^3} + \frac{96.72}{(1.13)^4} + \frac{375.24}{(0.12-0.1)} \times \frac{1}{(1.13)^4}$ = ₹ 11,724.5

WN 1 - Calculation of Increase in Working Capital (WC)

Year:	0	1	2	3	4	5
Revenue:	2,000	2,400	2,880	3,456	4,147.2	4,562
WC:	500	600	720	864	1,036.8	1,140.5
Increase:	-	100	120	144	172.8	103.7

WN 3 - Capex & Dep. will grow at 20% → Net value i.e. 280 (Capex) – 200 (dep.) = ₹80 crores will

grow at 20% during high growth period.

WN 3 - Depreciation offset by Capex during stable growth period. Hence, no impact on CFs.

ADDITIONAL NOTES: QUESTION VARIATIONS

- In this question EBIT of ₹300 crores was given directly.
- But sometimes question may not provide EBIT figure directly, but may rather say:
  - COGS = ₹1200 crores
  - Operating expenses = ₹500 crores
- Then, EBIT = Sales – COGS – Opex = 2000 – 1200 – 500 = ₹300 crores. Easy!

Value of strategy when ques provide constant asset turnover ratio

 # Ques 3 – Gumbel **{SM TYK, N20 RTP (New), Dec 21 MTP 2 (Old)}**

Gumbel Co. is considering a new sales strategy that will be valid for the next 4 years and will continue from that position acquired constantly forever. They want to know the value of Strategy.

Following information relating to the year which has just ended, is available:

Income Statement:	Amount in ₹
Sales	20,000
Gross Margin (20%)	4,000
Administration, Selling, Distribution Expense (10%)	2,000
PBT	2,000
Tax @ 30%	600
PAT	1,400

Balance Sheet Information:	Amount in ₹
Fixed Assets:	8,000
Current Assets:	4,000
Equity:	12,000

If it adopts the new strategy, sales will grow at 20% p.a. for 3 years. The Gross/Net Margin Ratio, Assets Turnover Ratio, Capital Structure, and Income Tax rate will remain unchanged. Depreciation would at 10% of the net fixed assets at the beginning of the year. The company's target Rate of return is 15%. Determine the incremental value of company due to new strategy assuming life of the company perpetual. **Ignore Depreciation on Existing strategy.**

Ans: **PART A -- Value under new strategy**

 # WN 1 – Calculation of closing balance of fixed assets (FA) and current assets (CA)

- Given - Asset turnover will remain same. Implies that "Assets as a % of Sales" will remain same.
- Current ratios: FA as % of sales = 8,000 / 20,000 = 40%
  CA as % of sales = 4,000 / 20,000 = 20%

Years	1	2	3	4
Sales	24,000	28,800	34,560	34,560
Fixed Assets Cl. Bal (40%)	9,600	11,520	13,824	13,824
Current Assets Cl. Bal (20%)	4,800	5,760	6,912	6,912
Increase in Working Capital	800	960	1,152	Nil*

 # WN 2 - Calculation of Depreciation & required capex

	Years	1	2	3	4
A.	Opening Bal	8,000	9,600	11,520	13,824
B.	Dep. @ 10%	(800)	(960)	(1,152)	(1,382.4)
C.	Bal. after depreciation	7,200	8,640	10,368	12,441.6
D.	Req. Closing Bal.	9,600	11,520	13,824	13,824
E.	Capex. (E = D – C)	2,400	2,880	3,456	1,382.4

 # WN 3 – Gross and Net margin ratio will remain same.

Net margin ratio of co. = 2,000 / 20,000 = 10%.

So, Net margin ratio will continue to be 10%.

 # Calculation of CF for the years under new strategy:

	Years	1	2	3	4
	Sales	24,000	28,800	34,560	34,560
	PBT = 10% (WN 3)	2,400	2,880	3,456	3,456
	PAT (PBT x 70%)	1,680	2,016	2,419.2	2,419.2
(+)	Depreciation (WN 2)	800	960	1,152	1,382.4
(-)	Capex (WN 2)	(2,400)	(2,880)	(3,456)	(1,382.4)
(-)	Increase in WC (WN 1)	(800)	(960)	(1,152)	-
»	Operating CF	(720)	(864)	(1,037)	2419.2

∴ Value under new strategy = $\frac{(720)}{1.15} + \frac{(864)}{(1.15)^2} + \frac{(1037)}{(1.15)^3} + \frac{(2419.2)\ 1}{(1.15)\ (1.15)^3}$ = ₹ 8,643.18

PART B -- Value under existing (old) strategy

- Given – Ignore depreciation on existing strategy.
- Hence, PAT for the year = CFs (as no other adjustments are given).
- Value under old strategy → $\frac{PAT = CF}{Ke} = \frac{1400}{0.15}$ = ₹ 9,333.33

Decision -- Old vs new strategy

Incremental value of new strategy = 8,643 – 9,333.33 = (-) 690.15 crores

Decision = New strategy is not advisable.

Value of new strategy with 'Hidden Liability' in ques

 # Ques 4 – Helium **{N18 Exam (New)}**

Helium Ltd has evolved a new sales strategy for next 4 Years. Following info is given

Income Statement	₹ in Thousands
Sales	40,000
Gross margin at 30%	12,000
Accounting, Admin. & dis. Exp. at 15%	6,000
Profit before tax	6,000
Tax @ 30%	1,800
Profit after tax	4,200

Balance Sheet Information	
Fixed asset	10,000
Current asset	6,000
Equity	15,000

As per new strategy, sales will grow at 30% year for the next four years. The assets turnover ratio, Net Profit ratio, and Income tax rate will remain unchanged.

Depreciation is to be at 15% on the value of the net fixed assets at the beginning of the year.

Company's target rate of return is 14%. **Determine if the strategy is financially viable.**

Ans: **PART A -- Value under new strategy**

 # WN 1 – (Imp!! Slippery point)

Total assets = 10,000 + 6,000 = ₹16,000

	Equity =	₹15,000				
»	Current liability (Bal. figure) =	₹ 1,000				
#	**WN 2 – Calculation of closing balance of fixed assets (FA) and current assets (CA)**					
•	Given - Asset turnover will remain same. Implies that "Assets as a % of Sales" will remain same.					
•	Current ratios: FA as % of sales = 10,000 / 40,000 = 25%					
	Net CA as % of sales = **(CA – CL)** / Sales = (6,000 – 1,000) / 40,000 = 12.5%					
	Year	**1**	**2**	**3**	**4**	**5**
	Sales	52,000	67,600	87,880	1,14,244	1,14,244
	Fixed Assets (25%)	13,000	16,900	21,970	28,561	28,561
	Current Assets (12.5%)	6,500	8,450	10,985	14,280.5	14,280.5
	Increase in WC	1,500	1,950	2,535	3,295.5	-
#	**WN 3 - Calculation of Depreciation & required capex**					
	Year	**1**	**2**	**3**	**4**	**5**
A.	Opening Balance	10,000	13,000	16,900	21,970	28,561
B.	Depreciation	(1,500)	(1,950)	(2,535)	(3,295.5)	(4,284)
C.	Bal. after depreciation	8,500	11,050	14,365	18,674.5	24,277
D.	Required Cl. Balance	13,000	16,900	21,970	28,561	28,561
E.	Capex (E = D – C)	4,500	5,850	7,605	9,886.5	4,284
#	**WN 4 – Net profit ratio will remain same.**					
•	Net profit ratio of co. = 4200 / 40,000 = 10.5%.					
#	**Calculation of CFs**	**1**	**2**	**3**	**4**	**5**
	Sales	52,000	67,600	87,880	1,14,244	1,14,244
	PAT (10.5%)	5,460	7,098	9227.4	11995.62	11995.62
(+)	Depreciation	1,500	1,950	2535	3,295.5	4284
(-)	Capex	(4500)	(5,850)	(7605)	(9,886.5)	(4284)
(-)	WC Increase	(1500)	(1,950)	(2535)	(3,295.5)	----
»	Cash Flow	960	1,248	1662.4	2,109.12	11995.62
•	Value under new strategy = $\frac{960}{1.14} + \frac{1248}{1.14^2} + \frac{1622.4}{1.14^3} + \frac{2109.12}{1.14^4} + \frac{(11995.62)}{0.14} \times \frac{1}{1.14^4}$ = ₹ 54,877.46					

PART B -- Value under existing (old) strategy

- PAT under existing strategy = CFs (as no other adjustments are given).
- Value under old strategy → PAT = CF = 4200 = ₹ 30,000
  Ke 0.14

Decision – Viability of new strategy

- Value of strategy = 54,877.46 – 30,000 = ₹14,877.46

Other Valuation Methods

(Profit capitalisation, NAV, CF/share method, Chop- shop, Comparables, Dividend discount model)

Profit Capitalisation method

 # Ques 5 – Eagle {SM TYK, N18 RTP (New), M19 RTP (Old), M19 Exam (Old), Jul 21 Exam (New), N22 MTP 1, M23 RTP}

Eagle Ltd, reported a profit of ₹77 Lakhs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extraordinary items of ₹8 Lakhs and an extra-ordinary loss of ₹10 Lakhs. The existing operations, expect for the extraordinary items, are expected to continue in the future. In addition, the results of the launch of a new product are expected to be as follows:

	₹ In Lakhs
Sale	70
Material Cost	20
Labour Cost	12
Fixed Cost (Additional cost)	10

You are required to:

(i) Calculate the value of business, given that the capitalisation rate is 14%.

(ii) Determine the market price per share, with Eagle's Ltd. share capital being compromise of 1,00,000 13% preference share of ₹100 each and 50,00,000 equity shares. PE ratio = 10.

Ans:

Calculating Future minitablet profits (FMP)	₹ (in lacs)
• Profit before tax = 77/0.7	110
(-) Extra ordinary income	(8)
(+) Extra ordinary Expenses	10
(+) New product benefits = Sales – Material – Labour – Fixed cost = 70 – 20 – 12 – 10 =	28
» Total adjusted PBT	140

(-)	Tax @ 30%	(42)
»	Post tax FMP	98
👉	Value of Business = FMP / Capitalisation rate = 98 / 0.14 = ₹ 700 lacs	
(ii)	**Calculating Market price per share (MPS)**	
•	EPS = EAESHs = FMP – Pref. dividend = 98 – (1L x 100 x 13%) = 1.7	
	No. of shares No. of shares 50	
•	MPS = EPS x PE ratio = 1.7 x 10 = ₹ 17 per share	

NAV and Dividend discount Method

 # Ques 6 – Templeton

There are two companies A Ltd. And B Ltd. Which are in same line in industry. In order to increase its size A Ltd. made a takeover bid for B Ltd. Equity beta for A Ltd. And B Ltd. is 1.2 and 1.05 respectively. Risk free rate of return is 10% and Market rate of return is 16%. The growth rate of earning after tax of A Ltd. in recent years has been 15% and B Ltd. is 12%. Further both companies had continuously followed Constant dividend policy. Mr V, the CEO of A ltd. Requires information about how much premium above the current market price to offer for B Ltd shares. Two suggestions have forwarded by Templeton merchant bankers:

(i) Price based on B Ltd. NAV (Net Worth) as per B/S, adjusted in the light of current value of assets and estimated After tax profit for the next 5 years calculated using growth rate & ignoring TVM in this case.

(ii) Price based on Dividend Valuation Model, using existing growth rate estimates.

Balance sheet (₹ in Lakhs)

Liabilities	A Ltd	B Ltd	Assets	A Ltd	B Ltd
Equity Share Capital	2000	1000	Land & building	5600	1500
General Reserves	4000	3000	Plant & Machinery	7200	2800
Share Premium	4200	2200			
Long term Loans	5200	1000			
Current Liabilities			Current Assets		
Sundry Creditors	2000	1100	A/c receivable	3400	2400
Bank overdraft	300	100	Stocks	3000	2100

	Tax Payable	1200	400	Bank/Cash	200	400
	Dividend Payable	500	400			
		19400	**9200**		**19400**	**9200**

Profit & Loss A/c (₹ in Lakhs)

		A Ltd	**B Ltd**		**A Ltd**	**B Ltd**
	To net interest	1200	220	By net profit	7000	2550
	To Taxation	2030	820			
	To Distributable profit	3770	1510			
		7000	2550		7000	2550
	To dividend paid	1130	760	By distributable profit	3770	1510
	To balance c/d	2640	750			
		3770	**1510**		**3770**	**1510**

Additional Information:

1 A Ltd. Land and building have been recently revalued B Ltd. Have not been revalued for 4 years, and during This period the average value of land and Building have increased by 25% p.a.

2. The face value of shares of A Ltd is ₹10 and of B Ltd. Is ₹25 per share.

3. The Current market price of shares of A Ltd is ₹310 and of B Ltd. ₹470 per share.

With the help of above data and given information you are required to calculate the premium per share above B Ltd. Current share price by two suggested valuation methods. Discuss which of these two values should be used for bidding the B Ltd. Shares. State the assumptions clearly, if any.

Ans: **WN 1: Calculation of next 5 years profit**

$\{1510 \times 1.12\} + \{1510 \times 1.12^2\} + \{1510 \times 1.12^3\} + \{1510 \times 1.12^4\} + \{1510 \times 1.12^5\} = 10,743.94$

(i) Calculation of NAV

Land & Building: 1500×1.25^4	3662.11
Plant & Mach.	2800
Accounts receivable	2400
Stock	2100
Bank/Cash	400
Estimated after tax profit (next 5 years)	10743.94
	22106.05
(-) S .Creditors	1100

	Bank overdraft	100
	Tax Payable	400
	Dividend Payable	400
	Long term loan	1000
	NAV = (in lacs approx.)	19106

Number of shares of B Ltd. = 1000L / 25 = 40 lacs

NAV per Share = 19106 / 40 = 477.65

Premium in this case = 477.65 – 470 = 7.65 i.e. 1.63%

(ii) **Using Dividend Model**

K_e = 10% + (16% - 10%) x 1.05 = 16.3%

DPS_0 = 760 / 40 = ₹ 19

Value = $\frac{19 \times 1.12}{0.163 - 0.12}$ = ₹ 494.88

Premium = 494.88 – 470 = 24.88 i.e. 5.29%

Conclusion: Use dividend method as the method (i) is ignoring TVM, which is not a right approach.

CF (for equity) per share method

 # Ques 7 - Carl Icahn {SM TYK, N19 RTP (Old), N20 RTP (New), M22 Exam, M24 RTP}

Calculate the value of share of Carl Icahn Ltd. using capital employed concept.

Current profit of the co. or Earning for Equity	₹ 290 crore
Equity capital of company	₹ 1300 crore
Par Value of share	₹ 40
Debt Ratio of Company	27%
Long run growth rate of the company	8%
Beta	0.1%
Risk free interest rate	8.7%
Market return	10.3%
Capital expenditure per basis	₹ 47
Depreciation per basis	₹ 39
Change (increase) in Working capital per basis	₹ 3.45

Ans: **Calculation of CF for Equity**

•	EPS	8.923
•	Less: Net capital expenditure = (47 - 39) x 73%	(5.84)
•	Less: Increase in WL = 3.45 x 73%	(2.5185)
•	Free cash flow for equity per share (FCFE / share)	0.5645

» Value of ES $= \frac{CF_0 (1 + g)}{K_e - g} = \frac{0.5645 (1.08)}{8.86\% - 8\%} =$ ₹70.89

WN 1: Debt Ratio = Debt / (Debt + Equity)

If Debt Ratio is 27%, then it means that debt = 27% & Equity= 73%.

WN 2: No. of shares = 1300 / 40 = 32.2

EPS = 290 / 32.5 = ₹ 8.923

WN 3: Cost of equity (Ke) as per CAPM = Rf + (Rm - Rf)×β = 8.7% + 0.1 (10.3 – 8.7) = 8.86%

ADDITIONAL NOTES: QUESTION VARIATIONS

Sometimes ques may give "Unlevered" beta of industry instead of Co.'s equity beta :

In such case, we just need to calculate Equity beta and then proceed like normal.

$$\text{Beta}_{\text{Equity}} = \text{Beta}_{\text{Asset}} \{1 + \frac{\text{Debt (1 – tax)}}{\text{Equity}}\}$$

• Above holds true if beta of debt = 0. More detail in portfolio management chapter)

• Alternatively, in some rare cases, we may have to use to use proxy firm to calculate equity beta.

Chop-Shop Method

 # Ques 8 – Munger {SM Illus}

Using the chop-shop approach (or Break-up value approach), Calculate Average Capital Value of Munger Ltd. The accounting data of three business segments: consumer services, and Consumer centres. Data for three segments are as follows:

BUSINESS SEGMENT	Sales	Assets	Operating Income
Consumer wholesale	€ 15,00,000	€ 7,50,000	€ 1,00,000
Consumer Services	€ 8,00,000	€ 7,00,000	€ 1,50,000
Consumer Centres	€ 20,00,000	€ 30,00,000	€ 6,00,000

Industry data are summarized as follows

B. SEGMENT	Capital/Sales	Capital/Assets	Capital/Operating Income
Consumer wholesale	0.75	0.60	10.00
Consumer Services	1.10	0.90	7.00
Consumer Centres	1.00	0.60	6.00

Ans: **Calculation of Capital Required as per**

(i) CAPITAL TO SALES RATIO

SEGMENT	Sales	Ratio	Capital Required
Wholesale	15 L	0.75	11.25 L
Services	8 L	1.10	8.8 L
Centres	20 L	1	20 L
			40.05 L

(ii) CAPITAL TO ASSET RATIO

SEGMENT	Asset	Ratio	Capital Required
Wholesale	7.5 L	0.6	4.5 L
Services	7 L	0.9	6.3 L
Centres	30 L	0.6	18 L
			28.8 L

(iii) CAPITAL TO OPERATING INCOME RATIO

SEGMENT	Op. Income	Ratio	Capital Required
Wholesale	1 L	10	10 L
Services	1.5 L	7	10.5 L
Centres	6 L	6	36 L
			56.5 L

Average Capital = $\frac{40.5 + 28.8 + 56.5}{3}$ = 41.7833 lacs.

Relative valuation - Comparables Method

 # Ques 9 – Greenblatt **{N19 Exam (Old), Dec 21 MTP 1 (Old)}**

Greenblatt Ltd., a cement manufacturing company has hired you as a financial consultant of the company. The Cement Industry has been very stable for some time and the cement companies SK

Ltd. & AS Ltd. are similar in size and have similar product market mix characteristic. Use comparable method to value the equity of Greenblatt.

In performing analysis, use the following ratios:

(i) Market to book value (ii) Market to replacement cost

(iii) Market to sales (iv) Market to Net Income

The following data are available for your analysis:

	SK Ltd.	AS Ltd.	Greenblatt ltd.	(Amount in ₹)
Market Value	450	400	-	
Book Value	400	300	250	
Replacement cost	600	550	500	
Sales	550	450	500	
Net Income	18	16	14	

Ans:

Particulars	SK Ltd.	AS Ltd.	Average
(i) Market to book value	450/400 = 1.125	400/300 = 1.333	1.2290
(ii) Market to Replacement cost	450/600 = 0.750	400/550 = 0.727	0.7385
(iii) Market to sales	450/550 = 0.818	400/450 = 0.889	0.8535
(iv) Market to Net Income	450/18 = 25	400/16 = 25	25

#	Particulars	Greenblatt Ltd.	Average	Indicative Value
(i)	Book Value	250	1.2290	250 x 1.2290 = 307.25
(ii)	Replacement cost	500	0.7385	500 x 0.7385 = 369.25
(iii)	Sales	500	0.8535	500 x 0.8535 = 426.75
(iv)	Net Income	14	25	14 x 25 = 350.0
				Average = 363.31

Value of co. according to the comparable method is ₹363.31

Using EBIDTA multiple to calculate value of firm

 # Ques 10 – Jhunjhunwala {SM Illus, N24 MTP 1}

There is a privately held company Jhunjhunwala Pvt. Ltd that is operating into the retail space, and is now scouting for Angel investors. The details pertinent to valuing Jhunjhunwala Pvt. Ltd are as follows:

The company has achieved break even this year and has an EBITDA of 90. The unleveraged beta based on the industry in which it operates is 1.8, and the average debt to equity ratio is hovering at 40:60. The rate of return provided by liquid bond is 5%. The EV is to be taken at a multiple of 5

on EBITDA. The accountant has informed that EBITDA of 90 includes an extraordinary gain of 10 for the year, and a potential writes off from preliminary sales promotion costs of 20 are still pending. The internal assessment of Rate of market return for the industry is 11%. The FCFs for the next three years are as follows:

	Y1	Y2	Y3
Future Cash Flows	100	120	150

The cost of debt (before tax assumed) will be 12%. Assume a tax regime of 30%. What is the potential Value to be placed on Jhunjhunwala Pvt. Ltd.?

Ans: Levered Beta = Beta unlevered { 1 + $\frac{\text{Debt (1 - tax)}}{\text{Equity}}$ } = 1.8 { 1 + $\frac{40\ (1 - 0.3)}{60}$ } = 2.64

- Ke = 5% +(11% - 5%) x 2.64 = 20.84
- Kd = 12% (1 – 0.3) = 8.40%
- Ko = 20.84% x 0.6 + 8.40 x 0.4 = 15.864

(i) Value of firm as per DCF

$$\text{Value} = \frac{100}{1.15864} + \frac{120}{1.15864^2} + \frac{150}{1.15864^3} = ₹272.1346$$

(ii) <u>Value per EBITDA Multiple</u>

2 options with students.

(a) Sales promotion is a recurring expense

=> Regular EBITDA = 90 – 10 – 20 = 60

∴ EV = 5 x 60 = 300

(b) Sales promotion is a one-time expense

=> Regular EBITDA = 90 – 10 = 80

∴ EV = 5 x 80 = 400

👉 Discrete Questions

Wrong use of BV weights (instead of MV) to calculate the value of co.

 # Ques 11 – Hansel {SM TYK, M18 Exam (New), M19 RTP (New), N19 RTP (New)}

The Valuation of Hansel Limited has been done by an investment analyst. Based upon the expected

free cash flow of ₹54 Lakhs for the following year and expected growth rate of 9%, the analyst has estimated the value of Hansel Limited to be ₹1,800 Lakhs. However, he committed a mistake of using the book value of debt and equity.

The book value weights employed by the analyst are not known, but you know that Hansel Limited has a cost of equity of 20% and post-tax cost of debt of 10%.

The value of equity is thrice its book value, whereas the market value of its debt is nine-tenths of its book value. What is the correct value of Hansel Ltd?

Ans: **Calculation of wrong K_0 used by Analyst:**

Value = $\frac{CF_1}{K_0 - g}$

» 1800 = $\frac{54}{K_0 - 9\%}$ = 12%

- **Calculating book value (BV) weights**

Let BV weight of equity be X. Then, BV weight of debt = 1-X

12% = 20% X + 10% (1 - X)

X = 0.2 or 20%.

-> BV weight of Equity = 0.2

BV weight of Debt = 0.8

- MV of Equity = 3 x BV = 3 x 0.2 = 0.6

MV of Debt = 0.9 x BV = 0.9x0.8 = 0.72

1.32

» Correct K_0 = {20% x 0.6/1.32} + {10% x 0.72 / 1.32} = 14.545%

- Correct value of firm = $\frac{54}{0.14545 - 0.09}$ = 973.85 lacs

Value of co. when Value of debt (V_D) > Value of firm (V_F)

 # Ques 12 – Dimple {SM TYK}

Simple Ltd. and Dimple Ltd. are planning to merge. The total value of the companies are dependent on the fluctuating business conditions.

The following information is given for total value (debt + equity) structure of each of the two co.

	Business Condition	Probability	Simple Ltd	Dimple Ltd.
	High Growth	0.20	820L	1050L
	Medium Growth	0.60	550L	825L
	Slow Growth	0.20	410L	590L

The current debt of Dimple Ltd. is ₹65 Lacs of Simple Ltd. ₹460 Lacs. Calculate the expected value of debt and equity separately for the merged entity.

Krack chart

Value of debt (V_D) can never exceed Value of firm (V_F)

If $V_D > V_F$, then there is a risk of Insolvency. In such cases, $V_E = 0$ (& not zero).

Ans: Calculation of Value of debt (V_D) & Value of equity (V_E) (₹ in lacs)

#	Scenario	Prob.	Simple: V_F	V_E	V_D	Dimple: V_F	V_E	V_D
	High	0.2	820	360	460	1050	985	65
	Medium	0.6	550	90	460	825	760	65
	Slow	0.2	410	0	410	590	525	65
	Expected Value =			126	450		758	65

» **For Merged Entity**

Value of equity = 126 + 758 = 884

Value of debt = 450 + 65 = 515

Value of firm = 1399

Impact of Decision's NPV on company's value

 # Ques 13 – Raamdeo **{M19 RTP (New), M19 RTP (Old)}**

The directors of Raamdeo Ltd wish to make an equity issue to invest $80,00,000, which has an expected net present value of $11,00,000, and to refund an existing $50,00,000 15% Bond that are due for maturity in 5-year time. For early redemption of these bonds there is a $350,000 penalty charge. The company will issue new shares of $1,50,00,000 at $150 per share. It is estimated that the floatation cost of the issue to be 4% of the gross proceeds. As on date the capital structure of Raamdeo ltd is as follows:

	$'000
Ordinary shares (25 per share)	8,000
Share Premium	2,000
Free Reserves	5,000

The entity's current share price is $190. Raamdeo Ltd can raise debenture or medium-term bank

finance at 10% per year, which can be treated as discount rate.

You are required to estimate Raamdeo Ltd expected value of equity taking into considering savings emerging out of early redemption. Also calculate expected market price per share.

Krack Chart: What does MV of the Co. reflects?

It reflects the Present value of all the benefits that are expected to flow to an entity.

Hence, any project/contract with a positive NPV will increase Co. market value & (MPS). Similarly, projects with negative NPV will decrease the MV.

Ans: Calculation of new total expected value and new MPS

	Particulars		**$ Lacs**
A.	Issue of new shares (Net of floatation cost) = 150L – 150 x 4%		144
B.	Expected NPV of new investment		11.0
C.	Savings due to early redemption of bonds. PVCO if :		
	(a) No early redemption = 7.5L × PVAF(10%, 5) + 50L × PVF(10%, 5) =	59.476	
	(b) There is early redemption = 50L + 3.5L =	53.500	5.976
D.	**Total increase in value = A + B + C**		**160.976**
E.	Current value: (80L / 25) x 190		608
F.	Total new value = D + E		768.976
G.	No. of shares (3.2L + 1L)		4.2
H.	**New Value per share = F / G**		**183.09**

ADDITIONAL NOTES: QUESTION VARIATIONS

Sometimes ICAI may introduce some unnecessary info in the above ques like:

1) "It may be further presumed that stock market is semi-strong form efficient and no information about the proposed use of funds from the issue has been made available to the public. You are required to calculate expected share price of company once full details of the placement and to which the finance is to be put, are announced."

Basically they are simply asking to calculate new MPS. But in a fancy way. 😵

2) "Any surplus funds from issue will be invested in IDRs which is currently yielding 10% per year."

Technically this additional info can be in fact a quite slippery point. (Detailed treatment discussed in classes). But since here **cost of funds = IDR yield = 10%**, so we don't need to do anything here.

Sustainable Growth rate (SGR)

 # Ques 14 – Vallabh **{N20 Exam (New)}**

Vallabh Industries has Equity Capital of ₹12 Lakhs, total Debt of ₹8 Lakhs, and annual sales of ₹30

Lakhs. Two mutually exclusive proposals are under consideration for the next year. The details of the proposals are as under:

Particular's	Proposal 1	Proposal 2
Target Assets to Sales Ratio	0.65	0.62
Target Net Profit Margin (%)	4	5
Target Debt Equity Ratio (DER)	2:3	4:1
Target Retention Ratio (of Earnings)	75%	-
Annual Dividend (₹ in Lacs)	-	0.30
New Equity Raised (₹ in Lacs)	-	1

You are required to calculate sustainable growth rate for both the proposals.

Note The below solution is directly taken from Suggested answer. The author is not satisfied with the below solution. However, alternative solution is intentionally not given here to avoid confusion.

Ans: **# Proposal 1**

- Sales (Given) ₹ 30 Lacs
- Total Assets = ₹30L x 0.65 ₹ 19.5 Lacs
- Net Profit = ₹30L x 4% ₹ 1.20 Lacs

- Equity Multiplier = $\frac{\text{Equity}}{\text{Equity + Debt}} = \frac{\text{12 Lacs}}{\text{12 Lacs + 8 Lacs}} = 0.6$

- ROE = {1.20L / 19.50L} x 0.60 x 100 = 3.69
- Sustainable Growth Rate = ROE x Retention Ratio = 3.69 x 0.75 = 2.77%

 # Proposal 2

- New Equity = ₹12L + ₹1L ₹ 13 Lacs
- New Debt = ₹13L x 4 ₹ 52 Lacs
- Total Assets = ₹13L + ₹52L ₹ 65 Lacs
- Target Assets to Sales Ratio (Given) 0.62
- Sales = ₹65L / 0.62 ₹ 104.84 Lacs
- Net Profit = ₹104.84L x 5% ₹ 5.242 Lacs

- Equity Multiplier = $\frac{\text{Equity}}{\text{Equity + Debt}} = \frac{\text{13 Lacs}}{\text{13 Lacs + 52 Lacs}} = 0.2$

- ROE = {5.242L / 65L} x 0.20 x 100 = 1.613%

- Retention Ratio = {5.242L – 0.30L} / 5.242L = 0.943
- Sustainable Growth Rate = 1.613% x 0.943 = 1.52%

👉 Economic Value Added

Basic EVA calculation

 # Ques 15 – Force {SM TYK, Dec 21 RTP (Old)}

Force Ltd.'s current financial year's income statement reported its net income after tax as ₹25,00,000. The applicable corporate income tax rate is 30%.

Details of Force Ltd. at the end of current financial year is as follows: (₹ in lacs)

Debt (Coupon rate = 11%)	40
Equity (Share Capital + Reserves & Surplus)	125
Invested Capital	165
"Equity" Beta of Force Ltd.	1.36
Risk-free rate i.e., current yield on Govt. bonds	8.5%
Average market risk premium	9.5%

Required:

(i) Estimate Weighted Average Cost of Capital (WACC) and

(ii) Estimate Economic Value Added (EVA)

Ans: (i) Cost of Capital (Ke) = Rf + (Rm – Rf) x Beta = 8.5% + 9% x 1.36 = 20.74%

- Cost of debt (Kd) = Interest x (1 – tax) = 11% x (1–0.3) = 7.7%
- WACC = 20.74% x (125 / 165) + 7.7% x (40/165) = 17.58%

(ii) NOPAT = NP + Interest (1 – tax) = 25 + 4.4L x (1–0.3) = ₹28.08 L

- EVA = NOPAT – (WACC x Invested Capital) = 28.08 L – (17.58% x 165 L) = -0.927 L

ADDITIONAL NOTES: QUESTION VARIATIONS

Sometimes ques may give "Asset (unlevered)" beta instead of Equity beta :

In such case, we just need to calculate Equity beta and then proceed like normal.

$$\text{Beta}_{\text{Equity}} = \text{Beta}_{\text{Asset}} \{1 + \frac{\text{Debt}\ (1 - \text{tax})}{\text{Equity}}\}$$

(Above holds true if beta of debt = 0. More detail in portfolio management chapter)

Calculation of EVA dividend

 # Ques 16 – Tender {SM TYK, N22 RTP}

Tender Ltd has earned a net profit of ₹15 lacs. 30% Interest cost charged by financial institutions was ₹10 lacs. The invested capital are ₹95 lacs of which 55% is debt. The after tax at company maintains a weighted average cost of capital of 13%. Required:

(a) Compute the **operating income**.

(b) Compute the Economic Value Added (EVA).

(c) Tender Ltd. has 6 lac equity shares outstanding. How much dividend can the company pay before the value of the entity starts declining? If Tender does not pay any dividends, what would you expect to happen to the value of the company?

Ans: Operating Income (EBIT) = NP/(1 – t) + Interest = 15/(1-0.3) + 10 = ₹31.4286 Lacs

- NOPAT = EBIT x (1 – tax) = 31.4286 x (1 – 0.3) = 22 L

(b) EVA = NOPAT – (WACC x Invested Capital) = 22 – (13% x 95) = ₹9.65 L

(c) EVA Dividend = 9.65L / 6L = ₹1.6083/share

- If Delta Ltd. does not pay a dividend, we would expect the value of the firm to increase because it will achieve higher growth, hence a higher level of EBIT. If EBIT is higher, then all else equal, the value of the firm will increase.

EVA & MPS calculation of multiple companies

 # Ques 17 – Orange Grape **{SM TYK, N23 Exam, M24 RTP}**

Following information is given for 3 companies that are identical except for their capital structure:

	Orange	Grape	Apple
Total invested capital	1,00,000	1,00,000	1,00,000
Debt/assets ratio	0.8	0.5	0.2
Shares outstanding	6,100	8,300	10,000
Pre-tax cost of debt	16%	13%	15%
Cost of equity	26%	22%	20%
Operating Income (EBIT)	25,000	25,000	25,000

The tax rate is uniform 35% in all cases.

(i) Compute the Weighted average cost of capital for each company.

(ii) Compute the Economic Valued Added (EVA) for each company.

(iii) Based on the EVA, which company would be considered for best investment? Give reasons.

(iv) If the industry PE ratio is 11x, estimate the price for the share of each company.

(v) Calculate the estimated market capitalisation for each of the companies.

Ans: **(i) Calculating WACC**

•	Orange = 26% x 0.2 + 16% (1 – 0.35) x 0.8 =	13.52%		
•	Grape = 22% x 0.5 + 13% (1 – 0.35) x 0.5 =	15.225%		
•	Apple = 20% x 0.8 + 15% (1 – 0.35) x 0.2 =	17.95%		
(ii)	**EVA**	**Orange**	**Grape**	**Apple**
	NOPAT = 25000 x (1–0.35)	16250	16250	16250
(-)	WACC x Total Capital	(13520)	(15225)	(17950)
		13.52% x 1L	15.225% x 1L	17.95%x1L
=>	EVA =	2730	1025	(1700)
(iii)	From EVA points of view, Orange Ltd. is best as it has highest EVA.			
(iv)	**Particular's**	**Orange**	**Grape**	**Apple**
	EBIT	25000	25000	25000
(-)	Interest	12800	6500	3000
		(1L×0.8)×16%	(1L×0.5)×13%	(1L×0.2)×15%
»	EBT	12200	18500	22000
	EAT: EBT(1- tax)	7930	12025	14300
÷	No. of shares	6100	8300	10000
»	EPS	1.3	1.45	1.43
•	Stock Price = EPS x PE ratio	14.3	15.95	15.73
»	Market Cap: MPS x No. of shares	87230	132385	157300

EVA when provision for bad debts is given

 # Ques 18 – Mass **{SM Illus, M19 Exam (New), N23 MTP 1, N24 RTP}**

Compute EVA of Mass Ltd. with the following information:

	Profit & Loss Statement	**₹ Lacs**	**Balance Sheet**	**₹ Lacs**
	Revenue	1000	PPE	1000
(-)	Direct cost	-390	Current Assets	300
(-)	Selling, general & admin exp (SGA)	-200		1300
	EBIT	410	Equity	700
(-)	Interest	-10	Reserves	100
	EBT	400	Non-Current borrowings	100
(-)	Tax Expenses	-120	Current Liabilities	400
	EAT	280		1300

A bad debt provision of ₹20 lacs is included in SGA. Interest on debt = 12%, tax rate = 30% and cost of equity = 8.45%.

Ans: NOPAT = EBIT (1 – tax) + non-cash expense = 410 x (1 – 0.3) + 20 = ₹307

- **Invested Capital:**

Equity	700
R & S: 100 + 20 (non-cash item adjusted)	120
Non-current borrowings	100
	920

- WACC = 8.45% x (700 + 120)/920 + 12% (1-0.3) x 100 / 920 = 8.44%
- EVA = NOPAT – (WACC x Invested Capital) = 307 – (8.44% x 920) = ₹229.352 L

Reverse calculating NOPAT using financial leverage ratio

 # Ques 19 – Jatayu **{SM TYK}**

With the help of the following information of Jatayu Limited compute the Economic Value Added:

Capital Structure:	Equity capital ₹160 Lakhs
	Reserves and Surplus ₹140 lakhs
	10% Debentures ₹400 lakhs
Cost of equity	14%
Financial Leverage	1.5 times
Income Tax Rate	30%

Ans: EVA = NOPAT – (WACC x Invested Capital)

= 84 – (700 L x 10%) = ₹14 L

WN 1 - Invested Capital = Equity + R&S + Debt = 160 + 140 + 400 = ₹700

WN 2 - WACC = 14% x 300/700 + 10% (1 – 0.3) x 400/700 = 10%

WN 3 – Calculating NOPAT

- Financial Leverage = $\frac{PBIT}{PBT}$ or $\frac{PBIT}{PBIT - Interest}$

- 1.5 = PBIT / (PBIT - 40)

- 1.5 (PBIT - 40) = PBIT
- PBIT = 120
- NOPAT = PBIT - Tax = 120×(1 – 0.3) = ₹84 Lacs

👉 Market Value added (MVA)

Basic MVA calculation

 # Ques 20 – Quantum **{Dec 21 Exam (New)}**

Following is the information of Quantum Ltd. for the year ending 31/03/2021:

Particulars	₹ in Lacs
Sales	1000
Operating Expenses including interest	620
8% Debentures	250
Equity Share Capital (Face value ₹10 each)	250
Reserves & Surplus	250
Market Value of Quantum Ltd.	900
Corporate tax rate	30%
Risk-free Rate of Return	7%
Marker Rate of Return	12%
Equity Beta	1.4

You are required to: -

(i) Calculate Weighted Average Cost of capital

(ii) Calculate Economic Value Added (iii) Calculate Market Value Added

Ans: **(i) Weighted Average Cost of capital (WACC)**

- Cost of Equity (Ke) = Rf + (Rm – Rf) x Beta = 7 + (12 - 7) x 1.4 = 14%
- WACC = $Ke.W_e$ + Kd.Wd = {14% x 500/750} + {8% (1 – 0.3) x 250/750} = 11.20%

(ii) EVA = NOPAT – (WACC x Invested capital) = 280 – (11.20% x 750) = ₹196 Lacs

# WN 1 - NOPAT calculation		₹ in Lacs
	Sales	1000
(-)	Operating Expenses	(620)
(+)	Add back: Interest component: 250 x 8%	20
	EBIT =	400
»	NOPAT = EBIT (1 – tax)	280

WN 2 - Invested Capital = Equity + R & S + Debt = 250 + 250 + 250 = ₹750 Lacs

(iii) MVA = MV of Company – Capital employed = 900 – (250 + 250 + 250) = ₹150 Lacs

Alternatively,

MVA = MV of Equity – Book value of Equity

•	MV of Equity = MV of Co. – Value of Debt = 900 – 250	650
(-)	Book Value of Equity = 250 + 250	500
»	MVA	150

Basic MVA calculation

 # Ques 21 – Thermodynamics **{SM TYK, N24 MTP 1}**

The following data pertains to Thermodynamics Inc. engaged in software consultancy business as on 31 December 2010. The co. has WACC of 12% and its share is quoted at $50 each.

	($ Million)
Income from consultancy	935.00
EBIT	180.00
Less: Interest on Loan	18.00
EBT	162.00
Tax @ 35%	56.70
	105.30

Balance Sheet

Liabilities	$ Million	Assets	$ Million
Equity Stock (10 Mn shares @ $10)	100	Land and Building	200
Reserves & Surplus	325	Computers & software	295
Loans	180	Debtors	150
Current Liabilities	180	Bank	100
		Cash	40
	785		**785**

Calculate Economic Value Added (EVA) and Market Value added (MVA) of the co.

Ans: **(i) EVA Calculation:**

• NOPAT = EBIT x (1 – tax) = 180 x (1 – 0.35) = $117 Million

- Invested Capital = Equity + R&S + Loans = 100 + 325 + 180 = $605 Million
- EVA = NOPAT – (WACC x Invested Capital) = 117 – (12% x 605) = $44.4 Million

ii) Market value added (MVA) = MV of equity – BV of equity = 50 x 10 – (100 + 325) = $75 Million

👉 ENTERPRISE VALUE

 # Ques 22 – Zebsonic {SM Illus}

Zebsonic Ltd. made a Gross Profit of ₹ 10,00,000 and incurred Indirect Expenses of ₹4 Lacs. Number of issued Equity Shares is 1,00,000. The company has a Debt of ₹ 3,00,000 and Surplus Funds to the tune of ₹ 5,00,000. The market related details are as follows:

Rf = 4.5%, Market Return = 12% and Beta of co. is 0.9.

Determine:

(a) Per Share Earning Value of the Company.

(b) Equity Value of the company if applicable EBITDA multiple is 5.

Ans: Cost of equity (Ke) as per CAPM = 4.5% + 0.9×(12% - 4.5%) = 11.25%

Calculation of Earning Value Per Share	(₹ 000)
Gross Profit	1000
Less: Indirect Expenses	(400)
EBITDA	600
Earning Value of Company (600/ 0.1125)	5333.33
Number of Shares	1,00,000
Earning Value Per Share	₹ 53.33

(b)

Equity Value of Company	(₹ 000)
EBITDA	600
EBITDA Multiple	5
Capitalized Value	3000
Less: Debt	(300)
Add: Surplus Funds	500
Equity Value	3200

👉 Valuation of Start-ups

Ques 23 - Arati Bells {N24 MTP 2}

Arati Bells co. (ABC) is a startup which has the following expected profits under different scenarios along respective probabilities:

(All Amounts in ₹ Lacs)

	Best Case		**Base Case**		**Worst case**	
Yr	**Revenue**	**Cost**	**Revenue**	**Cost**	**Revenue**	**Cost**
1	100	80	100	90	100	95
2	120	92.4	110	95.7	102	98.94
3	144	108	121	102.85	104.04	101.9592
	Prob. ->	30%	Prob. ->	60%	Prob. ->	10%

You are required to suggest the value of ABC Startup using First Chicago Method assuming that:

(i) Applicable discounting rate is 20%.

(ii) Startup is located in Tax-free Zone.

(iii) The multiple for Terminal is 10.

(iv) No depreciable assets are held by the ABC Startup.

- **Note 1 - Present Value Factors (PVF)**

Year	1	2	3
PVF @ 20%	0.8333	0.6944	0.5787

- **Note 2** - Round off the calculation to whole numbers.

Ans: **# Calculating CF under each case**

Year	**Best case**	**Base case**	**Worst case**
1	100 - 80 = 20	100 - 90 = 10	100 - 95 = 5
2	120 - 92.4 = 27.6	110 - 95.7 = 14.3	102 - 98.94 = 3.06
3	144 - 108 = 36	121 - 102.85 = 18.15	104.04 - 101.9592 = 2.0808

Calculating PV of cash flows (@ 20%)

	PVF	**Best case**		**Base case**		**Worst case**	
Year	**@ 20%**	**CF**	**PV**	**CF**	**PV**	**CF**	**PV**
1	0.8333	20	16.666	10	8.333	5	4.1665
2	0.6944	27.6	19.1654	14.3	9.9299	3.06	2.1249
3	0.5787	36	20.8332	18.15	10.5034	2.0808	1.2042
• Sub-total =			56.6646		28.7663		7.4956

(+)	TV = CF_3 x 10 x 0.5787 =	208.332	105.0341	12.0416
»	Total Value as per DCF =	264.9966	133.8004	19.5372

» **Value of ABC Startup as per First Chicago Method**

{0.30×264.9966} + {0.60×133.8004} + {0.10×19.5372} = 79.49898 + 80.28024 + 1.95372 = ₹161.73 Lacs

Additional Questions

👉 Basic questions on Valuation

Valuation using NAV & Profit capitalization method

 # Ques 1 – Bhuvar

Following is the balance sheet of Bhuvar Ltd.

Liabilities	(₹ in Lakhs)	Assets	(₹ in Lakhs)
Share Capital	100	Land & Buildings	40
Reserve and Surplus	40	Plant & Equipment	80
Creditors and Debentures	30	Investment	10
		Stock	20
		Debtors	15
		Cash at Bank	5
Total	170	Total	170

You are required to work out the value of the company's shares on the basis of Net assets and Profit-Earning capacity (capitalization) method and arrive at the fair price of the shares, by considering the following information:

(i) Profit before tax for the current year ₹ 64 includes ₹ 4 Lakhs extraordinary income and Rs 1 Lakh income from investment of surplus funds, such surplus funds are unlikely to recur.

(ii) In subsequent years, additional advertisement expenses of ₹ 5L are expected to be incurred each year

(iii) Market value of Land and Building and Plant and Machinery (Equipment) have been determined at ₹ 96 Lakhs and ₹ 100 Lakhs respectively. This will entail additional depreciation of ₹ 6 Lakhs each year.

(iv) Effective Income-tax rate is 30%

(v) The capitalization rate applicable to similar business is 15%

Ans:

Cal. Of value as per NAV	(₹ in lacs)
Land & Building	96
Machinery	100
Investment	10

	Stocks	20	
	Debtors	15	
	Cash at Bank	5	
		246	
(-)	Creditors	(30)	
	Net value of Company:	216	
	Per share NAV = 216L / 10L = ₹21.6		

•	**Value as per Profit-Capitalization Method**	**(₹ in lacs)**
	Profit before Tax:	64
(-)	Extra-ordinary income	(4)
(-)	Investment income on surplus funds unlikely to occur in future	(1)
(-)	Additional advertisement exp.	(5)
(-)	Additional depreciation	(6)
		48
(-)	Tax @ 30%	(14.4)
	FMP i.e. (Future Maintainable Profit)	33.6

» Value as per Profit Capitalization Method = $\frac{\text{FMP}}{\text{Capitalization rate}} = \frac{33.6}{0.15}$ = ₹224 L

» Value per share = 224L / 10L = ₹22.4

Note: Value as per ICAI under Profit Capitalization Method:

= 33.6 / 0.15 = 224 L

(-) Creditors = (30 L)

Value = 194 L

∴ Fair Price of share = $\frac{22.4 + 21.6}{2}$ = ₹22

Value of firm when "cash" is given in balance sheet

 # Ques 2 – Aditi **{N19 Exam (New)}**

Mrs. Aditi, a financial analysist, intends to value the business of PQR Ltd. in terms of the future cash generating capacity. He has projected the following after tax cash flows:

	Year (₹ in Lacs)	1	2	3	4	5
	Cash flow	1760	480	640	860	1170

It is further estimated that beyond 5th year, cash flows will perpetuate at a constant growth rate of 8% p.a., mainly on account of inflation. The perpetual cash flow is estimated to be ₹10,260 lacs at the end of 5th year.

Required:

(i) What is the value of firm in terms of expected future cash flow if cost of capital of the firm is 20%.

(ii) The firm has outstanding debts of ₹3,620 lacs and cash/bank balance of ₹2,710 lacs. Calculate the shareholder value per share if the number of outstanding shares is 151.50 lacs.

(iii) The firm has received a takeover bid from XYZ Ltd. of ₹225 per share. Is it a good offer?

Ans: (i) Value of firm = PVCI

$$\frac{1760}{1.2} + \frac{480}{1.2^2} + \frac{640}{1.2^3} + \frac{860}{1.2^4} + \frac{1170}{1.2^5} + \frac{10260 \times 1.08}{0.20 - 0.08} \times \frac{1}{1.2^5} = ₹40,164\ 68 \text{ lacs}$$

(ii) Shareholder value per share

- As per ICAI = $\frac{\text{(PV of cash flow – Outstanding debts)}}{\text{No. of shares}} = \frac{(40,164.68 - 3,620)}{151.50} = ₹\ 241.22/\text{share}.$
- As per author = $\frac{\text{(PVCI – Deb + cash balance)}}{\text{No. of shares}} = \frac{(40,164.68 - 3,620 + 2,710)}{151.50} = ₹\ 259.11/\text{share}$

(iii) Since, the bid price (₹225) < Intrinsic value (₹241.22), it is not a good offer.

👉 **EVA**

EVA when value of patents is given in ques

 # Ques 3 - Constant Engineering **{SM TYK, M18 Exam (Old)}**

Constant Engineering Ltd. has developed a high-tech product which has reduced the Carbon emission from the burning of the fossil fuel. The product is in high demand. The product has been patented and has a market value of ₹100 Crore, which is not recorded in the books. The Net Worth (NW) of Constant Engineering Ltd. is ₹200 Crore. Long term debt is ₹400 Crore. The product generates a net Operating Profit after Tax of ₹84 Crore. The rate on 365 days Government bond is 10 % p.a. Market portfolio generates a return of 12 percent per annum. The stock of the company moves in tandem with the market. Calculate Economic Value added of the company.

Ans: WN 1: Invested Capital = Net worth + Value of Debt + Patents = 200 + 400 + 100 = ₹700 crores

WN 2: Calculating cost of capital (K_o)

- Cost of Equity (Ke) = 10 + (12 – 10) x 1 = 12%
- Assuming Kd = Rate on Govt. Bonds = 10%

(As no information about Kd is given in ques)

- WACC = Ke.We + Kd.Wd = 12% x (200 + 100) / 700 + 10% x 400 / 700 = 10.86%
- EVA = NOPAT – (WACC x Invested Capital) = 84 – (10.86% x 700) = ₹7.98 Crores

EVA when opening balance of provision for doubtful debts is given

 # Ques 4 – Trigun {KE In-house}

Trigun Ltd. has 3 divisions namely Satgun, Rajsic & Tamsic. Rajsic Ltd. recently posted an annual operating profit of ₹50 crores. A new product was launched during the year for which ₹18 crores advertise expenditure was incurred. Management expects that the benefit of this expense shall last for three years. However, entire expenditure was written off as per applicable accounting standards. Also, a provision of ₹ 5 crores towards doubtful debts was made during the year. Closing balance of this provision account stands at ₹7 crores.

Total Capital of the Company as per its balance sheet is ₹790 crores. Out of this, Net assets worth ₹340 crores can be attributed to Rajsic Ltd. Replacement cost of these assets is ₹365 crores. The cost of capital is 12.5% & cost of debt is 9% (before tax). Tax rate is 30%.

Find the Economic Value Added (EVA) of the firm.

Ans: EVA = NOPAT – (WACC x Invested Capital) = 52 - (12.5% x 384) = ₹4 crores

#	**WN 1 - NOPAT**	**₹ in crores**
	EBIT x (1 – tax): 50 x (1 – 0.3)	35
(+)	Unutilized advertisement expenses: 18 x 2/3	12
(+)	Provision for doubtful debts made during the year:	5
	=> NOPAT	52

#	**WN 2 - Invested Capital**	**₹ in crores**
	Replacement Value	365
(+)	Unutilized advertisement exp. : 18 x 2/3	12
(+)	Closing balance of provision for doubtful debts	7
		384

Low Probability Unique Questions

Impact of debenture conversion on Equity & Debenture holders

 # Ques 5 – Nihar

Nihar Ltd. is contemplating conversion of 8% convertible debentures of Rs 1,000 each. At present, it has 500 such debentures outstanding. The market price of the debentures is ₹1080. Debentures indenture (contract) provides that one debenture will be converted for 10 shares. The PE ratio before conversation is 20:1 and anticipated price earnings ratio after conversion is 25:1 The number of shares outstanding prior to redemption was 10,000. Earnings before interest and taxes amounted to Rs 2,00,000. The company is in the 50% tax bracket. Should the company convert its debentures into shares keeping the interest of Equity Shareholders & Debentures holder taking MPS as base?

Ans:

		Before Conversion	After Conversion
	EBIT	2,00,000	2,00,000
(-)	Interest: 1,000 x 500 x 8%	(40,000)	------
»	EBT	1,60,000	2,00,000
(-)	Tax @ 50%	(80,000)	(1,00,000)
»	EAT	80,000	1,00,000
÷	Number of shares	10,000	15,000
»	EPS	8	6.67
	MPS = EPS x PE Ratio	160	166.75

Gain / Loss Cal.	Debenture Holder	Equity Shareholder
Before Conversion Value	1080	160
After Conversion Value: 166.67 x 10 =	1667.50	166.75
	587.50	6.75

Hence, conversion is beneficial for the both parties.

Value of equity using FCFF

 # Ques 6 – Nirbhao

Nirbhao ltd., market leader in printing industry, is planning to diversify its business. The CEO of the co. wants to get his company valued as he is not satisfied with the current market price of his scrip.

Following data for the year ended 2009 is available:

	Share price	₹66 per share
	Outstanding debt	1934 lacs
	Number of outstanding shares	75 lacs
	Net Income (PAT)	17.2 lacs
	EBIT	245 lacs
	Interest expenses	218.125 lacs
	Capital expenditure	234.4 lacs
	Depreciation	234.4 lacs
	Working Capital	44 lacs
	Growth rate	8% (from 2010 to 2014)
	Growth rate	6% (beyond 2014)
	Free cash flow	240.336 Lacs (2014 onwards)

The capital expenditure is expected to be equally offset by depreciation in future and the debt is expected to decline by 30% in 2014. Required:

Estimate the value of the company and ascertain whether the ruling market price is undervalued as felt by the CEO based on the foregoing data. Assume that the cost of the equity is 16% and 30% of debt repayment is made in the year 2014.

Ans: **WN 1: Calculation of tax rate (t)**

- PAT = (EBIT - Interest) (1 - t)
- 17.2 = (245 - 218.125) (1 - t)
- 0.64 = 1 – t => t = 0.36 or 36%

- **Calculation of free cash flow till 2014**

	Year	2010	2011	2012	2013	2014
	EBIT	264.6	285.768	308.629	333.319	359.985
(-)	Interest	218.125	218.125	218.125	218.125	218.125
»	EBT	46.475	67.643	90.504	115.194	141.86
	EAT: EBT (1-0.36)	29.744	43.292	57.923	73.724	90.790
(-)	Increase in WC	3.52	3.80	4.10	4.34	4.78
(-)	Debt repayment	-	-	-	-	580.2
»	FCFE	26.224	39.492	53.823	69.384	-494.19

- Value of Equity = $\frac{26.224}{1.16^1} + \frac{39.492}{1.16^2} + \frac{53.823}{1.16^3} + \frac{69.384}{1.16^4} + \frac{(494.19)}{1.16^5}$ + 679.0133* = ₹568.48 lacs.

• Value per share = Total value of equity = ₹568.48 lacs = ₹7.58/share
No. of shares 75 lacs

• Value of share (₹7.58) < Market Price (₹66). Hence, share is currently over-valued.

***WN 1 – Calculating Terminal value**

Given - Free cash flow from 2014 onwards = ₹240.336 Lacs

Ambiguity – Whether these are FCFF or FCFE?

Assumption – Assuming these free cash flows to be FCFF.

Therefore - FCFE = FCFF – Interest (1-t) = 240.366 – 218.125 **x 0.7** (1 – 0.36) = 142.616

Note - Since, 30% debt is repaid. ∴ Interest payments are reduced by 30%.

Terminal value = $\frac{142.616}{0.16 - 0.06} \times \frac{1}{1.16^5} = 679.0133$

Calculating FCFF (long question)

 # Ques 7 – Buffett **{M18 RTP (New), N23 RTP}**

Buffett Inc. deals in computer and IT hardware's and peripherals.

The expected revenue for the next eight years is as follows:

Years:	1	2	3	4	5	6	7	8
Revenue ($ million):	8	10	15	22	30	26	23	20

Summarized financial position as on 31st March, 2012 was the follows:

Liabilities	Amount	Assets	Amount
Equity Stock	12	Fixed Assets (Net)	17
12% Bond	8	Current Assets	3
	20		20

Additional Information:

(a) Its variable expenses are 40% of sales revenue and fixed operating expenses (cash) are estimated to be as follows:

Period	Amount ($million)
1 – 4 years	1.6
5 – 8 years	2

(b) An additional advertisement and sales promotion campaign shall be launched requiring expenditure

as per following details:

Period	Amount ($million)
1 year	0.50
2 – 3 years	1.50
4 – 6 years	3.00
7 – 8 years	1.00

(c) Fixed assets are subject to depreciation at 15% as per WDV method.

(d) The company has planned additional capital expenditures (in the beginning of each year) for the coming eight years as follows:

Period:	1	2	3	4	5	6	7	8
Amount ($ Mn):	0.5	0.8	2	2.5	3.5	2.5	1.5	1

(e) Investment in Working Capital is estimated to be 20% of Revenue

(f) Applicable tax rate for the company is 30%

(g) Cost of Equity is estimated to be 16%

(h) The Free Cash Flow of the firm is expected to grow at 5% p.a. after 8 years.

Calculate: (i) Value of Firm (ii) Value of Equity

Ans: **# WN 1 - Calculation of Depreciation**

Year	Open Bal	Addition	Total	Dep^{n} @ 15%	Closing bal
1	17	0.5	17.5	2.625	14.875
2	14.88	0.8	15.68	2.35	13.33
3	13.33	2	15.33	2.3	13.03
4	13.03	2.5	15.53	2.33	13.2
5	13.2	3.5	16.7	2.51	14.19
6	14.19	2.5	16.69	2.5	14.19
7	14.19	1.5	15.69	2.35	13.34
8	13.34	1	14.34	2.15	12.19

 # WN 2 – Calculating increase in working capital

Year	1	2	3	4	5	6	7	8 ($ Million)
Sales	8	10	15	22	30	26	23	20
Op bal	3	1.6	2	3	4.4	6	5.2	4.6
Req WC (@ 20%)	1.6	2	3	4.4	6	5.2	4.6	4
Increase	-1.4	0.4	1	1.4	1.6	-0.8	-0.6	-0.6

 # WN 3 - Calculation of Depreciation

WACC = Ke.We + Kd.Wd = 16% x (12/20) + 12(1 - 0.3) x (8/20) = 12.96%

Calculating Cash flows

	Year	1	2	3	4	5	6	7	8 ($ Million)
	Sales	8	10	15	22	30	26	23	20
(-)	Variable cost	3.2	4	6	8.8	12	10.4	9.2	8
(-)	Fixed cost	1.6	1.6	1.6	1.6	2	2	2	2
(-)	Adv. Exp.	0.5	1.5	1.5	3	3	3	1	1
(-)	Depreciation	2.625	2.35	2.3	2.33	2.51	2.5	2.35	2.15
»	EBIT	0.075	0.55	3.6	6.27	10.49	8.1	8.45	6.85
»	NOPAT [EBIT×0.7]	0.05	0.39	2.52	4.39	7.34	5.67	5.92	4.8
(-)	Capex	0.5	0.8	2	2.5	3.5	2.5	1.5	1
(-)	Increase in WC	-1.4	0.4	1	1.4	1.6	-0.8	-0.6	-0.6
»	FCFF	3.575	1.54	1.82	2.82	4.75	6.47	7.37	6.55
»	PVCI	3.164	1.206	1.261	1.73	2.578	3.108	3.133	2.464

- Total PV of free cash flows of 8 years = $18.644 Million
- The cash flows will grow at 5% p.a. after 8 years onwards.

i) Value of firm = PV of cash flows + Terminal value

$$= 18.644 + \frac{6.55 \times 1.05}{0.1296 - 0.05} \times \frac{1}{1.1296^8} = 18.644 + 32.60 = \$ 51.244 \text{ Million}$$

ii) Value of equity = Value of firm – Value of debt = 51.244 – 8 = $ 43.244 Million

Ch 14 – M&A

SSS Model for Ques Solutions → "Simplified, Short & Standard" Solutions

Simplified Solutions - Easy to understand (No more anxiety due to complex solutions)

Short Solutions - Ques are solved in the shortest possible manner (Finish exam in time :D)

Standard Solutions - Ques are solved in a consistent manner (no more confusing treatments)

Index - Main Questions	**Ques Number**
Basic SER, Gain/Loss, MPS after merger	1 – 7
Valuation under Merger deals	8 – 11
Financial prudence of merger, Cost of acquisition	12 – 13
True cost of merger	14 – 15
Promoter's holding, Bonus, Buy-back, Stock split	16 – 21
Levered and Unlevered beta	22
Restructuring, Divestiture, Demerger	23 – 25
Leveraged buy-out	26
Special / Discrete Ques	27 - 28

Index - Additional Questions	**Ques Number**
Basic SER, Gain/Loss, MPS after merger	1 – 2
Valuation under Merger deals	3
Discrete Questions	4
Low Probability Unique Questions	
- Equity beta (using proxy firm) + Range of valuation (pre & post synergetic)	5
- Equity beta (using proxy firm) when new debt is raised + Beta of debt ≠ 0	6
- Preparing revised P&L and CFS after restructuring	7
- LBO: Calculating growth in Book value of equity	8
- Max debt for takeover when target Debt Equity ratio is given	9
- Impact on MPS when PE & Kd changes as per level of Debt : CE ratio	10

Main Questions

👉 Basic SER, Gain/Loss, MPS after merger

Basic SER, Post merger EPS MPS MV etc. Calculation

 # Ques 1 - Ratnam **{SM TYK, N19 RTP (New), N19 Exam (Old), N23 MTP 1}**

Following information is provided relating to the acquiring company Mani Ltd. and the target company Ratnam Ltd.:

	Mani Ltd.	Ratnam Ltd.
Earning after tax (₹ Lacs)	2000	4000
No. of shares outstanding (lacs)	200	1000
P/E ratio (No. of times)	10	5

(i) What is the swap ratio based on current market prices?

(ii) What is the EPS of Mani Ltd. after the acquisition?

(iii) Cal. expected MPS of Mani Ltd. after acquisition, assuming its P/E ratio is adversely affected by 10%.

(iv) Determined the market value of merged Co.

(v) Calculate gain/loss for the shareholders of the two independent entities, due to the merger.

Ans:

	Mani Ltd.	Ratnam Ltd.
EPS	2000/20 = 10	4000/1000 = 4
PE Ratio	10	5
MPS = EPS x PE Ratio	100	20

(i) Swap Ratio as per CMP = $\frac{MPS_B}{MPS_A} = \frac{20}{100} = 0.2:1$

(ii) EPS after merger = $\frac{2000 + 4000 + 0}{200 + 1000 \times 0.2} = 15$

(iii) MPS = PE Ratio x EPS = (10 x 0.9) x 15 = ₹ 135

(iv) MV of merged Co. = MPS x Total no. of shares = 135 x 400 L = ₹54000 L

(v)	**Gain / Loss Cal.**	**Mani Ltd.**	**Ratnam Ltd.**
	Equivalent MPS after merger	135	135 x 0.2 = 27
(-)	MPS before merger	100	20
=	Gain /Loss per share	35	7
x	**Pre-merger** Number of shares	200L	1000L
=	Total gain / (loss) in MV	7000L	7000L

ADDITIONAL NOTES: QUESTION VARIATIONS

- Ques may sometimes say that Acquirer is willing to pay premium over CMP of target.
- Ex: Acquirer is willing to pay 25% premium over CMP of the target. CMP of Acquirer = 100 and CMP of target = 20. Then SER based on MPS will be:
- SER = 20 x 1.25 / 100 = 0.25:1
- Rest all the question remains same.

Basic calculations + Offloading decision

 # Ques 2 – Azad **{SM TYK, M18 Exam (New), Dec 21 RTP (Old), M22 RTP, N22 Exam}**

Azad Ltd. (A ltd) wants to acquire T Ltd. and has offered a swap ratio of 1:2 (0.5 shares for every one share of T Ltd.). Following information is provided:

	A Ltd.	**T.Ltd.**
Profit after tax	₹18,00,000	₹3,60,000
Equity shares outstanding (Nos.)	6,00,000	1,80,000
EPS	₹ 3	₹ 2
PE Ratio	10 times	7 times
Market price per share	₹30	₹14

Required:

i) The number of equity shares to be issued by A Ltd. for acquisition of T Ltd.

ii) What is the EPS of A Ltd. after the acquisition?

iii) Determine the equivalent earnings per share of T Ltd.

vi) What is the expected market price per share of A Ltd. after the acquisition, assuming its PE multiple remains unchanged?

v) Determine the market value of the merged firm.

vi) After the announcement of merger, price of shares of T Ltd. rose by 10% on BSE. Mr. X, an investor, having 10,000 shares of T Ltd. is having another investment opportunity, which yields annual return of 14% is seeking your advice whether he needs to offload the shares in the market or accept the shares from A Ltd.

Ans:	(i) Number of new shares to be issued = Shares of T ltd x SER = 1.8L x 0.5 =	90,000
(ii)	EPS after merger = $\frac{18L + 3.6L + 0}{6L + 1.8L \times 0.5}$ =	₹ 3.13
(iii)	Equivalent EPS of T ltd = EPS after merger x SER = 3.13 x 0.5 =	₹ 1.57
(iv)	New market price of A ltd = Post merger EPS x PE ratio = 10 x 3.13 =	₹ 31.3
(v)	Market value of merged firm = No. of shares after merger x MPS = 6.9L x 31.3 =	₹ 215.97 lacs
(vi)	Offloading decision	
	a) Equivalent EPS of T Ltd.	₹ 1.57
	b) Price of T ltd after merger announcement = 14 x 1.10	₹ 15.4
	c) Return on Market Price per share (a/b)	10.19%
»	Decision - Expected return on T ltd share (12.26%) < Return on other available investment (14%).	
	So, it is better to offload the shares in the market.	

Basic EPS impact, Max SER as per MPS calculation

 # Ques 3 - Xian **{SM TYK, N19 RTP (Old), Dec 21 Exam (New)}**

Xian ltd (XYZ ltd.) wants to purchase ABC ltd at a SER of 0.7:1. Relevant data is:

	XYZ Ltd.	ABC ltd.
Equity shares outstanding	10,00,000	4,00,000
EPS (₹)	40	28
Market Price per Share (₹)	250	160

(i) Illustrate the impact of merger on EPS of both the companies.

(ii) The management of ABC Ltd. has quoted a share exchange ratio of 1:1 for the merger. Assuming, that P/E ratio of XYZ Ltd. will remain unchanged after the merger, what will be the gain from merger of ABC Ltd.? What will be the gain/loss to shareholders of XYZ Ltd.?

(iii) Determine the maximum exchange ratio acceptable to shareholders of XYZ Ltd.

Ans: (i) Post-merger EPS = $\frac{\{40 \times 10L\} + \{28 \times 4L\} + 0}{10L + \{4L \times 0.7\}}$ = ₹40

# Gain / (loss) calculation in EPS	XYZ	ABC
• Post-merger equivalent EPS	40	40 x 0.7 = 28
• Pre-merger EPS	40	28
» Gain/Loss	0	0

(ii) Post-merger EPS if SER is 1:1

- EPS_{New} = $\frac{\{40 \times 10L\} + \{28 \times 4L\}}{10L + 4L}$ = ₹36.57

- PE ratio of XYZ before merger = MPS/EPS = 250/40 = 6.25
- MPS_{New} = EPS_{New} x PE ratio = 36.57 x 6.25 = ₹228.56

#	Gain / (loss) calculation in MPS	XYZ	ABC
•	Post-merger equivalent MPS	228.57	228.57 x 1=228.57
•	Pre-merger MPS	250	160
»	Gain/(Loss)	(21.43)	68.57

(iii) Max SER as per MPS

- MPS (after merger) = MPS (XYZ)
- $\frac{(40 \times 10L + 4L \times 28)}{10L + 4L \times SER} \times 6.25 = 250$ → SER = 0.7 : 1

Max / Min SER based on Market price

 # Ques 4 – Chinku **{N18 Exam (Old)}**

Chinku (C ltd) & Dinku (D ltd) are contemplating a merger deal in which C Ltd. will acquire D Ltd. The relevant information about the firms are given as follows:

Particulars	C ltd.	D ltd.
Total Earnings (₹ millions)	96	30
Number of outstanding shares (in millions)	20	14
EPS (₹)	4.8	2.143
Price earnings ratio (P/E)	8	7
Market Price per share (P) (₹)	38.4	15

(i) What is the maximum exchange ratio acceptable to the shareholders of C Ltd., if the P/E ratio of the combined firm is 7?

(ii) What is the minimum exchange ratio acceptable to the shareholders of D Ltd., if the P/E ratio of the combined firm is 9?

Ans: (i) Maximum exchange ratio acceptable to C ltd = SER @ which MPS of C ltd will not fall.

- i.e. $MPS_{Combined}$ ($EPS_{Combined}$ x PE ratio) = Existing MPS of C ltd
- $\frac{\{96 + 30 + 0\}}{20 + 14 \times SER} \times 7 = 38.4$

- 882 = 38.4 x (20 + 14×SER)
- 22.96875 = 20 + 14×SER
- SER = 0.212 : 1

(ii) Minimum exchange ratio acceptable to D ltd = SER @ which **Equivalent** MPS of D will not fall.

- i.e. Equivalent MPS ($EPS_{Combined}$ x PE ratio x SER) = Existing MPS of D ltd.
- $\frac{\{96 + 30 + 0\} \times 9 \times SER}{20 + 14 \times SER} = 15$
- 1134 x SER = 15{20 + 14 x SER}
- 1134 x SER = 300 + 210 x SER
- 924 x SER = 300
- SER = 300/924 = 0.325 : 1

EPS when synergy is expected

 # Ques 5 - Sunflower Industries **{SM TYK, M19 RTP (New), N22 MTP 2}**

Reliable Industries Ltd. (RIL) is considering a takeover of Sunflower Industries Ltd. (SIL).

The particulars of 2 companies are given below:

Particular's	A Ltd (₹)	B Ltd (₹)
Earnings After Tax (EAT)	₹ 20,00,000	₹ 10,00,000
Equity Shares Outstanding	10,00,000	10,00,000
Earning Per Shares (EPS)	2	1
P/E Ratio (Times)	10	5

Required:

(i) What is the market value of each company before merger?

(ii) Assume that management of RIL estimates that the shareholders of SIL will accept an offer of 1 share of RIL for 4 shares of SIL. Assuming P/E ratio after merger is same as that of RIL.

a) What is the new price per share?

b) What is the market value of the Post-merger RIL?

c) Calculate Gain or Loss in terms of market value?

(iii) Due to synergy effects, the management of RIL estimates that the earnings will increase by 20%.

a) What is the new post-merger EPS and Price per share?

b) Calculate Gain or Loss in terms of market value for both company shareholders?

Ans: (i) Before merger MPS = EPS x PE Ratio

RIL = 2 x 10 = 20

SIL = 1 x 5 = 5

(ii) a) MPS after Merger = $\frac{(20L + 10L) \times 10}{10L + 10L \times 0.25}$ = 24

(b) Total MV = MPS x No. of Shares = 24 x 12,50,000 = ₹3 Crores

(c)

Gain / Loss Calculation	**RIL**	**SIL**
Equivalent Post-merger MPS	24	24 x 0.25 = 6
(-) Pre-merger MPS	(20)	(5)
Gain/(Loss) :	4	1

(iii) When 20% synergies are expected

(a) Post- merger EPS = $\frac{(20 L + 10 L) \times 1.2}{10 L + 10 L \times 0.25}$ = 2.88

MPS = 2.88 x 10 = 28.8

(b)

Gain/Loss in MPS:	**RIL**	**SIL**
After Merger	28.8	28.8 x 0.25 = 7.2
Before Merger	20	5
Gain / (loss) :	8.8	2.2
In MV terms:	8.8×10L = 88L	2.2×10L = 22L

Value of original SHs in combined entity

 # Ques 6 – Predator **{SM TYK, M22 Exam}**

Predator Ltd. (P ltd.) is considering take-over of R Ltd. by the exchange of 4 new shares in P Ltd. for every five shares in R Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

	P Ltd	**R Ltd.**
Profit before Tax (₹ Crore)	15	13.50
No. of Shares (Crore)	25	15
P/E Ratio	12	9

Corporate Tax Rate 30%.

	Required:		
i)	Market value of both the company.		
ii)	Value of original shareholders.		
iii)	Price per share after merger.		
iv)	Effect on share price of both the companies if the Directors of P ltd. expect their own pre-merger P/E ratio to be applied to combined earnings.		
Ans:	**i) Calculation of MV**	**P Ltd.**	**R Ltd.**
A.	PAT = PBT x 0.7	15 x 0.7 = 10.5 crore	13.50 x 0.7 = 9.45 crore
B.	No. of shares	25 crore	15 crore
C.	EPS (A/B)	₹ 0.42	₹ 0.63
D.	PE ratio	12	9
E.	MPS (C x D)	₹ 5.04	₹ 5.67
F.	MV of company (E x B)	₹ 126 crore	₹ 85.05 crore
ii)	No. of shares after merger = 15 crore x 4/5		12 crores
•	Total number of shares after merger = 15 + 12		27 crores
•	Value of combined Entity = 126 + 85.05		₹ 211.05 crores
•	Owned by P Ltd. = 15/27		67.57%
	or 211.05 x 67.57%		₹ 142.61 crores
•	Owned by R Ltd. = 12/27		32.43%
	or 211.05 x 32.43%		₹ 68.44 crores
iii)	EPS after merger = {10.5 + 9.45} / 37		₹ 0.5392
	MPS after merger = Post merger EPS x PE ratio = 0.5392 x 12		₹ 6.47
iv)	**Effect on share price: Gain/(loss) per share**		
•	P ltd = {6.47 ÷ 5.04 – 1} x 100		28.4% (Increase)
•	R ltd = {(6.47 x 4/5) ÷ 5.67 – 1} x 100		–8.64% (Decrease)

Impact of merger on MV (wealth) of companies

 # Ques 7 - Simpson **{SM Illus}**

Simpson Ltd. is considering a merger with Wilson Ltd. The data below are in the hands of both Board of Directors. The issue at hand is how many shares of Simpson should be exchanged for Wilson ltd. Both boards are considering three possibilities 20,000 25,000 and 30,000 shares. You are required to construct a table demonstrating the potential impact of each scheme on each set of shareholders:

		Simpson ltd	Wilson ltd	Combined Post merger firm 'A'
A.	Current earnings per year	2,00,000	1,00,000	3,50,000
B.	Shares outstanding	50,000	10,000	?
C.	Earnings per share (₹) (1÷2)	4	10	?
D.	Price per share (₹)	40	100	?
E.	Price-earnings ratio (4 ÷3)	10	10	10
F.	Value of firm (₹)	20,00,000	10,00,000	35,00,000
G.	Future Growth rate	0	0	0

Ans: Potential impact of each scheme on each set of shareholders

		Case I	Case II	Case III
A.	No. of shares issued	20,000	25,000	30,000
B.	Existing no. of shares of Simpson	50,000	50,000	50,000
C.	Total shares of merged Co.	70,000	75,000	80,000
D.	Total MV of merged Co.	35 L	35 L	35 L
E.	Simpson proportionate share (B/C)	50/70	50/75	50/80
F.	Simpson SH's wealth (D x E)	25 L	23.33 L	21.875 L
G.	Wilson SH's wealth (D – F)	10 L	11.67 L	13.125 L

👉 Valuation under Merger deals

Min / Max value based on cash flows (DCF)

 # Ques 8 - Amulya **{M19 Exam (Old)}**

Amulya ltd. (A Ltd.) and B Ltd. operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. A Ltd. management is interested in acquisition of B Ltd. due to its excess plant capacity. Share of B Ltd. is trading in market at $4 each.

Particulars	A Ltd.	B Ltd.	Combined
Profit after tax	$4,800,000	$3,000,000	$9,200,000
Residual Net CF/year	$6,000,000	$4,000,000	$12,000,000
Required Return (Ke)	12.5%	11.25%	12%

Balance Sheet of B Ltd.

Assets	Amount ($)	Liabilities	Amount ($)
Current Assets	27,300,000	Current Liability	13,450,000

	Other Assets	5,500,000	Long Term liabilities	11,100,000
	Property plant & Equipment	21,500,000	Share Capital (of $1 each)	5,000,000
		54,300,000		54,300,000

You are required to compute;

(i) Minimum price per share B Ltd. should accept from A Ltd. as per its cash flow and book value.

(ii) Maximum price per share A Ltd. shall be willing to offer to B Ltd.

(iii) Floor Value per Share of B Ltd. Whether it shall pay any role in decision for its acquisition by A Ltd.

Ans: Slippery Slope!!! Reserve & Surplus is "hidden" in ques.

 # WN 1 – Calculation of Reserve & Surplus

Total assets of the co.	$ 543L
Total liabilities = 13.45 + 11.10 + 5	$ 295.5L
*Therefore Reserve & surplus (Balancing figure) =	$ 247.5L

(i) Minimum price that B ltd. would accept

» Value as per CF = Annual CF / Ke = 40L / 0.1125 ₹ 355.5556 L

• Value per share = ₹355.5556L / 50L ₹ 7.11

» BVPS of B Ltd = Share capital + R&S = (50L + 247.5L*) / 50L ₹ 5.95

(ii) Maximum Price

•	PV of total CF of merged entity = 120L / 0.12	1000L
(-)	PV of current CF of A Ltd. = 60 / 0.125	(480L)
=	PV of incremental cash inflow	520L
»	Maximum price per share = 520L / 50L =	₹ 10.4

* Note for students: Maximum Price that I can pay for something = PVCI from that Investment

(iii) Floor Value = Minimum of all Values

• MPS = ₹4

• BVPS = ₹5.95

• Value as PVCI = ₹7.11

» Floor Value = ₹4 (i.e. MPS)

Comment - This floor value shall not play any role as it is even less than its BVPS.

Value as per DCF

 # Ques 9 - Yes ltd **{SM TYK, N18 RTP (New)}**

Yes Ltd. wants to acquire NO Ltd. and the cash flow of Yes Ltd. and the merged entity is given:

Year	1	2	3	4	5	(₹ In Lakhs)
Yes Ltd.	175	200	320	340	350	
Merged Entity	400	450	525	590	620	

Earning would have witnessed 5% constant growth rate without merger and 6% with merger on account of economies of operations after 5 years in each case. The cost of capital is 15%. The number of shares outstanding in both the companies before the merger is the same and the companies agree to an exchange ratio of 0.5 shares of Yes Ltd. for each share of No Ltd.

(i) Compute the value of Yes Ltd. before and after merger.

(ii) Value of acquisition OR total benefit due to merger and

(iii) Gain to shareholders of Yes Ltd.

Ans: **(i) Value of Yes Ltd. Before merger**

$$\frac{175}{1.15} + \frac{200}{1.15^2} + \frac{320}{1.15^3} + \frac{340}{1.15^4} + \frac{350}{1.15^5} + \frac{(350 \times 1.05)}{0.15-0.05} \times \frac{1}{1.15^5} = ₹\ 2708.96$$

- **Value of Yes ltd. after merger:**

$$\frac{400}{1.15} + \frac{450}{1.15^2} + \frac{525}{1.15^3} + \frac{590}{1.15^4} + \frac{620}{1.15^5} + \frac{(620 \times 1.06)}{0.15-0.06} \times \frac{1}{1.15^5} = ₹\ 5308.474$$

(ii) Value of acquisition or Total benefit due to merger:

= Value of merged entity – Value of Yes Ltd. = 5308.474 – 2708.915 = ₹2599.559 L

(iii) Number of shares in Yes Ltd. = Number of shares in No Ltd. & SER = 0.5 : 1 share.

- Share of Yes Ltd. in merged entity = 1 / {1 + 0.5} = 1/1.5
- Value of Yes Ltd.'s shares in merged entity = 5308.474 x 1/1.5 = ₹ 3538.983
- » Benefit to Yes Ltd.'s = 3538.983 – 2708.915 ₹ 830.068

When growth rate changes under new management

 # Ques 10 - Aarav **{SM TYK, N22 RTP}**

Aarav (A Ltd.) wanted to acquire B Ltd. The shares issued by the two companies are 10,00,000 and 5,00,000 respectively:

(i) Calculate increase in the total value of B Ltd. resulting from the merger if:

	Current Expected Growth Rate of B Ltd.	7%	
	Expected Growth Rate under control of A Ltd	8%	
	Current Market Price per Share of A Ltd	₹ 100	
	Current Market Price per Share of B Ltd	₹ 20	
	Expected Dividend Price per share of B Ltd	₹ 0.60	
(ii)	**Based on aforesaid conditions** calculate the gain or loss to shareholders of both the companies, if A Ltd. were to offer one of its share for every four shares of B Ltd.		
(iii)	Calculate the gain to the shareholders of both the companies, if A Ltd. pays ₹22 for each share of B Ltd. assuming the P/E Ratio of A Ltd. does not change after the merger. EPS of A Ltd. is ₹8 and that of B is ₹2.50. It is assumed that A Ltd. invests in cash to earn 10%. Hence if cash is paid by A Ltd., earning will be reduced to the extent of opportunity Cost of Interest Loss.		
Ans:	**Current Ke of B ltd (i.e. Ke before merger):**		
•	Value per share = $\frac{DPS\ 1}{Ke - g}$		
•	$20 = \frac{0.60}{Ke - 0.07}$ → Ke = 10%		
(i)	**Calculating increase in Market Value of B ltd.**		
A.	MPS before merger		₹ 20
B.	MSP after merger = 0.60 / (0.10 – 0.08)		₹ 30
C.	Increase in value of B Ltd (per Share)= B – A		₹ 10
D.	Total increase in MV = 5L x 10		₹ 50L
	(Note– This increase of value of 50L represents synergy benefit)		
(ii)	MPS after Merger: = $\frac{10L \times 100 + 5L \times 20 + 50L}{10L + 5L \times ¼}$ = ₹102.22		
#	**Gain / Loss**	**A Ltd.**	**B Ltd.**
	Equivalent MPS of new entity	102.22	102.22 x ¼ = 25.55
	MPS of old entity	(100)	(20)
	Gain / Loss	2.22	5.55
(iii)	**Calculating MPS after merger**		
A.	Pre-merger earnings of A ltd = 8 x 10L		80 Lacs

B.	Pre-merger earnings of B ltd = 2.5 x 5L	12.5 Lacs
C.	Interest income lost due to cash paid to B ltd = (22 x 5L) x 0.1	11 Lacs
D.	Total earning after merger = A + B – C	81.5 Lacs
E.	EPS of merged entity = D ÷ 10L shares	₹ 8.15 / share
F.	Existing PE ratio of A ltd = 100/8	12.5
G.	New MPS of merged entity = New EPS x PE ratio = 8.15 x 12.5	₹ 101.875

#	**Gain/Loss:**	**A Ld.**	**B Ltd.**
	MPS or Cash received after merger	101.875	22
	MPS of old entity	(100)	(20)
	Gain/Loss	1.875	2

Imp! Synergy given in question is relating to MV & not earnings. (Earnings related synergy is taken as 0.

Valuation using EBIDT multiple

 # Ques 11 - Aadi **{SM TYK, M18 RTP (New), N18 Exam (New)}**

Aadi (A Ltd.) wants to acquire B Ltd. Important information about the two companies as per their latest financial statement is given below:

	A Ltd.	**B Ltd.**
₹10 equity shares outstanding	12 lacs	6 lacs
Debt: 10% debentures	₹ 580 lacs	-
12.5% Institutional Loan	-	₹ 240 lacs
EBIDT (Earnings Before Interest Depreciation & Tax.)	₹ 400.86 L	₹ 115.71 L
Market price/share	₹ 220	₹ 110

A Ltd. is planning to offer a price for B Ltd., business, which will be seven times EBIDT reduce by the outstanding debt, to be discharged by own shares at market price. B Ltd. is planning to receive Net consideration based on its market value (Or B Ltd is planning to seek one share in A Ltd. for every two shares in B Ltd. based on the market price). Tax rate for the two companies may be assumed as 30%.

Calculate the following under both alternatives: A Ltd. offer and B Ltd. plan:

(i) Net consideration payable

(ii) No. of shares to be issued by A Ltd.

(iii) EPS of A Ltd. after acquisition.

(iv) Expected MPS of A Ltd. after acquisition. Assume PE ratio of A Ltd. after merger is same.

(v) State briefly the advantages to A Ltd. from the acquisition. Calculations (except EPS) may be rounded off to two decimal places in lacs.

Ans: **Case A: Consideration = 7 times EBIDT**

#	**(i) & (ii) Calculation of Net consideration & no. of shares to be issued**		
A.	EBIDT of B ltd x 7 = {7 x 115.71}		809.97 L
B.	Debt		240.00 L
C.	Net consideration payable = A – B		569.97 L
D.	MPS of A ltd.		220
E.	Number of new shares to be issued to B ltd = C ÷ D		2.5817 L
(iii)	**EPS after Acquisition:**	**A Ltd.**	**B Ltd.**
A.	EBIDT	400.86L	115.71L
B.	Interest	(58L)	(30L)
C.	EBT	342.86L	85.71L
D.	EAT = C x 0.7	240L	60L

» EPS after Merger: = $\frac{240L + 60L}{12L + 2.5817L}$ = ₹ 20.57

(iv)	**MPS after Merger**	
	PE Ratio before Merger= 220 / 20	11
	MPS after Merger = 20.57 x 11	226.27

Case B: Swap Ratio = 0.5 : 1

(i)	Net Consideration = (6L x 0.5) x 220	₹ 660 Lacs
(ii)	Number of shares = 6L x 0.5	3L shares
(iii)	EPS after Merger = $\frac{\text{Total earning after merger}}{\text{Total number of shares}} = \frac{300\ L}{12L + 6L \times 0.5}$	₹ 20
(iv)	MPS after Merger = EPS x PE Ratio = 20 x 11	₹ 220

(v) **Advantage of Merger**: such as synergy benefit, larger entity, economies of scale, more competitive power etc.

Financial prudence of merger, Cost of acquisition

Checking Financial feasibility of acquisition (NPV of acquisition)

 # Ques 12 - Tiger {SM TYK, M24 MTP 2}

M/S Tiger Ltd. wants to acquire M/S leopard Ltd. The balance sheet of Leopard Ltd. as on 31st March, 2012 is as Follows:

Liabilities	(₹ Lacs)	Assets	(₹ Lacs)
Eq. capital (0.7L shares)	7	Cash	0.5
Retained Earnings	3	Debtors	0.7
12% Debentures	3	Inventories	2
Cr. & other liabilities	3.2	PPE	13
Total	16.2		16.2

Additional Information:

(i) Shareholders of Leopard Ltd will get on share in Tiger Ltd for every two shares. External liabilities are expected to be settled at ₹500000. Shares of tiger Ltd would be issued at its current price of ₹15 per share. Debenture holder will get 13% convertible debentures in the purchasing company for the same amount. Debtors and inventories are expected to realize ₹2,00,000.

(ii) Tiger Ltd has decided to operate the business of Leopard Ltd as a separate division. The division is likely to give cash flows (after tax) to the extent of ₹5,00,000 per year for 6 Years. Tiger ltd has planned that after 6 years, this division would be demerged and disposed of for ₹2 lacs.

(iii) The company's cost of capital is 16%. Make a report to the board of the company advising them about the financial feasibility of this acquisition.

Ans: To calculate financial feasibility of the acquisition » We use NPV.

NPV = PVCI – PVCO = 19,24,000 – 10,75,000 = ₹8,49,000

WN 1: PVCI = 5L x PVAF(16%,6) + 2L x PVF (16%, 6) = ₹19,24,000.

WN 2: Calculation of Net PVCO

External Liabilities	5,00,000
Equity shares: 70,00 x ½ x 15	5,25,000
13% Debentures	3,00,000
» Total A:	**13,25,000**
Debtors & Inventories	2,00,000
Cash	50,000

»	**Total B:**	**2,50,000**
»	PVCO = A - B = 13,25,000 – 2,50,000	10,75,000

Note: Why issuance of securities like debentures/ Preference shares etc. are considered as cash outflow?

» Because these securities could have been issued in market for cash.

But these were issued to R Ltd. without any cash. Hence, it has good as cash outflows.

ADDITIONAL NOTES: QUESTION VARIATIONS

1) Sometimes question may mention that target co. has some preference shares and the acquirer is issuing new preference shares as payment for the existing ones.

• Its treatment is exactly same as the treatment in case of debentures above.

• Old preference shares will be redeemed, and new ones will be issued. These new PS issue will be considered as "Cash outflow" (just like debenture issue).

2) If ques mentions "Dissolution expenses", then its treatment will depend on who is paying for it.

» If paid by acquirer → Considered as "cash outflow" (PVCO).

» If paid by target co. → It will reduce its "Cash balance"

Cost of acquisition + Reverse calculation required Annual CFs using desired Kc

 # Ques 13 - Adrika

Adrika Ltd. (A Ltd) is investing in merger of B Ltd. Balance Sheet of B Ltd is given below:

Liabilities	Price ₹	Assets	Price ₹
10% Cumulative Preference Capital	100	Net Fixed Assets	275
Ordinary Share Capital (₹10 / share)	300	Investments	50
Reserves & Surplus	150	Current Assets	
14% Debentures	80	Stock	190
Current liabilities	100	Book Debts	150
		Cash & Bank Bal.	65
Total	730	Total	730

A Ltd. proposed to offer the following to B Ltd.:

(a) 10% convertible preference shares of ₹100 crore in A Ltd. for paying 10% cumulative preference capital of B Ltd.

(b) 12% convertible debentures of ₹84 crore in A Ltd. to redeem 14% debentures of B Ltd.

(c) One ordinary share of A Ltd. for every three shares held by B Ltd.'s shareholders, the market price per share being ₹42 for A Ltd's shares & ₹20 for B Ltd.`s shares. It would pay entire after acquisition, A Ltd. is expected to dispose of B Ltd.`s stock current liabilities. for ₹150 crore, book debts for ₹102 crore and investment for ₹55 crore.

(i) What is the Cost of Acquisition to A Ltd.?

(ii) If A Ltd.'s required rate of return is 20% how much should be the annual after-tax cash flows from B Ltd. acquisition to justify merger assuming a time horizon of eight years and a zero-salvage value?

(iii) Would your answer change if there is a salvage value of ₹30 crore after 8 years?

Ans: **(i) Cost of acquisition = Total payment – Total receipts**

10% Convertible Preference Shares	100
12% Convertible Debenture	84
Equity Share Capital = (30 x 1/3) x 42	420
Current Liabilities	100
» Total Payments (A):	**704**
Investments	55
Stock	150
Book Debts.	102
Cash	65
» Total Receipts (B):	**372**
» Cost of acquisition = A – B = 704 – 372	332

(ii) At 20% rate, PVCO = PVCI

- 332 = Annual CF x PVAF (20%, 8 Years)
- Annual CF = ₹86.53 Crores.

(iii) If salvage value = ₹30 Crores

- 332 = Annual CF x PVAF (20%,8) + 30 x PVF (20%,8)
- 325.023 = Annual CF x PVAF (20%, 8 years)
- Annual CF = ₹84.70 Crores.

👉 **True cost of merger**

True cost of merger (in case of cash takeover & stock takeover)

 # Ques 14 - Night **{M19 Exam (New)}**

Given is the following information of Day ltd and Night ltd

	Day Ltd.	Night Ltd.
Net Earnings	₹ 5 crores	₹ 3.5 crores
No. of Equity Shares	10,00,000	7,00,000

The shares of Day Ltd. and Night Ltd. trade at 20 and 15 times their respective P/E ratios. Day Ltd. considers taking over Night ltd. by paying ₹55 crores considering that the market price of Night Ltd. reflects its true value. It is considering both the following options :

(i) Takeover is funded entirely in cash .

(ii) Takeover is funded entirely in stock.

You are required to calculate the cost of takeover and advise Day Ltd. on the best alternative.

Ans:

		Day Ltd.	Night Ltd.
	Earnings	₹5 crores	₹3.5 crores
÷	No. of equity shares	10,00,000	7,00,000
=	EPS	50	50
x	P/E ratio	20 times	15 times
=	MPS	₹1,000	₹750
=	Total MV	₹100 crores	₹52.5 crores

(i) Takeover funded by cash

True cost of merger = Cash paid – MV of company acquired = 55 – 52.5 = ₹2.5 crores

(ii) Takeover funded by stock

True cost of merger = MV of merged entity given (-) MV of company acquired

= (100 + 52.5) x 35.48% – 52.5 = ₹1.607 crores

WN 1: No. of shares issued to Night Ltd. = 55 crores / 1,000 = 5.5 lacs

• % of merged entity given to Night Ltd. = 5.5L / {10L + 5.5L} = 35.48%

Net cost of merger when growth rate changes under new management

 # Ques 15 - Akriti **{Jul 21 Exam (New), M23 MTP 1, N24 RTP}**

Following data is available to you of Akriti Ltd. (A Ltd.)

	A Ltd.	B Ltd.
Expected earnings per share	₹10	₹3
Expected dividend per share	₹6	₹1.60
Number of shares	20,00,000	12,00,000

	Current market price	₹180	₹40

As a finance director of A Ltd., you are thinking of merging B Ltd. your estimate indicates growth of earnings and dividend of B ltd. is to the tune of 6% per year. However, under the new management the growth rate Is likely to go up to 8% p.a.

Calculate:

(i) The net cost of merger of A Ltd. is ₹50 is paid for each share of B Ltd.

(ii) Net cost of merger if 1 share of A Ltd. for every three shares of B Ltd. is the agreed exchange ratio.

(iii) Compute synergy gain from merger or Calculate gain from acquisition.

(iv) Calculate Net Cost of Merger in case of (i) & (ii) if growth rate continues to be 6%. Also calculate MPS after Merger if the merger is financed by Share Exchange.

Ans: **WN 1 - Current Ke of B ltd (i.e. Ke before merger):**

- Value per share = $\frac{DPS\ 1}{Ke - g}$
- $40 = \frac{1.60}{Ke - 0.06}$ → Ke = 10%

 # WN 2 - Calculating increase in Market Value of B ltd.

A.	Market value of B ltd before merger = 40 x 12L	₹ 480L
B.	MPS of B after merger = 1.60 / (0.10 – 0.08)	₹ 80
C.	Total Market value of B ltd after merger = 80 x 12L	₹ 960L
D.	Increase in value of B ltd (i.e. Benefit of Synergy) = C – A	₹ 480L

 # WN 3 – Total Market value of merged entity

- Total MV = MV of A + MV of B + Synergy benefit = {180 x 20L} + 480L + 480L = ₹ 4560L

 # WN 4 – Calculating No. of shares given to B ltd.

- Total no. of shares after merger = 20L + {12L x 1/3} 24L shares
- No. of shares allotted to B Ltd = 12L x 1/3 4L shares

(i) Cash Takeover:

Net Cost = Cash paid – MV of B received = {50 x 12L} – 480L = ₹120L

(ii) Share Takeover:

Net Cost = MV of merged co. given to B ltd – MV of B ltd received

= {4560L x 4L / 24L} – 480L = ₹280L

(iii) Gain from synergy (in terms of Market value) = ₹ 480 lacs (computed above in WN 2)

(iv) Net Cost of merger when growth rate remains at 6%:

a) Cash takeover = {50 x 12L} – 480L = ₹ 120 lacs

(b) Share Takeover

- MV of merged entity = 3600L + 480L + 0* = ₹4080L (*No benefit of synergy here)
- Net cost of merger = {4080L x 4L / 24L} – 480L = ₹200L

c) MPS of merged entity = $\frac{3600L + 480L + 0}{20L + 12L \times 1/3}$ = ₹ 170 per share

Author Note: Did you observed that Net Cost of merger in case of "**cash takeover**" is not impacted by synergy benefits. Therefore, answer is same in case (i) & (iii).

👉 Promoter's holding, Bonus, Buy-back, Stock split

Basic post-merger figures + Revised promoter's holding

 # Ques 16 - Aabha **{SM TYK, N20 Exam (Old), M23 RTP}**

The following information is provided relating to the Acquiring Co. Aabha ltd. (A ltd.) and the target company B ltd.

	A Ltd.	B Ltd.
No. of shares (F.V. ₹10 each)	10 lacs	7.5 lacs
Market Capitalization	500 lacs	750 lacs
P/E Ratio (Times)	10	5
Reserves and Surplus	300 lacs	165 lacs
Promoter's Holding (No of shares)	4.75 lacs	5.00 lacs

Board of Directors of both the companies have decided to give a fair deal to the shareholders & accordingly for swap ratio the weights are decided as 40%, 25% and 35% respectively for EPS, BVPS and MPS of share of each company:

(i) Calculate the swap ratio and calculate Promotor's holding % after merger.

(ii) What is the EPS of A Ltd. after acquisition of B Ltd.?

(iii) What is the expected market price per share and market capitalization of A Ltd. after acquisition, assuming P/E ratio of A Ltd. remains unchanged?

(iv) Calculate free float market capitalization of the merged firm.

Ans:

	A Ltd.	**B Ltd.**
• MPS = Market cap / No. of shares	500L / 10L = 50	750L / 7.5L = 100
• EPS = MPS / PE ratio	50 / 10 = 5	100 / 5 = 20
• BVPS	{10L×10 + 300L} / 10L = 40	{7.5L×10 + 165L}/7.5L = 32

(i) Swap Ratio = $\frac{20}{5} \times 0.4 + \frac{32}{40} \times 0.25 + \frac{100}{50} \times 0.35 = 2.5 : 1$

(ii) EPS after Merger = $\frac{5 \times 10L + 20 \times 7.5L}{10L + 7.5L \times 2.5}$ = ₹ 6.956

(iii) MPS after Merger = EPS x PE Ratio = 6.957 x 10 = 69.57

(iv)

Promoter's holding after Merger = {4.75L + 5L x 2.5} / 28.75L	60%
Free-Float market cap = 100% - 60%	40%
Free-float market cap (in no. shares terms) = 28.75L x 40%	11.5 L shares.

Basic post-merger figures + Revised promoter's holding

 # Ques 17 - Aon Wells **{SM TYK, N23 Exam}**

Aon Wells ltd.(A ltd.) is interested in acquiring B ltd. The following information is given:

	A Ltd.	**B Ltd.**
% Shareholding of Promoter	50%	60%
Share Capital	200 lacs	100 lacs
Free Reserves and Surplus	900 lacs	600 lac
Paid Up Value per share	100	10
Free float market capitalization	500 lacs	156 lacs
P/E Ratio (Times)	10	4

The following parameters have been signed by the Board A Ltd., for determining the swap ratio.

Book Value = 25%, EPS = 50% and Market Price = 25%.

You are required to compute:

(i) The Swap Ratio

(ii) The book value, EPS and expected market price of A Ltd. after merger, (assuming P/E Ratio of A Ltd. remains the same and all assets and liabilities of B Ltd. are taken over at book value).

(iii) Revised promoter's holding (%) in A ltd. after acquisition.

(iv) Post-acquisition free float market capitalization.

Ans: **Calculation of BVPS before merger**

- A Ltd. = {200L + 900L} / 2L = ₹ 550
- B Ltd. = {100L + 600L} / 10L = ₹ 70

#	Calculation of MPS & EPS	A Ltd.	B Ltd.
A	Promoter's holding	50%	60%
B	Free - Float holding (100% - A)	50%	40%
C	Free - Float market capital	500 L	156 L
D	Total MV (C/B)	1000 L	390 L
E	Number of Shares	2 L	10 L
F	MPS (D/E)	₹500	₹39
G	P/E Ratio	10	4
H	EPS (MPS / PE Ratio)	50	9.75

(i) Swap Ratio = $\frac{70}{550} \times 0.25 + \frac{9.75}{50} \times 0.5 + \frac{39}{500} \times 0.25$ = 0.1488 : 1

(ii) Post-Merger Figures:

» Before merger Total Assets of:

A Ltd. = 200L + 900L = 1100L

B Ltd. = 100L + 600L = 700L

(Assuming external liability = 0 as no info. is given)

- BVPS after merger = $\frac{1100L + 700L}{2L + 1.488L}$ = ₹ 516.055

- EPS after merger = $\frac{50 \times 2L + 9.75 \times 10L}{2L + 10L \times 0.1488}$ = ₹ 56.62

- MPS after merger = EPS x PE ratio = 56.62 x 10 = ₹ 566.20 per share

(iii)	**Revised promoter's holding**	
A.	Total number of shares in merged entity = 2L + 10L x 0.1488	3.488 lacs
B.	Shares held by existing promoters = 2L x 0.5	1 lac
C.	Shares allotted to promoters of B ltd. = 10L x 60% x 0.1488	0.8928 lacs
D.	Total promoter holding = B + C	1.8928 lacs
E.	Revised promoter's holding % = D/A	54.266%

(iv) Revised free float market capitalization = (3.488 – 1.8928) x 566.20 = ₹ 903.20 lacs (approx.)

Note: Alternative way to calculate BVPS (not required. Given for knowledge purpose only)

Balance sheet after merger

Share capital 200L + {1.488L x 100}	348.8	Assets from A ltd	1100
Reserve & Surplus (B.F.)	1451.2	Assets from B ltd	700
	1800		1800

- BVPS after merger = $\frac{348.8 + 1451.2}{2L + 1.488L}$ = ₹ 516.055

Required Bonus ratio to manage promoter's holding within limits

 # Ques 18 - Intel **{M18 Exam (Old), Dec 21 MTP 1 (Old)}**

INTEL Ltd. promoted by a Trans National company, is listed on the stock exchange **holding 80% shares***. The value of the floating stock is ₹45 crores. The market price per share (MPS) is ₹150. The capitalization rate is 20%. The promoters holding is to be restricted to 75% as per the norms of listing requirement. The Board of Directors have decided to fall line to restrict the Promoter's holding to 75% by issuing Bonus Shares to minority shareholders while maintaining the same Price. Earnings Ratio(P/E).

You are required to calculate :

(i) Bonus Ratio (ii) MPS after issue of Bonus Share

(iii) Free Float Market capitalization after issue of Bonus Shares.

{Author Note: When this question was 1st asked in May 18 exam, then promoter's holding % was erroneously missing in question.}

Ans: No. of free float shares = Market Cap / MPS = 45 crores / 150 = 30 lacs

•	Current total no. shares = 30 lacs/0.2	150 lacs
•	Current promoter's holding = 150 x 0.8	120 lacs
•	Required total no. of shares (restricted to 75%) = 120/0.75	160 lacs
•	Required bonus issue = 160 – 150	10 lacs
(i)	Bonus ratio = Required bonus issue = 10 = 1:3	
	Free float market cap 30	
(ii)	**MPS after bonus issue**	
»	PE ratio = 1 = 1 = 5 times	
	Ke 0.20	
A.	Current EPS = MPS ÷ PE ratio = 150/5	₹ 30
B.	No. of shares before bonus	150 lacs
C.	Current total earnings (A x B)	₹ 4,500 lacs
D.	No. of shares after bonus	160 lacs
E.	EPS after bonus (C ÷ D)	₹ 28.125
F.	MPS after bonus = EPS x PE ratio = 28.125 x 5	₹ 140.625
(iii)	No. of Free float shares = 160L – 120L	40 Lacs
•	Free float market cap = Free float shares x MPS after bonus = 40L x 140.625	₹ 5625 lacs

Buy-back price calculation & its impact

 # Ques 19 - Rambha {SM TYK, M19 Exam (New), Jul 21 Exam (New), N22 RTP, N22 MTP 1}

Rambha Ltd. has surplus cash of ₹ 100 lacs and wants to distribute 27% of it to the shareholders. The company decides to buy back shares. The Finance Manager of the company estimates that its price after re-purchase is likely to be 10% above the buyback price if the buyback route is taken. The number of shares outstanding at present is 10 lakhs and the current EPS is ₹ 3.

You are required to determine:

i) The price at which the shares can be re-purchased, if the market capitalization of the company should be ₹210 lakhs after buyback.

ii) The number of shares that can be re-purchased, and

iii) The impact of share re-purchase on the EPS, assuming that net income is the same.

Ans:	Amount to be distributed under buy-back = 120L x 27%	₹ 27 lacs
•	Let buy back price be "p". Then price after buy-back =	1.1p
•	Number of shares bought back =	27L/p

•	Required market cap after buy-back =	210 Lacs
•	1.1p (10L – 27L) = 210L	
	p	
•	11L.p – 29.7L = 210L	
•	p = 21.79	
i)	Buy-back price (p) =	₹ 21.79 per share
ii)	No. of shares repurchased = 27lacs ÷ 21.79 =	1,23,910 shares.
iii)	Current EPS	₹ 3
•	New EPS = $\frac{3 \times 10L}{10L - 1.2391L}$	₹ 3.42
•	EPS will increase by ₹ 0.42 (i.e 3.42-3)	
	Reverse calculation – Amount of loan to be raised for buy-back	
#	**Ques 20 – Superhigh Growth**	**{M23 Exam}**
	Superhigh Growth Ltd. (HGL) was having an excellent growth over a number of years. The Board of Directors is considering a proposal to reward its shareholders by buying back 20% shares at a premium. The premium is to be paid by raising a loan from the Bank. The interest on loan is to be serviced by internal accruals as supported by the financials of HGL. The company has a market capitalization of ₹ 15,000 crore and current Earnings Per Share (EPS) is ₹ 600 with a Price Earnings Ratio (PER) of 25. The Board expects a post buy back Market Price per Share (MPS) of ₹ 10,000. The PER, post buy back, will remain the same. The loan can be availed at an interest rate of 16 % p.a.	
	Applicable corporate tax rate is 30%. You are required to calculate:	
(i)	Interest amount which can be paid for availing the bank loan.	
(ii)	The loan amount to be raised.	
(iii)	Buy back premium per share.	
Ans:	**# Pre Buy-Back figures**	
•	Market cap	₹ 15,000 crores
•	EPS	₹ 600
•	PE ratio	25
»	MPS = EPS x PE ratio = 600 x 25	₹ 15000
»	Number of shares = Market cap / MPS	1 crore

»	Total earnings before buy-back = 600 x 1 crore	₹ 600 crore
#	**Post Buy-Back figures**	
•	Post Buy-back MPS	10,000
»	Post Buy-back EPS = MPS/PE ratio = 10,000 / 25	₹ 400
•	Number of shares after buy-back = 1 crore x 0.8	0.8 crores
»	Total required earnings after buy-back = 400 x 0.8	₹ 320 crores
#	**Amount of loan**	
•	Post-tax earnings available for interest = 600 – 320	₹ 280 crores
•	Pre-tax earnings available for interest = 280 / 0.7	₹ 400 crores
•	Max loan amount = Pre-tax earnings / Pre-tax loan rate = 400 / 0.16	₹ 2500 crores
(i)	Hence, interest which can be paid on bank loan = ₹ 400 crores	
(ii)	Amount of loan raised = ₹ 2500 crores	
(iii)	**Calculating buy-back price per share**	
•	Amount of Loan (A)	₹ 2500 crore
•	No. of Shares to be bought back (B)	20 Lakh
•	Price Per Share to be paid (C) = (A)/ (B)	₹ 12,500
•	Post Buy back Share Price (D)	₹ 10,000
•	Buy Back Premium per share (C) – (D)	₹ 2,500

Revised promoter's holding + Impact of Bonus shares & stock split

 # Ques 21 - Trident **{SM TYK, M20 RTP (Old), N20 RTP (New)}**

The following information relating to the acquiring Company A ltd. and the target Co B ltd. is available. Both the Co. are promoted by Multinational Company, Trident Ltd. The promoter's holding is 50% and 60% respectively in A Ltd. & B Ltd.:

	A Ltd.	**B Ltd.**
Share Capital (₹)	200 lacs	100 lacs
Free Reserves and Surplus (₹)	800 lacs	500 lacs
Paid up Value per share (₹)	100	10
Free Float Market Capitalization (₹)	400 lacs	128 lacs
P/E Ratio (times)	10	4

Trident ltd. is interested to do justice to the shareholders of both the companies. For the swap ratio weights are assigned to different parameters by the Board of Directors as follows:

Book Value: 25%

EPS (Earning per share): 50%

Market Price: 25%

(a) What is the swap ratio based on above weights?

(b) What is the Book Value, EPS and Expected Market Price of A Ltd. after acquisition of B Ltd? Assuming P/E ratio of A Ltd. remains unchanged and all assets and liabilities of B Ltd. are taken over at book value.

(c) Calculate Promoter's revised holding in the A Ltd

(d) Free float market capitalization.

(e) Also calculate No. of Shares, Earning per Share (EPS) and Book Value (B.V.), if after acquisition of B Ltd., A Ltd. decided to:

i) Issue Bonus Shares in the ratio of 1:2 , and

ii) Split the stock (share) as ₹5 each fully paid.

Ans: Calculation of swap ratio based on mentioned weights

 # Calculation of BV

- A Ltd. = {200L + 800L} / 2L = 500
- B Ltd. = {100L + 500L} / 10L = 60

#	Calculation of MPS	A Ltd.	B Ltd.
	Free float market cap	400 L	128 L
(÷)	Free float market cap (%)	50%	40%
=	Total Market Cap	800 L	320 L
(÷)	No. of shares	2 L	10 L
»	MPS	400	32

 # EPS = MPS / PE ratio

- EPS of A ltd = 400 / 10 = 40
- EPS of B ltd = 32 / 4 = 8

(a) Swap ratio = $\frac{BVPS_B}{BVPS_A} \times 0.25 + \frac{EPS_B}{EPS_A} \times 0.5 + \frac{MPS_B}{MPS_A} \times 0.25$

$= \frac{60}{500} \times 0.25 + \frac{8}{40} \times 0.5 + \frac{32}{400} \times 0.25 = 0.15 : 1$

- Number of shares issued to B Ltd. = 0.15 x 10L = 1.5 Lacs
- Paid up value of shares issued = 1.5 L x 100 = 150 Lacs

**Calculation of BVPS after Merger**

Total net assets before merger:

A Ltd. = 200 L + 800 L = 1000 L

B Ltd. = 100 L + 500 L = 600 L

- Total Net Assets after merger = 1600 L

**Balance Sheet after Merger (amount in ₹ lacs)**

Share Cap (200L + 150L)	350	Net Assets	1600
R & S (B.F.)	1250		
	1600		1600

(b) BVPS after merger = $\frac{350L + 1250L}{3.5L}$ = 457.14

- EPS after merger = $\frac{40 \times 2L + 8 \times 10L}{3.5}$ = 45.714

- MPS = EPS x PE Ratio = 45.714 x 10 = 457.14

(c) **Calculation of Promoter's holding**

A.	A Ltd. Promoter : 2 L x 50%	1 lacs
B.	B Ltd. Promoter : (10 L x 60%) x 0.15	0.9 lacs
C.	Total Promoter's holding (A + B)	1.9 lacs
D.	Total No. of Shares	3.5 L
E.	% Promoter's holding = (C / D) x 100	54.29%
F.	Free- float market cap = (100% – promoter's holding %)	45.71%

(d) Free-float Market Cap = (3.5L x 45.71%) x 457.14 731.355 lacs

(e) Number of shares after bonus issue = 3.5L x 3/2 5.25 lacs

- Number of shares after stock split = 5.25L x 20 105 lacs

- So, total number of shares after bonus and stock split = 105 lacs.

New EPS = {40 x 2L + 8 x 10L} / 105L = 1.5238

New BVPS = {350L + 1250L} / 105L = 15.24

👉 Levered and Unlevered beta

Equity Beta of merged entity (using proxy firm)

Ques 22 - Xara

Xara Ltd. (XYZ ltd.) a large business house is planning to acquire ABC another business entity in similar line of business. XYZ has expressed its interest in making a bid for ABC. XYZ expects that after acquisition the annual earning of ABC will increase by 10%. Following information ignoring any potential synergistic benefits arising out of possible acquisition, are available:

	XYZ	ABC	Proxy entity in the same business
Paid-up Capital (₹crores)	1025	106	--
Current share price (FV ₹10)	129.60	55	--
Debt: Equity (Market value)	1:2	1:3	1:4
Equity Beta	--	--	1.1

Assume Beta of debt = 0 and corporate tax rate as 30%, determine the Beta of combined entity.

Ans: $B_L = B_U [1 + \frac{debt\ (1 - tax)}{Equity}]$ {Where : BL = Levered Beta & BU = Unlevered Beta}

Step 1: Unlevered beta (B_U) of proxy firm

$1.1 = B_U [1 + \frac{1}{4}(1 - 0.3)] \rightarrow B_U = 0.9362$

Step 2: Calculating Levered Beta

- B_L of XYZ = $0.9362 [1 + \frac{1}{2}(1 - 0.3)] = 1.2639$
- B_L of ABC = $0.9362 [1 + \frac{1}{3}(1 - 0.3)] = 1.1546$

Step 3: Beta of Combined Entity	**XYZ**	**ABC**
• No. of shares (crores) = paid-up Capital ÷ 10	102.5	10.6
• Current share price	₹ 129.6	₹ 55
• Total MV (in crores)	₹ 13,284	₹ 583

- Combined Market value = 13,284 + 583 = ₹ 13,867 crores
- Beta Merged co. (Weighted avg beta) = {13,284 / 13,867} x 1.2639 + {583 / 13,867} x 1.1546 = 1.26

👉 Restructuring, Divestiture, Demerger

Impact of Financial Restructuring

 # Ques 23 - Xyla **{N18 RTP (Old), M23 MTP 2, N23 RTP}**

The following is the Balance Sheet of Xyla ltd. (XYZ Ltd.) as on 31st March 2016:

Liabilities	(₹ lacs)	Assets	(₹ lacs)
Equity shares of ₹10 each	500	Land & Building	150
11% Preference shares (FV ₹10)	100	Plant & Machinery	200
12% Debentures	100	Furniture & Fixtures	60
Debenture's interest payable	12	Inventory	60
Loan from bank	60	Sundry Debtors	50
Trade Creditors	300	Cash at bank	50
		Preliminary Exp.	15
		Cost of issue of debentures	7
		Profit & Loss A/c	480
Total	1072		1072

The company's performance is not good and has suffered sizable losses during the last few years.

The company can be nursed back to health with proper financial restructuring.

As such, the following scheme is prepared:

(i) Equity Shares are to be reduced to ₹2 per share, fully paid-up.

(ii) Preference Shares are to be reduced (with coupon rate of 9%) to equal number of shares of ₹5 each, fully paid-up.

(iii) Debenture holders have agreed to forgo accrued interest due to them and for the future the rate of interest on Debentures to be 10%.

(iv) Trade Creditors will forgo 20% of the amount due to them.

(v) The Company to issue 50 lacs shares at ₹2 each to be paid fully on Application. The entire amount is fully subscribed by Promoters.

(vi) Land & building to be revalued at ₹350 lacs, Plant & Machinery value to be taken at ₹150 lacs and a provision of ₹5 lacs to be made for Bad and doubtful debts.

	You are required to :			
(1)	Show the impact of Financial Restructuring on the Company's activities.			
(2)	Prepare the fresh Balance Sheet after reconstruction is completed on the basis of above proposals.			
Ans:	**(i) Benefit to XYZ Ltd.**			**(₹ lacs)**
(a)	Reduction of liabilities payable			
•	Reduction in equity share capital (50 lacs shares x ₹8 per share)			400
•	Reduction in preference share capital (10 lacs shares x ₹5 per share)			50
•	Waiver of outstanding debenture interest			12
•	Waiver from trade creditors (300 x 0.20)			60
				522
(b)	Revaluation of Assets			
•	Appreciation of Land & Building (350 – 150)			200
»	Total (A)			722
(ii)	**Amount utilized to write off losses, fictitious assets and over-valued assets**			**(₹ lacs)**
•	Write off profit and loss A/C			480
•	Cost of issue of Debentures			7
•	Preliminary expenses			15
•	Provision for bad and doubtful debts			5
•	Re-valuation of Plant & Machinery (200 – 150)			50
»	Total (B)			557
»	Capital Reserve (A) – (B)			165
(ii)	Balance Sheet of XYZ Ltd. as at 31st March 2016 (after reconstruction)			

Liabilities	**(₹ lacs)**	**Assets**		**(₹ lacs)**
100L equity shares (₹2)	200	Land & Building		350
9% Preference shares of ₹5/- each	50	Plant & Mach.		150
Capital Reserve	165	Furniture & Fixture		60
10% Debentures	100	Inventory		60
Loan from bank	60	S. Debtors	50	
Trade creditors (300 – 60)	240	(-) Doubtful Debts prov.	(5)	45
		Cash at bank (bal. figure)*		150
	815			815

*Opening balance of ₹50 lacs + Sale proceeds from issue of new equity shares ₹100 lacs.

ADDITIONAL NOTES: QUESTION VARIATIONS

• Sometimes ques may state something like that "Creditors will forgo 20% of their existing claim, and for the balance 50%, they have agreed to convert their claim into equity shares of ₹2 per share, fully paid. (Total creditor amount = ₹300 lacs)

Journal entry – Creditor (Dr) ₹ 120 lacs (i.e. 300 x 0.8 x 0.5)

to Equity share capital (Cr) ₹ 120 lacs

(60 lacs equity shares of ₹2 each issued to creditors against 50% of their balance claim)

» This will reduce creditors by ₹120 lacs and will increase equity share capital by the same amount.

» Updated balance sheet in this case will contain ESC = ₹320 lacs & Creditors = ₹120 lacs.

» Rest everything will remain same.

De-merger of an entity

 # Ques 24 - Fortune India {SM TYK}

The following information is relating to Fortune India ltd having two division, viz Pharma Division and Fast-Moving Consumer Goods Division (FMCG Division). Paid up share capital of Fortune India Ltd. is consisting of 3,000 Lacs equity shares of ₹1 each. Fortune India Ltd. decided to demerge Pharma Division as Fortune Pharma Ltd. w.e.f. 1.4.2005. Details of Fortune India Ltd. as on **31.03.2005** and of Fortune pharma Ltd. as on **1.4.2005** are given below:

	Particulars (amount in ₹ lacs)	Fortune Pharma ltd.	Fortune India ltd.
»	Outside Liabilities		
	Secured Loans	400	3000
	Unsecured Loan	2400	800
	Current Liabilities & Provisions	1300	21200
	Total Liabilities (A)	4100	25000
»	Assets		
	Fixed Assets	7740	20400
	Investments	7600	12300
	Current Assets	8800	30200
	Loans and Advances	900	7300
	Deferred Tax Asset	60	----
	Miscellaneous expenses Outstanding	-----	(200)
	Total Asset (B)	25100	70000
»	Net worth Or Shareholder's Worth (B – A)	21,000	45,000

	For that purpose, following points are to be considered:	
1.	Transfer of Liabilities & Assets at Book Value.	
2.	Estimated profit for year 2005-06 is ₹11,400L for Fortune India & ₹1,470L for Fortune Pharma.	
3.	Estimate Market price of Fortune Pharma Ltd. is ₹24.5 per share.	
4.	Average P/E Ratio of FMCG sector is 42 & Pharma sector is 25, which is to be expected for both the companies.	
	Calculate:	
1.	How many new numbers of shares to be issued to new company created on account of De-merger? What is the required Exchange ratio?	
2.	Expected Market price of Fortune (FMCG Division) India Ltd. after De-merger.	
3.	Book Value per share of both the companies immediately after De-merger.	
Ans:	Calculation of Exchange Ratio is a little tricky in this question.	
	It is given that MPS of Fortune Pharma will be 24.5 & its PE ratio = 25	
1)	**Calculation of number of new shares in Fortune Pharma & SER**	
•	EPS of fortune pharma = MPS / PE ratio = 24.5 / 25	0.98
•	Total earnings	1470 lacs
•	Therefore, number of shares = Total earnings / EPS = 1470 / 0.98	1500 shares
•	Hence, Share exchange ratio = 1500 / 3000	0.5 : 1
2.	EPS of Fortune India after Demerger = 11400 / 3000	3.8
•	MPS = EPS x PE Ratio = 3.8 x 42	₹ 159.6
3.	**BVPS = Net worth ÷ No. of shares**	
•	Fortune India = {45,000 – 21,000} / 3000	₹ 8
•	Fortune Pharma = 21,000 / 1500	₹ 14
	Merger of two banks	
#	**Ques 25 - Weak Bank**	**{SM TYK, M18 Exam (Old), N24 MTP 1}**
	During the audit of the Weak Bank (W), RBI has suggested that the Bank should either merge with another bank or may close down. Strong Bank (S) has submitted a proposal of merger of Weak Bank with itself. The relevant information and Balance Sheets of both the companies are as under:	

	Particulars	Weak bank (W)	Strong bank (S)	Assigned weights %
	Gross NPA (%)	40	5	30
	Capital Adequacy Ratio (CAR)*	5	16	28
	Market price per Share (MPS)	12	96	32
	Book value	--	--	10
	Trading on Stock Exchange	Irregular	Frequent	

	Balance sheet (Amount in ₹ lacs)	Weak Bank (W)	Strong Bank (S)
	Paid up Share Capital (FV ₹10)	150	500
	Reserves & Surplus	80	5,500
	Deposits	4,000	44,000
	Other Liabilities	890	2,500
	Total Liabilities	**5,120**	**52,500**
	Cash in Hand & with RBI	400	2,500
	Balance with Other Banks	-	2,000
	Investments	1,100	19,000
	Advances	3,500	27,000
	Other Assets	70	2,000
	Preliminary Expenses	50	-
	Total Assets	**5,120**	**52,500**

You are required to:

(a) Calculate Swap ratio based on the above weights:

(b) Ascertain the number of Shares to be issued to Weak Bank;

(c) Prepare Balance Sheet after merger; and

(d) Calculate CAR and Gross NPA of Strong Bank after merger.

Ans:

(a) Swap Ratio	Ratio	Ratio x Weight
Gross NPA	5:40	5/40 x 30% = 0.0375
CAR	5:16	5/16 x 28% = 0.0875
Market Price	12:96	12/96 x 32% = 0.0400
Book Value Per Share	12:120	12/120x 10% = 0.0100
		0.1750

Thus, for every share of Weak Bank, 0.1750 share of Strong Bank shall be issued.

**Calculation of Book Value Per Share**

- BVPS = {Share capital + Reserve & Surplus – Any preliminary expense} / No. of shares
- BVPS of weak bank = {150L + 80L – 50L} / 15L = ₹12 per share
- BVPS of strong bank = {500L + 5500L} / 50L = ₹120 per share

(b) No. of equity shares to be issued:

(150/10) x 0.1750 = 2.625 lakh shares

(c) Balance Sheet after Merger

Calculation of Capital Reserve

Book Value of Shares	₹ 180.00 lac
Less: Value of Shares issued	₹ 26.25 lac
Capital Reserve	₹ 153.75 lac

Balance Sheet (₹ Lacs)

Paid up Share capital	526.25	Cash in hand & RBI	2900
Reserves & Surplus	5500	Balance with other banks	2000
Capital Reserve	153.75	Investments	20100
Deposits	48000	Advances	30500
Other Liabilities	3390	Other Assets	2070
	57,570		57,570

(d) Calculation CAR & Gross NPA % of Bank 'S' after merger

#	Particulars	Weak	Strong	Merged
		5%	16%	
	Total Capital	180L	6000L	6180L
	Risky Weighted Assets	3600L	37500L	41100L

(i) CAR / CRWAR = $\frac{\text{Total Capital}}{\text{Risky Weighted Assets}} = \frac{6180}{41,100} \times 100 = 15.04\%$

(ii) Gross NPA (GNPA) = GNPA ratio x Gross advances

- GNPA of Weak bank = 0.4 x 3500 = ₹ 1400 lacs
- GNPA of Strong bank = 0.05 x 27000 = ₹ 1350 lacs
- GNPA of Merged bank = 1400 + 1350 = ₹ 2750 lacs

Leveraged buy-out

LBO – Max amount that can be offered to target co.

 # Ques 26 - Suchitra {SM TYK, N18 RTP (Old)}

CEO of Suchitra ltd. thinks that shareholders always look for EPS. So, he considers maximization of EPS as his company's objective. His company's current Net Profits are ₹ 80 lakhs and P/E multiple is 10.5. He wants to buy another firm which has current income of ₹ 15.75 lakhs & P/E multiple of 10. What is the maximum exchange ratio which CEO should offer so that he could keep EPS at the current level, given that the current market price of both the acquirer and the target company are ₹42 and ₹ 105 respectively? If the CEO borrows funds at 15% and buys out Target Company by paying cash, how much cash should he offer to maintain his EPS ? Assume tax rate of 30%.

Ans: (i)

	Acquirer Company	Target Company
Net Profit	₹ 80 lakhs	₹ 15.75 lakhs
PE Multiple	10.50	10.00
Market Capitalization	₹ 840 lakhs	₹ 157.50 lakhs
Market Price	₹ 42	₹ 105
No. of Shares	20 lakhs	1.50 lakhs
EPS	₹ 4	₹ 10.50

- Maximum Exchange Ratio = 4 : 10.50 or 1 : 2.625
- Thus, for every one share of Target Company 2.625 shares of Acquirer Company.

ii) Let "a" lakhs be the amount paid by Acquirer company to Target Co.

Then to maintain same EPS (₹4) the number of shares to be issued will be:

- $\frac{(80 \text{ lakhs} + 15.75 \text{ lakhs}) - \{0.70 \times 15\% \times a\}}{20 \text{ lakhs}} = 4$
- 95.75L - 0.105a = 80 L
- a = (95.75L – 80 L)/0.105 = ₹150 Lacs

Thus, ₹ 150 lakhs shall be offered in cash to Target Company to maintain same EPS.

Special / Discrete Ques

Max price when 'Savings' from overpaid management is given

 # Ques 27 - Xin Yin Zin {SM TYK, N22 MTP 1, M24 Exam}

Shares of Xin Yin Zin ltd. (XYZ Ltd.) are currently being traded at ₹24 per share in the market. XYZ Ltd. has total 10,00,000 equity shares outstanding in number; and promoters equity holding in the company is 40% PQR Ltd. wishes to acquire XYZ Ltd. because of likely synergies.

The estimated present value of these synergies is ₹80,00,000. Further PQR ltd. feels that management of XYZ ltd. has been over paid. With better motivation, lower salaries, and fewer perks for the top management will lead to the savings of ₹4,00,000 p.a. Top management with their families are promoters of XYZ ltd. Present value of these saving would add ₹30,00,000 in value to the acquisition.

Following additional information is available regarding PQR Ltd.:

Earnings per share	₹4
Total number of equities shares outstanding	15,00,000
Market price of equity share	₹40

Required:

(i) What is the maximum price per equity share which PQR Ltd. can offer to pay for XYZ Ltd?

(ii) What is the minimum price per equity share at which the management of XYZ Ltd. will be willing to offer their controlling interest?

(iii) What is the negotiable range?

Ans: **Maximum price calculation** (Note for students -> Max Price that I can pay = PVCI)

	MV of equity shares: 10L x 24	240 L
(+)	Benefit of synergy	80 L
(+)	PV of savings in salary	30 L
	Total PVCI :	350 L

» Maximum price per share = 350L / 10L = ₹35

(ii) Calculation of Minimum price of Controlling Interest:

(Note for students -> Minimum Price = What seller will sacrifice)

•	MV of equity shares (10 L x 40%) x 24	96 L
(+)	PV of salary (that will be foregone)	30 L
	Total :	126 L
(÷)	Number of Promoter's shares	4 L
»	Minimum Price	31.50

(iii) Negotiable range = 31.5 – 35

Decomposing share price, EPS + Growth rate estimation

 # Ques 28 - Boat Audio **{SM TYK}**

Following is the statement for Boat Audio (BA ltd) & Dot Audio (DA Ltd.) for the current year. Both the co. operate in same industry.

Balance Sheets	BA Ltd.	DA Ltd.
Total Current Assets	14,00,000	10,00,000
Total Fixed Assets (net)	10,00,000	5,00,000
Total	24,00,000	15,00,000
Equity Capital (of ₹ 10 each)	10,00,000	8,00,000
Retained Earnings	2,00,000	------
14% Long-term Debt	5,00,000	3,00,000
Total Current Liabilities	7,00,000	4,00,000
Total	24,00,000	15,00,000

INCOME STATEMENT	BA Ltd.	DA Ltd.
Net Sales	34,50,000	17,00,000
Less: Cost of Goods Sold	27,60,000	13,60,000
Gross Profit	6,90,000	3,40,000
Operating Expenses	2,00,000	1,00,000
Interest	70,000	42,000
Earnings Before Taxes	4,20,000	1,98,000
Taxes (50%)	2,10,000	99,000
Earnings after taxes (EAT)	2,10,000	99,000

Additional Information:

Number of Equity Shares	1,00,000	80,000
Dividend Payment Ratio (D/P)	40%	60%
Market Price Per Share	₹40	₹15

Assume that the 2 company are in the process of negotiating a merger through exchange of equity shares. You have been asked to assist in calculating equitable exchange term, and are required to:

(i) Decompose share prices of both companies into EPS & P/E components & also segregate their EPS

figures into return on equity (ROE) and book value per share (BVPS) components.

(ii) Estimate future EPS growth rates for each firm.

(iii) Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be ₹20 per share on its acquisition. You are required to develop a range of justifiable equity share exchange ratio that can be offered by BA ltd. to the share -holders of DA ltd. Based on your analysis in part (i) and (ii), would you expect the negotiated terms to be closer to the upper or the lower exchange ratio limits? Why?

(iv) Calculate post-merger EPS based on an exchange ratio of 0.4 : 1 being offered by BA Ltd. Indicate the immediate EPS accretion or dilution if any, that will occur for each group of shareholders.

(v) Based on 0.4 : 1 exchange ratio, and assuming, that BA's pre-merger P/E ratio will continue after the merger estimate the post-merger market price. Show the resulting accretion or dilution in pre-merger market prices.

Ans: P/E ratio = MPS/EPS

(i)

Particulars	**BA Ltd.**	**DA Ltd.**
Earnings After Tax	₹2,10,000	₹99,000
No. of Shares	1,00,000	80,000
EPS	₹2.10	₹1.2375
Market price per share	40	15
P/E Ratio	19.05	12.12
Equity Funds	₹12,00,000	₹8,00,000
BVPS	12	10
ROE	17.50%	12.37%

(ii)

Estimation of growth rates in EPS	**BA Ltd.**	**DA Ltd.**
Retention Ratio = 1 – D/P ratio	0.6	0.4
Growth Rate = ROE × Retention Ratio	10.50%	4.95%

(iii) **Justifiable equity shares exchange ratio**

(a) Intrinsic value based = ₹20 / ₹40 = 0.5:1 (upper limit)

(b) Market price based = MPS_{DA} / MPS_{BA} = 15/40 = 0.375 : 1 (lower limit)

Since, BA ltd. has a higher EPS, ROE, P/E ratio and even higher EPS growth expectations, the negotiable terms would be expected to be closer to the lower limit, based on existing share prices.

(iv) EPS after Merger = $\frac{\text{Earnings}_{BA} + \text{Earnings}_{DA}}{N_{BA} + N_{DA} \times SER}$ = $\frac{2,10,000 + 99,000}{1,00,000 + 80,000 \times 0.4}$ = ₹ 2.34

#	Gain/(loss) in EPS	BA Ltd.	DA Ltd.
•	Equivalent post-merger EPS	2.34	2.34 x 0.4 = 0.936
•	EPS before merger	2.1	1.2375
»	Gain/(loss)	0.24	(0.3015)

(v) MPS after Merger = EPS after merger x PE ratio = 2.34 x 19.05 = 44.60

#	Gain/(loss) in MPS	BA Ltd.	DA Ltd.
•	Equivalent post-merger MPS	44.6	44.6 x 0.4 = 17.84
•	MPS before merger	40	(15)
»	Gain / (loss)	4.6	2.84

Additional Questions

👉 Basic SER, Gain/Loss, MPS after merger

Basic – Valuation under NAV and Earning Capitalization Method

 # Ques 1 - Alisha {SM TYK, N23 MTP 2}

Alisha ltd. (A ltd.) agrees to buy over the business of B Ltd. Effective 1st April, 2012. The summarized balance sheets of A ltd. & B ltd. as on 31st March, 2012 are as follows:

Balance Sheet as at 31st March, 2012 (in ₹ Crores)

Liabilities	A Ltd.	B Ltd.
Paid up share capital:		
Equity Share of ₹100 each	350	
Equity shares of ₹10 each		6.50
Reserves & Surplus	950	25.00
Total	1300	31.50
Assets		
Net Fixed Assets	220	0.50
Net Current Assets	1020	29.00
Deferred Tax Assets	60	2.00
Total	1300	31.50

A Ltd. proposes to buy out B Ltd. and the following information is provided to you as part of the scheme of buying:

(1) The weighted average post tax maintainable profits of A ltd. & B ltd. for the last 4 years are ₹300 crores and 10 crores respectively.

(2) Companies' capitalization rate is 8%.

(3) A Ltd. has a contingent liability of ₹300 crores as on 31/3/2012.

(4) A Ltd. to issue share of ₹100 each to the shareholders of B Ltd. in terms of the exchange ratio as arrived on a Fair Value basis. (Please consider weight of 1 & 3 for the value of shares arrived on Net Asset basis and Earning Capitalization method respectively for both A Ltd. & B Ltd.

You are required to arrive at the value of shares of both A Ltd. & B Ltd. Under:

(a) (i) Net Asset Value Method (ii) Earning Capitalization Method

(b) Find Exchange Ratio of shares of A Ltd. to be issued to shareholders of B Ltd. on a Fair Value basis. (Taking into consideration the assumption mentioned in point 4 above).

Ans:	**Value as per:**	**A ltd.**	**B ltd.**
A.	NAV per share	(1300 – 300*) / 3.5 = 285.71	31.50 / 0.65 = 48.46
B.	Earning cap total value	300 / 0.08 = 3750 Crores	10 / 0.08 = 125 Crores
C.	Earning cap value per share	3750 / 3.5 = 1071.43	125 / 0.65 = 192.31
D.	Fair value = A x ¼ + C x ¾	875	156.3475

* Note: Assuming contingent liability will materialize.

» Swap Ratio = 156.3475 /875 = 0.17868 : 1

Reverse calculating missing figures when synergy is zero

 # Ques 2 - Amrit

Amrit ltd. (A ltd.) acquires B Ltd. Assuming that it has been ensured that after merger the EPS shall be at least ₹5.33 per share and there shall be **no synergies gain** from merger complete the following table:

	A Ltd.	**B Ltd.**	**Merged Firm**
EPS	₹ 4.00	₹ 5.00	₹ 5.33
Price per Share	₹ 80.00	₹ 50.00	?
Price Earnings Ratio	20	10	?
No. of Shares	10,00,000	20,00,000	?
Total Market Value	8,00,00,000	10,00,00,000	?

Ans: **Krack chart** – Ques clearly mentions that "there are no synergy" from merger. So, we can say:

- Post-merger Earnings = Earnings of A + Earnings of B = 4 x 10L + 5 x 20L = ₹140 lacs
- Post-merger Market value (MV) =MV of A + B = 800L + 1000L = ₹1800 lacs

(a) Shares in merged firm = Post-merger earnings / Post-merger EPS = 140L / 5.33 = 26,26,642

(b) Price per share = $\frac{\text{Post-merger MV}}{N_{new}} = \frac{1800 \text{ lacs}}{26,26,642} =$ ₹ 68.53/share

(c) New PE ratio = MPS/EPS = 68.53 / 5.33 = 12.86

Valuation under Merger deals

Valuation of target using DCF

 # Ques 3 - Nishana

Teer Ltd is considering acquisition of Nishana Ltd. CFO of Teer ltd. is of opinion that Nishana Ltd. will be able to generate operating cash flows (After deducting necessary capital expenditure) of ₹10 crore p.a. for 5 years.

The following additional information was not considered in the above estimations.

(i) Office premises of Nishana Ltd. can be disposed of and its staff can be relocated in Teer Ltd.`s office not impacting the operating cash flows of either business. However, this action will generate an immediate capital gain of ₹20 crore.

(ii) Synergy gain of ₹2 crore per annum is expected to be accrued from the proposed acquisition.

(iii) Nishana Ltd. has outstanding Debentures having a market value of ₹15 crore. It has no other debt.

(iv) It is also estimated that after 5 years, if necessary, Nishana Ltd. can also be disposed of for an amount equal to five times its operating annual cash flow.

Calculate the maximum price to be paid for Nishana Ltd. if cost of capital of Teer Ltd. is 20%. Ignore any type of taxation.

Ans: Calculation of maximum price to be paid to Nishana Ltd.

Year	Operating CF	Capital gain	Synergy	Disposal CF	Total CF
0	0	20	-	-	20
1	10	-	2	-	12
2	10	-	2	-	12
3	10	-	2	-	12
4	10	-	2	-	12
5	10	-	2	10 x 5 = 50	62

	Particulars	₹ Crores
•	PVCI = 20 + {12 x PVAF(20%,4)} + {62 x PVF(20%,5)}	75.98
(-)	Value of Debenture	(15.00)
»	Maximum amount that can be paid by Teer ltd to Nishana ltd.	60.98

Discrete Questions

Reverse calculating sales, PAT, EPS using given ratios

 # Ques 4 - Xing {N20 MTP 1 (New), N20 MTP 1 (Old)}

Xing ltd. (X ltd.) is studying the possible acquisition of Y Ltd. by way of merger. The following data are available in respect of both the companies.

Particulars	X Ltd.	Y Ltd.
Market Capitalization (₹)	75,00,000	90,00,000
Gross Profit Ratio	20%	20%
Inventory Turnover Ratio	5 times	4 times
Debtor Turnover Ratio	3 times	5 times
12% Debenture (₹)	10,00,000	-
10% Debenture (₹)	-	14,40,000
No. of Equity Shares	1,00,000	60,000
Operating Expenses	86%	78%
Corporate Tax Rate	30%	30%
Closing Stock (₹)	15,00,000	50,00,000
Debtors (₹)	10,00,000	8,00,000

You are required to calculate :

(i) Swap ratio based on EPS & MPS respectively as weightage of 40% and 60%.

(ii) Post-Merger EPS

(iii) Post-Merger market price assuming same PE ratio of X Ltd.

(iv) Post-Merger gain or loss in EPS.

Ans: Krack chart -- We need EPS. But PAT is missing in question. Reverse tracing :

- We have "Opex" & "interest" info. So, if we can find "sales", then PAT = Sales – Op. Exp. – Interest.
- For sales → We have "GP ratio". So, if we can find "COGS" then we can find sales figure.
- For COGS -> We have 'Inventory turnover ratio' & closing inventory.
- Our roadmap will be → COGS → Sales → PAT → EPS.

Start from here in exam ...

WN 1: Inventory turnover ratio = $\frac{\text{COGS}}{\text{Closing stock}}$ → COGS = ITR x Closing stock

- X ltd COGS = 5 x 15L = ₹ 75 lacs
- Y ltd COGS = 4 x 5L = ₹ 20 lacs

WN 2: GP ratio = 20% means COGS = 80% of sales.

- Sales of X Ltd. = 75 L / 0.8 = ₹ 93.75 lacs
- Sales of Y Ltd. = 20 L / 0.8 = ₹ 25 lacs

WN 3:	**Calculating EPS (₹ in lacs)**	**X Ltd.**	**Y Ltd.**
	Sales	93.75	25
(-)	Operating Exp.	80.625 (86%)	19.5 (78%)
=	EBIT	13.125	5.5
(-)	Interest	10L x 0.12 = 1.2	14.4L x 0.10 = 1.44
=	EBT	11.925	4.06
	PAT = EAT x (1 – tax)	8.3475	2.842
÷	No. of shares	1	0.6
=	EPS	8.3475	4.74
*	MPS = Market cap ÷ N. of shares	75	150
*	PE ratio = MPS ÷ EPS	8.99	31.65

(i) Swap ratio = $\frac{\text{EPS Y}}{\text{EPS X}} \times 0.4 + \frac{\text{MPS Y}}{\text{MPS X}} \times 0.6 = \frac{4.74}{8.3475} \times 0.4 + \frac{150}{75} \times 0.6 = 1.427$

(ii) Post-merger EPS = $\frac{\text{Earning after merger}}{\text{No. of shares after merger}} = \frac{8.3475 + 2.842}{1 + 0.6 \times 1.427} =$ ₹6.03

(iii) Post-merger MPS = EPS x PE ratio = 6.03 x 8.99 = ₹54.21

(iv)	**Post-merger gain/loss in EPS**	**X Ltd.**	**Y Ltd.**
•	Equivalent post-merger EPS	6.03	6.03 x 1.427 = 8.605
•	Current EPS	8.3475	4.74
»	Gain/(loss)	(2.3175)	3.865

👉 **Low Probability Unique Questions**

Equity beta (using proxy firm) + Range of valuation (pre & post synergetic)

 # Ques 5 - Amara

Amara Ltd. (ABC), a large business house is planning to sell its wholly owned subsidiary KLM. Another large business entity XYZ has expressed its interest in making a bid for KLM. XYZ expects that after acquisition the annual earnings of KLM will increase by 10%.

(i) Following information, ignoring any potential synergistic benefits arising out of possible acquisition,

are available.

(ii) Profit after tax for KLM for the financial year which has just ended is estimated to be ₹10 crores.

(iii) KLM's after-tax profit has an increasing trend of 7% each year and the same is expected to continue.

(iv) Estimated post-tax market return is 10% and Rf is 4%. These rates are expected to continue.

(v) Corporate tax rate is 30%.

	XYZ	ABC	Proxy entity in the same business
No. of shares	100L	80L	--
Current share price	₹287	₹375	--
Dividend pay-out	40%	50%	50%
Debt: Equity (Market value)	1:2	1:3	1:4
P/E ratio	10	13	12
Equity Beta	1	1.1	1.1

Assuming gearing level of KLM to be the same as for ABC and a debt beta of zero. You are required to calculate:

(a) Appropriate cost of equity for KLM based on the data available for the proxy entity.

(b) A range of values for KLM both before and after any potential synergistic benefits to XYZ of the acquisition.

Ans: $B_L = B_U \left[1 + \frac{\text{Debt } (1 - \text{tax})}{\text{Equity}}\right]$

Where : B_L = Levered Beta & B_U = Unlevered Beta

Step 1: Calculating unlevered beta of proxy firm

- $1.1 = B_U \left[1 + \frac{1}{4}(1 - 0.3)\right]$
- $B_U = 0.9362$

Step 2: Calculating Levered Beta

B_L of ABC = $0.9362 \times \left[1 + \frac{1}{3}(1 - 0.3)\right] = 1.1546$

(a) Cost of Equity (as per CAPM) = $R_F + (R_M - R_F) B_L$

Ke = 4% + (10% - 4%) x 1.1546 = 10.93%

(b)	**P/E valuation (Based on earning of ₹10 crores)**		
		Using proxy Entity's P/E	**Using XYZ's P/E**
	Pre synergistic value	12 x 10 = ₹ 120 crore	10 x 10 = ₹ 100 crore
	Post synergistic value	12 x 10 x 1.1 = ₹ 132 crore	10 x 10 x 1.1 = ₹ 110crore
#	**Dividend Valuation Model**	**Based on 50% pay out**	**Based on 40% pay out**
•	EPS	0.5 x 10 = 5	0.4 x 10 = 4
•	Pre synergistic value	$\frac{5 \times 1.07}{0.1093 - 0.07}$ = ₹136.13 crore	$\frac{4 \times 1.07}{0.1093 - 0.07}$ = ₹108.91 crore
•	Post synergistic value	$\frac{5 \times 1.1 \times 1.07}{0.1093 - 0.07}$ = ₹149.75 crore	$\frac{4 \times 1.1 \times 1.07}{0.1093 - 0.07}$ = ₹119.79 crore
#	**Range of Valuation**		
•	Pre synergistic = ₹100 crore – ₹136.13 crore		
•	Post synergistic = ₹110 crore – ₹149.75 crore		

Equity beta (using proxy firm) when new debt is raised + Beta of debt ≠ 0

 # Ques 6 - KGF

Equity of KGF Ltd. (KGFL) is ₹410 crore. Its debt, is worth ₹170 crore. Printer Division segments value is attributable to 74%, which has an Asset Beta (Bp) of 1.45, balance value is applied on Spares & Consumable Division, which has an Asset Beta (Bs) of 1.20 KGFL Debt Beta (Bo) is 0.24.

You are required to calculate :

(i) Equity Beta (B_E)

(ii) Ascertain Equity Beta (B_E), If KGF Ltd. decides to change its Debt Equity Position by raising further debt and buying back of equity to have its Debt Equity Ratio at 1.90? Assume that the present Debt Beta (Bo1) is 0.35 and any further funds raised by way of debt will have a Beta (Bo2) of 0.40.

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

Ans: Weighted Average Asset Beta = {1.45 x .074} + {1.20 x 0.26} = 1.385

» $\text{Asset Beta} = \text{Beta}_{\text{Equity}} \times \frac{E}{E + D(1-t)} + \text{Beta}_{\text{Debt}} \frac{[D(1-\text{tax})]}{E + D(1-\text{tax})}$

•	1.385 = Beta Equity x 410 / (410 + 170) + 0.24 x 170 / (410 + 170)	
•	Beta Equity = 1.86	
(ii)	Total Capital of firm = 410 + 170	₹ 580 crores
•	Desired debt to equity	1.9:1
•	desired Debt amount = 580 x 1.9/(1.9 + 1)	₹ 380 crores
•	Required new debt = 380 – 170	₹ 210 crores
•	Desired Equity amount = 580 – 380	₹ 200 crores
#	**Calculating new Beta of Equity (i.e. Levered Beta)**	
•	Asset Beta = $Beta_{Equity}$ x E / (E + D(1 - t)) + $Beta_{Debt}$ [D (1 – tax) / (E + D (1 – tax))]	
•	1.385 = B_E x 200/580 + 0.35 x 170/580 + 0.40 x 210/580	
•	1.385 = 0.3448 B_E + 0.1026 + 0.1448	
»	B_E = 3.3	
(iii)	Yes, it justifies the increase as it leads to increase in the value of equity due to increase in Beta.	

Preparing revised P&L and CFS after restructuring

 # Ques 7 - Kashyapa

Kashyapa ltd. has 35,000 shares of equity stock outstanding with a book value of ₹20 per share. It owes debt ₹15,00,000 at an interest rate of 12%. Selected financial results are as follows.

Income & Cash Flow	(₹)	Capital	(₹)
EBIT	80,000	Debt	1,500,000
Interest	1,80,000	Equity	7,00,000
EBT	(1,00,000)		
Tax	--------		
EAT	(1,00,000)		
Depreciation	50,000		
Principal repayment	(75,000)		
Cash Flow	(1,25,000)		

Restructure the financial line items assuming a composition in which Debt agrees to convert two

	thirds of their debt into equity at book value. Assume that the co. will pay tax at a rate of 15% on income after restructuring and those principal repayments are reduced proportionately with debt. Present revised Income & Cash Flow Statement. Who will control the company and by how big a margin after the restructuring?	
Ans:	**Revised Income and Cash flow statement**	
	EBIT =	80,000
(-)	Interest 1,80,000 x 1/3 =	(60,000)
	EBT =	20,000
	EAT = EBT x 0.85	17,000
(+)	Depreciation	50,000
(-)	Principal Repayment 75,000 x 1/3	(25,000)
	Cash Flow =	42,000
(ii)	**Calculation of Control:**	
•	Number of Shares before restructuring	35000
•	Shares issued to lenders: 15 L x 2/3 x1/20	50000
•	Total Shares	85000
•	% Of Lenders in shares = 50,000 / 85,000	58.8%
»	Lender will control the company post re-structuring.	

LBO - Calculating growth in Book value of equity

 # Ques 8 - Distress

Personal Computer Division of Distress ltd. a computer hardware manufacturing company has started facing financial difficulties for the last 2 to 3 years. The management of the division headed by Mr. Smith is interesting in a buyout on 1st April 2013. However, to make this buyout successful there is an urgent need to attract substantial funds from venture capitalists. Ven Cap, a European venture capitalists' firm has shown its interest to finance the purposed buy -out. Distress Ltd. is interested to sell the division for ₹180 crore and Mr. Smith is of opinion that an initial amount of ₹85 crore shall be required to make this division viable. The expected financing pattern shall be as follows :

	Source	Mode	Amt. (₹crore)
A.	Management	Equity Shares of ₹10 each	60.00
B.	Venture Capital (VC)	Equity Shares of ₹10 each	22.50
		9% Debentures with attached warrant of ₹100 each	22.50
		8% Loan	160.00
		Total	265.00

The warrants can be exercised any time after 4 years from now for 10 equity shares @ ₹120 per share. The loan is repayable in one go at the end of 8th year. The debentures are repayable in equal annual instalment consisting of both principal and interest amount over a period of 6years. Mr. smith is of view that the proposed dividend shall not be kept more than 12.5% of distributable profit for the first four years. The forecasted EBIT after the proposed buyout is as follows:

Year	2013-14	14-15	15-16	16-17
EBIT (₹ crores)	48	57	68	82

Applicable tax rate is 35% and it is expected that it shall remain unchanged at least for 5-6 years. In order to attract Ven Cap, Mr. Smith stated that book value of equity shall increase by 20% during above four years. Although, Ven Cap has shown their interest in investment but are doubtful about the projections of growth in the value as per projections of Mr. Smith. Further Ven Cap also demanded that warrants should be convertible in 18 shares instead of 10 shares as proposed by Mr. Smith.

You are required to determine whether or not the book value of equity is expected to grow by 20% per year. Further, if you have been appointed by Mr. Smith as advisor then whether you would suggest to accept the demand of Ven Cap of 18 shares instead of 10 or not.

Ans: Krack chart : Ques may look intimidating, but is easy. We need to check growth in BV of equity.

- We want → BV of equity = Paid up share capital + Reserve and surplus.
- Paid up capital is directly given. So, all we need is closing balance of R&S for each year.
- Closing balance of R&S = EBIT –Interest–Tax–any dividend paid.

WN 1: **Calculating annual installment :**

- Value of debenture today = PV of equal annual instalment
- ₹22.50 crores = Annual instalment x PVAF (9%, 6)
- ₹22.50 crores = Annual instalment x 4.48
- Annual instalment = 22.50 / 4.48 = ₹ 5.0156 crores

WN 2: **Annual interest calculation**

Year	Opening Balance	Interest	Instalment	Closing Balance
1	22.5	2.025	5.0156	19.5094
2	19.5094	1.756	5.0156	16.2498
3	16.2498	1.462	5.0156	12.6962
4	12.6962	1.143	5.0156	8.8236

#	**Calculated accumulated profit of each year (₹ crores)**				
	Year	**1**	**2**	**3**	**4**
	EBIT	48	57	68	82
(-)	Interest on 9% debenture	2.025	1.756	1.462	1.143
(-)	Interest on 8% loan	12.8	12.8	12.8	12.8
=	EBT	33.175	42.444	53.738	68.057
	EAT = EBT x (1 – tax)	21.564	27.589	34.93	44.237
(-)	Dividend @ 12.5%	2.696	3.449	4.366	5.53
=	Accumulated Profit	18.868	24.14	30.564	38.707

- Total Accumulated profit of 4 years = 18.868 + 24.14 + 30.564 + 38.707 = ₹112.279 crores

#	**Closing BV of Equity**	
	Opening book value = 60 + 22.5	82.5
(+)	Total accumulated profit of 4 years	112.279
=	Closing book value of equity	194.779

(i) Compound average growth rate of Equity Book Value

- $(\text{Closing BV / Opening BV})^{1/4} - 1$
- $(194.779/82.5)^{1/4} - 1 =$ 23.96%

* Hence, expected growth rate of BV of equity (23.96%) is even higher than Mr. Smith's claim of 20%.

(ii) If demand of 18 shares per warrant is accepted, then shareholding after 4 years will be:

		No. of shares	**%**
-	Management	6 crores	48.79%
-	VC = 2.25 + (0.225 x 18)	6.3 crores	51.21%
	Total	12.3 crores	100%

This demand may not be accepted by Mr. Smith as management will then own < 51% of the company and hence will lose control.

Max debt for takeover when target Debt Equity ratio is given

 # Ques 9 - Akhila

Akhila ltd. (A Ltd.) (Acquirer co.) equity capital is ₹2,00,00,000. Both A Ltd. and T Ltd. (Target co.)

	have arrived at an understanding to maintain debt equity ratio at 0.30:1 of the merged company.	
	Pre-merger debt outstanding of A Ltd. stood at ₹ 20,00,000 and T Ltd. at ₹ 10,00,000 and marketable securities of both companies stood at ₹ 40,00,000.	
	You are required to determine whether liquidity of merged company shall remain comfortable if A ltd. acquires T ltd. against cash against cash payment at mutually agreed price of ₹65,00,000.	
Ans:	Debt capacity of merged company (2,00,00,000 x 0.30)	60,00,000
(-)	Debt of A Ltd. and T Ltd.	30,00,000
		30,00,000
(+)	Marketable securities of both companies	40,00,000
		70,00,000
	Since the combined liquidity of merged company shall remain comfortable, it shall be feasible to pay cash acquiring the T Ltd. against tentative price ₹65,00,000.	

Impact on MPS when PE & Kd changes as per level of Debt : CE ratio

#	**Ques 10 - Triund Sky**	
	Following information is available of M/s Triund Sky ltd. (TS ltd.)	
		(₹ in crores)
	PBIT	5.00
	Less : Interest on debt (10%)	1.00
	PBT	4.00
	Less : Tax @ 25%	1.00
	PAT	3.00
	No. of outstanding shares of ₹10 each	40 lacs
	EPS (₹)	7.5
	Market price of share (₹)	75
	P/E ratio	10 times
	TS Ltd. has an un-distributed, reserves of ₹8 crores. The company requires ₹3 crores for the purpose of expansion which is expected to earn the same rate of return on capital employed as present. However, if the debt to capital employed ratio is higher than 35%, then P/E ratio is expected to decline to 8 times and rise in the cost of additional debt to 14%. Given this data which of the following options the company would prefer, and why?	
	Option (i) : If the required amount is raised through debt, and Option	
	Option (ii) : If the required amount is raised through equity and the new shares will be issued at a price of ₹25 each.	
Ans:	**WN 1 : Return on Capital Employed (ROCE)**	

A.	Book value of equity = Equity share capital + R&S = 4 + 8	12 crores
B.	Book Value of debt = Interest / Interest rate = 1 / 0.1	10 crores
C.	Total capital employed (CE) = A + B	22 crores
D.	ROCE = PBIT / Total CE = 5 / {12 + 10}	22.73%

WN 2: New PBIT after expansion = 22.73% x (22 + 3) = ₹5.6825

WN 3: Debt to CE ratio if amount is raised via debt = $\frac{10 + 3}{22 + 3}$ = 52%

- Hence, cost of new debt will be 14% and PE ratio will be 8 times.

WN 4: PE ratio if amount is raised via equity = $\frac{10}{22 + 3}$ = 0.4

- Again, since debt to CE ratio > 35% , So PE ratio will reduce to 8.
- No. of shares in this case = 0.4 crores + 3 crores /25 = 0.52 crores

#	**Particulars**	**Case I**	**Case II**	**(in ₹)**
	Revised EBIT (WN 2)	5.6825 crores	5.6825 crores	
(-)	Interest on debt: Existing	(1 crores)	(1 crores)	
	New debt = 3 x 14%	(0.42 crores)	--	
=	EBT	4.2625 crores	4.6825 crores	
	EAT = EBT (1 – tax)	3.1969 crores	3.5119 crores	
÷	No. of shares	0.40 crores	0.52 crores	
=	EPS	7.99225	6.7537	
x	PE ratio	8	8	
»	MPS	63.94	54.03	

Decision: Option I is preferred due to higher MPS.

Krivii Eduspace

Finance Acharya
Jatin Nagpal (CA, FRM)

- Bagged 1st position at district level in all the levels of CA exams
- Scored 1st Quartile in 8 subjects of FRM.
- Ex-PwC Article
- Holds NISM-Research Analyst Certification
- Ex-Trader: stocks and F&O segment

I Have One Goal -->
"To Simplify your Finance Journey."

All our Classes, books & revision videos have 1 single aim - To provide you with the finest knowledge in the simplest manner possible.

0% Sacrifice on Quality or Technicality, yet 100% focus on Simplicity.

This isn't easy at all. But with strong conviction even mountains can move. :)

Scan this QR code to Connect to our Student help & Get all your queries answered!

Connect with Us:

www.krivii.in

+91 94784-23144

Krivii Eduspace

Krivii Eduspace