AIR1CA CAREER INSTITUTE

AFM

ADVANCED FINANCIAL MANAGEMENT

CA AJAY AGARWAL (AIR 1)

For
MAY & NOV 2025
Exams



CA FINAL

Handwritten
Concept Book

Best Wishes... Radhe Radhe!!

air1ca.com

INDEX

ADVANCED FINANCIAL MANAGEMENT

Section A – Practical Concepts

Chapter No.	Chapter Name	Page No.
	Basics of AFM	1 – 14
1	Financial Policy and Corporate Strategy	15
2	Risk Management	16 – 18
3	Advanced Capital Budgeting Decisions	19 – 35
4	Security Analysis	36 – 39
5	Security Valuation	40 – 59
6	Portfolio Management	60 –87
7	Securitization	88
8	Mutual Funds	89 – 96
9	Derivatives Analysis and Valuation	97 –116
10	Foreign Exchange Exposure and Risk Management	117 –156
11	International Financial Management	157 – 161
12	Interest Rate Risk Management	162 – 170
13	Business Valuation	171 – 183
14	Mergers, Acquisitions & Corporate Restructuring	184 – 199
15	Startup Finance	200

Section B – Theory Concepts

Chapter No.	Chapter Name	Page No.
1	Financial Policy and Corporate Strategy	201 – 203
2	Risk Management	204 – 207
3	Advanced Capital Budgeting Decisions	208
4	Security Analysis	209 – 212
5	Security Valuation	213
6	Portfolio Management	214 – 215
7	Securitization	216 – 220
8	Mutual Funds	221 – 223
9	Derivatives Analysis and Valuation	224 – 227
10	Foreign Exchange Exposure and Risk Management	228 – 229
11	International Financial Management	230 – 232
12	Interest Rate Risk Management	233 – 235
13	Business Valuation	236 – 237
14	Mergers, Acquisitions & Corporate Restructuring	238 – 239
15	Startup Finance	240 – 246

Scan this QR code to watch Free Revision Lectures on YouTube for AFM May & Nov 25 Exams



SECTION A

Practical Concepts

Basics of AFM



Basics of AFM

- Ratio Analysis
- Interpretation of Dividend
- Interpretation of Interest Rate
- Basic Mathematics
- Time Value of Money

Ratio Analysis

(1) Income Statement [for AFM Purpose Only] :-

Sales	xxx
(-) COGS	(xxx)
Gross Profit | Gross Income | Gross Margin	xxx
(-) Operating Expenses [Eg: Admin. Selling & Distribution Expense]	(xxx)
EBIT | PBIT | Operating Profit | Operating Income | Operating Margin	xxx
(-) Interest Expense	(xxx)
EBT | PBT | Taxable Income	xxx
(-) Tax	(xxx)
EAT | PAT | Net Profit | Net Income | Net Margin	xxx
(-) Dividend on Preference Shares	(xxx)
EATESH [Earnings Available to Equity Shareholders]	xxx
(-) Dividend on Equity Shares	(xxx)
Retained Earnings | Undistributed Profits	xxx

(2.) Balance Sheet [For AFM Purpose Only] :-

Equity & Liabilities	Assets
Share Capital [Always Assume it as Equity Share Capital in AFM]	Fixed Assets
Reserves & Surplus	Current Assets
Debt [Eg: Debentures, Bonds, Borrowings, Loan, etc.]	Preliminary Expenses
Current Liabilities [Eg: Creditors, Provisions, etc.]	
xxx	xxx

(3.) Total Assets = Fixed Assets + Current Assets

(4.) Total Liabilities = Debt + Current Liabilities

(5.) Working Capital = Current Assets - Current Liabilities

(6.) Net Worth | Book Value | Shareholders funds | Equity

⇒ Share Capital + Reserves & Surplus - Preliminary Expenses

OR

Total Assets - Total Liabilities

(7.) Capital Employed

⇒ Share Capital + Reserves & Surplus + Debt - Preliminary Expenses

OR

Equity + Debt

OR

Total Assets - Current Liabilities

(8.) GP Ratio = $\frac{\text{Gross Profit}}{\text{Sales}} \times 100$

(9.) COGS Ratio = $\frac{\text{COGS}}{\text{Sales}} \times 100$ OR 100% - GP Ratio

(10.) Operating Profit Ratio or Operating Margin Ratio = $\frac{\text{EBIT}}{\text{Sales}} \times 100$

(11.) Operating Ratio = $\frac{\text{COGS + Operating Expenses}}{\text{Sales}} \times 100$

OR

100% - Operating Profit Ratio

(12.) Net Profit Ratio = $\frac{\text{Net Profit}}{\text{Sales}} \times 100$

(13.) Debt Ratio or Debt to Capital Employed Ratio = $\frac{\text{Debt}}{\text{Equity + Debt}}$

(14.) Equity Ratio or Equity to Capital Employed Ratio = $\frac{\text{Equity}}{\text{Equity + Debt}}$

(15.) Debt Equity Ratio = $\frac{\text{Debt}}{\text{Equity}}$

(16.) Assets Turnover Ratio = $\frac{\text{Sales [Turnover]}}{\text{Assets}} \times 100$

(17.) Fixed Assets Turnover Ratio = $\frac{\text{Sales}}{\text{fixed Assets}} \times 100$

(18.) Current Assets Turnover Ratio = $\frac{\text{Sales}}{\text{Current Assets}} \times 100$

(19.) Inventory Turnover Ratio = $\frac{\text{COGS}}{\text{Stock}} \times 100$

(20.) Debtors Turnover Ratio = $\frac{\text{Credit Sales}}{\text{Debtors}} \times 100$

(21.) Assets to Sales Ratio = $\frac{\text{Assets}}{\text{Sales}} \times 100$

(22.) Interest Coverage Ratio = $\frac{\text{EBIT}}{\text{Interest}}$ [Higher the Better]

(23.) Interest & fixed Dividend Coverage Ratio

$$\Rightarrow \frac{\text{PAT} + \text{Interest}}{\text{Interest} + \text{Preference Dividend}}$$ [Higher the Better]

(24.) Capital Gearing Ratio = $\frac{\text{Debt} + \text{Preference Share Capital}}{\text{Equity Share Capital} + \text{R\&S}}$ [Lower the Better]

(25.) Earnings Per Share [EPS] = $\frac{\text{EATESH}}{\text{No. of Equity Shares}}$

(26.) Dividend Per Share [DPS] = $\frac{\text{Dividend on Equity Shares}}{\text{No. of Equity Shares}}$

(27.) Book Value Per Share [BVPS] = $\frac{\text{Book Value}}{\text{No. of Equity Shares}}$

(28.) Market Price Per Share [MPS] = Market Price of Equity Share

(29.) Dividend Payout Ratio = $\frac{\text{Dividend on Equity Shares}}{\text{EATESH}} \times 100$

OR

$\frac{\text{DPS}}{\text{EPS}} \times 100$

OR

100% - Retention Ratio

(30.) Retention Ratio = $\frac{\text{Retained Earnings}}{\text{EATESH}} \times 100$

OR

100% - Dividend Payout Ratio

(31.) Dividend Yield = $\frac{\text{DPS}}{\text{MPS}} \times 100$

(32.) Return on Capital Employed [ROCE] = $\frac{EBIT}{\text{Capital Employed}} \times 100$

(33.) Return on Equity [ROE] = $\frac{EATESH}{\text{Net Worth [Book Value]}} \times 100$

OR

$\frac{EPS}{BVPS} \times 100$

(34.) P/E Ratio = $\frac{MPS}{EPS}$

Note: Sometimes ROE is calculated on Market Price, i.e. ROE = $\frac{EPS}{MPS}$

Hence, P/E Ratio = $\frac{1}{ROE}$

(35.) Market Capitalisation ⇒ Total Market Value of Equity Shareholders

⇒ MPS × No. of Equity Shares

OR

P/E Ratio × EATESH

Interpretation of Dividend

(1.) Dividend ⇒ On Face Value

(2.) Dividend Yield ⇒ On Market Price

(3.) Dividend Payout ⇒ On Earnings

Interpretation of Interest Rate

(1.) 100 Basis Points [BP] = 1%

(2.) Interest Rate given in question will always be assumed as Per Annum [p.a.] unless specifically mentioned.

Example:

(i) Interest Rate is 10% ⇒ p.a.

(ii) Interest Rate for 6 months Borrowings is 10% ⇒ p.a.

(iii) 6 Months LIBOR is 10% ⇒ p.a.

(iv) Interest Rate is 1% per month ⇒ p.m. [Per Month]

Basic Mathematics

(1) International Number System :-

1 Million = 10 Lakh = 1,000,000

1 Billion = 100 Crore = 1,000,000,000

(2) Equation Solving :-

$x + y = z$ → $x = z - y$

$x - y = z$ → $x = z + y$

$x \times y = z$ → $x = \frac{z}{y}$

$\frac{x}{y} = z$ → $x = z \times y$

(3) Converting Data into Percent (%) or Back to Normal :-

Example: Marks Obtained in Exams = 24

Total Marks = 30

∴ Marks obtained in relation to Total Marks = $\frac{24}{30} = 0.80$

Convert it into % by Multiplying it by 100 = $\frac{24}{30} \times 100 = 80\%$

Now, To Remove % from Any figure, Divide it by 100

Example: 80% ⇒ $\frac{80}{100}$ ⇒ 0.80

(4) Some Mathematical Notations :-

- Base with Power $[\text{Base}^{\text{Power}}]$

Example:

$(6)^4 \Rightarrow 6 \times 6 \times 6 \times 6 \Rightarrow 1,296$

- Base with Negative Power $\left[\text{Base}^{\text{Negative Power}}\right]$

Example:

$$(6)^{-4} \Rightarrow \left(\frac{1}{6}\right)^{4} \Rightarrow \frac{1}{(6)^{4}} = \frac{1}{1296} = 0.0007716$$

- Squareroot $[\sqrt{\ }]$

Example:

$$\sqrt{36} \Rightarrow (36)^{\frac{1}{2}} = 6$$

(5) Solving Base with Power Using Calculator :-

- Normal Power [Example $\Rightarrow (6)^{4}$]:

Steps to solve this on calculator

→ Type Base in Calculator [Example $\Rightarrow$ 6]

→ Press Multiply (x) Button

→ Now, Press Equals to (=) Button for (Power − 1) Times [Example $\Rightarrow$ 4−1=3]

- Dirty Power [Example $\Rightarrow (6)^{\frac{3}{10}}$ OR $(6)^{0.30}$]:

Steps to solve this on calculator

→ Type Base in Calculator [Example $\Rightarrow$ 6]

→ Press Underroot ($\sqrt{\ }$) Button 12 times

→ Subtract (−) 1 from it

→ Multiply (x) it by Power [Example $\Rightarrow \frac{3}{10}$ OR 0.30]

→ Add (+) 1 to it

→ Press Multiply Equals to (x =) Button 12 times

(6) BODMAS Rule :-

- It tells the sequence in which mathematical operations are required to be performed to solve an equation.

- Sequence is as follows:

1st ⇒ B = Bracket

2nd ⇒ O = Orders [i.e. Power or Underroot]

3rd ⇒ D = Divide

4th ⇒ M = Multiply

5th ⇒ A = Add

6th ⇒ S = Subtract

Example:

$3 \times 16 \div 4 + 2 (9-4)^2$

$\Rightarrow 3 \times 16 \div 4 + 2 \times (5)^2$

$\Rightarrow 3 \times 16 \div 4 + 2 \times 25$

$\Rightarrow 3 \times 4 + 2 \times 25$

$\Rightarrow 12 + 50$

$\Rightarrow 62$

(7) Addition, Subtraction, Multiplication or Division of figures with Minus Sign:-

Example:

(i) $5 + 3 = 8$

(ii) $5 + (-3) = 5 - 3 = 2$

(iii) $5 + (-9) = 5 - 9 = -4$

(iv) $-5 - 3 = -8$

(v) $-5 + (-3) = -5 - 3 = -8$

(vi) $5 \times (-3) = -15$

(vii) $(-5) \times (-3) = 15$

(viii) $\frac{-6}{3}$ OR $\frac{6}{-3}$ OR $-\frac{6}{3} = -2$

(ix) $\frac{-6}{-3} = 2$

Time Value of Money

(1.) Future Value = Present Value $(1+R)^t$

OR

Cash flow × FVf_t

Here, $FVf_t = (1+R)^t$

Example:

Principal Amount to be Invested = ₹ 1,000 ; Interest Rate is 10%.

(i.) Calculation of future Value after 1 Year ⇒ $1,000 \times (1.10)^1$ = ₹ 1,100

(ii.) Calculation of future Value after 2 Years ⇒ $1,000 \times (1.10)^2$ = ₹ 1,210

(iii.) Calculation of future Value after 3 Years ⇒ $1,000 \times (1.10)^3$ = ₹ 1331

(2.) Present Value (PV) = $\frac{\text{future Value}}{(1+R)^t}$

OR

Cash Flow_t × PVf_t

Here, $PVf_t = \frac{1}{(1+R)^t}$

- It is a Process which discounts future cash flows, i.e. Process of Removing Interest / Return Component from future cash flows.

Example:

Interest Rate is 10%

(i.) Calculation of PV if future Value after 1 Year is ₹ 1,100

⇒ $\frac{1,100}{(1.10)^1}$ OR 1100×0.909 ⇒ ₹ 1,000

(ii.) Calculation of PV if future Value after 2 Years is ₹ 1,210

⇒ $\frac{1,210}{(1.10)^2}$ OR $1,210 \times 0.826$ ⇒ ₹ 1,000

(iii) Calculation of PV if future Value after 3 Years is ₹ 1,331

$\Rightarrow \frac{1,331}{(1.10)^3}$ OR $1,331 \times 0.751 \Rightarrow$ ₹ 1,000

- Calculation of Present Value in Various Scenarios:

(i) If there is Uneven Cash flow for Limited Period

$P.V. = \text{Cash flow}_1 \times PVF_1 + \text{Cash flow}_2 \times PVF_2 + \ldots \text{Cash flow}_n \times PVF_n$

OR

It can be calculated using following Table format

Year	Cash flow	PVF @ Discounting Rate	P.V.
(1)	(2)	(3)	(4) = (2) x (3)

Example:

Year	Cash Flow	PVF @ 10%	P.V.
1	1,000	0.909	909
2	1,500	0.826	1,239
3	800	0.751	600.8
		P.V. =	2,748.80

(ii) If there is Even Cash flow for Limited Period

P.V. = Even Cash flow x PVAf

Here, PVAf = Present Value Annuity Factor

Example:

Cash flow of ₹ 1,000 will be received at end of each years for 3 Years. Discounting Rate is 10%. Calculate PV

$P.V. = 1,000 \times PVAF_3 = 1,000 \times 2.486 \Rightarrow$ ₹ 2,486

(iii) If there is Perpetual Cash Flow [i.e. Cash Flow forever]

$$P.V. = \frac{\text{Perpetual Cash Flow}}{\text{Discounting Rate}}$$

Example:

Cash Flow of ₹ 1,000 will be received at the end of each year forever. Discounting Rate is 10%. Calculate PV

$$PV = \frac{1,000}{10\%} = ₹\ 10,000$$

(iv) If there is Perpetual Cash Flow with Constant Growth Rate [i.e. Cash Flow with Constant Growth]

$$P.V. = \frac{\text{First Perpetual Cash Flow}}{\text{Discounting Rate} - \text{Growth Rate}}$$

Example:

Cash Flow of ₹ 1,000 will be received at 1st year end & thereafter it will grow by 2% p.a. forever. Discounting Rate is 10%. Calculate P.V.

$$P.V. = \frac{1,000}{10\% - 2\%} = \frac{1,000}{8\%} = ₹\ 12,500$$

(v) If there is Uneven Cash Flow for Limited Period & thereafter Perpetual Cash flow

PV is calculated as follows:

PV of Uneven Cash flow for Limited Period [Calculated using PV Table] ✓

(+) PV of Perpetual Cash Flow [Terminal Value$_{(t-1)}$ × PVF$_{(t-1)}$] ✓

P.V. = ✓

Here, Terminal Value $_{(t-1)}$ = $\frac{\text{Perpetual Cash flow}_t}{\text{Discounting Rate}}$

⇓

This Value will be of 1 Year Before the Date on which Perpetual Cash Flow will start to receive

Example:

Year	Cash flows	
1	1,000	} Discrete Values
2	2,000	
3	5,000	

Further, Cash Flow of ₹ 7,000 will be received at each year end from 4th year & onwards. Discounting Rate is 10%. Calculate P.V.

Calculation of P.V.:

PV of Uneven Cash flow

Year	Cash flows	PVf @ 10%	PV
1	1,000	0.909	909
2	2,000	0.826	1,652
3	5,000	0.757	3,755
			6,316

PV of Perpetual Cash Flow

Terminal Value $[TV_3] = \frac{Cf_4}{10\%} = \frac{7,000}{10\%} = ₹\ 70,000$

P.V. of TV_3 = 70,000 × 0.751 ⇒ ₹ 52,570

∴ Total P.V. = 6,316 + 52,570 ⇒ ₹ 58,886

(v) If there is Uneven Cash flow for Limited Period & thereafter Perpetual Cash flow with Constant Growth

PV is calculated as follows:

PV of Uneven Cash flow for Limited Period [Calculated using PV Table] ✓

(+) PV of Perpetual Cash flow [Terminal Value$_{(t-1)}$ × PVF$_{(t-1)}$] ✓

P.V. = ✓

Here, Terminal Value$_{(t-1)}$ = $\frac{\text{First Perpetual Cash Flow}_t}{\text{Discounting Rate} - \text{Growth Rate}}$

⇓

This Value will be of 1 Year Before the Date on which Perpetual Cash Flow will start to receive

* First Perpetual Cash Flow$_t$ = Cash Flow$_{(t-1)}$ × (1+g)

Example:

Year	Cash Flows	
1	1,000	} Discrete Values
2	2,000	
3	5,000	

Further, Cash Flow from 4th Year & Onwards will grow at 2% p.a. forever. Discounting Rate is 10%.

Calculate P.V.

Calculation of P.V.:

PV of Uneven Cash flow

Year	Cash Flows	PVf @ 10%	PV
1	1,000	0.909	909
2	2,000	0.826	1,652
3	5,000	0.751	3,755
			6,316

PV of Perpetual Cash flow

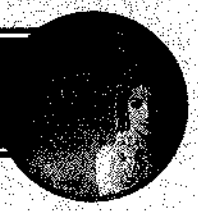
Terminal Value $[TV_3] = \frac{CF_4}{10\% - 2\%} = \frac{CF_3(1+g)}{8\%} = \frac{5,000(1+0.02)}{8\%}$

$\Rightarrow$ ₹ 63,750

P.V. of TV_3 = 63,750 × 0.751 $\Rightarrow$ ₹ 47,876

∴ Total P.V. = 6,316 + 47,876 $\Rightarrow$ ₹ 54,192

Note:- PV factor [PVf] should always be taken in 3 decimals unless specifically mentioned in question



No practical concepts in this chapter.

Theory concepts of this chapter are covered in Section B of this book.

Standard Normal Distribution Table

- It is used to Calculate the Probability for a Specific Case
- Steps to be followed to Calculate the Probability of a Specific Case :-

Step 1: Calculate Z Score of Required Value

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

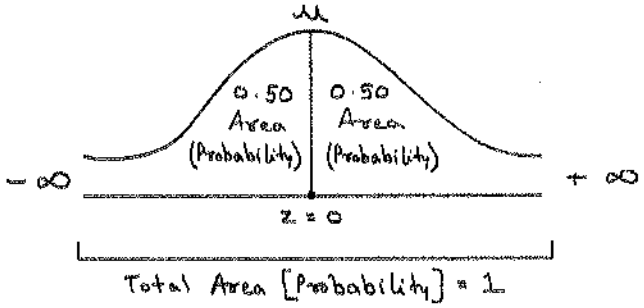
Here, Z = Z Score [It reflects Average Value से Standard Deviation का कितना Times Change करने से Required Value आएगी]

x = Required Value

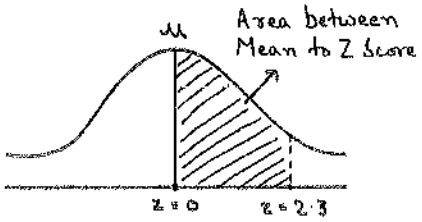
μ = Average Value [Mean Value]

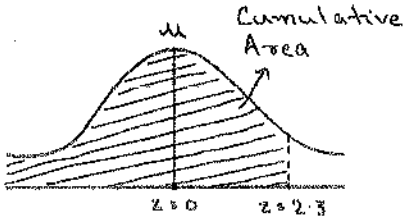
σ = Standard Deviation

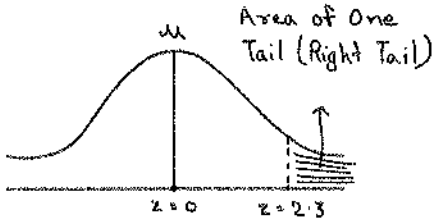
Step 2 : Calculate Probability on the basis of Z Score [By Using Standard Normal Distribution Table]



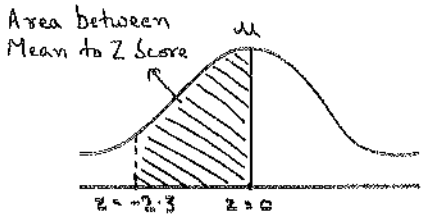
Example :- If Z Score = 2.3

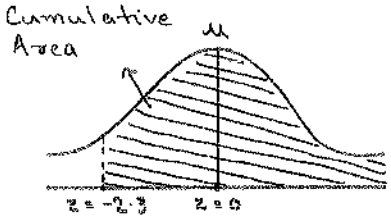


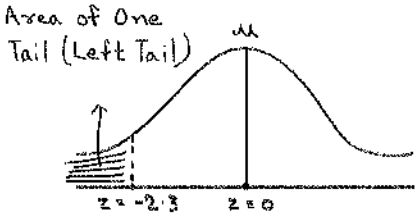




Example :- If Z Score = −2.3





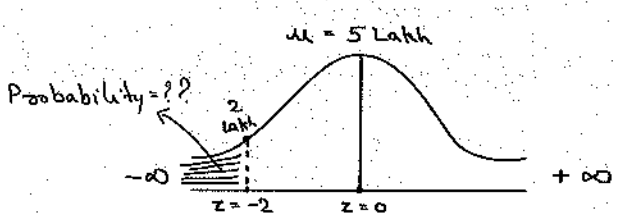


Example 1 :-

Average Wealth of a Person in a City is ₹ 5 Lakhs. Standard Deviation is ₹ 1.5 Lakhs
Calculate Probability of People having Wealth of Less than ₹ 2 Lakhs if
Case (i) Area between Mean & Z Score of 2 is 0.4772
Case (ii) Cumulative Area upto Z Score of 2 is 0.9772
Case (iii) Area of One Tail (Right or Left) from Z Score of 2 is 0.0228

Solution :-

$$Z\ Score = \frac{2\ Lakh - 5\ Lakh}{1.5\ Lakh} = -2$$



Case (i) : Probability ⇒ 0.50 − 0.4772 ⇒ 0.0228 or 2.28%

Case (ii) : Probability ⇒ 1 − 0.9772 ⇒ 0.0228 or 2.28%

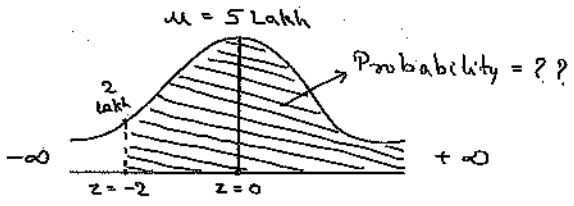
Case (iii) : Probability ⇒ 0.0228 or 2.28%

Example 2 :-

Average Wealth of a Person in a City is ₹ 5 Lakhs. Standard Deviation is ₹ 1.5 Lakhs
Calculate Probability of People having Wealth of More than ₹ 2 Lakhs if
Case (i) Area between Mean & Z Score of 2 is 0.4772
Case (ii) Cumulative Area upto Z Score of 2 is 0.9772
Case (iii) Area of One Tail (Right or Left) from Z Score of 2 is 0.0228

Solution :-

$$Z\ Score = \frac{2\ Lakh - 5\ Lakh}{1.5\ Lakh} = -2$$



Case (i) : Probability ⇒ 0.50 + 0.4772 ⇒ 0.9772 or 97.72%

Case (ii) : Probability ⇒ 0.9772 or 97.72%

Case (iii) : Probability ⇒ 1 − 0.0228 ⇒ 0.9772 or 97.72%

Value At Risk [VAR]

- It is used to Calculate the Expected Maximum Loss on Investment in Shares | Portfolio of Shares in a given period of time

- **Calculation of VAR of an Individual Security :-**

VAR = Investment Amount in Security $\times \sigma_s \times \sqrt{t} \times$ Z Score

Here, σ_s = Standard Deviation of Security per day [Daily Standard Deviation of Security]

t = No. of Days for which Loss is to be calculated

Z Score = Z Score in Cumulative Area Table for a Particular Probability (Confidence Level)

- **Calculation of VAR of Portfolio :-**

VAR = Investment Amount in Portfolio $\times \sigma_p \times \sqrt{t} \times$ Z Score

Here, σ_p = Standard Deviation of Portfolio per day [Daily Standard Deviation of Portfolio]

$\Rightarrow$ Calculated as per MPT

Advanced Capital Budgeting Decisions

Advanced Capital Budgeting Decisions

- **Part I: Introduction to Capital Budgeting**
  - Techniques used in Capital Budgeting Decisions
  - Impact of Inflation on Capital Budgeting Decisions
- **Part II: Techniques of Risk Analysis in Capital Budgeting**
  - Conventional Techniques
  - Sensitivity Analysis Technique
  - Statistical Technique
  - Decision Tree Analysis Technique
- **Part III: Other Decisions**
  - Replacement Decision
  - Selection of Asset using Equivalent Annual Cost [EAC]
  - Optimum Replacement Cycle
- **Part IV: Real Options**
  - Timing Option
  - Abandonment Option
  - Growth Option

Part I: Introduction to Capital Budgeting

It is the process of evaluating & selecting long term investments / projects.

Techniques used in Capital Budgeting Decisions

(1) Net Present Value (NPV) Method :

Steps to be followed to solve the Question :

Step 1: Calculate Initial Investment in the Project [Initial Cash Outflow at Beginning]

Cost of Asset [Purchase Cost + Installation Cost]	xxx
(+) Investment in Working Capital	xxx
	xxx

Step 2: Calculate Cash Inflows from the Project

- Cash Inflows at each year end during the Life of Project

NOPAT	xxx
(+) Depreciation	xxx
(±) Decrease / (Increase) in Working Capital	xxx / (xxx)
	xxx

- Additional Cash Inflows at last year end [i.e. At end of Life of Project]

Release of Working Capital Invested till date in Project	xxx
(+) Salvage Value of Asset	xxx
(±) Tax Effect on Sale of Asset	xxx / (xxx)
	xxx

Note:

(i) Allocated fixed Costs [Apportioned Existing Overheads] & Historical Costs are not considered in calculation of cash flows.

(ii) Tax Effect on Sale of Asset = [Salvage Value of Asset − Book Value of Asset] × Tax Rate

- If Positive ⇓ Tax on Capital Gain [Cash Outflow]
- If Negative ⇓ Tax Saving on Capital Loss [Cash Inflow]

Step 3: Calculate PV of Cash Inflows from the Project using following Discount Rate

1st Priority ⇒ Discount Rate as given in question
2nd Priority ⇒ Required Rate of Return from the Project
3rd Priority ⇒ Cost of Capital [WACC]

Step 4: Calculate NPV of the Project

NPV of the Project = PV of Cash Inflows from the Project − Initial Investment in the Project

- If NPV is Positive ⇓ Accept the Project
- If NPV is Negative ⇓ Reject the Project

(2) Profitability Index (PI) Method:

$$\text{Profitability Index} = \frac{\text{PV of Cash Inflows from the Project}}{\text{Initial Investment in the Project}}$$

- If PI ≥ 1 ⇓ Accept the Project
- If PI < 1 ⇓ Reject the Project

(3) Internal Rate of Return (IRR) Method:

- It is the Rate which equates PV of Cash Inflows from the Project with Initial Investment in the Project, i.e.
  PV of Cash Inflows from the Project = Initial Investment in the Project
- At IRR, NPV of the Project is Zero (0).

(4) Modified Internal Rate of Return (MIRR) Method [Terminal Value Method]:

- It is IRR calculated on the assumption that all Cash Inflows during the life of Project will be Reinvested at Discounting Rate till the end of life of Project & will be received together at end of life of Project.
- It is calculated as follows:

$$MIRR = \left[\frac{\text{Total Amount Received at End of Life of Project}}{\text{Initial Investment in the Project}}\right]^{\frac{1}{t}} - 1$$

Here, t = Life of Project

(5) Adjusted Present Value (APV) Method:

Base NPV [NPV of Project by discounting Cash Inflows from Project using Cost of Equity (Ke)]	xxx
(+) Effect of Debt [PV of Tax Shield on Interest by discounting it using Pre Tax Cost of Debt]	xxx
Adjusted NPV	xxx

Impact of Inflation on Capital Budgeting Decisions

- While Calculating NPV of the Project, Cash flows & Discount Rate should be Nominal [i.e. adjusted with inflation].
- Conversion of Cash Flows from Real (Without Inflation) to Nominal (With Inflation):

(i) If Inflation Rate is Same for all years:

$$\text{Nominal Cash flow}_t = \text{Real Cash flow}_t \times (1 + \text{Inflation Rate})^t$$

Here, t = Year of Cash flow

Example:

Inflation Rate is 10% p.a.

Year	Real Cash flow	Nominal Cash flow
1	100	$100 \times (1.10)^1 = 110$
2	250	$250 \times (1.10)^2 = 302.50$
3	300	$300 \times (1.10)^3 = 399$

(ii) If Inflation Rate is different for all years:

$$\text{Nominal Cash flow}_1 = \text{Real Cash flow}_1 \times (1 + \text{IR of Year 1})$$

$$\text{Nominal Cash flow}_2 = \text{Real Cash flow}_2 \times (1 + \text{IR of Year 1}) \times (1 + \text{IR of Year 2})$$

$$\text{Nominal Cash flow}_n = \text{Real Cash flow}_n \times (1 + \text{IR of Year 1}) \times (1 + \text{IR of Year 2}) \times \ldots \times (1 + \text{IR of Year n})$$

Here, IR = Inflation Rate

Example :

Year	1	2	3
Inflation Rate	10%	9%	8%

Year	Real Cash flow	Nominal Cash flow		
1	100	100 × (1.10)	=	110
2	250	250 × (1.10) × (1.09)	=	299.75
3	300	300 × (1.10) × (1.09) × (1.08)	=	388.48

Note : Depreciation is calculated on historical cost. Inflation does not affect Depreciation Amount.

- Conversion of Discount Rate from Real (Without Inflation) to Nominal (With Inflation) :

Nominal Rate = (1 + Real Rate) × (1 + Inflation Rate) − 1

Part II : Techniques of Risk Analysis in Capital Budgeting

Conventional Techniques

(1) Risk Adjusted Discount Rate (RADR) Method :

- If there is High Risk in Project, then Discount Rate should also be High according to the Risk in Project or vice versa.
- So, NPV of the Project in RADR Method is calulated using following Discount Rate :

Risk Adjusted Discount Rate = Risk Free Rate + Risk Premium

Here, Risk Premium = [Minimum Required Return of firm − Risk Free Rate] × Risk Index

(2) Certainty Equivalent (CE) Approach :

- In this Approach, Expected future Cash flows from the Project (which are Risky) are converted in Certain Cash Flows using Certainty Equivalent Coefficient.
- So, NPV of the Project in CE Approach is calculated using following Cash flows & Discount Rate :

$\text{Certain Cash flow}_t = \text{Expected Cash flow}_t \times \text{Certainty Equivalent Coefficient}_t$

Here, t = Year of Cash flow

Discount Rate = Risk free Rate

(3) Utility Approach :

- In this Approach, Expected future Cash flows from the Project are assigned Utility Values (as per Utility function given in question) & the Project having Highest Expected Utility Value is selected.

- Expected Utility Value of the Project = Utility Value$_1$ × Probability$_1$ + Utility Value$_2$ × Probability$_2$ + ... + Utility Value$_n$ × Probability$_n$

Sensitivity Analysis Technique

- NPV of any Project is calculated using factors / parameters / variables such as Initial Investment in the Project, Cash Inflows from the Project [Sales Volume, Selling Price per unit, Variable Cost per unit, fixed cost], Discount Rate, Project life, etc.
- In this technique, we analyse the impact of change in each factor (Keeping other factors same) on NPV of the Project, i.e. How NPV of the Project will change due to change in any factor.
- Methods to conduct Sensitivity Analysis :

(i) Sensitivity of Project considering a fixed % adverse change / variance in each factor :

Step 1 : Calculate Existing NPV of the Project considering existing value of factors.

Step 2 : Calculate Revised NPV of the Project considering a fixed % (Given in Question) adverse change in each factor independently, keeping other factors same.

$$\% \text{ Change in NPV} = \frac{\text{Existing NPV} - \text{Revised NPV}}{\text{Existing NPV}} \times 100$$

* Repeat this Step 2 Process for each factor.

Step 3 : Determine the Most Sensitive Factor
⇒ factor which leads to highest % Change in NPV.

(ii) Sensitivity of Project in relation to each factor such that NPV of Project becomes Zero (0):

Step 1 : Calculate Existing NPV of the Project considering existing value of factors.

Step 2 : Calculate value of each factor independently, keeping other factors same, so that NPV of the Project will be Zero (0).

$$\% \text{ Change in each factor} = \frac{\text{Revised Value of factor} - \text{Existing Value of factor}}{\text{Existing Value of factor}} \times 100$$

* Repeat this Step 2 Process for each factor.

Step 3 : Determine the Most Sensitive Factor
⇒ factor which have lowest % Change.

Example:

Initial Investment in Project = ₹ 1,00,000 ; Annual Cash Inflow = ₹ 50,000
Discount Rate = 10% ; Project Life = 3 Years

(i) Measure Sensitivity of Project considering 10% adverse variance in Initial Investment & Annual Cash Inflows.

(ii) Measure Sensitivity of Project in relation to Initial Investment & Annual Cash Inflows such that NPV becomes Zero.

[Given: PVAF @ 10% for 3 Years is 2·487]

Solution:

(i) Step 1: Existing NPV = [50,000 × 2·487] − 1,00,000 ⇒ 1,24,350 − 1,00,000 ⇒ ₹ 24,350

Step 2: (a) If Initial Investment is varied adversely by 10%

Revised Initial Investment = 1,00,000 + 10% ⇒ ₹ 1,10,000

Revised NPV = 1,24,350 − 1,10,000 ⇒ ₹ 14,350

$\therefore$ % Change in NPV = $\frac{24,350 - 14,350}{24,350} \times 100 \Rightarrow 41.07\%$

(b) If Annual Cash Inflow is varied adversely by 10%

Revised Annual Cash Inflow = 50,000 − 10% ⇒ ₹ 45,000

Revised NPV = [45,000 × 2·487] − 1,00,000 ⇒ 1,11,915 − 1,00,000 ⇒ ₹ 11,915

$\therefore$ % Change in NPV = $\frac{24,350 - 11,915}{24,350} \times 100 \Rightarrow 51.07\%$

Step 3: Annual Cash Inflow is most sensitive for Project.

(ii) Step 1: Existing NPV = [50,000 × 2·487] − 1,00,000 ⇒ 1,24,350 − 1,00,000 ⇒ ₹ 24,350

Step 2: (a) Initial Investment

[50,000 × 2·487] − Initial Investment = 0

Initial Investment = ₹ 1,24,350

$\therefore$ % Rise in Initial Investment = $\frac{1,24,350 - 1,00,000}{1,00,000} \times 100 \Rightarrow 24.35\%$

(b) Annual Cash Inflow

[A × 2·487] − 1,00,000 = 0

A × 2·487 = 1,00,000

$A = \frac{1,00,000}{2.487} \Rightarrow$ ₹ 40,209

$\therefore$ % fall in Annual Cash Inflow = $\frac{50000 - 40209}{50,000} \times 100 \Rightarrow 19.58\%$

Step 3: Annual Cash Inflow is most sensitive for Project.

Statistical Technique

In this technique, Decision making is done by calculating Expected NPV of the Project using Probability distribution of cash flows, Standard Deviation in Expected NPV of Project & Coefficient of Variation as follows:

- If various NPV of Project with Probability distribution are given in question:

Step 1: Calculate Expected NPV (ENPV) of the Project

$$ENPV = \Sigma PX$$

Here, ΣPX = Sum Total of (Probability x NPV of Project)

Step 2: Calculate Risk in the Project

$$\text{Variance of Project } (\sigma^2) = \Sigma P (X - ENPV)^2$$

$$\text{Standard Deviation of Project } (\sigma) = \sqrt{\Sigma P (X - ENPV)^2} \text{ OR } \sqrt{\text{Variance}}$$

Here, $\Sigma P(X - ENPV)^2$ = Sum Total of (Probability x Deviation Square of NPV from ENPV)

Example:

NPV of Project A	Probability
8,000	0.10
10,000	0.20
12,000	0.40
14,000	0.20
16,000	0.10

Calculate Expected NPV & Standard Deviation of the Project.

Solution:

Step 1 & 2: Calculation of ENPV & Standard Deviation of Project

NPV (X)	Probability	ENPV	(X - ENPV)	$(X - ENPV)^2$	$(X - ENPV)^2 \times P$
8,000	0.10	800	-4,000	1,60,00,000	16,00,000
10,000	0.20	2,000	-2,000	40,00,000	8,00,000
12,000	0.40	4,800	0	0	0
14,000	0.20	2,800	2,000	40,00,000	8,00,000
16,000	0.10	1,600	4,000	1,60,00,000	16,00,000
		ENPV = 12,000			Variance (σ^2) = 48,00,000

Standard Deviation (σ) = $\sqrt{48,00,000}$

$\Rightarrow$ 2,190.90

- If Perfectly Independent Future Cash Flows from the Project with Probability distribution are given in question:

Step 1: Calculate Expected Net Cash Flow (ENCF) for each year

$$ENCF = \Sigma PX$$

Here, ΣPX = Sum Total of (Probability x Cash Flows from Project)

Step 2 : Calculate Risk in Cash Flows for each year

Variance in Cash Flows of each year $(\sigma^2_{CF}) = \Sigma P (x - ENCF)^2$

Standard Deviation in Cash Flows of each year $(\sigma_{CF}) = \sqrt{\Sigma P (x - ENCF)^2}$ OR $\sqrt{\text{Variance}}$

Here, $\Sigma P(x - ENCF)^2$ = Sum Total of (Probability × Deviation Square of Cash Flows from ENCF)

Step 3 : Calculate Expected NPV (ENPV) of the Project

ENPV = PV of ENCf − Initial Investment

Step 4 : Calculate Risk in the Project

Variance of Project $(\sigma_p^2) = (\sigma_{CF_1} \times PVF_1)^2 + (\sigma_{CF_2} \times PVF_2)^2 + \ldots + (\sigma_{CF_n} \times PVF_n)^2$

Standard Deviation of Project $(\sigma_p) = \sqrt{\text{Variance of Project}}$

Here, σ_{CF} = Standard Deviation in Cash Flows of each year

n = Last Year of Life of Project

Example :

Possible Cash flows from Project for next 2 years are as follows :

Year 1		Year 2	
Cash Flow	Probability	Cash Flow	Probability
1,000	0.10	500	0.40
2,000	0.50	1,000	0.40
3,000	0.40	1,500	0.20

Discount Rate is 10%. Initial Investment in Project is ₹ 2,000.

Calculate Expected NPV & Standard Deviation of the Project.

Solution :

Step 1 & 2 : Calculation of ENCf & Standard Deviation in Cash Flows

Year 1

Cash Flow (x)	Probability	ENCf	(x − ENCF)	(x − ENCF)²	(x − ENCF)² × P
1,000	0.10	100	−1300	16,90,000	1,69,000
2,000	0.50	1000	−300	90,000	45,000
3,000	0.40	1,200	700	4,90,000	1,96,000
	$ENCF_1$ =	2,300		$\sigma^2_{CF_1}$ =	4,10,000
				σ_{CF_1} =	640.31

Year 2

Cash Flow (x)	Probability	ENCf	(x − ENCF)	(x − ENCF)²	(x − ENCF)² × P
500	0.40	200	−400	160,000	64,000
1,000	0.40	400	100	10,000	4,000
1,500	0.20	300	600	3,60,000	72,000
	$ENCF_2$ =	900		$\sigma^2_{CF_2}$ =	1,40,000
				σ_{CF_2} =	374.17

Step 3 : Calculation of ENPV of Project

Year	ENCf	PVF @ 10%	PV
1	2,300	0.909	2,090.70
2	900	0.826	743.40
PV of ENCF			2,834.10
(-) Initial Investment			(2,000)
		ENPV	834.10

Step 4 : Calculation of Standard Deviation of Project

Year	S.D. in Cash flows (σ_{CF})	P.V.F.	$\sigma_{CF} \times PVF$	$(\sigma_{CF} \times PVf)^2$
1	640.31	0.909	582.04	3,38,770.56
2	374.17	0.826	309.06	95,518.68
		Variance of Project (σ_p^2)	=	4,34,288.64
		S.D. of Project (σ_p)	=	$\sqrt{4,34,288.64}$
			⇒	659.01

- If Perfectly Dependent Future Cash Flows from the Project with Probability distribution are given in question [Scenario Analysis] :

There are 3 Possible Scenarios / Streams of Cash Flows arising from the Project [i.e. Worst Case Cash Flows, Most Likely Case Cash Flows & Best Case Cash Flows].

Step 1 : Calculate NPV of the Project in 3 possible scenarios
- (i) NPV of Worst Case
- (ii) NPV of Most Likely Case
- (iii) NPV of Best Case

Step 2 : Calculate Expected NPV (ENPV) of the Project

$ENPV = \Sigma PX$

Here, ΣPX = Sum Total of (Probability x NPV of Project)

Step 3 : Calculate Risk in the Project

Variance of Project (σ^2) = $\Sigma P (x - ENPV)^2$

Standard Deviation of Project (σ) = $\sqrt{\Sigma P (x - ENPV)^2}$ OR $\sqrt{\text{Variance}}$

Here, $\Sigma P(x - ENPV)^2$ = Sum Total of (Probability x Deviation Square of NPV from ENPV)

Example :

Possible Cash flows from Project for next 2 years are as follows :

Scenario	Probability	Year 1 Cash Flow	Year 2 Cash Flow
Worst Case	0.20	1,000	500
Most Likely Case	0.50	2,000	1,000
Best Case	0.30	3,000	1,500

Discount Rate is 10%. Initial Investment in Project is ₹ 2,000.

Calculate Expected NPV & Standard Deviation of the Project.

Solution:

Step 1: Calculation of NPV of the Project in 3 Possible Scenarios

(i) NPV of Worst Case = [1,000 × 0.909 + 500 × 0.826] − 2,000 ⇒ − ₹ 678

(ii) NPV of Most Likely Case = [2,000 × 0.909 + 1,000 × 0.826] − 2,000 ⇒ ₹ 644

(iii) NPV of Best Case = [3,000 × 0.909 + 1,500 × 0.826] − 2,000 ⇒ ₹ 1,966

Step 2 & 3: Calculation of ENPV & Standard Deviation of Project

NPV (x)	Probability	ENPV	(x − ENPV)	(x − ENPV)^2	(x − ENPV)^2 × P
− 678	0.20	−135.60	−1,454.20	21,14,698	4,22,940
644	0.50	322	−132.20	17,477	8,739
1,966	0.30	589.80	1,189.80	14,15,624	4,24,687
		ENPV = 776.20			Variance (σ^2) = 8,56,366

Standard Deviation (σ) = $\sqrt{8,56,366}$

⇒ 925.40

- If Moderately Dependent future Cash flows from the Project with Probability distribution are given in question:

Step 1: Draw a Decision Tree showing various paths of cash flows from the Project & Calculate Joint Probability of each path.

Step 2: Calculate NPV of each path.

Step 3: Calculate Expected NPV (ENPV) of the Project using Joint Probability

$ENPV = \Sigma PX$

Here, ΣPX = Sum Total of (Joint Probability × NPV of Project)

Step 4: Calculate Risk in the Project

Variance of Project (σ^2) = $\Sigma P (x - ENPV)^2$

Standard Deviation of Project (σ) = $\sqrt{\Sigma P (x - ENPV)^2}$ OR $\sqrt{\text{Variance}}$

Here, $\Sigma P(x - ENPV)^2$ = Sum Total of (Joint Probability × Deviation Square of NPV from ENPV)

Example:

Possible Cash flows from Project for next 2 years are as follows:

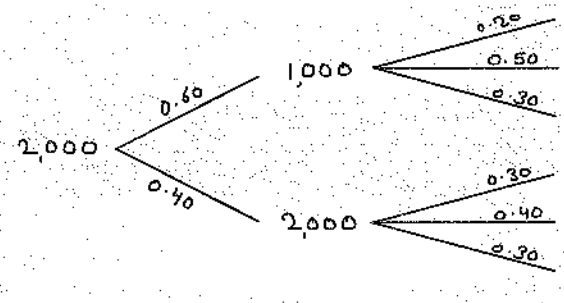
Year 1 Cash Flow	1,000 [Probability 0.60]	2,000 [Probability 0.40]
Year 2 Cash Flow	1,000 [Probability 0.20]	2,000 [Probability 0.30]
	2,000 [Probability 0.50]	3,000 [Probability 0.40]
	3,000 [Probability 0.30]	4,000 [Probability 0.30]

Discount Rate is 10%. Initial Investment in Project is ₹ 2,000.

Calculate Expected NPV & Standard Deviation of the Project.

Solution:

Step 1: Decision Tree showing various Paths & Joint Probabilities



Path	Joint Probability
1	0.12
2	0.30
3	0.18
4	0.12
5	0.16
6	0.12
	1.00

Step 2: Calculation of NPV of each path

NPV of Path 1 = [1,000 x 0.909 + 1,000 x 0.826] - 2,000 ⇒ - ₹ 265

NPV of Path 2 = [1,000 x 0.909 + 2,000 x 0.826] - 2,000 ⇒ ₹ 561

NPV of Path 3 = [1,000 x 0.909 + 3,000 x 0.826] - 2,000 ⇒ ₹ 1,387

NPV of Path 4 = [2,000 x 0.909 + 2,000 x 0.826] - 2,000 ⇒ ₹ 1,470

NPV of Path 5 = [2,000 x 0.909 + 3,000 x 0.826] - 2,000 ⇒ ₹ 2,296

NPV of Path 6 = [2,000 x 0.909 + 4,000 x 0.826] - 2,000 ⇒ ₹ 3,122

Step 3 & 4: Calculation of ENPV & Standard Deviation of Project

NPV (x)	Joint Prob.	ENPV	(x - ENPV)	$(x - ENPV)^2$	$(x - ENPV)^2 \times P$
-265	0.12	-31.80	-1,569.56	24,63,519	2,95,622
561	0.30	168.30	-743.56	5,52,881	1,65,864
1,387	0.18	249.66	82.44	6,796	1,223
1,470	0.12	176.40	165.44	27,370	3,284
2,296	0.16	367.36	991.44	9,82,953	1,57,273
3,122	0.12	374.64	1,817.44	33,03,088	3,96,371
		ENPV = 1,304.56			Variance (σ^2) = 10,19,638

Standard Deviation (σ) = $\sqrt{10,19,638}$

⇒ 1,009.77

Note:

(i) Cash Flows are assumed as perfectly independent unless any hint is given in question.

(ii) Decision making regarding Selection of a Project out of multiple Projects:

→ On the basis of NPV: Project having Highest NPV should be selected

→ On the basis of Standard Deviation (S.D.): Project having Lowest S.D. should be selected

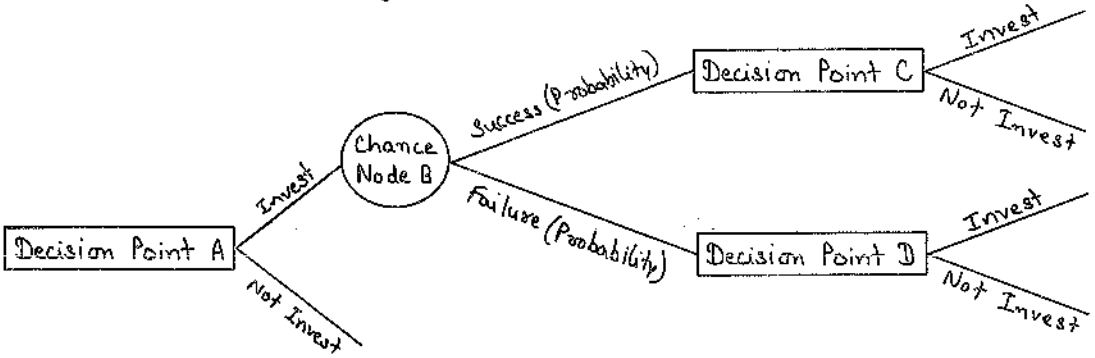
→ On the basis of Coefficient of Variation (C.V.): Project having Lowest C.V. should be selected

$$\text{Coefficient of Variation of a Project} = \frac{\text{Standard Deviation of Project } (\sigma)}{\text{Expected NPV (ENPV) of Project}}$$

Decision Tree Analysis Technique

- It is used for Projects which require further Investment decisions in future on the basis of future events [i.e. it involves sequence of decisions over a period].
- Steps to be followed to solve the Question :

Step 1 : Draw a Decision Tree Diagram



Step 2 : Calculate NPV of Investment decision at Decision Point 'C' & 'D', and then decide whether it is beneficial to invest or not.

Step 3 : Calculate Expected Monetary Value (EMV) at Chance Node 'B' as follows :

Outcome	Probability	Benefit Amount at Decision Point [If Negative, it is not beneficial to Invest ; Consider it as Zero]	Probability × Benefit Amount
Success [Decision Point 'C']	✓	xxx	xxx
failure [Decision Point 'D']	✓	xxx	xxx
		EMV	xxx

Step 4 : Take Decision at Decision Point 'A' by considering Investment Amount & EMV as calculated at Chance Node 'B'.

Part III : Other Decisions

Replacement Decision

- It is a decision concerning whether Existing Asset should be replaced by a New Asset.
- Replacement Decision are of 2 Types :

(i) Whether to Replace the Existing Asset now or not :

This decision is taken on the basis of Incremental NPV [i.e. NPV of Incremental Cash Flows from New Asset] as follows :

Step 1 : Calculate Incremental Initial Investment in New Asset

Cost of New Asset [Purchase Cost + Installation Cost]		xxx
Less :		
Current Salvage Value of Existing Asset	xxx	
(±) Tax Effect on Sale of Existing Asset	xxx/(xxx)	(xxx)
		xxx

Step 2 : Calculate Incremental Cash Inflows from New Asset

- Incremental Cash Inflows at each year end during the Life New Asset

Method 1

Increase in Sales if New Asset is used	xxx
(+) Savings in Operating Cost if New Asset is used	xxx
(–) Increase in Depreciation [Depreciation if New Asset is used – Depreciation if Existing Asset is continued]	(xxx)
	xxx
(–) Tax	(xxx)
	xxx
(+) Increase in Depreciation	xxx
	xxx

Method 2

Cash Inflows at each year end if New Asset is used	xxx
(–) Cash Inflows at each year end if Existing Asset is continued	(xxx)
	xxx

- Incremental Additional Cash Inflows at last year end [At end of Life of New Asset]

Salvage Value of New Asset		xxx
(±) Tax Effect on Sale of New Asset		xxx/(xxx)
Less :		
Salvage Value of Existing Asset if it is continued	xxx	
(±) Tax Effect on Sale of Existing Asset if it is continued	xxx/(xxx)	(xxx)
		xxx

Step 3: Calculate PV of Incremental Cash Inflows from the New Asset using Discount Rate.

Step 4: Calculate Incremental NPV of the New Asset

Incremental NPV of the New Asset = PV of Incremental Cash Inflows from the New Asset − Incremental Initial Investment in New Asset

If Incremental NPV is Positive	If Incremental NPV is Negative
⇓	⇓
Replace the Existing Asset	Do not Replace the Existing Asset

(ii) Whether to Replace Existing Asset now or later [When to Replace the Existing Asset]:

This decision is taken on the basis of Total NPV in various scenario as follows:

Step 1: Calculate NPV of New Asset [as discussed in beginning of this Chapter].

Step 2: Calculate Total NPV in various scenarios

→ Total NPV if Asset is Replaced Now :

Current Salvage Value of Existing Asset	xxx
(±) NPV of New Asset	xxx/(xxx)
	xxx/(xxx)

→ Total NPV if Asset is Replaced After 1 Year :

Cash Inflow/(Outflow) from Existing Asset in Year 1	× PVf_1	xxx/(xxx)
(+) Salvage Value of Existing Asset at end of Year 1	× PVF_1	xxx
(±) NPV of New Asset	× PVF_1	xxx/(xxx)
		xxx/(xxx)

→ Total NPV if Asset is Replaced After 2 Years :

Cash Inflow/(Outflow) from Existing Asset in Year 1	× PVf_1	xxx/(xxx)
(±) Cash Inflow/(Outflow) from Existing Asset in Year 2	× PVf_2	xxx/(xxx)
(+) Salvage Value of Existing Asset at end of Year 2	× PVF_2	xxx
(±) NPV of New Asset	× PVF_2	xxx/(xxx)
		xxx/(xxx)

→ And So on.

Step 3: Determine when to replace the existing asset

⇒ Scenario in which Total NPV is the Highest

Selection of Asset using Equivalent Annual Cost [EAC]

- If various Asset with different useful life are available but we have to choose any 1 Asset, then Equivalent Annual Cost (EAC) Method is used.
- EAC of an Asset represents the annual cost of owning, operating & maintaining an asset over its useful life. Hence, Asset having Lowest EAC should be selected.
- EAC is calculated as follows:

$$\text{EAC of an Asset} = \frac{\text{PV of Cash Outflows of Asset}}{\text{PVAF @ Discount Rate for Life of Asset}}$$

Here, PV of Cash Outflows of Asset ⇒

Initial Investment in Asset [Purchase Cost of Asset]	xxx
(+) PV of Annual Running Costs of Asset [Example: Repair Costs, Maintenance Costs, Operating Costs, Insurance Costs, etc.]	xxx
(-) PV of Salvage Value of Asset [Example: Resale / Scrap Value]	(xxx)
	xxx

Optimum Replacement Cycle

- If Asset involves continuous Replacement Cycle [i.e. Project can be repeated], then Optimum Replacement Cycle is determined because as Asset becomes older, it leads to increase in annual running costs & reduction in Salvage Value.
- Optimum Replacement Cycle is determined on the basis of Equivalent Annual Cost [EAC] of asset as follows:

Step 1: Calculate EAC of Asset in various scenarios
- (i) EAC of Asset if it is used for 1 Year
- (ii) EAC of Asset if it is used for 2 Years
- (iii) EAC of Asset if it is used for 3 Years

And so on

Step 2: Determine Optimum Replacement Cycle
⇒ Scenario in which EAC is the Lowest

Part IV : Real Options

Meaning & Types of Real Options

- It is an approach to Capital Budgeting Decisions for evaluating projects using Option Pricing concept of Derivatives Chapter as follows:
  → Right to Invest in a Project at certain future date [Call Option], or
  → Right to dispose off or abandon a project at certain future date [Put Option]
- Types of Real Options :
  (i) Timing Option
  (ii) Abandonment Option
  (iii) Growth Option

Timing Option

- It is used to take decision regarding when to invest in a project [i.e. Whether to accept the project now or wait for a future date.
- It is treated as a Call Option & Binomial Model is applied to take decision as follows:

Step 1 : Apply Single Period Binomial Model as discussed in Derivatives Chapter to get the Value of Timing Option [i.e. NPV of Project if wait for a future date].

Inputs required for applying Binomial Model ⇒

(i) Current Price of Underlying = PV of Cash Inflows from the Project

(ii) Strike Price = Investment Amount in Project [Cost of Project]

(iii) Expected Price of Underlying (Move Up) = PV of Cash Inflows from the Project on future Investment Date (Higher)

(iv) Expected Price of Underlying (Move Down) = PV of Cash Inflows from the Project on future Investment Date (Lower)

(v) T = Time till future Investment Date

Step 2 : Calculate NPV of Project if accept now [as discussed in beginning of this Chapter].

Step 3 : Determine whether to accept the project now or wait for a future date
⇒ Timing in which NPV of Project is Higher

Abandonment Option

- It is used to calculate extra value in a project due to Option of disposing off the project at a future date.
- It is treated as a Put Option & Binomial Model is applied to calculate the Value of Abandonment Option as follows :
  - → Apply Single Period Binomial Model as discussed in Derivatives Chapter to get the Value of Abandonment Option [i.e. Extra Value in Project due to Option of disposing off].
  - → Inputs required for applying Binomial Model ⇒
    - (i) Current Price of Underlying = PV of Cash Inflows from the Project
    - (ii) Strike Price = Sale Price of Project
    - (iii) Expected Price of Underlying (Move Up) = PV of Cash Inflows from the Project on future Investment Date (Higher)
    - (iv) Expected Price of Underlying (Move Down) = PV of Cash Inflows from the Project on future Investment Date (Lower)
    - (v) T = Time till future Disposing Off Date of the Project

Growth Option

- It is used to calculate Value of Intangible Assets [Example : Patent] since it may have insignificant NPV but it leads to future growth in business.
- It is treated as a Call Option & Black Scholes Model is applied to calculate the Value of Intangible Assets as follows :

$$\text{Value of Growth Option} = \frac{\text{Current Price of Underlying}}{e^{DT}} \times N(d_1) - \frac{\text{Strike Price}}{e^{RT}} \times N(d_2)$$

Here,

Current Price of Underlying = PV of Cash Inflows from the Project

Strike Price = Investment Amount in Project [Cost of development]

R = Interest Rate p.a.

T = Life of Intangible Asset in Years

$$D = \text{Expected Cost of Delays} = \frac{1}{\text{Life of Intangible Asset in Years}}$$

$$d_1 \left[Z\ Score_1\right] = \frac{\left[Ln \frac{\text{Current Price of Underlying}}{\text{Strike Price}}\right] + \left[\left\{(R-D) + 0.5 \times \sigma^2\right\} \times T\right]}{\sigma \sqrt{T}}$$

$$d_2 \left[Z\ Score_2\right] = d_1 - \sigma \sqrt{T}$$

σ^2 = Variance in PV of Cash Inflows from the Project

Security Analysis



Meaning & Approaches of Security Analysis

- Security Analysis involves Systematic Analysis of Prices of Securities so that an Investor can take decision regarding Purchase | Sale of a Security
- Two Approaches are used for carrying out Security Analysis :-

Fundamental Analysis [Discussed in Security Valuation Chapter] | Technical Analysis

Decision Making by Technical Analysts Using Moving Averages

1. Arithmetic / Simple Moving Average [AMA | SMA] :-

- It is Simple Average of Share Prices of Last 'n' No. of days
- Calculation of AMA | SMA :-

$$\text{AMA | SMA} = \frac{\text{Sum Total of Share Prices of Last 'n' No. of Days}}{\text{No. of Days}}$$

2. Exponential Moving Average [EMA] :-

- It is Exponentially Weighted Average of Share Prices of Last 'n' No. of days
- Calculation of EMA :-

$$\text{EMA of Today} = \text{Previous Day EMA} + \left[\left(\begin{matrix}\text{Closing Price}\\ \text{of Share Today}\end{matrix} - \begin{matrix}\text{Previous}\\ \text{Day EMA}\end{matrix}\right) \times \text{exponent}\right]$$

$$\text{Here, Exponent} = \frac{2}{n+1}$$ [It is Weight to the Change in Latest Price of Share from Previous Day EMA]

* n = No. of Days for which Average is to be calculated
* Value of Exponent can be given in question also

Notes :-
(i) AMA & EMA cannot be calculated for No Trading Days

(ii) Analysis on the basis of AMA & EMA :-

If it is Increasing Day by Day (Uptrend) ⇓ It Means Market is Bullish ⇓ Take Long Position on Share (Buy Share)

If it is Decreasing Day by Day (Downtrend) ⇓ It Means Market is Bearish ⇓ Take Short Position on Share (Sell Share)

Efficient Market Theory / Hypothesis

- According to this Theory, Efficient Market means a Market in which Investor cannot forecast Share Prices by using Technical Analysis
- There exists 3 Levels of Market Efficiency :-

Weak Form Efficiency ⇓ Share Price reflects all information of Past Prices of Share [i.e. Technical Analysis can not help to earn profits in Stock Market]

Semi Strong Form Efficiency ⇓ Share Price reflects all information of Past Prices of Share & Other Publically available information of that Company [i.e. Only Private Information of Company can help to earn profits in Stock Market]

Strong Form Efficiency ⇓ Share Price reflects all information of Past Prices of Share & Other Publically available information as well as Private information of that Company [i.e. Noone can earn Profit in Stock Market]

- Methods to Test the Weak Form of Market Efficiency :-

1. Run Test :-

Step 1: Determine No. of Runs (r) in given data of Share Prices for a Period :-

No. of Runs (r) = No. of Times Market Price Moves
i.e. Market Price starts decreasing from a level or starts increasing from a level

Eg :-

Day	Market Price of Share	
1	500	
2	520	+
3	530	+
4	515	−
5	525	+
6	535	+

$\therefore r = 3$

* for Market to be in Weak form of Efficiency, No. of Runs (r) should be near to Average. It should not be either very Low or Very High

Step 2: Determine Total No. of Plus Signs in Price Movements (n_1)

Step 3: Determine Total No. of Minus Signs in Price Movements (n_2)

Step 4: Calculate Average No. of Runs (μ_r) :-

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

Step 5: Calculate Standard Deviation in No. of Runs (σ_r) :-

$$\sigma_r = \sqrt{\frac{(\mu - 1) \times (\mu - 2)}{n_1 + n_2 - 1}}$$

Step 6: Calculate Range in between of which No. of Runs (r) should lie to reflect Weak form of Market Efficiency :-

Upper Limit = $\mu + (\sigma \times t)$

Lower Limit = $\mu - (\sigma \times t)$

Conclusion :-

If No. of Runs (r) as calculated in Step 1 lies between Lower Limit & Upper Limit, then it reflects Weak form of Market Efficiency

Note :-

't' means Standard Deviation में कितना Times Change आ सकता है because of Error in our Estimation

't' Value is always given in question which is taken from Standard t Table at Particular :

- Significance Level
  - Probability or Chance of having Error in our Estimation
  - It is as per the discretion of Person performing Run Test
- and
- Degree of Freedom
  - No. of Data used in Standard Deviation Calculation
  - $n_1 + n_2 - 1$

2. Auto-Correlation Test / Serial Correlation Test :-

Step 1: Calculate the Correlation between Closing Prices of Share of a Period by dividing the Period into 2

Eg:- If Prices of Share is given for 20 days, then 1st Period will be of 1 to 10 days & 2nd Period will be of 11 to 20 Days

Now, Consider these 2 periods as Separate Shares & Calculate Correlation between Prices of these 2 Periods

Step 2: If Correlation between Closing Prices of 2 Periods of a Share as calculated in Step 1 is near to '0', then it reflects Weak Form of Market Efficiency

Security Valuation



Security Valuation

- **Part I: Introduction to Security Valuation**
  - Meaning of Security Valuation
  - Required Rate of Return on Security using CAPM
- **Part II: Valuation of Equity Shares**
  - Models for Valuation of Equity Shares
  - Valuation of Rights
- **Part III: Valuation of Bonds [fixed Income Securities]**
  - Bond Pricing
  - Bond Yield
  - Bond Forward Rates
  - Bond Duration
  - Bond Immunization
  - Bond Refunding
  - Convertible Bond
  - Money Market Instruments
- **Part IV: Other Topics**
  - Fund Raising Decision
  - External fund Requirement
  - Effect of New Project or Expansion Scheme on Price of Share of Company

Part I: Introduction to Security Valuation

Meaning of Security Valuation

- It involves valuation of prices of securities so that an Investor can take decision regarding Purchase / Sale of a Security.
- Fundamental Analysis Approach [i.e. Using Financial Data of Company] is used to carry out Security Valuation.

Required Rate of Return on Security using CAPM [Also known as Expected Return]

R_s = Risk free Rate + Risk Premium on Security

$R_s = R_f + B_i (R_m - R_f)$

Here,

R_s = Required Rate of Return on Security

R_f = Risk free Rate of Return [Eg: Treasury Bills (T-Bills), Treasury Bonds, Government Securities, etc.]

R_m = Market Rate of Return [Eg: Senses, Nifty, Index, etc. of Stock Exchange]

β_s = Beta of Security

$R_m - R_f$ = Risk Premium in Market [Market Risk Premium]

$\beta_s (R_m - R_f)$ = Risk Premium on Security [Security Risk Premium]

Part II: Valuation of Equity Shares

Models for Valuation of Equity Shares

- Dividend Based Models
- Earning Based Models

Dividend Based Models

(1) Perpetual Dividend With Constant Growth Assumption [Dividend Growth Model which is Based on Gordon Growth Model]

$$V_0 = \frac{D_1}{K_e - g}$$

Here,

D_1 = Expected Dividend Per Share [DPS] at the End of 1st Year $\Rightarrow D_0 (1+g)$

D_0 = Dividend just paid by the Company

g = Growth Rate $\Rightarrow$ Retention Ratio × ROE

K_e = Required / Expected Rate of Return of Investor on Equity Share

OR

Cost of Equity Capital

V_0 = Intrinsic Value of Share

OR

Equilibrium / Fair / Theoretical Price of Share

Example:- $D_0 = ₹ 10$, $g = 5\%$ p.a., $k_e = 15\%$

$$V_0 = \frac{D_1}{k_e - g} = \frac{10 (1 + 0.05)}{15\% - 5\%} = \frac{10.50}{10\%} = ₹ 105$$

(2) Perpetual Dividend with Variable Growth Assumption [Two Stage Dividend Discount Model]:

P.V. of Uneven Dividend for Certain Period [i.e. Calculate P.V. of Discrete Values Using Table]	xxx
(+) P.V. of Perpetual Dividend [i.e. Calculate P.V. of Terminal Value]	xxx
V_0 =	xxx

Example:- D_0 = ₹ 5, g = 10% for first 3 years & 5% thereafter, ke = 15%

Solution:-

Calculation of Intrinsic Value of Share

P.V. of Dividend for first 3 Years

Year	Dividend	PVf @ 15%	P.V.
1	5 (1.10) = 5.50	0.870	4.785
2	5.50 (1.10) = 6.05	0.758	4.574
3	6.05 (1.10) = 6.655	0.658	4.379
			13.74

P.V. of Perpetual Dividend with fix Growth Rate from 4th year & onwards

$$TV_3 = \frac{D_4}{Ke - g} = \frac{6.655\,(1.05)}{15\% - 5\%} = \frac{6.988}{10\%} = ₹\ 69.88$$

P.V. of T.V. = 69.88 × 0.658 = 45.98

$\therefore V_0$ = 13.74 + 45.98 ⇒ ₹ 59.72

(3) Share is Held for Limited Period Assumption [Two Stage Dividend Discount Model]:

P.V. of Uneven Dividend for Certain Period [i.e. Calculate P.V. of Discrete Values Using Table]	xxx
(+) P.V. of price expected to be received on Sale of Share	xxx
V_0 =	xxx

Example:- D_0 = ₹ 14, g = 9% p.a. for first 3 years & Price expected to be received on Sale of Share at End of 3rd Year = ₹ 360, Ke = 13%

Solution:-

Calculation of Intrinsic Value of Share

P.V. of Dividend for first 3 years

Year	Dividend	PVf @ 13%	P.V.
1	14 (1.09) = 15.26	0.885	13.50
2	15.26 (1.09) = 16.63	0.783	13.02
3	16.63 (1.09) = 18.13	0.693	12.56
			39.08

P.V. of Expected Price to be received at end of 3rd Year ⇒ 360 × 0.693 = 249.48

∴ V_0 = 39.08 + 249.48 = 288.56 ₹

Note:-

(i) If Question is silent regarding whether Dividend is D_0 or D_1, then Assume it as D_0 in following Cases [Otherwise We Will Assume it as D_1] :-

→ 'Dividend Paid' or 'Dividend Pays' wording is given in question

→ Dividend is given in Income Statement for the Year in question

(ii) Decision making on the basis of Intrinsic Value of Share:

- If Intrinsic Value > Current MPS = Underpriced = Buy Share
- If Intrinsic Value < Current MPS = Overpriced = Sale Share
- If Intrinsic Value = Current MPS = Fair priced = Buy Share

(iii) Calculation of Ke Using DDM Approach:-

(a) In Case of Perpetual Dividend with Constant Growth Assumption:

$$K_e = \left[\frac{D_1}{P_0} \times 100\right] + g$$

Here, P_0 = Current MPS

Example:- $D_1 = 6$, $P_0 = 80$, $g = 5\%$ p.a.

$$\therefore K_e = \left[\frac{6}{80} \times 100\right] + 5\% = 7.5\% + 5\% = 12.5\%$$

(b) In All Other Cases, K_e is calculated using Trial & Error Method [i.e. Rate at which P.V. of future Cash flows is equals to P_0]

Example :-

Company will pay Dividend for 3 Years as follows :-

Year	Dividend
1	10
2	12
3	8

After that, Dividend will grow at 10% p.a.

Current MPS (P_0) = ₹ 200. Calculate K_e

Given PV factors @

	Year 1	Year 2	Year 3
13%	0.885	0.783	0.693
14%	0.877	0.769	0.675

Solution :-

Calculation of P.V. at Both Rates

Year	Div.	PVf @ 13%	P.V.	PVf @ 14%	P.V.
1	10	0.885	8.85	0.877	8.77
2	12	0.78	9.40	0.769	9.23
3	8	0.693	5.54	0.675	5.40
			23.79		23.40
(+) P.V. of T.V.	$\left[\frac{8(1.10)}{13\%-10\%} \times 0.693\right]$		203.28	$\left[\frac{8(1.10)}{14\%-10\%} \times 0.675\right]$	148.50
			227.07		171.90

Now, Do Interpolation to find K_e at which P_0 is ₹ 200

$$\Rightarrow 13\% + \frac{227.07 - 200}{227.07 - 171.90} \times (14\% - 13\%)$$

$$\Rightarrow 13.49\%$$

* formula for Interpolation $\Rightarrow$ $LR + \frac{\text{Value at LR} - \text{Required Value}}{\text{Value at LR} - \text{Value at HR}} \times (HR - LR)$

Earning Based Models

(1) Earnings Growth Model (EPS Growth Model) :-

$$V_0 = \frac{EPS\ (1+g)}{ROE - g}$$

(2) P/E Multiple Approach :-

Market Price Per Share (MPS) = P/E Ratio × EPS

(3) Gordon's Model :-

$$V_0 = \frac{EPS\ (1-b)}{K_e - br} \quad \boxed{OR} \quad \frac{D_1}{K_e - g}$$

Here, b = Retention Ratio
r = ROE

(4) Walter's Model :-

$$V_0 = \frac{D + (E - D)\frac{r}{K_e}}{K_e}$$

Here, D = DPS
E = EPS
r = ROE
K_e = Required Rate of Return of Investors or Cost of Equity

(5) Yield on Share Approach [Accounting Based Model] :-

$$V_0 = \frac{\text{Actual Yield on Equity Share (\%)}}{\text{Expected Yield on Equity Share (\%)}} \times \text{Paid up Value of Equity Share}$$

Here, $\text{Actual Yield on Equity Share (\%)} = \frac{\text{Yield on Equity Shares}}{\text{Equity Share Capital}} \times 100$

Expected Yield on Equity Share (%) =

Normal Return on Equity Shares of Similar Companies in Market	xxx
(±) Risk Premium of our Company [Calculated on the basis of Some Ratios]	xxx
	xxx

Valuation of Rights

Right Issue means issuing Equity Shares to Existing Shareholders of Company

(1) Theoretical Ex-right / Post-rights Price Per Share [i.e. Price to be Expected in Market after Right Issue]

$$\Rightarrow \frac{\text{Existing MPS} \times \text{Existing No. of Shares} + \text{Right Issue Price} \times \text{No. of Right Shares}}{\text{Existing No. of Shares} + \text{No. of Right Shares}}$$

(2) Theoretical Value of a Right

⇒ Theoretical Ex-right Price − Right Issue Price

(3) Theoretical Value of Right Per Original Share [It represents Reduction in MPS of Share after Right Issue]

$$\Rightarrow \frac{\text{Theoretical Value of a Right}}{\text{No. of Original Shares required to Buy 1 Right Share}}$$

OR

⇒ Existing MPS − Theoretical Ex-right Price

(4) Effect of Right Issue on Shareholder's Wealth:

(i) If Shareholder Exercises Right Issue ⇒ No Change in Wealth

Value Before Right Issue [Original Shares × Existing MPS]	xxx
Value After Right Issue	
Total Shares including Right Shares × Ex-right Price	xxx
Less: Payment for Purchase of Right Shares [No. of Right Shares × Right Issue Price]	(xxx)
	xxx

(ii) If Shareholder Sells the Rights ⇒ No Change in Wealth

Value Before Right Issue [Original Shares × Existing MPS]	xxx
Value After Right Issue	
Original Shares × Ex-right Price	xxx
Add: Sale of Right [No. of Right Shares × Theoretical Value of a Right]	xxx
	xxx

(iii) If Shareholder Ignores the Right Issue ⇒ Wealth will Decline

Value Before Right Issue [Original Shares × Existing MPS]	xxx
Value Afte Right Issue [Original Shares × Ex-right Price]	xxx

Part III: Valuation of Bonds [Fixed Income Securities]

Bond Pricing

- Bonds can be of following types:
  - → Redeemable Bonds
  - → Irredeemable Bonds
  - → Zero Coupon Bonds (ZCB)
- Intrinsic Value of the Bond = P.V. of All future Cash Flows from the Bond discounted using the Required Rate of Return on Bond (i.e. Yield on Similar Bond)

It is calculated for each type of Bond as follows:-

(1) Redeemable Bonds:-

V_0 = P.V. of Interest + P.V. of Redemption Amount

OR

In formula Terms

$$V_0 = \frac{\text{Interest}_1}{(1+K_d)^1} + \frac{\text{Interest}_2}{(1+K_d)^2} + \dots + \frac{\text{Interest}_n}{(1+K_d)^n} + \frac{\text{Redemption Amount}_n}{(1+K_d)^n}$$

Here, K_d = Required Rate of Return on Bond (i.e. Yield on Similar Bond)

n = Redemption Year

Example:- Face Value of Bond = ₹ 1,000. Interest / Coupon Rate = 10%. Redeemable At Par At end of 3rd Year. Required Return is 12%. Calculate Intrinsic Value of Bond.

Solution:-

Year	Cash flow	PVF @ 12%	P.V.
1	100	0.893	89.30
2	100	0.797	79.70
3	100	0.712	71.20
3	1,000	0.712	712
		V_0 =	952.20

(2) Irredeemable Bonds:-

$$V_0 = \frac{\text{Interest}}{K_d}$$

Example:- Face Value of an Irredeemable Bond = ₹ 1000. Interest Rate is 10%. Required Return is 12%. Calculate IV of Bond.

Solution:-

$$V_0 = \frac{100}{12\%} = ₹\ 833.33$$

(3.) Zero Coupon Bond (ZCB) :-

Bonds which are issued at Discount & Redeemed at Face Value

V_0 = PV of Redemption Amount

⇒ Redemption Amount (Face Value) × PVf of Redemption Year

OR

In formula Terms

$$V_0 = \frac{\text{Face Value}}{(1+k_d)^n}$$

Example :- Face Value of a ZCB is ₹ 1000 which is issued at a Price of ₹ 900. Maturity Period is 3 Years. Required Return is 12%. Calculate IV

Solution :-

$$V_0 = \frac{1,000}{(1+0.12)^3} = ₹\ 712$$

OR

$$V_0 = 1,000 \times 0.712 = ₹\ 712$$

Note :-

(i) If Face Value (Nominal Value) of Bond is not given in question, then Assume it as ₹ 100

(ii) If Redemption Amount is not given in question, then Assume it as Redeemable At Par (i.e. on Face Value)

(iii) Interest on Bond is always calculated at Face Value. Interest Rate is also known as Coupon Rate

(iv) Redemption Period means Maturity Time | Period of Bond.

(v) If different Yield Rates (Spot Yield Curve) is given for Each Year, then Calculate P.V. of Cash flow of Each Year using Yield Rate of that Year.

Example :- Face Value of Bond = 1000 ₹. Interest Rate = 10%. Redeemable At par at end of 3rd Year.

Yield Rates: Year 1 — 12%
Year 2 — 11.50%
Year 3 — 11%

Calculate I.V. of Bond.

Solution :-

$$V_0 = \frac{100}{(1.12)^1} + \frac{100}{(1.115)^2} + \frac{100}{(1.11)^3} + \frac{1000}{(1.11)^3}$$

$$= 89.29 + 80.44 + 73.11 + 731.19$$

⇒ ₹ 974.03

(vi) Calculation of Expected Market Price on the basis of Intrinsic Value of Bond :-

⇒ Intrinsic Value of Bond (V_0) × Beta of Bond

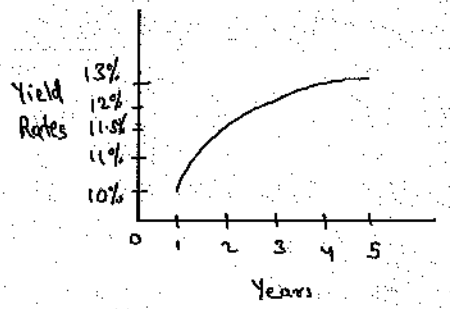
Example :- IV_0 = 974.03, Beta of Bond = 1.2

∴ Expected Market Price of Bond = 974.03 × 1.2 = 1,168.84 ₹

(vii) Types of Yield Curve :-

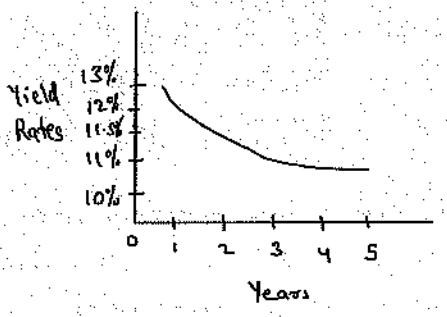
Normal Yield Curve

It happens in a Market where Long-term Bonds has Higher Yield in Comparison to Short-Term Bonds
[ie. Market is in Normal Situation]



Inverted Yield Curve

It happens in a Market where Short-term Bonds has Higher Yield in Comparison to Long-Term Bonds
[ie. Market is in Recession Situation]



(viii) If there is Semi-Annual Interest / Coupon on Bond, then

→ Convert Interest Rate into Semi-Annual Rate [By dividing it by 2]

→ Convert Discounting Rate into Semi-Annual Rate [By dividing it by 2]

→ Convert Years to Maturity into Half-Yearly Periods [By Multiplying it by 2]

Example :- Face Value of Bond = ₹ 1,000. Interest Rate is 10% p.a. which is paid Semi-Annually. Redeemable At Par at end of 3rd Year. Required Return is 12%. Calculate IV.

Solution :-

Half Yearly Periods	Cash flow	PVf @ 6%	P.V.
1	50	0.943	47.15
2	50	0.890	44.50
3	50	0.840	42
4	50	0.792	39.60
5	50	0.747	37.35
6	50	0.705	35.25
6	1,000	0.705	705
		V_0 =	950.85

Bond Yield

- It is the Return an Investor gets on its Investment on Market Price in a Bond.
- Bond Yield can be of 2 types :-
  - → Current Yield : It considers only Interest Payments received on Bond [Ignoring Redemption Amount]
  - → Yield to Maturity (YTM) : It considers Total Payments received on a Bond till Maturity including Redemption Amount
- It is calculated for each type of Bond as follows :

(1) Redeemable Bonds :-

$$\text{Current Yield} = \frac{\text{Interest}}{\text{Current Market Price of Bond}} \times 100$$

YTM = Rate at which P.V. of All future Cash flows from Bond is equals to the Current Market Price of Bond

[It is calculated using Trial & Error Method]

Example :- Face Value of Bond = ₹ 1000. Interest Rate = 10%. Redeemable at par at end of 3rd Year. CMP of Bond = ₹ 950. Calculate Current Yield & YTM of the Bond.

Given PV factors	Year 1	Year 2	Year 3
@12%	0.893	0.797	0.712
@13%	0.885	0.783	0.693

Solution :-

$$\text{Current Yield} = \frac{100}{950} \times 100 = 10.53\%$$

Calculation of YTM :-

Year	Cash Flow	PVF @ 12%	P.V.	PVF @ 13%	P.V.
1	100	0.893	89.30	0.885	88.50
2	100	0.797	79.70	0.783	78.30
3	100	0.712	71.20	0.693	69.30
3	1,000	0.712	712	0.693	693
			952.20		929.10

Now, Do Interpolation to find YTM at which CMP is ₹ 950

$$\text{YTM} = 12\% + \frac{952.20 - 950}{952.20 - 929.10} \times (13 - 12)$$

$$= 12.10\%$$

(2.) Irredeemable Bonds:-

In this Bond, Only Interest Payments are received as it is Not Redeemable. Hence, Current Yield & YTM will be same for Irredeemable Bonds

$$\text{Current Yield} = \text{YTM} = \frac{\text{Interest}}{\text{Current Market Price of Bond}} \times 100$$

(3.) Zero Coupon Bonds (ZCB):-

In this Bond, Current Yield cannot be calculated as there is No Interest Payment. Hence, Only YTM can be calculated for ZCB

$$\text{YTM} = \left[\frac{\text{Face Value}}{\text{Current Market Price of Bond}}\right]^{\frac{1}{n}} - 1$$

* Answers will be in decimals. Multiply by 100 to get YTM in %

Example:- Face Value of ZCB = ₹1,000. CMP of Bond = ₹900. Maturity Period is 3 Years. Calculate YTM.

Solution:- $\text{YTM} = \left(\frac{1000}{900}\right)^{\frac{1}{3}} - 1$

$= 1.0357 - 1 = 0.0357$ or 3.57%

Note:-

(i.) If we discount the future Cash flows from the Bond using YTM, then we will get CMP (Current Market Price) of Bond

(ii.) Current Market Price means Price at which Bond is currently selling / trading in the Market or Quoted Price of Bond

(iii.) If Question asks to calculate Prevailing Interest or Yield on Similar Bond, then it means we have to calculate YTM

(iv.) Spread of Yield = YTM of our Bond - Yield of Similar Bond

(v.) Realised Yield:- It means YTM calculated on the assumption that All coupon payments & Redemption Amount will be received together at End of Maturity of Bond. It is calculated as follows:

$$\text{Realised Yield} = \left[\frac{\text{Total Payments received on Maturity}}{\text{Current Market Price of Bond}}\right]^{\frac{1}{n}} - 1$$

Here, Total Payments received on Maturity from Bond = All Coupon Payments + Redemption Amount

Bond forward Rates [Term Structure Theory]

- This theory is based on the assumption that Interest Rates in Market is going to increase every year.

  Accordingly, To get more return, Any rational person should invest in a Bond for 1 year & At end of 1st Year, he should invest in Bond again for 1 year at New Interest Rate ; & At end of 2nd Year, he should invest in Bond again for 1 year at New Interest Rate for 3rd Year & this process continues so on.

- So, In that case, Intrinsic Value of a Bond will be calculated as follows :-

$$V_0 = \frac{CF_1}{(1+R_1)^1} + \frac{CF_2}{(1+R_1)(1+R_2)} + \frac{CF_3}{(1+R_1)(1+R_2)(1+R_3)} + \ldots$$

Here, CF = Cash flow from the Bond for each year [i.e. Interest or Redemption Amount]

R_1 = Interest Rate for 1st Year

R_2 = Interest Rate for 2nd Year

R_3 = Interest Rate for 3rd Year

Bond Duration

(1) Duration of Bond (Macaulay's Duration) :-

- It represents Average time taken by Investor to recover his Investment in a Bond [i.e. Weighted Average Life of Bond]
- Steps for calculation of Duration of Bond :

  Step 1 :- Find Expected Cash flow from Bond in each year

  Step 2 :- Calculate Present Value of each year Cash flow using YTM ⇒ Sum of All ⇓ Market Price of Bond

  Step 3 :- Calculate Weight of Present Value of Cash flow of each year

$$\frac{\text{P.V. of Cash flow of each year}}{\text{Sum of PV of Total Cash flow}}$$

  Step 4 :- Year × Weight of P.V. of Cash flow of each year ⇒ Sum of All ⇒ Duration of Bond

- Format for Calculation of Duration of Bond :

Year	Cash flow	PVf @ YTM	P.V.	Weight of P.V.	Weight of P.V. × Year
(1)	(2)	(3)	(4) = (2)×(3)	(5)	(6) = (1) × (5)

- Bond having Lower Duration is Better in comparison to other Bond

(2) Volatility of Bond [Modified Duration] :-

- It represents % Change in Market Price of Bond due to 1% Change in Yield Rate or YTM
- Volatility of Bond = $\frac{\text{Duration of Bond}}{1 + \text{YTM}}$

  Here, Take Current YTM (used in calculation of Duration) in decimals
- % Change in Market Price of Bond (Due to Change in YTM) = Change in YTM in % × Volatility

∴ Change in Market Price of Bond in ₹ = Current Market Price of Bond × % Change in Market Price of Bond

- If YTM increases, Market Price will decrease & Vice-Versa

(3) Convexity of Bond :-

- Volatility does not provide accurate change in Market Price of Bond resulting from Change in YTM
- So, New Concept of Convexity is introduced. It is an adjustment to % Change in Market Price of Bond calculated using Volatility.
- Convexity of Bond (%) = $C \times (\text{Change in YTM in decimals})^2 \times 100$

  * $C = \frac{V_+ + V_- - 2V_0}{2 \times V_0 \times (\Delta y)^2}$

  Here, V_+ = Price of Bond if YTM increases by Δy

  V_- = Price of Bond if YTM decreases by Δy

  V_0 = Current Market Price of Bond at Initial YTM

  Δy = Change in YTM in decimals

- % Change in Market Price of Bond

  If YTM decreases ⇓ % Change in Market Price of Bond using Volatility + Convexity of Bond

  If YTM increases ⇓ % Change in Market Price of Bond using Volatility − Convexity of Bond

Bond Immunization

We have to meet a Liability after sometime. for that, We are making Investment in Bonds so that we can get required amount to settle the Liability at that point of time. But there can be two types of Risks in a Bond which can affect the Amount Receivable (i.e. Price Risk & Reinvestment Risk)

⇓

So, there is a need to Immunise the Bond. for this, We have to Invest in Atleast 2 Bonds proportionately so that their Weighted Duration (i.e. Duration of Bond Portfolio) become equal to the Duration of Liability as follows:

Duration of Bond Portfolio = Duration of Liability

↓ ↓

$Duration_A \times Weight_A + Duration_B \times Weight_B + Duration_C \times Weight_C$ — It will be given in question

$* \; Weight_A + Weight_B + Weight_C = 1$

Note:-

(i) If in future Duration of Bond changes, then We have to calculate Revised Weights for each Bond accordingly [Churning Out Portfolio of Bonds]

(ii) Amount to be Invested Initially in each Bond on the Basis of Weights Calculated Above

⇒ P.V. of Liability to be Settled using Bond's YTM × Weight of Bond as Calculated above

Bond Refunding

- When Interest Rates in Market are falling, Company may issue New Bonds at Lower Coupon Rate & Refund the existing Bonds issued earlier prior to its Maturity Date
- Company is required to pay Existing Bondholders an Amount Higher than Face Value which is known as Call Premium to refund the Old Bonds

Call Premium = [Call Price − Face Value] × No. of Old Bonds

OR

Face Value of Old Bonds × Call Premium %

- Net Present Value (NPV) Method is used to Evaluate Bond Refunding Decision as follows:-

Step 1:- Calculate Initial Cash Outflow:-

Call Premium	xxx	
(-) Tax Saving [Call Premium × Tax Rate]	(xxx)	xxx
Issue Cost (floatation Cost) of New Bonds		xxx

Tax Saving on Unamortised Discount & Floatation Cost of Old Bonds (xxx)

$$\left[\left(\frac{\text{Discount \& Floatation Cost of Old Bonds}}{\text{Maturity Period of Old Bonds}} \times \text{Remaining Period}\right) \times \text{Tax Rate}\right]$$

Overlapping Interest on Old Bond xxx
(-) Tax Saving [Overlapping Interest x Tax Rate] (xxx) xxx

xxx

Step 2:- Calculate Annual Cost on Old Bond :

Interest Cost per year on Old Bond xxx
(-) Tax Saving [Interest x Tax Rate] (xxx) xxx

Tax Saving on Discount & Floatation Cost of Old Bond per year (xxx)

$$\left[\frac{\text{Discount \& Floatation Cost of Old Bonds}}{\text{Maturity Period of Old Bonds}} \times \text{Tax Rate}\right]$$

xxx

Step 3:- Calculate Annual Cost on New Bond :

Interest Cost per year on New Bond xxx
(-) Tax Saving [Interest x Tax Rate] (xxx) xxx

Tax Saving on Discount & Floatation Cost of New Bond per year (xxx)

$$\left[\frac{\text{Discount \& Floatation Cost of New Bonds}}{\text{Maturity Period of New Bonds}} \times \text{Tax Rate}\right]$$

xxx

Step 4:- Calculate Annual Savings & its Present Value :

Annual Savings = Annual Cost on Old Bond − Annual Cost on New Bond

P.V. it for the period of New Bonds by using discounting Rate

Note:- Discounting Rate :-

→ After Tax Cost of Debt [Given in question]

→ Otherwise, After Tax Interest Rate of New Bonds

Step 5:- Calculate NPV :-

P.V. of Annual Savings [As calculated in Step 4] xxx
(-) Initial Cash Outflow [As calculated in Step 1] (xxx)

NPV xxx

Decision :- If NPV is → Positive ⇒ Bond Refunding is Beneficial
→ Negative ⇒ Bond Refunding is Not Beneficial

Convertible Bond

- In Convertible Bond, Option is given to Bondholders to Convert the Bonds in a fixed Number of Equity Shares
- Some Calculations related to Convertible Bond for Decision making :-

(1) Conversion Ratio = No. of Shares per Bond on Conversion

(2) Conversion Value / Stock Value of Bond = Conversion Ratio × Market Price Per Share

(3) Conversion Premium :-

(i) Total Conversion Premium = Market Price of Bond − Conversion Value

(ii) Conversion Premium or Ratio of Conversion Premium or Premium Over Conversion Value [%]

$$\Rightarrow \frac{\text{Market Price of Bond} - \text{Conversion Value}}{\text{Conversion Value}} \times 100$$

(iii) Conversion Premium Per Share = $\frac{\text{Market Price of Bond} - \text{Conversion Value}}{\text{Conversion Ratio}}$

(4) Conversion Parity Price or Market Conversion Price

$$\Rightarrow \frac{\text{Market Price of Bond}}{\text{Conversion Ratio}}$$ OR Current Market Price of Share + Conversion Premium Per Share

(5) Favourable Income Differential Per Share

$$\Rightarrow \frac{\text{Coupon Interest from Bond} - (\text{Conversion Ratio} \times \text{Dividend Per Share})}{\text{Conversion Ratio}}$$

(6) Premium Payback Period = $\frac{\text{Conversion Premium Per Share}}{\text{favourable Income Differential Per Share}}$

(7) Straight Value of Bond = P.V. of Future Cash Flow from Bond using Without Conversion Option Interest Rate

(8) Percentage of Downside Risk = $\frac{\text{Market Price of Bond} - \text{Straight Value of Bond}}{\text{Market Price of Bond}} \times 100$

(9) Premium Over Straight Value = $\frac{\text{Market Price of Bond} - \text{Straight Value of Bond}}{\text{Straight Value of Bond}} \times 100$

(10) Investor / Bondholder will exercise Conversion Option only when Conversion Value of Bond exceeds Straight Value of Bond

Money Market Instruments

- It is a Source of Short Term Borrowings (≤ 1 Year)
- Example :- Commercial Papers (CP), Certificate of Deposits (CDs), Treasury Bills (T-Bills), etc.
- It is issued at Discount & Redeemed At Face Value
- Some Calculations that are need to be done for Exam purpose :-

(1) Nominal Interest or Yield / Bond Equivalent Yield :-

$$Y = \frac{F - P}{P} \times \frac{12 \text{ or } 365}{n} \times 100$$

Here, Y = Nominal Interest Rate p.a. paid by the Company on Issue Price
OR
Yield / Bond Equivalent Yield p.a. earned by the Investor on his Investment Amount

F = Face Value of Instrument

P = Issue Price received by the Company
OR
Investment Amount paid by the Investor
OR
Current Price of the Instrument

n = No. of Months or Days for which the Instrument is issued

F - P = Interest Expense paid by the Company
OR
Interest Income earned by the Investor

Note :- Shortcut For Calculation of 'P' [Issue Price or Investment Amount] on given Yield in question :-

$$P = \frac{F}{1 + Y \times \frac{n}{12 \text{ or } 365}}$$

Here, Take Yield in decimals

(2) Discount Yield :-

$$\text{Discount Yield} = \frac{F - P}{F} \times \frac{12 \text{ or } 365}{n} \times 100$$

(3.) Effective Annual Return | Interest [EAR | EAI] :-

$$EAR \mid EAI = \left[1 + Y \times \frac{n}{12 \text{ or } 365}\right]^{\frac{12 \text{ or } 365}{n}} - 1$$

(4.) Cost of Funds [Calculated in case of Commercial Papers (CP) only] :-

$$\Rightarrow \frac{[\text{Interest Expense} + \text{Issue Expenses}](1-T)}{\text{Net Amount received by the Company}} \times \frac{12 \text{ or } 365}{n} \times 100$$

Here, Interest Expense = Face Value − Issue Price

T = Tax Rate

Net Amount received by the Company ⇒ Issue Price − Issue Expenses − Minimum Balance to be maintained in Bank

· Repurchase Agreement (Repo) Transaction in Money Market :-

→ In this transaction, A Bank raises funds from Another Bank by selling Government of India Bonds and also agrees to Repurchase the Bonds after a specified time by paying Interest at Repo Rate on the initially raised fund

→ Calculation of Amount Initially Raised [First Leg or Start Proceeds] :-

GOI Bond Sales Amount [No. of GOI Bond sold × Dirty Price]	xxx
(−) Initial Margin [GOI Bond Sales Amount × Initial Margin %]	(xxx)
	xxx

Here, No. of GOI Bond sold = $\frac{\text{Total Face Value of GOI Bonds}}{\text{Face Value of Single GOI Bond}}$

* If face Value of Single GOI Bond is not given in question, Assume it As ₹ 100

Dirty Price = Clean Price + Accrued Interest on GOI Bond

* Clean Price is the Price of GOI Bond at the time when Last Interest is paid on the Bond

* Accrued Interest on GOI Bond = Face Value of Single GOI Bond × Interest/Coupon Rate on GOI Bond × $\frac{\text{Accrued Interest Days}}{365 \mid 360}$

→ Calculation of Amount to be paid at the time of Repurchase [Second Leg or Repayment At Maturity] :-

Start Proceeds [First Leg] Amount	xxx
(+) Repo Interest $\left[\text{Start Proceeds} \times \text{Repo Rate} \times \frac{\text{No. of Days of Repo Transaction}}{365 \mid 360}\right]$	xxx
	xxx

Part IV : Miscellaneous Topics

Fund Raising Decision

- Company need funds for expansion of business which it wants to raise through Debt or Equity
- Company should choose that option in which Market Price of Share (MPS) as per P/E Multiple Approach will be Higher

External Fund Requirement [EFR]

- It is the Amount which Company is required to raise from Various Sources to Invest in Company's Total Assets Less Payables & Provisions, when Sales are expected to grow by a Certain percentage for the Next Year
- EFR is calculated as follows :-

[Total Assets Less Payables & Provisions] × Sales Growth %	xxx
(-) Retained Earnings Expected in the Next Year	(xxx)
EFR (i.e. Total Amount to be raised from External Sources)	xxx

- Calculation of Amount to be Raised from Each External Source :-

New Amount of Debt / Loan or Equity as per given Ratio in Question	xxx
(-) Existing Amount of Debt / Loan or Equity in Balance Sheet	(xxx)
Amount to be raised from Debt / Loan or Equity	xxx

Effect of New Project or Expansion Scheme on Price of Share of Company

Expected Share Price is calculated as follows :-

Market Value of Existing Shares [No. of Existing Shares × Current Share Price]		xxx
(+) Expected NPV from New Project / Scheme		xxx
(+) Amount Raised from Equity Shares to finance the Project		xxx
(-) Issue Cost (floatation Cost) on Amount Raised from Equity Shares		(xxx)
(+) Any Other Benefit like Benefit on Early Redemption of Bonds :		
Intrinsic Value of Bonds [As of Today]	xxx	
Less :- Amount Paid on Early Redemption of Bonds [Face Value + Penalty]	(xxx)	xxx
Expected Total Market Value of Shareholders		xxx
(÷) No. of Total Equity Shares [No. of Existing Shares + No. of New Shares Issued]		xxx
Expected Share Price of Company		xxx



Portfolio Management

- **Part I: Modern Portfolio Theory (MPT) by Markowitz**
  - Return & Risk of a Security
  - Return & Risk of Portfolio
  - Minimum Risk Portfolio
  - Markowitz Efficient Portfolio
- **Part II: Capital Market Theory (CMT) by Sharpe**
  - CAPM Equation
  - Beta
  - Portfolio Beta Management
  - Sharpe Index Model
  - Market Lines
  - Sharpe Optimum Portfolio
- **Part III: Other Topics**
  - Arbitrage Pricing Theory
  - Portfolio Evaluation
  - Portfolio Rebalancing
  - Stock Lending Scheme

Portfolio Management is the process of selection of Securities for Investment with the objective of Maximum Return & Minimum Risk

Part I: Modern Portfolio Theory (MPT) by Markowitz

As per Markowitz, We should invest amount in more than 1 Security to get diversification benefit (i.e. to reduce the risk) on the basis of Correlation between Securities

Expected / Average Return & Risk of a Single Security

1. Calculation on the basis of Past Data [Ex-post Analysis] :-

Step 1: Calculate Annual Return of Security for Each Past Year

$$\text{Annual Return } (x) = \frac{D + P_1 - P_0}{P_0} \times 100$$

Here, D = Dividend / Interest Income on Security for the year
P_1 = Market Price of Security at end of the year
P_0 = Market Price / Cost of Security at beginning of the year

Step 2: Calculate Expected / Average Return of Security

$$\text{Expected Return } (\bar{x}) = \frac{\Sigma x}{N}$$

Here, Σx = Sum Total of All Annual Returns of Security
N = No. of Annual Returns of Security

Step 3: Calculate Risk (Variability) in Security [Variance & Standard Deviation]

It represents how much a Security's Return can vary from its Expected / Average Return [Both Positively or Negatively]

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

$$\text{Standard Deviation } (\sigma) = \sqrt{\frac{\Sigma (x-\bar{x})^2}{N}} \quad \boxed{OR} \quad \sqrt{\text{Variance}}$$

Here, $\Sigma (x-\bar{x})^2$ = Sum Total of Deviation Square of Annual Returns from Expected Return of Security

N = No. of Annual Returns of Security

Example:-

Year	Price of Share at year end	Dividend per share for the year
1	110	10
2	120	12
3	140	20
4	130	5
5	137	10

Calculate Expected Return & Risk on this Security

Solution:-

Step 1: Calculation of Annual Return (x) for each year

Year	Calculation
1	It cannot be calculated since Price at beginning of 1st year is not available
2	$\frac{12 + 120 - 110}{110} \times 100 = 20\%$
3	$\frac{20 + 140 - 120}{120} \times 100 = 33.33\%$
4	$\frac{5 + 130 - 140}{140} \times 100 = -3.57\%$
5	$\frac{10 + 137 - 130}{130} \times 100 = 13.08\%$

Step 2: Calculation of Expected Return ($\bar{x}$):-

$$ER(\bar{x}) = \frac{20 + 33.33 - 3.57 + 13.08}{4} = \frac{62.84}{4} = 15.71\%$$

Step 3: Calculation of Risk :-

Year	Annual Return (x)	$(x-\bar{x})$	$(x-\bar{x})^2$
2	20	4.29	18.4041
3	33.33	17.62	310.7644
4	-3.57	-19.28	371.7184
5	13.08	-2.63	6.9169
		0	707.5038 $(\%)^2$

$$\text{Variance } (\sigma^2) = \frac{707.5038}{4} = 176.88\ (\%)^2$$

$$\text{Standard Deviation } (\sigma) = \sqrt{176.88} = 13.30\%$$

Conclusion: This Security is providing Average Return of 15.71% but it may vary by 13.30% positively or negatively i.e. 15.71% ± 13.30%

2. Calculation on the basis of future Data with Probability [Ex-Ante Analysis] :-

Step 1: Calculate Annual Return of Security for each possible Scenario

Step 2: Calculate Expected Return of Security

$$\text{Expected Return } (\bar{x}) = \Sigma P x$$

Here, $\Sigma P x$ = Sum Total of (Probability × Annual Return of Security)

Step 3: Calculate Risk in Security

$$\text{Variance } (\sigma^2) = \Sigma P (x-\bar{x})^2$$

$$\text{Standard Deviation } (\sigma) = \sqrt{\Sigma P (x-\bar{x})^2} \text{ OR } \sqrt{\text{Variance}}$$

Here, $\Sigma P (x-\bar{x})^2$ = Sum Total of (Probability × Deviation Square of Annual Returns from Expected Return of Security)

Example:-

Current MPS of Share = ₹100. Market Condition can be as follows after 1 Year :

Market Condition	Probability	Market Price Per Share	Dividend Per Share
Good	0.25	115	9
Normal	0.50	107	5
Bad	0.25	97	3

Calculate Expected Return & Risk on this Security

Solution:-

Step 1: Calculation of Annual Returns (x) in each Scenario:-

Market Condition	Calculation
Good	$\frac{9 + 115 - 100}{100} \times 100 = 24\%$
Normal	$\frac{5 + 107 - 100}{100} \times 100 = 12\%$
Bad	$\frac{3 + 97 - 100}{100} \times 100 = 0\%$

Step 2 & 3: Calculation of Expected Return ($\bar{x}$) & Risk:-

Market Condition	Annual Returns (x)	Probability (P)	Px	$(x-\bar{x})$	$(x-\bar{x})^2$	$(x-\bar{x})^2 \times P$
Good	24	0.25	6	12	144	36
Normal	12	0.50	6	0	0	0
Bad	0	0.25	0	−12	144	36
			ER ($\bar{x}$) = 12%		Variance (σ^2) =	72 (%)^2

∴ Expected Return ($\bar{x}$) = ΣPx = 12%

Variance (σ^2) = $\Sigma P(x-\bar{x})^2$ = 72 (%)^2

Standard Deviation (σ) = $\sqrt{72}$ = 8.49%

Notes:-

(i) Annual Return (x) % can be directly given in question.

(ii) Risk calculated above will be Total Risk of Security.

(iii) Variance & Standard Deviation of Risk free Security is always Zero.

Expected / Average Return of Portfolio

Expected / Average Return of Portfolio [ER_P] is Weighted Average of Expected Return of Each Security in the Portfolio

$$ER_P = ER_A \times W_A + ER_B \times W_B + \ldots + ER_n \times W_n$$

Here, $ER_A, ER_B, \ldots ER_n$ = Expected Return of Security A, B, ... n

$W_A, W_B, \ldots W_n$ = Weight of Security A, B, ... n in the Portfolio

Note:- Weight of Securities in the Portfolio :-

→ Given in Question

→ Otherwise Weight should be based on Amount Invested in Each Security, i.e. Initial Cost or Investment Amount / Opening Market Value

Example :-

Mr. A has invested in 3 Securities as follows:

Security	Expected Returns [ER]	No. of Shares	Market Price Per Share
A	12%	1,000	10 ₹
B	20%	500	12 ₹
C	18%	800	5 ₹

Calculate Expected Return of Portfolio.

Solution :-

Calculation of Weights of Security in the Portfolio :-

Security	Amount Invested [Opening Market Value of Investment]			Weights
A	1000 × ₹10	=	₹ 10,000	0.50
B	500 × ₹12	=	₹ 6,000	0.30
C	800 × ₹5	=	₹ 4,000	0.20
			₹ 20,000	1.00

ER_P = 12% × 0.50 + 20% × 0.30 + 18% × 0.20

⇒ 15.60%

Risk of Portfolio

Portfolio Risk cannot be directly calculated as Weighted Average of Securities Risk since Portfolio is diversified by Investment in multiple Securities.

Hence, To Calculate Portfolio Risk, We need to give impact of Correlation between Each Security in the Portfolio.

1. Correlation Coefficient (r) :

It determines the Strength of Relationship between two items

$$r_{AB} = \frac{Cov_{AB}}{\sigma_A \sigma_B}$$

Here, r_{AB} = Correlation Coefficient between Security A & B

Cov_{AB} = Covariance between Security A & B

σ_A = Standard Deviation of Security A

σ_B = Standard Deviation of Security B

Note:-

(i) Correlation is calculated in a numerical value [Eg: -1, 0, 0.7, 1, etc.]

(ii) It may range from -1 to 1

→ $\gamma = +1$ indicates Perfect Positive Correlation between Securities

→ $\gamma = -1$ indicates Perfect Negative Correlation between Securities

→ $\gamma = 0$ indicates Securities are Independent

(iii) If Correlation between Security & Market is given, then Correlation between Each Securities can be calculated as below:-

$$\gamma_{AB} = \gamma_{AM} \times \gamma_{BM}$$

Here, γ_{AB} = Correlation between Security A & B

γ_{AM} = Correlation between Security A & Market

γ_{BM} = Correlation between Security B & Market

2. Covariance (COV):-

- It determines Joint Deviation between Annual Returns of 2 Securities from their respective Expected Return
- Calculation of Covariance:-

On the Basis of Past Data

$$COV_{AB} = \frac{\Sigma (x-\bar{x})(y-\bar{y})}{N}$$

Here,

COV_{AB} = Covariance between Security A & Security B

$\Sigma (x-\bar{x})(y-\bar{y})$ = Sum Total of Joint Deviations of Annual Returns from Expected Return of Security A & B

N = No. of Annual Returns

On the Basis of future Data with Probability

$$COV_{AB} = \Sigma P (x-\bar{x})(y-\bar{y})$$

Here,

COV_{AB} = Covariance between Security A & Security B

$\Sigma (x-\bar{x})(y-\bar{y})$ = Sum Total of (Probability × Joint Deviations of Annual Returns from Expected Return of Security A & B

OR

$$COV_{AB} = \sigma_A \times \sigma_B \times \gamma_{AB}$$ [Derived from Correlation Coefficient formula]

Note:- If in question, Covariance between a Security itself is given [Eg: COV_{AA}], then it means Variance of that Security [Eg. Variance of Security A]

Example 1 :-

Following data is available for Security A & B for past 3 years :-

Year	Security A Return	Security B Return
1	30%	20%
2	18%	10%
3	42%	12%

Calculate $Covariance_{AB}$ & $Correlation_{AB}$

Solution :-

Year	Sec. A Return (x)	Sec. B Return (y)	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$	$(y-\bar{y})^2$
1	30	20	0	6	0	0	36
2	18	10	-12	-4	48	144	16
3	42	12	12	-2	-24	144	4
	90	42			24	288	56

$\sigma_A = \sqrt{\frac{288}{3}} = 9.8\%$ $\sigma_B = \sqrt{\frac{56}{3}} = 4.32\%$

$ER_A(\bar{x}) = \frac{90}{3} = 30\%$

$ER_B(\bar{y}) = \frac{42}{3} = 14\%$

$COV_{AB} = \frac{24}{3} = 8\ (\%)^2$

$r_{AB} = \frac{8\ (\%)^2}{9.8\% \times 4.32\%} = 0.19$

Example 2 :-

Consider the following data & Calculate $Covariance_{AB}$ & $Correlation_{AB}$:-

Probability	Security A Return	Security B Return
0.4	30%	-10%
0.4	20%	30%
0.2	10%	40%

Solution :-

Prob. (P)	Sec. A (x)	Sec. B (y)	Px	Py	$(x-\bar{x})$	$(y-\bar{y})$	$P(x-\bar{x})(y-\bar{y})$	$P(x-\bar{x})^2$	$P(y-\bar{y})^2$
0.4	30	-10	12	-4	8	-26	-83.2	25.6	270.4
0.4	20	30	8	12	-2	14	-11.2	1.6	78.4
0.2	10	40	2	8	-12	24	-57.6	28.8	115.2
			ER_A = 22%	ER_B = 16%			COV_{AB} = -152	σ_A^2 = 56	σ_B^2 = 464

$\sigma_A = \sqrt{56} = 7.48\%$; $\sigma_B = \sqrt{464} = 21.54\%$

$r_{AB} = \frac{-152}{7.48 \times 21.54} = -0.9434$

3. Portfolio Risk [Variance & Standard Deviation of Portfolio] :-

(i) In Case of Portfolio with 2 Securities :-

Portfolio Variance $(\sigma_p^2) = (W_A^2 \times \sigma_A^2) + (W_B^2 \times \sigma_B^2) + (2 \times W_A \times W_B \times \underbrace{\sigma_A \times \sigma_B \times r_{AB}}_{COV_{AB}})$

Portfolio Standard Deviation $(\sigma_p) = \sqrt{\text{Portfolio Variance}}$

Here, $W_A^2 \times \sigma_A^2$ = Weight of Security A square × Variance of Security A

$W_B^2 \times \sigma_B^2$ = Weight of Security B square × Variance of Security B

Example:-

$\sigma_A = 8\%$, $\sigma_B = 10\%$, $W_A = 0.60$, $W_B = 0.40$, $r_{AB} = 0.2$

Calculate Portfolio Risk.

Solution:-

$\sigma_p^2 = (0.60)^2 \times (8)^2 + (0.40)^2 \times (10)^2 + 2 \times 0.60 \times 0.40 \times 8 \times 10 \times 0.2$

$\sigma_p^2 = (0.36 \times 64) + (0.16 \times 100) + 7.68$

$\sigma_p^2 = 23.04 + 16 + 7.68$

$\sigma_p^2 = 46.72\ (\%)^2$

$\sigma_p = \sqrt{46.72} = 6.84\%$

(ii) In Case of Portfolio with 3 Securities :-

Portfolio Variance $(\sigma_p^2) = (W_A^2 \times \sigma_A^2) + (W_B^2 \times \sigma_B^2) + (W_C^2 \times \sigma_C^2) + (2 \times W_A \times W_B \times \underbrace{\sigma_A \times \sigma_B \times r_{AB}}_{COV_{AB}}) + (2 \times W_B \times W_C \times \underbrace{\sigma_B \times \sigma_C \times r_{BC}}_{COV_{BC}}) + (2 \times W_A \times W_C \times \underbrace{\sigma_A \times \sigma_C \times r_{AC}}_{COV_{AC}})$

Portfolio Standard Deviation $(\sigma_p) = \sqrt{\text{Portfolio Variance}}$

Minimum Risk Portfolio [Minimum Variance Portfolio]

We need to calculate Proportion (Weight) of Securities to formulate a Portfolio with Minimum Risk as follows:-

1. In Case of Portfolio with 2 Securities :-

$$W_A = \frac{\sigma_B^2 - COV_{AB}}{\sigma_A^2 + \sigma_B^2 - 2\,COV_{AB}} \quad \Rightarrow \text{हल करने के लिए} \Rightarrow \frac{\text{दूसरे का Variance} - \text{Covariance}}{\text{दोनों का Variance} - 2 \times \text{Covariance}}$$

$$W_B = 1 - W_A$$

2. In Case of Portfolio with 3 Securities :- [Critical Line Equation is Used]

Critical Line Equation : $W_B = a + b \times W_A$

Step 1: Formulate 2 Critical Line Equations by using Weights of Security A & B in existing minimum variance portfolios of Investor for same Securities

Step 2: Solve the equations mathematically & find out the Value of 'a' & 'b'

Step 3: Then, find W_B in New Minimum Variance Portfolio by putting the value of 'a', 'b', & W_A which is given in question for New Minimum Variance Portfolio

Step 4: $W_C = 1 - W_A - W_B$ [Since $W_A + W_B + W_C = 1$]

Markowitz Efficient Portfolio

1. Efficient Frontier Method :- ✓

We have to Select Efficient Securities out of given number of Securities to make a Efficient Portfolio (ie. Portfolio providing highest return for a Specific Risk) as follows:-

→ At 1st, Compare Securities having Same Return & Select the Security having Lowest Risk among them

→ Then, Compare Securities having Same Risk & Select the Security having Highest Return among them

→ finally, If required Select the Securities from those that have not been Compared yet

2. Coefficient of Variation (CV) Method :-

- It is used to Select Efficient Portfolio by Analysing Investments from Risk-Return Trade off view point.

$$CV = \frac{\text{Standard Deviation of Security } (\sigma)}{\text{Expected Return of Security } (ER)} \times 100$$

- We should Select the Security having Lower CV [Since Lower CV means Lower Risk and vice-versa]

Part II: Capital Market Theory (CMT) by Sharpe

As per Sharpe, We should invest amount in more than 1 Security to get diversification benefit (i.e. to reduce the risk) on the basis of Beta of Securities

Capital Asset Pricing Model [CAPM] Equation

It is used to Calculate Required Rate of Return [Also known as Expected Return / Equilibrium Return]

1. Required Rate of Return on Security:-

⇒ Risk Free Rate + Risk Premium on Security

$$R_s = R_f + \beta_s (R_m - R_f)$$

Here, R_s = Required Rate of Return on Security
R_f = Risk free Rate of Return
R_m = Market Rate of Return
β_s = Beta of Security
$R_m - R_f$ = Risk Premium in Market [Market Risk Premium]
$\beta (R_m - R_f)$ = Risk Premium on Security [Security Risk Premium]

Notes:-

(i) Risk Free Rate of Return [Rf]:

→ Risk Free Securities means Treasury Bills [T-Bills], Treasury Bonds, Government Securities, etc.

→ Risk Free Rate of Return is generally given in question, otherwise it can be calculated as follows:

$$R_f = \frac{\text{Coupon Payment on Treasury Bills}}{\text{Market Trading Price of Treasury Bills}} \times 100$$

→ If 2 or More Risk free Rate of Returns are given in question, then as per Moderate Approach, we have to Average out those Risk free Rate of Returns

(ii) Market Rate of Return [Rm]:

→ Market means Sensex, Nifty, Index, etc. of Stock Exchange [BSE or NSE]

→ Market Rate of Return is generally given in question, otherwise it can be calculated as follows:

If Market Related Data is given in question

$$R_m = \left[\frac{\text{Index Value at End of the Year} - \text{Index Value at Beginning of the Year}}{\text{Index Value at Beginning of the Year}} \times 100\right] + \text{Market Dividend Yield \%}$$

If Market Related Data is not given in question but Data related to our portfolio is given in question

$$R_m = \frac{\text{Total Market Value of All Securities in our Portfolio at End of the Year} - \text{Total Initial Cost / Investment in All Securities in our Portfolio} + \text{Total Dividend/Interest Income on All Securities in our Portfolio}}{\text{Total Initial Cost / Investment in All Securities in our Portfolio}} \times 100$$

(iii) If R_m & R_f is required to be calculated in the question & Data is available only of Expected Return [Required Return] & Beta of 2 Securities, then Make 2 CAPM Equations for both securities using the available data & then Solve these Equations mathematically to arrive at R_m & R_f

(iv) If Inflation Premium is given in question, then Add such Inflation Premium in CAPM Equation to arrive at Required Rate of Return [Already discussed question on this in Security Valuation Chapter]

2. Required Rate of Return on Portfolio:-

$$R_p = R_f + \beta_p (R_m - R_f)$$

Here, R_p = Required Rate of Return on Portfolio

β_p = Beta of Portfolio

Notes:-

(i) Beta of Portfolio [β_p] is Weighted Average of Beta of Each Security in the Portfolio

$$\beta_p = \beta_A \times W_A + \beta_B \times W_B + \ldots + \beta_n \times W_n$$

Here, $\beta_A, \beta_B, \ldots \beta_n$ = Beta of Security A, B, ... n

$W_A, W_B, \ldots W_n$ = Weight of Security A, B, ... n

(ii) If Question is asking to calculate Simple Average Return of Portfolio, then Use of Beta of Portfolio [β_p] as Simple Average of Beta of Each Security in the Portfolio

$$\beta_p = \frac{\beta_A + \beta_B + \ldots + \beta_n}{N}$$

Here, N = Total No. of Securities in the Portfolio

(iii.) If Required Rate of Return of Portfolio is needed to calculate any item as Balancing figure in CAPM Equation, then Required Rate of Return of Portfolio is calculated as follows:

$$R_p = \frac{\text{Total Market Value of All Securities in our Portfolio at the End of the Year} - \text{Total Initial Cost / Investment in All Securities in our Portfolio} + \text{Total Dividend / Interest Income on All Securities in our Portfolio}}{\text{Total Initial Cost / Investment in All Securities in our Portfolio}} \times 100$$

3. Decision Making on the basis of CAPM :-

- Evaluation of Stocks as Over Valued, Under Valued or Correctly Valued is done to provide:
  - → Decision to Investor regarding whether he should Liquidate his holdings in Stocks or make fresh Investments in them
  - → Strategy or Observation on Stocks
  - → Whether Portfolio has outperformed or underperformed
  - → Whether Company should change Composition of its Portfolio
- For Evaluating Stocks, Compare Required Return on Stocks as per CAPM with Expected Return on Stocks as per MPT as follows:

Required Return [CAPM] > Expected Return [MPT] ⇒ Over Valued ⇒ Sell Share

Required Return [CAPM] < Expected Return [MPT] ⇒ Under Valued ⇒ Buy Share

Required Return [CAPM] = Expected Return [MPT] ⇒ Correctly Valued ⇒ Buy / Hold Share

Beta

- Beta represents that how many times Stock Returns will fluctuate to changes in Market Returns.

For Example, If A ltd. Shares has Beta of 1.2 & Market Returns falls by 5%, then it means Return on A ltd. Shares will fall by 5% × 1.2 ⇒ 6%

Hence, Beta is also known as Sensitivity of Returns of Stock with respect to Market (i.e. Risk of Stock relative to Market)

- **Calculation of Beta of Securities:-**

Method I: If 2 Period Data of Returns of Both Security & Market is given in question:-

$$\text{Beta of Security } (\beta) = \frac{\text{Change in Security Return}}{\text{Change in Market Return}} = \frac{\text{Return}_1 \text{ of Security} - \text{Return}_2 \text{ of Security}}{\text{Return}_1 \text{ of Market} - \text{Return}_2 \text{ of Market}}$$

Method II: If Multiple Periods Data of Returns of Both Security & Market is given in question:-

$$\text{Beta of Security } (\beta) = \frac{COV_{SM}}{\sigma_M^2}$$

Here, COV_{SM} = Covariance between Security & Market

σ_M^2 = Variance of Market

Further, this formula can be expressed as follows

$$\beta = \frac{COV_{SM}}{\sigma_M^2} = \frac{\sigma_S \times \sigma_M \times \gamma_{SM}}{\sigma_M \times \sigma_M} = \gamma_{SM} \times \frac{\sigma_S}{\sigma_M}$$

$$\therefore \text{Beta of Security } (\beta) = \gamma_{SM} \times \frac{\sigma_S}{\sigma_M}$$

[This formula will be used only if Data related to γ_{SM}, σ_S, σ_M is given in question]

Here, γ_{SM} = Correlation between Security & Market

σ_S = Standard Deviation of Security

σ_M = Standard Deviation of Market

* Beta calculated from all the Methods will be same

Notes:-

(i) Beta is calculated in a Numerical Value [Eg:- -1.5, -1, 0.7, 1, 1.2, etc.]

(ii) Beta of Market is always 1 & Beta of Risk free Security is always 0

(iii) Interpretation of Beta:

- **Positive Beta** → Security's Return moves in the direction in which Market Moves
  - If Beta = 1 → Security's Return has same Risk as of Market
  - If Beta > 1 → Security's Return are more Volatile (Risky) as compared to Market
  - If Beta < 1 → Security's Return are less Volatile (Risky) as Compared to Market
- **Negative Beta** → Security's Return moves in the opposite direction in which Market moves

(iv) Beta of Portfolio $[\beta_P]$ is Weighted Average of Beta of Each Security in the Portfolio

(v) From the above formulas, We can calculate Beta of Equity Shares of Listed Companies Only. Hence, To Calculate Beta of Equity Shares of an Unlisted Company, We have to do the following procedure:

Step 1: Find a Listed Company which is a Proxy (i.e. Company with Similar Business) for Unlisted Company

Step 2: Find Equity Beta of Listed Proxy Company (Using Above Discussed formulas)

Step 3: Find Asset Beta of Listed Proxy Company (Using Listed Proxy Company's Debt Equity Structure)

Step 4: Calculate Unlisted Company's Equity Beta by using Unlisted Company's Debt Equity Structure (Assuming Asset Beta of Unlisted Company is equals to the Asset Beta of Listed Proxy Company)

* Generally Asset Beta is given in questions, then We have to directly apply Step 4 Only.

(vi) Relationship between Asset Beta & Equity Beta:

→ Asset Beta [Also known as Company Beta, Project Beta, Overall Beta, Unlevered Beta or Ungeared Beta]

⇓

It represents the Risk in the Business in which Company is engaged

⇓

This Risk will be borne by the Investors in Company, i.e.

Equity	Debt
⇓	⇓
Equity Beta [Also known as Stock Beta, Levered Beta or Geared Beta] represents the Risk borne by Equity Shareholders	Debt Beta represents the Risk borne by Debtholders
⇓	⇓
Equity Shareholders have to bear Risk in Business & Also Risk due to Debt in the Company	Debtholders generally does not bear any Risk
⇓	⇓
So, Equity Beta will always be greater than or equals to the Asset Beta	So, In Silent Situation, Debt Beta is Assumed as Zero

⇓

Hence, Asset Beta of the Company is the Weighted Average of Equity Beta & Debt Beta of the Company

→ As per above discussion, following Equation is derived:

$$\beta_A = \beta_E \times \frac{E}{E + D(1-T)} + \beta_D \times \frac{D(1-T)}{E + D(1-T)}$$

Here, β_A = Asset Beta ; β_E = Equity Beta ; β_D = Debt Beta

E = Market Value of Equity ; D = Market Value of Debt

T = Tax Rate

→ If a Company has More than 1 Business, then its Asset Beta will be Weighted Average of Asset Beta of All Business of the Company.

Asset Beta of the Company $[\beta_A]$ = Asset Beta of Business 1 × Weight of Business 1 + Asset Beta of Business 2 × Weight of Business 2

Example 1:

X Ltd. has Equity of ₹ 1100 & Debt of ₹ 900. Its nearest competitor (Y Ltd.) has Equity Beta of 1.35. Value of Equity in Y Ltd. is ₹ 1850 & Value of Debt in Y Ltd. is ₹ 510. Tax Rate is 20%.
Calculate Equity Beta of X Ltd.

Solution:

Step 1: Proxy Co. = Y Ltd.

Step 2: Equity Beta of Y Ltd. = 1.35

Step 3: Asset Beta $[\beta_A] = 1.35 \times \frac{1850}{1850 + 510(1-0.20)} + 0$

$$= 1.35 \times \frac{1850}{1850 + 408}$$

$$= 1.35 \times \frac{1850}{2258}$$

$$= 1.106$$

Step 4: Equity Beta of X Ltd. $[\beta_E]$ =

$$1.106 = \beta_E \times \frac{1100}{1100 + 900(1-0.20)} + 0$$

$$1.106 = \beta_E \times \frac{1100}{1820}$$

$$\beta_E = 1.106 \times \frac{1820}{1100}$$

$$\beta_E = 1.830$$

* β_D is assumed as Zero

Example 2:

A ltd. is engaged in 2 business, i.e. Business X & Business Y
Business X value is 75% & Business Y value is 25% of Total Company.
Asset Beta of Business X is 1.5 & Business Y is 1.2
Value of Equity in A ltd. is ₹ 500 & Value of Debt in A ltd. is ₹ 200. Tax Rate is 30%
Case I: Calculate Equity Beta of A ltd. from above information
Case II: Calculate Equity Beta of A ltd. if Debt Beta is 0.16

Solution:

Case I:

Asset Beta of A ltd. $[\beta_A] = 1.5 \times 75\% + 1.2 \times 25\%$

$= 1.125 + 0.3$

$= 1.425$

Now,

$$1.425 = \beta_E \times \frac{500}{500 + 200(1-0.30)} + 0$$

$$1.425 = \beta_E \times \frac{500}{640}$$

$$\therefore \beta_E = 1.425 \times \frac{640}{500} = 1.824$$

* β_D is assumed as Zero

Case II:

$\beta_A = 1.425$

$$1.425 = \beta_E \times \frac{500}{500 + 200(1-0.30)} + 0.16 \times \frac{200(1-0.30)}{500 + 200(1-0.30)}$$

$$1.425 = \beta_E \times \frac{500}{640} + 0.16 \times \frac{140}{640}$$

$$1.425 = \beta_E \times \frac{500}{640} + 0.035$$

$$1.425 - 0.035 = \beta_E \times \frac{500}{640}$$

$$\therefore \beta_E = 1.39 \times \frac{640}{500} = 1.7792$$

Portfolio Beta Management

- It is a process of Increasing or Reducing Beta of Portfolio on the basis of Market expectations as follows :-
  - → If Market is expected to fall ⇒ Beta of Portfolio should be reduced
  - → If Market is expected to Rise ⇒ Beta of Portfolio should be increased
- There are 3 Methods of Portfolio Beta Management :-

(1) Using Risk Free Securities :

To Reduce Beta of Portfolio	To Increase Beta of Portfolio
⇓	⇓
Invest Some Amount in Risk Free Securities	Borrow Some Amount from Risk free Securities

Steps to Calculate the Amount to be Invested | Borrowed from Risk free Securities :-

Step 1 : Weight of Risky Portion in New Portfolio $[W_R] = \frac{\text{Required Beta of Portfolio}}{\text{Existing Beta of Portfolio}} \times 100$

Step 2 : Weight of Risk free Security in New Portfolio $[W_{RF}] = 100\% - W_R$

Step 3 : Amount to be Invested / (Borrowed) from Risk free Security :

⇒ $\frac{\text{Existing Market Value of All Securities in the Portfolio}}{W_R} \times W_{RF}$

(2) Disposing off Some Risky Securities of Portfolio & Acquiring Risk free Securities :

This Method is used only to Reduce the Beta of Portfolio.

Steps to Calculate the Amount to be disposed off from Risky Securities of Portfolio to acquire Risk free Securities :-

Step 1 : Weight of Risky Portion in New Portfolio $[W_R] = \frac{\text{Required Beta of Portfolio}}{\text{Existing Beta of Portfolio}} \times 100$

Step 2 : Weight of Risk free Security in New Portfolio $[W_{RF}] = 100\% - W_R$

Step 3 : Amount to be disposed off from Risky Securities of Portfolio to acquire Risk Free Securities :

⇒ Existing Market Value of All Securities in the Portfolio $\times W_{RF}$

Step 4 : Amount of Securities of Each Company in the Portfolio to be disposed off :

⇒ Step 3 Amount × Weight of Each Security in the Portfolio

* Weight of Securities should be based on Amount Invested in Each Security

(3) Using Future Contracts [To be discussed in Derivatives Chapter]

Sharpe Index Model / Single Index Model [Systematic & Unsystematic Risk]

As per Sharpe, Total Risk [Variance] is divided into 2 Parts:

Systematic Risk (SR)
[Systematic Variance]

- It is Market Based Risk
  Eg: Downfall in Economy / GDP etc. will effect All the Securities in Market
- This Risk cannot be avoided in any situation
- It can be measured with the help of Beta

Unsystematic Risk (USR)
[Unsystematic Variance]

- It is Company Specific Risk
  Eg: fire in Company, Labour Strike in Company etc.
- This Risk can be avoided with the help of diversification
- It cannot be measured reliably
- It is also known as Residual Risk [Residual Variance], Random Error, etc.

1. Calculation of Risk for Each Security:-

Systematic Risk = $\beta_i^2 \times \sigma_M^2$

Here, β_i^2 = Beta of Security Square

σ_M^2 = Variance of Market

Unsystematic Risk $[\sigma_e^2 / \epsilon^2]$ = Given in question

Total Risk [Variance] = Systematic Risk + Unsystematic Risk

Total Risk [Standard Deviation] = $\sqrt{\text{Total Risk [Variance]}}$

Note:- If in question, Unsystematic Risk is not given, then it will be calculated as follows:

Unsystematic Risk = Variance of Security as per MPT − Systematic Risk

2. Calculation of Risk for Portfolio :-

(i) If Question is asking to Calculate Total Portfolio Risk only [No Bifurcation of Systematic Risk & Unsystematic Risk]

Systematic Risk = $\beta_p^2 \times \sigma_M^2$

Here, β_p^2 = Beta of Portfolio Square

σ_M^2 = Variance of Market

$$\text{Unsystematic Risk} = W_A^2 \times USR_A + W_B^2 \times USR_B + \ldots + W_n^2 \times USR_n$$

Here, $W_A^2, W_B^2, \ldots, W_n^2$ = Weight of Security A, B, ..., n Square

$USR_A, USR_B, \ldots, USR_n$ = Unsystematic Risk (Variance) of Security A, B, ..., n

Total Risk of Portfolio [Variance] = Systematic Risk + Unsystematic Risk

Total Risk of Portfolio [Standard Deviation] = $\sqrt{\text{Total Risk of Portfolio [Variance]}}$

(ii) If Question is asking to Calculate Systematic Risk & Unsystematic Risk of Portfolio Separately

Systematic Risk = $\beta_P^2 \times \sigma_M^2$

Unsystematic Risk = Variance of Portfolio as per MPT − Systematic Risk of Portfolio

Note:- Coefficient of Determination (r_{sM}^2):-

$\Rightarrow$ (Correlation between Security & Market)^2 $\Rightarrow$ $\frac{\text{Systematic Risk}}{\text{Total Risk}}$

Market Lines

1. Security Market Line [SML] :-

- When Required Returns of a Security calculated by CAPM Equation on different Beta Values are represented through a line on a graph paper, it is known as Security Market Line (SML).
- If Question is asking to derive | calculate Security Market Line (SML), then we have to write CAPM Equation without putting values of Required Return & Beta of Security in it as follows:

$$R_S = \underset{\text{Put Value}}{Rf} + \beta \underset{\text{Put Value}}{(Rm - Rf)}$$

2. Characteristic Line :-

- When Expected Return of a Security & Expected Return of Market are represented through a line on a graph paper, it is known as Characteristic Line

- Equation of a Characteristic Line:

$$\overline{R_s} = \alpha + \beta R_m$$

Here, $\overline{R_s}$ = Expected Return of Security as per MPT
R_m = Expected Return of Market
β = Beta of Security
α = Alpha of Security, i.e. Portion of Return from Security that does not depends on Market

- Using above Equation, We can calculate Alpha (α) as follows:

$$\alpha = \overline{R_s} - \beta R_m$$

- If Question is asking to determine Characteristic Line for a Security, then we have to write Equation of Characteristic Line without putting values of Expected Return of Security & Market in it as follows:

$$\overline{R_s} = \underset{\text{Put Value}}{\alpha} + \underset{\text{Put Value}}{\beta} R_m$$

Sharpe Optimum Portfolio

- We need to calculate Proportion (Weight) of Securities to formulate an Optimum Portfolio having Maximum Return & Minimum Risk.
- Steps for Calculating Proportion (Weight) of Securities in the Optimum Portfolio :-

Step 1: Calculate Treynor Ratio for Each Security:

$$\text{Treynor Ratio} = \frac{ER - Rf}{\beta}$$

Step 2: Prepare Ranked Table by Listing Securities in Sequence of Highest to Lowest Treynor Ratio:

Security [In Sequence of Highest to Lowest Treynor Ratio]	Treynor Ratio [As Calculated in Step 1]	$\frac{\beta^2}{\text{USR}}$	Cumulative Total of Column No. 3	Treynor Ratio $\times \frac{\beta^2}{\text{USR}}$	Cumulative Total of Column No. 5	'C' Value $\left[\frac{\sigma_M^2 \times \text{Column No. 6}}{1 + (\sigma_M^2 \times \text{Column No. 4})}\right]$
(1)	(2)	(3)	(4)	(5) = (2) × (3)	(6)	(7)
✓						
✓						
✓						

Step 3: Highest 'C' Value as calculated in Column No. 7 is taken as a Cut off Point

Step 4: Securities having Treynor Ratio ≥ Cut off Point should be selected

Step 5: Calculate 'Z' Value for Selected Securities (in 4 Decimals):

$$\text{'Z' Value} = \frac{\beta}{USR} \times (\text{Treynor Ratio of Security} - \text{Cut off Point})$$

Step 6: Calculate Proportion (Weight) of Each Selected Security:

$$\Rightarrow \frac{\text{'Z' Value of Security}}{\text{Sum of 'Z' Value of All Selected Securities}} \times 100$$

Here, β = Beta of Security

USR = Unsystematic Risk of Security (σ_e^2)

ER = Expected Return of Security

σ_M^2 = Variance of Market

Part III: Other Topics

Arbitrage Pricing Theory Model [APT]

1. Expected Return of Security:-

$$\text{Expected Return} = Rf + \beta_1 FRP_1 + \beta_2 FRP_2 + \ldots + \beta_n FRP_n$$

Here, Rf = Risk Free Rate of Return

$\beta_1, \beta_2, \ldots, \beta_n$ are Sensitivity (Beta) of factors such as Market, Inflation, GDP, Interest Rate, etc.

$FRP_1, FRP_2, \ldots, FRP_n$ are Risk Premium for factors $\beta_1, \beta_2, \ldots, \beta_n$

Note:- Factor Risk Premium (FRP) is generally the Surprise Element in Factor calculated as follows:

Actual Value (%) − Expected Value (%)

2. Expected Return of Portfolio :-

Expected Return = $Rf + \beta_{p1} FRP_1 + \beta_{p2} FRP_2 + \ldots + \beta_{pn} FRP_n$

Here, $\beta_{p1}, \beta_{p2}, \ldots, \beta_{pn}$ are Portfolio Sensitivity (Beta) of Factors such as Market, Inflation, GDP, Interest Rate, etc.

β_{p1} = Weighted Average of β_1 of Each Security in the Portfolio
β_{p2} = Weighted Average of β_2 of Each Security in the Portfolio
β_{pn} = Weighted Average of β_n of Each Security in the Portfolio

Portfolio Evaluation

- Following 3 Ratios are used to Evaluate the Portfolio :-

1. Sharpe Ratio [Reward to Variability Ratio] :-

$$\Rightarrow \frac{ER - Rf}{\sigma}$$

Here, ER = Expected / Average Return of Security / Portfolio as per MPT
Rf = Risk free Rate of Return
σ = Standard Deviation of Security / Portfolio

2. Treynor Ratio [Reward to Volatility Ratio] :-

$$\Rightarrow \frac{ER - Rf}{\beta}$$

Here, ER = Expected / Average Return of Security / Portfolio as per MPT
Rf = Risk free Rate of Return
β = Beta of Security / Portfolio

3. Jensen Alpha :-

Expected / Average Return as per MPT − Required Return as per CAPM

- Ranking of Security / Portfolio on the basis of Above Ratios :-

Highest Ratio ⇒ Rank 1 & So on.

Note :- If Question is asking to Compare the Performance with the Market, then Calculate Sharpe Ratio & Treynor Ratio for Market by using Market related Data in formula of Sharpe & Treynor Ratio [i.e. Expected Return of Market (R_m), Standard Deviation of Market (σ_M), Beta of Market (β_M)]

Portfolio Rebalancing

- As per this Concept, We should compose a Portfolio by Investing Some Amount in Equity Shares [Aggressive Security] & Some Amount in Bonds [Conservative | Risk Free Security]

and

Rebalance this Portfolio on timely basis Since Market Price of Equity Shares keeps on changing

- There are 3 Policies of Portfolio Rebalancing :-
  - → Buy & Hold Strategy [Do Nothing Policy]
  - → Constant Ratio Plan
  - → Constant Proportion Portfolio Insurance (CPPI) Policy

1. Buy & Hold Strategy [Do Nothing Policy] :-

→ As per this Policy, Investor should Invest the Total Amount in Equity Shares Only & Hence, No Rebalancing is done.

→ Value of Portfolio on a particular date = No. of Equity Shares | Mutual Fund Units Initially Purchased × Market Price Per Equity Share / NAV per unit of MF on that date

Here, No. of Equity Shares | Mutual Fund Units Initially Purchased = $\frac{\text{Total Investment Amount in beginning}}{\text{Market Price Per Equity Share / NAV per unit of MF in Beginning}}$

2. Constant Ratio Plan :-

→ As per this Policy, Investor should Invest the Total Amount in Equity Shares & Bonds in a Pre-determined Constant (Fix) Ratio

and

Whenever Price of Equity Share increases or decreases, Rebalancing is done by Buying or Selling Equity Shares

→ Steps for Calculation of Value of Portfolio on a particular date :

Step 1 : Allocate Amount to be Invested in Equity Shares & Bonds using pre-determined Constant Ratio

Step 2 : No. of Equity Shares | Mutual Fund Units Initially Purchased = $\frac{\text{Investment Amount in Equity Shares in beginning}}{\text{Market Price Per Equity Share / NAV per unit of MF in Beginning}}$

Step 3: Format for Calculation of Value of Portfolio on a particular date:

Date ①	Market Price Per Equity Share / Mutual Fund NAV Per Unit ②	Total Value of Equity Shares ③ = ② × No. of Equity Shares / Mutual Fund Units	Total Value of Bonds ④	Total Value of Portfolio ⑤ = ③ + ④	Rebalancing Action [Buy or Sell Equity Shares] ⑥	Total No. of Equity Shares / Mutual Fund Units ⑦
⌄ ⌄ ⌄						

Example :-

Amount of ₹ 2 Lakhs is Invested equally in Equity Shares & Bonds.

Date	Price Per Equity Share
Investment Date	₹ 40
After 1 Month	₹ 25
After 2 Month	₹ 31.25

Portfolio is Rebalanced each time when Price of Equity Share changes. Calculate Value of Portfolio after 1 Month & 2 Month using Constant Ratio Plan.

Solution :-

Step 1: Allocation of Amount to be Invested in - [Equally]

Equity Shares [Aggressive] = ₹ 1 Lakh

Bonds [Conservative] = ₹ 1 Lakh

Step 2: No. of Equity Shares Initially Purchased ⇒ $\frac{₹1 \text{ Lakh}}{₹ 40}$ = 2,500 Shares

Step 3: Calculation of Value of Portfolio :-

Date ①	Market Price Per Equity Share ②	Total Value of Equity Shares (₹) ③ = ② × No. of Equity Shares	Total Value of Bonds (₹) ④	Total Value of Portfolio (₹) ⑤ = ③ + ④	Rebalancing Action [Buy or Sell Equity Shares] ⑥	Total No. of Equity Shares ⑦
Inv. Date	40	1,00,000	1,00,000	2,00,000	-	2,500
After 1 Month	25	62,500	1,00,000	1,62,500	-	2,500
		81,250 ←	81,250	1,62,500	Buy 750 Shares	3,250
After 2 Month	31.25	1,01,562.50	81,250	1,82,812.50	-	3,250
		→ 91,406.25	91,406.25	1,82,812.50	Sell 325 Shares	2,925

3. Constant Proportion Portfolio Insurance (CPPI) Policy :-

→ As per this Policy, Investor should Invest the Amount in Equity Shares in Constant Proportion using a Multiplier & the balance amount is Invested in Bonds

and

Whenever Price of Equity Share increases or decreases, Rebalancing is done by Buying or Selling Equity Shares

→ Steps for Calculation of Value of Portfolio on a particular date :

Step 1 : Calculate Expected Maximum Decline % in Stock Market in Investment Period :

$$\Rightarrow \frac{\text{Present Market Index} - \text{Expected Minimum Market Index}}{\text{Present Market Index}} \times 100$$

Step 2 : Calculate floor Value :

⇒ Total Investment Amount − Expected Maximum Decline %

Step 3 : Initial Investment in :

- Equity Shares ⇓ [Total Investment Amount − Floor Value] × Multiplier
- Bonds ⇓ Balancing figure ⇓ Total Investment Amount − Amount Invested in Equity Shares

Step 4 : At 1st Rebalancing Date after Initial Investment :

→ Calculate Total Value of Portfolio :

$$\text{Value of Equity Shares} = \text{Value of Equity Shares on Initial Investment Date} \times \frac{\text{Market Price of Equity Share on Current Rebalancing Date}}{\text{Market Price of Equity Share on Initial Investment Date}} = \text{xxx}$$

(+) Value of Bonds = Value of Bonds on Initial Investment Date = xxx

xxx

→ Now, Rebalance the Portfolio

- Investment in Equity Shares ⇓ [Total Portfolio Value on this Date as calculated above − Floor Value] × Multiplier
- Investment in Bonds ⇓ Balancing Figure ⇓ Total Portfolio Value on this Date as calculated above − Amount Invested in Equity Shares

Step 5: At Further Rebalancing Dates:

→ Calculate Total Value of Portfolio:

$$\text{Value of Equity Shares} = \text{Value of Equity Shares on Previous Rebalancing Date} \times \frac{\text{Market Price of Equity Share on Current Rebalancing Date}}{\text{Market Price of Equity Share on Previous Rebalancing Date}} = xxx$$

(+) Value of Bonds = Value of Bonds on Previous Rebalancing Date = xxx

xxx

→ Now, Rebalance the Portfolio

- Investment in Equity Shares ⇓
  [Total Portfolio Value on this Date as calculated above − Floor Value] × Multiplier
- Investment in Bonds ⇓ Balancing Figure ⇓
  Total Portfolio Value on this Date as calculated above − Amount Invested in Equity Shares

Stock Lending Scheme [SLS]

- **Process of Stock Lending & Borrowing :-**

Time	Long Term Investor (Lender)	Short Seller (Borrower)	Market
0 Time [Today]	→ Lend Share	→ Short Sell Share	
Later On	← Give Back Share to Lender		← Buy Share from Market

- **Calculation of Total Earnings of Lender in this Process :-**

Lending Charges / Fees Per Share	xxx
(+) Dividend Received on Share	xxx
Total Earnings Per Share	xxx
(×) Total No. of Shares	✓
Total Earnings	xxx

- Calculation of Total Profit / (Loss) of Borrower in this Process :-

Lending fees Paid Per Share	(xxx)
Bank Guarantee Charges [Price of Share At 0 Time × Bank Guarantee Cost % × Months of Borrowing / 12]	(xxx)
Gain / (Loss) on Shortening the Share [Price of Share At 0 Time − Price of Share At End Date]	xxx / (xxx)
Total Profit / (Loss) Per Share	xxx / (xxx)
(x) Total No. of Shares	✓
Total Profit / (Loss)	xxx / (xxx)

Points to Remember in Portfolio Chapter

1. All Data should be used in % in formulas [Return, Variance, Standard Deviation, etc.]
2. Weights should be taken in 4 decimals
3. Beta is to be calculated upto 3 decimals unless specifically mentioned
4. Stock Market & its Terminologies :-

(i) Market Index :

- NIFTY ⇓ Index Value Based on Top 50 Companies Listed on NSE
- SENSEX ⇓ Index Value Based on Top 30 Companies Listed on BSE

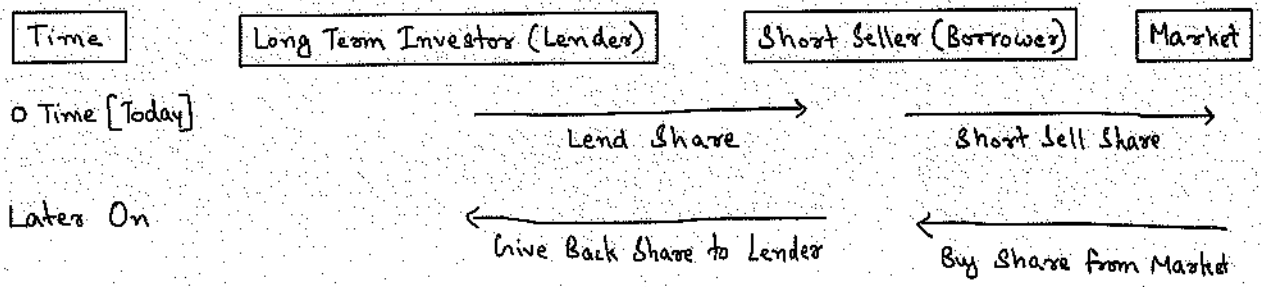
(ii) Market Sentiments :

If Investor expects

- Upward Price Movement in Share [i.e. Price Increase] ⇓ It means he is Bullish ⇓ To Earn Profit in this Situation, Investor will Buy Share Today & Sell it Later on [Long Position]
- Downward Price Movement in Share [i.e. Price Decrease] ⇓ It means he is Bearish ⇓ To Earn Profit in this Situation, Investor will Sell Share Today & Buy it Later on [Short Position/ Short Selling]

(iii.) Long Position :- Buy first & Sell Later

(iv.) Short Position / Short Selling : Sell first & Buy Later



5. Weights of Securities in the Portfolio if We have Invested Amount in a Security, Short Sell Another Security & Borrowed Amount from Risk Free Security :-

→ Weight of Security in which Amount is Invested $= \frac{\text{Total Investment Amount in such Security}}{\text{Own funds of Investor}}$

→ Weight of Security which has been Short Sell $= \frac{-\text{Short Sell Amount}}{\text{Own funds of Investor}}$

→ Weight of Security in which Amount is Borrowed $= \frac{-\text{Borrowed Amount}}{\text{Own funds of Investor}}$

Securitization



No practical concepts in this chapter.

Theory concepts of this chapter are covered in Section B of this book.

Mutual Funds

- **Part I: Introduction to Mutual Funds**
  - Meaning of Mutual Funds
  - Classification / Types of Mutual funds
- **Part II: Net Asset Value of Mutual fund**
  - Meaning of NAV
  - Calculation of NAV
  - Issue Price & Repurchase Price
- **Part III: Returns from Mutual fund**
  - Holding Period Return
  - Annual Return
- **Part IV: Other Topics**
  - Evaluation of Mutual Funds
  - Return that Mutual fund should earn so that Investor will be Indifferent
  - Fee Calculation of Hedge fund Manager

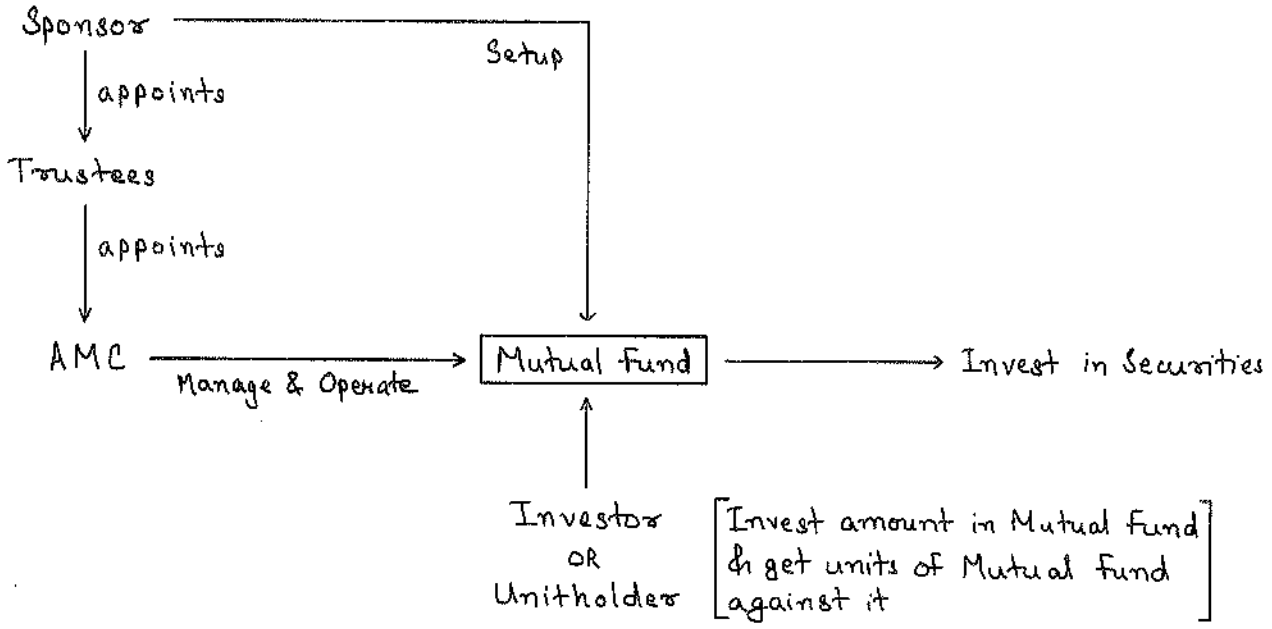
Part I: Introduction to Mutual Funds

Meaning of Mutual funds

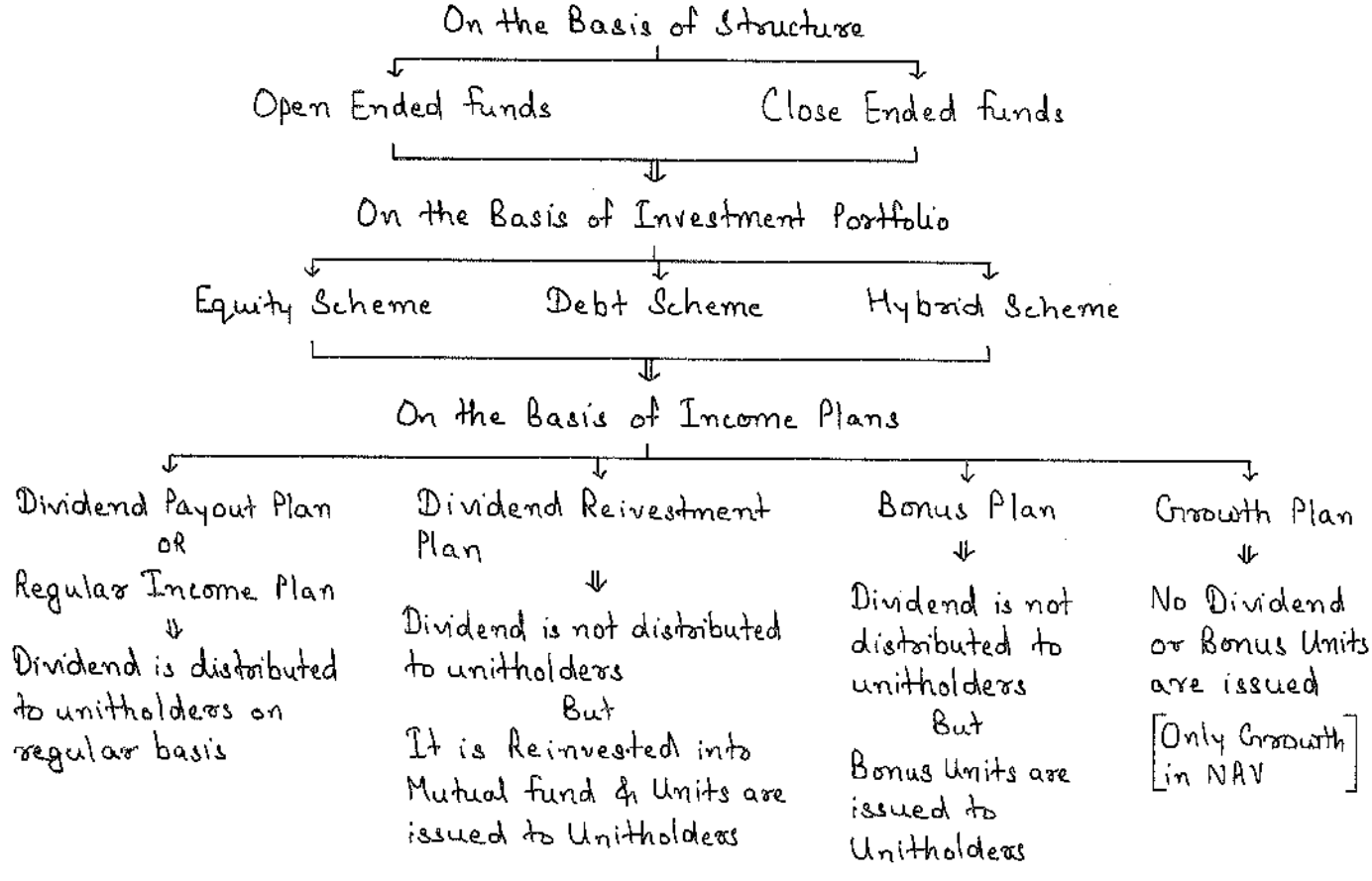
- Investors can invest in Securities (Shares, Debentures, Bonds, etc.)
  - Directly through Stock Market
  - Indirectly through Mutual fund

If Investor
→ has No Time / Expert Knowledge
→ wants diversification in less money

- Mutual fund is a trust that collects investment from multiple investors [through issue of units] for investment in securities.



Classification | Types of Mutual funds



Part II : Net Asset Value of Mutual Fund

Meaning of NAV [Net Asset Value] of Mutual fund

- NAV is the Value of Per Unit of Mutual fund held by an Investor [Unitholder].
- It is calculated on daily basis [i.e. calculated at the end of each day].

Calculation of NAV [Net Asset Value] of Mutual fund

Steps to be followed to calculate NAV per unit of Mutual fund :

Step 1 : Calculate Net Assets of the Mutual fund [At Market Value] :

Particulars	Amount
Market Value of Investment in Securities (Shares, Debentures, Bonds, etc.)	xx
(+) Accrued Income [Example : Dividend accrued on Shares]	xx
(+) Closing Cash Balance	xx
	xx
(-) Accrued Expenses [Example : Arrears of Expenses, Expenses Payable]	(xx)
(-) Other Liabilities [Example : Amount Payable on Shares]	(xx)
Net Assets of the Mutual Fund	xx

Step 2 : Calculate NAV of the Mutual fund :

$$NAV = \frac{\text{Net Assets of the Mutual Fund}}{\text{No. of Units Outstanding of Mutual fund}}$$

Note :-

(i) NAV & No. of Units should be taken in 2 decimals unless specifically mentioned.

(ii) Calculation of Closing Cash Balance [If it is not given in question]:

Particulars	Amount
Amount received on issue of units	xx
(-) Initial Expenses	(xx)
(-) Initial Investment in Securities	(xx)
	xx
(+) Amount received from Sale of Securities	xx
(-) Amount Paid for Purchase of Securities	(xx)
(+) Income received on Investment in Securities [Example: Dividend or Interest received]	xx
(-) Realized Earnings distributed (Paid) to Unitholders [Example: Income (Dividend or Interest) distributed, Capital Gains arising on sale of securities distributed]	(xx)
(-) Operating Expenses Paid [Example: fund Management Expenses]	(xx)
(+) Amount received on issue of new units	xx
(-) Amount Paid on repurchase of units	(xx)
Closing Cash Balance	xx

(iii) If details of Assets & Liabilities of the Mutual fund are not given in question but Opening NAV is available, then Closing NAV of Mutual fund is calculated as follows:

Particulars	Amount
Opening Net Assets of Mutual fund [No. of units at opening date × Opening NAV]	xx
(±) Investment Portfolio Value appreciation /(depreciation)	xx/(xx)
(+) Amount received on issue of new units [No. of units issued × Issue Price]	xx
(-) Amount Paid on repurchase of units [No. of units repurchased × Repurchase Price]	(xx)
(+) Income earned during the period	xx
(-) Income distributed to Unitholders	(xx)
(+) Amount received from Sale of Securities	xx
(-) Amount Paid for Purchase of Securities	(xx)
Closing Net Assets of the Mutual fund	xx

$$\therefore \text{Closing NAV} = \frac{\text{Closing Net Assets of the Mutual Fund}}{\text{Closing No. of Units Outstanding of Mutual fund}}$$

Issue Price & Repurchase Price p.u. of Mutual Fund

(1) Issue Price per unit [Public Offer Price]:

NAV on date of issue of units	xx
(+) Entry Load [Frontend Load] @ ... % of NAV	xx
(+) Dividend Equalization p.u. collected on issue of units	xx
	xx

(2) Repurchase Price per unit [Redemption Price]:

NAV on date of repurchase of units	xx
(−) Exit Load [Backend Load] @ ... % of NAV	(xx)
(+) Dividend Equalization p.u. paid on repurchase of units	xx
	xx

Note: Calculation of Dividend Equalization per unit [By Preparing Statement of Mutual fund's Income Available for Distribution]:

Particulars	No. of Units of Mutual Fund	Per Unit Income (₹)	Total Income (₹)
Income earned by Mutual Fund in 1st Period	No. of units at Opening date	Calculate (A)	Given
(+) Dividend Equalization collected on issue of new units @ above p.u. income (A)	No. of units issued	↓ Same	Calculate
	Total	Calculate	Total
(+) Income earned by Mutual Fund in Next Period	–	Calculate	Given
	Total	Calculate (B)	Total
(−) Dividend Equalization paid on repurchase of units @ above p.u. income (B)	No. of units repurchased	↓ Same	Calculate
	Total	Calculate	Total
(+) Income earned by Mutual Fund in Next Period	–	Calculate	Given
Income available for distribution	Total	Calculate	Total
(−) Dividend distributed	–	(✓)	(✓)
Remaining Income available	Total	Calculate	Total

Part III : Returns from Mutual Fund

Holding Period Return | Yield

(1) It means Total Return (in %) earned by Investors [Unitholders] from Mutual Fund throughout the period of their Investment.

(2) Calculation of Holding Period Return [HPR] :

· In Case of Dividend Payout [Regular Income] Plan

$$HPR = \frac{\text{Total Yield or Profit}}{\text{Investment Value at Beginning}} \times 100$$

Here,

$$\text{Total Yield} = \left[\begin{array}{l}\text{Investment Value}\\ \text{at end}\end{array}\right] - \left[\begin{array}{l}\text{Investment Value}\\ \text{at beginning}\end{array}\right] + \left[\begin{array}{l}\text{Income received as}\\ \text{Dividend \& Capital}\\ \text{Gains distribution}\end{array}\right]$$

↓	↓	↓
No. of Units × NAV at end	No. of Units × NAV at beginning	No. of Units × Income received p.u.

· In Case of Dividend Reinvestment Plan, Bonus Plan & Growth Plan

$$HPR = \frac{\text{Total Yield or Profit}}{\text{Investment Value at Beginning}} \times 100$$

Here,

$$\text{Total Yield} = \text{Investment Value at end} - \text{Investment Value at beginning}$$

↓	↓
No. of Units at end [Initially Purchased Units + Units received under Dividend Reinvestment or Bonus Plan] × NAV at end	No. of Units at beginning [Initially Purchased Units] × NAV at beginning

Note :- If Issue Price & Repurchase Price is available in question, then these will be used instead of NAV in above formulas.

Annual Return / Annualised Yield / Average Yield / Effective Yield per annum

$$\text{Annual Return (\%)} = \text{HPR} \times \frac{365 \text{ / } 12}{\text{No. of days / months for which Investment is held}}$$

Note:- Consider Both Starting Date & End Date for calculation of No. of days for which Investment is held.

Part IV : Other Topics

Evaluation of Mutual Funds

(1) Expense Ratio :

- It indicates how much of Mutual Fund's assets are used towards Operating Expenses like Consultancy & Management fee, Office Expenses, Advertisement Expenses, etc.

$$\text{Expense Ratio (\%)} = \frac{\text{Total Operating Expenses of Mutual fund during the period}}{\left[\frac{\text{Opening Net Assets of Mutual Fund} + \text{Closing Net Assets of Mutual fund}}{2}\right]} \times 100$$

(2) Tracking Error :

- It is used for calculating deviation in Return on Mutual Fund from Return on Benchmark it is following.

$$\text{Tracking Error} = \sqrt{\frac{\Sigma (d - \bar{d})^2}{n-1}}$$

Here, d = Differential Return [Return on Mutual fund − Return on Benchmark]

$\bar{d}$ = Average of Differential Return

n = Number of Differential Returns

Example:

Year	Return on MF	−	Return on BM	=	Differential Return (d)	$d-\bar{d}$	$(d-\bar{d})^2$
1	10%		9%		1	0.88	0.7744
2	8%		10%		−2	−2.12	4.4944
3	−2%		−4%		2	1.88	3.5344
4	7%		7%		0	−0.12	0.0144
5	−1%		−0.6%		−0.4	−0.52	0.2704
					0.6		9.088

$\bar{d} = \frac{0.6}{5} = 0.12$

$\therefore$ Tracking Error $= \sqrt{\frac{9.088}{5-1}} = \sqrt{2.272} = 1.507\%$

Return that Mutual Fund should earn so that Investor will be Indifferent on Direct Investment through Stock Market or Indirect Investment through Mutual fund

$\Rightarrow \frac{\text{Return earned by Investor on direct investment through Stock Market \%}}{1 - \text{Initial Expenses in Mutual Fund \%}} + \text{Annual Recurring Expenses in Mutual Fund \%}$

Fee Calculation of Hedge Fund Manager

- Hedge fund is a type of Mutual fund which is less regulated than others. These are structured as a Private Entity which does not reveal anything about its operations. It have selected clients for whom Hedge fund Manager aims to generate high returns.

- So, Hedge fund Manager charges following two types of fee from its clients:

(i) Base Fee [Fixed Fee] : Fix % on Assets under Management (Portfolio) of Client
[Irrespective of Positive or Negative Return on Fund]

(ii) Incentive fee : Linked to the Performance of fund
[It is charged only if value of portfolio increases above a particular level as decided in the Contract, i.e. Incentive fee % on that Excess Value of Portfolio]



Derivatives Analysis and Valuation

- **Part I: Introduction to Derivatives**
  - Meaning of Derivatives
  - Participants in Derivative Contracts
  - Classification of Derivatives on the basis of Underlying Assets
  - Types of Derivative Contracts
- **Part II: Forwards & futures [Equity Derivatives]**
  - Meaning of forwards & futures
  - Pricing of forwards & futures
  - Gain | Loss [Pay off] on future Contracts
  - Types of Margin in future Contracts
  - Hedging Using futures
  - Arbitrage Using futures
- **Part III: Options [Equity Derivatives]**
  - Meaning of Options
  - Gain | Loss [Pay off] on Options
  - Expected Value of Option at Maturity [Expected Pay off]
  - Value of Option at Beginning [Fair Option Premium | Fair Value of Option]
- **Part IV: Swaps [Equity Derivatives]**
  - Equity Swap
- **Part V: Commodity Derivatives**
  - Meaning of Commodity Derivatives
  - Hedging of Commodities using Commodity Futures

Part I: Introduction to Derivatives

Meaning of Derivatives

- Derivative is a Contract between 2 Parties which derive its value from an Underlying Asset.
  [Underlying Asset can be Equity (Share or Index), Commodity, Currency, Interest Rate, etc.]
- Derivative Contract is entered into
  - for doing Transaction on a future date
    - ⇓
    - Contract to Buy or Sell Underlying Asset on a specified future date at a Pre fixed Price
    - [Settlement by Delivery]
  - for Betting (सट्टा) on Price of Underlying Asset on a future date
    - ⇓
    - Contract of Upside Betting [Buy] or Downside Betting [Sell] on Price of Underlying Asset on a specified future date at a Pre fixed Price
    - [Cash Settlement]

Note:- Generally, Cash Settlement is done in all Derivative Contracts.

Participants in Derivative Contracts

- **Speculators** ⇓ — Those who don't have any existing exposure (risk) but wants to earn profit by Betting
- **Hedgers** ⇓ — Those who have any existing exposure (risk) & they want to kill that risk by Betting
- **Arbitrageurs** ⇓ — Those who don't have any existing exposure (risk) but wants to earn risk less profit by taking advantage of mispricing in market

Classification of Derivatives on the basis of Underlying Assets

- Equity Derivatives
- Interest Rate Derivatives [IRRM]
- Currency Derivatives [FOREX]
- Commodity Derivatives
- Other Derivatives [Credit, Weather, Electricity, etc.]

Types of Derivative Contracts

- forwards
- Futures
- Options
- Swaps

Part II: Forwards & futures [Equity Derivatives]

Meaning of forwards & futures

- Forwards & futures [Equity] are Derivative Contracts in which Underlying Asset is Equity [Share or Index].
- Forwards & futures Contract are same except that forward Contract is done over the counter (OTC) & futures contract is done on a Stock Exchange.
- These Contracts create obligation on both the parties of the Contract, i.e. Each Party in the Contract has to fulfill their promise in any case; they have no choice.

Pricing of forwards & futures

(1) Theoretical Value (Fair Value) of forwards & futures [Cost of Carry Model] :-

- **Simple Interest** ⇓ $F = S \times (1 + R \times T)$
- **Continuous Compounding Interest** ⇓ $F = S \times e^{RT}$
- **Monthly Compounding Interest** ⇓ $F = S \times (1 + R)^T$

Here,

F = Future Price

S = Current Spot Price | Value of Underlying Share | Index

R = Interest Rate p.a.

$T = \frac{\text{No. of days | months of future contract}}{365 \mid 12}$

Here,

R = Interest Rate p.m. $\left[\text{i.e. } \frac{\text{Interest Rate p.a.}}{12}\right]$

T = No. of months of future contract

Note:

(i) If Dividend Income on Underlying Share | Index is given in question in fixed Amount [i.e. Dividend Rate on face Value is given], then Deduct PV of Dividend Amount from 'S' [Current Spot Price | Value of Underlying Share | Index] in above formulas.

PV of Dividend Amount is calculated as follows:

Simple Interest	Continuous Compounding Interest	Monthly Compounding Interest
$\frac{\text{Dividend Income}}{(1+R\times T)}$	$\frac{\text{Dividend Income}}{e^{RT}}$ OR $\text{Dividend Income} \times e^{-RT}$	$\frac{\text{Dividend Income}}{(1+R)^{T}}$

Here,

$T = \frac{\text{No. of days / months after which Dividend Income will be received}}{365 \,/\, 12}$

Here,

T = No. of months after which Dividend Income will be received

(ii) If Dividend Income on Underlying Share | Index is given in question in Yield % [i.e. Dividend Yield Rate is given], then Deduct Dividend Yield Rate (Y) from 'R' [Interest Rate] in above formulas.

(iii) Which type of Interest is to be applied [i.e. Simple, Continuous Compounding or Monthly Compounding]:

→ Specifically given in question

Example: If Compounded Continuously Interest Rate is given in question, then Apply Continuous Compounding Interest.

Example: If Interest Rate p.m. or Interest on Monthly Rest is given in question, then Apply Monthly Compounding Interest.

→ Otherwise, Apply Simple Interest

(iv) Above Calculated Price is Theoretical (Fair) Price of future; Actual Quoted (Trading) Price of future can be different in market.

(v) Contango & Backwardation Market Situations:

Basis = S − F

If it is Positive	If It is Negative
Backwardation Market	Contango Market

Example:

Consider a 3 Months maturity future contract on A ltd.'s share.
Spot Price of A ltd.'s Share is ₹ 200. Face Value of Share is ₹ 10.
Continuously Compounded Interest Rate is 10% p.a.
Calculate fair future Price in following cases:
(i) If there is no dividend income expected on A ltd.'s share.
(ii) If 25% Dividend Income is expected on A ltd.'s share after 2 Months.
(iii) If expected Dividend Yield on A ltd.'s share is 6% p.a.
Given: $e^{0.025} = 1.0253$, $e^{0.01} = 1.01005$, $e^{-0.0167} = 0.98344$

Solution:

(i) $F = 200 \times e^{0.10 \times \frac{3}{12}} \Rightarrow 200 \times e^{0.025} \Rightarrow 200 \times 1.0253 \Rightarrow ₹ 205.06$

(ii) Dividend Income Amount $= 10 \times 25\% \Rightarrow ₹ 2.50$

PV of Dividend Income Amount $= \frac{2.50}{e^{0.10 \times \frac{2}{12}}} \Rightarrow \frac{2.50}{e^{0.0167}} \Rightarrow 2.50 \times e^{-0.0167}$

$\Rightarrow 2.50 \times 0.98344 \Rightarrow ₹ 2.46$

$F = [200 - 2.46] \times e^{0.10 \times \frac{3}{12}} \Rightarrow 197.54 \times e^{0.025} \Rightarrow 197.54 \times 1.0253 \Rightarrow ₹ 202.54$

(iii) $F = 200 \times e^{[0.10 - 0.06] \times \frac{3}{12}} \Rightarrow 200 \times e^{0.04 \times \frac{3}{12}} \Rightarrow 200 \times e^{0.01} \Rightarrow 200 \times 1.01005$

$\Rightarrow ₹ 202.01$

(2) Price of 1 future Contract | Lot :-

⇒ Actual Quoted (Trading) Price of future × Lot Size

- If Actual Quoted (Trading) Price of future is not given in question, then Assume it as same as Theoretical (fair) Price of future.
- Lot Size means No. of Shares or Units in 1 Contract | No. of times Shares delivered in 1 Contract | Minimum Trading Lot | Contract Multiplier | Trade Multiple

(3) Contract Value :-

⇒ Price of 1 future Contract | Lot × No. of Contracts | Lots

Gain | Loss [Pay off] on future Contracts

- It is calculated by squaring off the contract on maturity [Cash Settlement] as follows:

If Initially Long Position on futures is taken [Buy futures]

⇓

It means Upside Betting (Price बढ़ने पर Gain होगा)

⇓

In this Case, If Price of future on Maturity

- Rises ↓ Gain
- Falls ↓ Loss

If Initially Short Position on futures is taken [Sell futures]

⇓

It means Downside Betting (Price गिरने पर Gain होगा)

⇓

In this Case, If Price of future on Maturity

- Rises ↓ Loss
- Falls ↓ Gain

- Calculation of Gain | Loss on future Contracts

⇒ No. of Contracts / Lots × Lot Size × Difference between Price of future on Maturity (Settlement Price) & Initially Contracted Price

OR

⇒ Contract Value × Rise / fall % in Price of future on Maturity

Example:

On 1st January, NIFTY future for 3 Months is trading at ₹ 20,000. One Lot of NIFTY future consists of 50 units.
Mr. A has taken a Long Position on 2 Lots of NIFTY futures. Calculate Gain | Loss of Mr. A if

Case 1: Price of NIFTY future after 3 Months becomes ₹ 21,000.
Case 2: NIFTY future rises by 5% after 3 Months.
Case 3: NIFTY future falls by 2% after 3 Months.

Solution:

Since, Mr. A has taken a Long Position on futures; he will make gain only if Price of future rises on maturity.

Case 1: Gain = 2 × 50 × (21,000 − 20,000) = ₹ 1,00,000

Case 2: Gain = [(20,000 × 50) × 2] × 5% = ₹ 1,00,000

Case 3: Loss = [(20,000 × 50) × 2] × 2% = (₹ 40,000)

Types of Margin in future Contracts

(1) Initial Margin :-

- It is the Initial Amount which an Investor has to deposit in the Margin A/c with Stock Exchange to enter into a future contract.
- Calculation of Initial Margin Amount :
  ⇒ Contract Value × Initial Margin %

  OR

  ⇒ $\mu + 3\sigma$

  Here, μ = Average Daily Absolute Change Amount in Contract Value
  σ = Standard Deviation in Average Daily Absolute Change Amount

(2) Mark to Market Margin :-

- It is the Amount of Gain / Loss arising due to Daily Settlement of future Contract by Stock Exchange. This Gain / Loss is adjusted in the Margin A/c of Investor on daily basis.
- Calculation of Mark to Market Margin Amount [Gain / Loss on Daily Settlement of future contract] :
  ⇒ No. of Contracts / Lots × Lot Size × Difference between Closing future Price of Today & Closing future Price of Previous Day

(3) Maintenance Margin :-

- When the Balance in Margin A/c of Investor goes below the Maintenance Margin, then the Stock Exchange will Call Money from the Investor to restore the Balance in Margin A/c upto the Initial Margin Amount.
- Calculation of Maintenance Margin Amount :
  ⇒ Initial Margin Amount × Maintenance Margin %

  OR

  ⇒ Contract Value × Maintenance Margin %

Note: Format for Statement showing Daily Balances in Margin A/c & Call Money :-

Date	Opening Balance in Margin A/c	Mark to Market Margin [Gain / (Loss) on Daily Settlement]	Balance in Margin A/c after adjusting Mark to Market Margin	Call Money	Closing Balance in Margin A/c
(1)	(2)	(3)	(4) = (2) ± (3)	(5)	(6) = (4) + (5)
✓	✓	✓ / (✓)	✓	When Amount in Column (4) goes below Maintenance Margin	✓

Example:

On 1st January, NIFTY future for 3 Months is trading at ₹ 20,000. One Lot of NIFTY future consists of 50 units.

Mr. A has taken a Long Position on 2 Lots of NIFTY futures. Calculate Gain/Loss of Mr. A if Price of NIFTY future become as following:

Date	Price of NIFTY future (₹)
2nd January	20,050
3rd January	19,850
4th January	20,200

Initial Margin is 5% of Contract Value. Maintenance Margin is 90% of Initial Margin. Prepare a Statement showing Daily Balances in Margin A/c & Call Money.

Solution:

Contract Value = [(₹ 20,000 × 50) × 2] ⇒ ₹ 20,00,000

Initial Margin = 20,00,000 × 5% ⇒ ₹ 1,00,000

Maintenance Margin = 1,00,000 × 90% ⇒ ₹ 90,000

Statement showing Daily Balances in Margin A/c & Call Money:

Date	Opening Balance in Margin A/c	Mark to Market Margin [Gain/Loss on Daily Settlement]	Balance in Margin A/c after adjusting Mark to Market Margin	Call Money	Closing Balance in Margin A/c
(1)	(2)	(3)	(4) = (2) ± (3)	(5)	(6) = (4) + (5)
1st Jan.	1,00,000	-	1,00,000	-	1,00,000
2nd Jan.	1,00,000	2 × 50 × (20,050 − 20,000) = 5,000	1,05,000	-	1,05,000
3rd Jan.	1,05,000	2 × 50 × (19,850 − 20,050) = (20,000)	85,000	15,000	1,00,000
4th Jan.	1,00,000	2 × 50 × (20,200 − 19,850) = 35,000	1,35,000	–	1,35,000

Calculation of Gain to Mr. A ⇒ 2 × 50 × (20,200 − 20,000) = ₹ 20,000

OR

⇒ 1,35,000 − (1,00,000 + 15,000) = ₹ 20,000

(1,35,000 ↓ Margin A/c Balance at End; 1,00,000 ↓ Initial Margin; 15,000 ↓ Call Money)

OR

⇒ Total of Column (3) Mark to Market Margin = ₹ 20,000

Hedging Using futures

(1) Hedging Using Respective Share futures :-

If we have Long Position on Shares of a Company
[i.e. Bought Shares of a Company]
⇓
Create Short Position on Share futures of that Company
[i.e. Sell Share futures]

If we have Short Position on Shares of a Company
[i.e. Short Sell Shares of a Company]
⇓
Create Long Position on Share futures of that Company
[i.e. Buy Share futures]

(2) Hedging Using Index futures :-

- It is used to hedge
  - → Portfolio of Shares
  - → Shares of a Company for which respective Share futures is not available

- Steps to be followed to solve the Questions :

Step 1: Which Position should be created in Index Futures

If we have Long Position on Shares Portfolio
[i.e. Bought Shares of Companies]
⇓
Create Short Position on Index futures
[i.e. Sell Index futures]

If we have Short Position on Shares Portfolio
[i.e. Short Sell Shares of Companies]
⇓
Create Long Position on Index Futures
[i.e. Buy Index futures]

Step 2: No. of Index Future Contracts to be bought or sold

$$\Rightarrow \frac{\text{Value of Shares Portfolio} \times \left[\begin{matrix}\text{Existing Beta of} \\ \text{Shares Portfolio}\end{matrix} - \begin{matrix}\text{Required Beta} \\ \text{of Portfolio}\end{matrix}\right]}{\text{Price of 1 future Contract}}$$

Note:

(i) If Required Beta of Portfolio is not given in question, then Assume it as 'Zero' (0).

(ii) If No. of Contracts come in decimals, then Round Off it to Upper Side whole number. [Example: No. of Contracts = 2.47 ⇒ 3]

Step 3: Calculate Overall Gain | Loss on Maturity due to Hedging

Gain	(Loss) on Index future Contracts [Refer Note (iii)]	xxx / (xxx)
Gain	(Loss) on Shares Portfolio [Refer Note (iv)]	xxx / (xxx)
Overall Gain	(Loss) on Maturity	xxx / (xxx)

Note:

(iii) Calculation of Gain | Loss on Index future Contracts is already discussed in Topic 'Gain | Loss [Pay off] on future Contracts'.
But if Rise | fall % in Price of Index future is not given in question, then it will be equals to Rise | fall % in Index (Market)

$$\text{Rise | fall \% in Index (Market)} = \frac{\text{Rise | fall \% in Shares Portfolio}}{\text{Existing Beta of Shares Portfolio}}$$

(iv) Gain | Loss on Shares Portfolio

If we have Long Position on Shares Portfolio
[i.e. Bought Shares of Companies]
⇓
In this Case, If Price of Shares on Maturity
- Rises ↓ Gain
- Falls ↓ Loss

If we have Short Position on Shares Portfolio
[i.e. Short Sell Shares of Companies]
⇓
In this Case, If Price of Shares on Maturity
- Rises ↓ Loss
- Falls ↓ Gain

Calculation of Gain | Loss on Shares Portfolio
⇒ Value of Shares Portfolio × Rise | fall % in Shares Portfolio

OR

$$\Rightarrow \text{Value of Shares Portfolio} \times \left[\text{Existing Beta of Shares Portfolio} \times \text{Rise | Fall \% in Price of Index Future}\right]$$

Step 4: Calculate Total Portfolio Beta on Maturity after Hedging

$$\text{Beta of Total Portfolio} = \frac{\text{\% Change in Total Portfolio}}{\text{Rise | fall \% in Index (Market)}}$$

Here,

$$\text{\% Change in Total Portfolio} = \frac{\text{Overall Gain | (Loss) on Maturity as calculated in Step 3}}{\text{Value of Total Portfolio at beginning}} \times 100$$

$$\text{Value of Total Portfolio at beginning} = \text{Investment in Shares Portfolio} + \text{Cash \& Bank Balance}$$

Note:

(v) Cash & Bank Balance is Risk free [Beta of Cash & Bank Balance is 'Zero' (0)]. Hence, it is not considered in Value of Portfolio for hedging in Step 1, 2 & 3.

Example:

Mr. A has made Investment in shares of various companies worth ₹ 25,00,000.
Beta of Shares Portfolio is 1·2
Mr. A wants to reduce Beta of Portfolio to 0·8
NIFTY future for 3 Months is currently trading at ₹ 20,000 & traded in multiple of 10.
NIFTY rises by 2% after 3 Months.

Solution:

Step 1: Since we have Long Position on Shares Portfolio, we should create Short Position on NIFTY future.

Step 2: No. of NIFTY future Contracts to be sold $= \frac{25,00,000 \times (1.2 - 0.8)}{20,000 \times 10}$

$\Rightarrow$ 5 Contracts

Step 3: Calculation of Overall Gain / (Loss) on Maturity

	₹
Loss on NIFTY future [(20,000 × 10) × 5 × 2%]	(20,000)
Gain on Shares Portfolio [25,00,000 × (1.2 × 2%)]	60,000
Overall Gain on Maturity	40,000

Step 4: Calculation of Beta of Portfolio after 3 Months

% Change in Portfolio $= \frac{40,000}{25,00,000} \times 100 \Rightarrow 1.6\%$

$\therefore \beta_p = \frac{1.6\%}{2\%} \Rightarrow 0.8$

Arbitrage Using futures

If Actual Quoted (Trading) Price of future > Theoretical (Fair) Price of Future

⇓

It means future is Overvalued

⇓

Arbitrageur should do Cash & Carry Arbitrage i.e. Create Short Position on future [Sell future]

⇓

Gain on Arbitrage = Actual Quoted Price of future − Theoretical (Fair) Price of future

If Actual Quoted (Trading) Price of future < Theoretical (Fair) Price of Future

⇓

It means future is Undervalued

⇓

Arbitrageur should do Reverse Cash & Carry Arbitrage i.e. Create Long Position on future [Buy future]

⇓

Gain on Arbitrage = Theoretical (Fair) Price of future − Actual Quoted Price of future

Part III: Options [Equity Derivatives]

Meaning of Options

(1)

Option Premium

	Option Buyer (Holder)	Option Seller (Writer)
Call Option	Right to buy underlying share on a specified future date at a pre fixed price (Strike Price)	Obligation to sell underlying share on a specified future date at a pre fixed price (Strike Price)
Put Option	Right to sell underlying share on a specified future date at a pre fixed price (Strike Price)	Obligation to buy underlying share on a specified future date at a pre fixed price (Strike Price)

(2) Features of Options :-

- Option Premium / Option Price : It is the amount paid by Option Buyer to Option Seller at beginning to buy the Option.
- Strike Price / Exercise Price : Price at which Option can be exercised by the Option Buyer at Maturity.
- Exercise of Option by Option Buyer

Call Option	Put Option
It will be exercised by Option Buyer if Price of Underlying Share at Maturity > Strike Price Under Option	It will be exercised by Option Buyer if Price of Underlying Share at Maturity < Strike Price Under Option

- Options are also classified as European Options & American Options.

Gain | Loss [Pay off] on Options

(1) Gain | Loss on Options for the Option Holder :-

- Call Option :

Price of Underlying Share at Maturity	xxx
(-) Strike Price	(xxx)
Pay off [If Negative, Consider it as Zero (0)]	xxx
(-) Option Premium paid at beginning	(xxx)
Gain / (Loss) [Net Pay off]	xxx / (xxx)

- Put Option :

Strike Price	xxx
(-) Price of Underlying Share at Maturity	(xxx)
Pay off [If Negative, Consider it as Zero (0)]	xxx
(-) Option Premium paid at beginning	(xxx)
Gain / (Loss) [Net Pay off]	xxx / (xxx)

(2) Gain / Loss on Options for the Option Seller :-

Calculate Gain / Loss on Option for the Option Holder

If it is Gain for the Option Holder ⇓ Same Amount will be Loss for the Option Seller

If it is Loss for the Option Holder ⇓ Same Amount will be Gain for the Option Seller

Note :-

(i) Pay off will always be equals to or greater than Zero (0). It cannot be negative in any case.

(ii) Option Holder's Gain can be unlimited but its Loss is limited upto the Option Premium paid.

(iii) Option Seller's Loss can be unlimited but its Gain is limited upto the Option Premium received.

(iv) Breakeven Price of Underlying Share on Maturity ⇓ Price of Underlying Share on Maturity at which there is No Gain or Loss

Call Option ⇓ Strike Price + Option Premium ⇓ Option Holder can gainfully exercise the Call Option on any price above this Breakeven Price of Underlying Share on Maturity

Put Option ⇓ Strike Price − Option Premium ⇓ Option Holder can gainfully exercise the Put Option on any price below this Breakeven Price of Underlying Share on Maturity

Example :

Mr. A purchased a 3 Months Call Option for 1 Share in ABC Ltd. at a Premium of ₹ 30 with an exercise price of ₹ 500.

Calculate Gain / Loss to Mr. A if Price of Share of ABC Ltd. after 3 Months become
Case 1: ₹ 650
Case 2: ₹ 400

Solution :

Case 1 :

	₹
Price of Share of ABC Ltd. on Maturity	650
(-) Strike Price	(500)
Pay off	150
(-) Option Premium	(30)
Gain [Net Pay off] to Option Holder ⇓ This Amount is Loss to Option Seller	120

Case 2 :

	₹
Price of Share of ABC Ltd. on Maturity	400
(-) Strike Price	(500)
Pay off [Since Negative, Considered as Zero (0)]	0
(-) Option Premium	(30)
Loss [Net Pay off] to Option Holder	(30)

↓

This Amount is Gain to Option Seller

Expected Value of Option at Maturity

If Multiple Expected Price of Underlying Share on Maturity is given in question, then Expected Value of Option at Maturity is calculated as follows:

Expected Value of Option at Maturity = $Payoff_1 \times P_1 + Payoff_2 \times P_2 + ... + Payoff_n \times P_n$

Here,

$Payoff_1$ = Payoff on Expected $Price_1$ of Underlying Share at Maturity

$Payoff_2$ = Payoff on Expected $Price_2$ of Underlying Share at Maturity

$Payoff_n$ = Payoff on Expected $Price_n$ of Underlying Share at Maturity

P_1 = Probability of Expected $Price_1$ of Underlying Share at Maturity

P_2 = Probability of Expected $Price_2$ of Underlying Share at Maturity

P_n = Probability of Expected $Price_n$ of Underlying Share at Maturity

Value of Option at Beginning [Fair Option Premium / Fair Value of Option]

(I) Binomial Model :

- In this Model, Value of Option at beginning is calculated on basis of following assumptions:
  (i) Price of Underlying Share on Maturity will either move up or move down [i.e. Only 2 Possible Expected Price of Underlying Share on Maturity]
  (ii) Return on Option will be same as Risk Free Return.
- This model provides two approaches for calculation of Value of Option at Beginning as follows:

Risk Neutral Approach [For Option Holder]	Delta Hedging | Riskless Hedge Portfolio | Replicating Portfolio Approach [For Option Seller]

↓

Value of Option at Beginning calculated from Both Approaches is Same

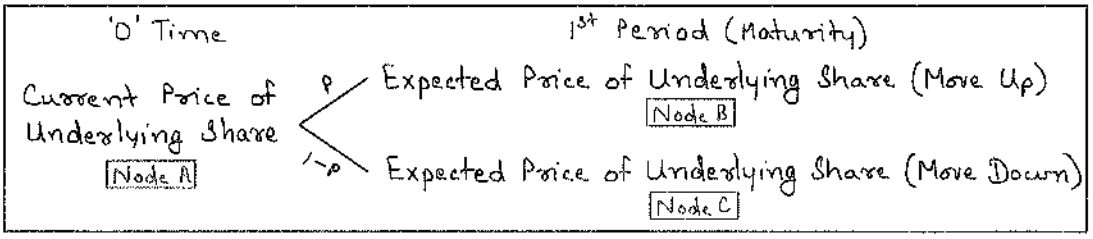
- Calculation of Value of Option at Beginning :

(i) Single Period Binomial Model

→ It is applied when Price of Underlying Share will move up or down on maturity only for the single time.

→ Steps to be followed to solve the Questions :

Step 1 : Draw a Binomial Tree



Step 2 : Calculate Risk Neutral Probabilities of Price Moving Up or Moving Down

Probability of Price Moving Up (in 4 Decimals) $\Rightarrow$ $p = \dfrac{e^{rt} - d}{u - d}$ OR $\dfrac{(1 + R \times T) - d}{u - d}$

If Continous Compounding Interest — If Simple Interest

Here,

$u = \dfrac{\text{Expected Price of Underlying Share at Maturity (Move Up)}}{\text{Current Price of Underlying Share at '0' Time}}$

$d = \dfrac{\text{Expected Price of Underlying Share at Maturity (Move Down)}}{\text{Current Price of Underlying Share at '0' Time}}$

R = Interest Rate p.a.

$T = \dfrac{\text{No. of Months till 1st Period End}}{12}$

Probability of Price Moving Down (in 4 Decimals) $\Rightarrow 1 - p$

Step 3 : Calculate Pay off on each Node of 1st Period (Maturity)

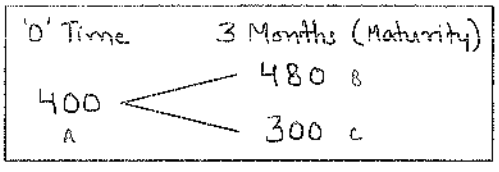
Step 4 : Value of Option at Beginning $= \dfrac{\text{Expected Value of Option at Maturity}}{e^{rt} \text{ OR } (1 + R \times T)}$

Example :

Current Price of Share of ABC Ltd. is ₹ 400. It will either increase to ₹ 480 or decrease to ₹ 300 after 3 Months.
Calculate Value of a 3 Months Call Option if Strike Price is ₹ 450 & Interest Rate is 12% p.a.

Solution :

Step 1 : Binomial Tree.



Step 2: Calculation of Risk Neutral Probabilities

$$u = \frac{480}{400} = 1.2 \quad , \quad d = \frac{300}{400} = 0.75$$

$$P = \frac{\left(1 + 0.12 \times \frac{3}{12}\right) - 0.75}{1.2 - 0.75} = \frac{1.03 - 0.75}{1.2 - 0.75} \Rightarrow 0.6222$$

$$1 - P = 1 - 0.6222 \Rightarrow 0.3778$$

Step 3: Calculation of Pay off on each Node of 3 Months (Maturity)

Node B = 480 − 450 ⇒ 30

Node C = 0 (Not Exercisable)

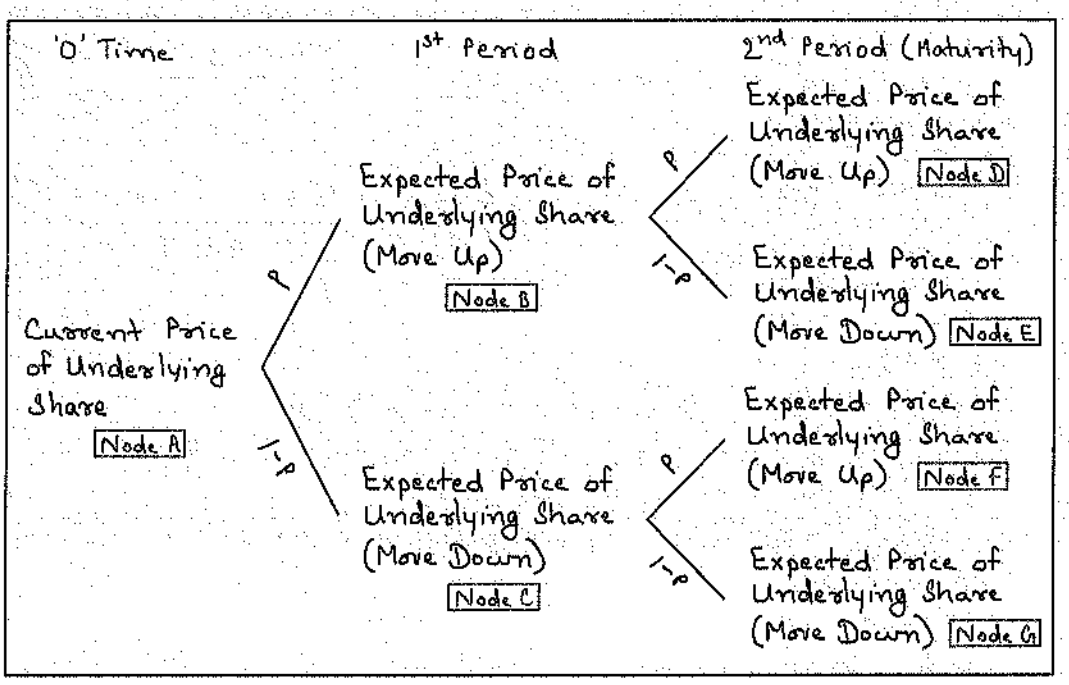
Step 4: Value of Option at Beginning $= \frac{30 \times 0.6222 + 0 \times 0.3778}{1.03} \Rightarrow ₹ 18.12$

(ii) Two Period Binomial Model

→ It is applied when Price of Underlying Share will move up or down before maturity for the 1st time & again on Maturity for the 2nd time.

→ Steps to be followed to solve the Questions:

Step 1: Draw a Binomial Tree



Step 2: Calculate Risk Neutral Probabilities of Price Moving Up or Moving Down (Consider 1st Period only, since Probabilities will be same for 2nd Period)

Probability of Price Moving Up (in 4 Decimals) ⇒ $P = \frac{e^{rt} - d}{u - d}$ OR $\frac{(1 + R \times T) - d}{u - d}$

$\frac{e^{rt} - d}{u - d}$ ⇓ If Continious Compounding Interest

$\frac{(1 + R \times T) - d}{u - d}$ ⇓ If Simple Interest

Here,

$$u = \frac{\text{Expected Price of Underlying Share at 1st Period (Move Up)}}{\text{Current Price of Underlying Share at '0' Time}}$$

$$d = \frac{\text{Expected Price of Underlying Share at 1st Period (Move Down)}}{\text{Current Price of Underlying Share at '0' Time}}$$

R = Interest Rate p.a.

$$T = \frac{\text{No. of Months till 1st Period End}}{12}$$

Probability of Price Moving Down (in 4 Decimals) $\Rightarrow 1-P$

Step 3: Calculate Pay off on each Node of 2nd Period (Maturity)

Step 4: Calculate Value of Option at each Node of 1st Period

$$\text{Value of Option at Node B} = \frac{\text{Expected Value of Option at 2nd Period (Maturity) Considering Node 'D' \& 'E'}}{e^{rt} \text{ OR } (1+R\times T)}$$

$$\text{Value of Option at Node C} = \frac{\text{Expected Value of Option at 2nd Period (Maturity) Considering Node 'F' \& 'G'}}{e^{rt} \text{ OR } (1+R\times T)}$$

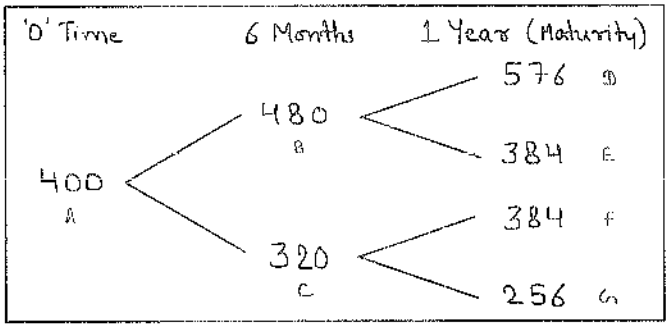
$$\text{Step 5: Value of Option at Beginning} = \frac{\text{Value of Option at Node 'B'} \times P + \text{Value of Option at Node 'C'} \times (1-P)}{e^{rt} \text{ OR } (1+R\times T)}$$

Example:

Current Price of Share of ABC Ltd. is ₹ 400.
Consider 2 time periods of 6 Months each & in each period price of share of ABC Ltd. can move up or down by 20%.
Calculate Value of a 1 Year Call Option if Strike Price is ₹ 450 & Interest Rate is 12% p.a.

Solution:

Step 1: Binomial Tree



Step 2 : Calculation of Risk Neutral Probabilities

$$u = \frac{480}{400} = 1.2 \quad , \quad d = \frac{320}{400} = 0.80$$

$$P = \frac{\left(1 + 0.12 \times \frac{6}{12}\right) - 0.80}{1.2 - 0.} = \frac{1.06 - 0.80}{1.2 - 0.80} \Rightarrow 0.65$$

$$1 - P = 1 - 0.65 \Rightarrow 0.35$$

Step 3 : Calculation of Pay off on each Node of 1st Year (Maturity)

Node D = 576 − 450 ⇒ 126
Node E = 0 (Not Exercisable)
Node F = 0 (Not Exercisable)
Node G = 0 (Not Exercisable)

Step 4 : Calculation of Value of Option at each Node of 6 Months (1st Period)

$$\text{Node B} = \frac{126 \times 0.65 + 0 \times 0.35}{1.06} \Rightarrow 77.26$$

$$\text{Node C} = \frac{0 \times 0.65 + 0 \times 0.35}{1.06} \Rightarrow 0$$

Step 5 : Value of Option at Beginning $= \dfrac{77.26 \times 0.65 + 0 \times 0.35}{1.06} \Rightarrow ₹ 47.38$

Note :

(i) Which type of Interest is to be applied [i.e. Simple or Continuous Compounding] :

→ Specifically given in question

Example : If Compounded Continuously Interest Rate is given in question, then Apply Continuous Compounding Interest.

→ Otherwise, Apply Simple Interest

(ii) If Probabilities of Price Moving Up or Moving Down is given in question, then Ignore the given probabilities & calculate Risk Neutral Probabilities as above to apply Binomial Model.

(iii) Expected Rate of Return on Option :

$$\Rightarrow \frac{\text{Expected Value of Option at Maturity considering the probabilities given in question} - \text{Option Premium [Value of Option at Beginning]}}{\text{Option Premium [Value of Option at Beginning]}} \times 100$$

(iv) Determining Composition of Riskless Hedge Portfolio, i.e. Combination of Share & Option to have a Perfect Hedge :

$$\text{Delta } (\Delta) = \frac{\text{Pay off at Node 'B'} - \text{Pay off at Node 'C'}}{\text{Expected Price of Underlying Share at Node 'B'} - \text{Expected Price of Underlying Share at Node 'C'}}$$

↓

It represents No. of Underlying Shares to be bought by Option Seller for selling 1 Call Option to have a perfect hedge.

(2) Black Scholes Model (BSM) :-

- This Model is applied when Expected Price of Underlying Share is not given in question but Standard Deviation / Variance in Price of Underlying Share is given in question.

- Calculation of Value of Call Option at Beginning :

$$\text{Value of Call Option at Beginning} = \text{Current Price of Underlying Share} \times N(d_1) - \frac{\text{Strike Price}}{e^{RT}} \times N(d_2)$$

Here, R = Interest Rate p.a.

$$T = \frac{\text{No. of months till Maturity}}{12}$$

$N(d_1)$ = Probability of Increase in Price of Underlying Share on Maturity
[Cumulative Area upto d_1 (Z Score$_1$) in Standard Normal Distribution Table]

$N(d_2)$ = Probability of Exercising the Option on Maturity
[Cumulative Area upto d_2 (Z Score$_2$) in Standard Normal Distribution Table]

$$d_1 \left[Z \text{ Score}_1\right] = \frac{\left[\text{Ln} \frac{\text{Current Price of Underlying Share}}{\text{Strike Price}}\right] + \left[\left(R + 0.5 \times \sigma^2\right) \times T\right]}{\sigma \sqrt{T}}$$

$$d_2 \left[Z \text{ Score}_2\right] = d_1 - \sigma \sqrt{T}$$

* Ln means Natural Log
* σ = Standard Deviation
* R & σ are used in decimals in formula

- Calculation of Value of Put Option at Beginning :

$$\text{Value of Put Option at Beginning} = \frac{\text{Strike Price}}{e^{RT}} - \text{Current Price of Underlying Share} + \text{Value of Call Option at Beginning using BSM}$$

Note :

(i) If Dividend Income on Underlying Share is given in question in fixed amount, then Deduct PV of Dividend Amount from Current Price of Underlying Share in all above formulas.

(ii) If Dividend Income on Underlying Share is given in question in Yield %, then Deduct Dividend Yield Rate (Y) from 'R' [Interest Rate] in all above formulas.

Part IV: Swaps [Equity Derivatives]

Equity Swap

- It is exchange of Return % in Equity (Shares Portfolio) with fixed % between 2 Parties on Notional Principal Amount.
- One Party will pay Amount equivalent to Return % in Equity (Shares Portfolio) on Notional Principal. Other Party will pay Amount equivalent to fixed % on Notional Principal.
- Calculation of Net Payment Received | (Paid) on a particular date for fixed Amount Receiver is done as follows:

⇒ Amount received on Notional Principal at fixed % [Notional Principal × fixed %] − Amount Payable on Notional Principal equivalent to Return % in Equity (Shares Portfolio) [Notional Principal × Return % in Equity (Shares Portfolio)]

Part V: Commodity Derivatives

Meaning of Commodity Derivatives

It means Derivative Contract in which Underlying Asset is a Commodity like Rice, Wheat, Copper, Gold etc.

Hedging Commodities using Commodity Futures

- Commodity futures are future Contract on Commodities.
- Steps to be followed to solve the Questions:

Step 1: Which Position should be created in Commodity Futures

If we have Long Position on Commodity [i.e. Bought Commodity] ⇓ Create Short Position on Commodity Futures [i.e. Sell Commodity futures]

If we have Short Position on Commodity [i.e. Sold Commodity] ⇓ Create Long Position on Commodity Futures [i.e. Buy Commodity futures]

Step 2: No. of Commodity Future Contracts to be bought or sold

$$\Rightarrow \frac{\text{Total Quantity of Commodity} \times \text{Hedge Ratio}}{\text{Future Contract Size}}$$

* Hedge Ratio $= r_{sf} \times \frac{\sigma_s}{\sigma_f}$

Here,
σ_s = Standard Deviation of Change in Spot Price of Commodity
σ_f = Standard Deviation of Change in Future Price of Commodity
r_{sf} = Correlation between Change in Spot & Future Price

Note:

(i) If Hedge Ratio is not given in question, then Assume it as 1.

(ii) Exposure in Commodity futures:

Amount of Commodity future Contract to be bought or sold	=	Number of Commodity future Contracts	×	future Contract Size	×	Actual Quoted (Trading) Price of Commodity futures

Step 3: Calculate Net Cash received on Maturity after Hedging

Amount received from actual sale of commodity on maturity [Total Quantity of Commodity × Actual Spot Price]	×××
(±) Gain /(Loss) on Commodity future Contracts [Number of future Contracts × future Contract Size × Difference between Price of future on Maturity (Settlement Price) & Initially Contracted Price]	××× /(×××)
	×××

Step 4: Calculate Effective Price Realised from Sale of Commodity on Maturity after Hedging

$$\Rightarrow \frac{\text{Net Cash Received on Maturity after Hedging}}{\text{Total Quantity of Commodity}}$$

Foreign Exchange Rate Quotation

(i) Meaning :-

- It is the Rate at which one currency will be exchanged for another currency
- It reflects the Price of one currency in relation to another currency
- Example ⇒ 1 $ = ₹ 80

1 $ ⇓ It is Base Currency
- It means currency for which Price / Quotation is given
- → It is the first currency appearing in foreign Exchange Rate Quotation

₹ 80 ⇓ It is Price Currency or Other Currency

In the above example, Interpretation will be done as follows :-
→ If a person wants to purchase 1 $, he has to pay 80 ₹
→ If a person wants to sell 1 $, he will get 80 ₹

- In Simple Words, We can understand it as follows :-
  We go to Market & Ask for Price / Quotation of a Pen, i.e.
  1 Pen = ₹ 50
  It means 50 ₹ is price for 1 Pen
  Here, Pen is the item for which price is quoted
  Similarly, In above example (1 $ = ₹ 80), $ is the item for which 80 ₹ Price is quoted

- If Exchange Rate is quoted in a way which reflects No. of Home Currency for 1 Unit of foreign Currency, then the quotation is called as Direct Quote

Eg:-

For India	For America
1 $ = ₹ 80	1 ₹ = 0.0125 $
1 £ = ₹ 90	1 £ = 1.2 $
1 ¥ = ₹ 0.60	1 ¥ = 0.0071 $

- If Exchange Rate is quoted in a way which reflects No. of foreign Currency for 1 Unit of Home Currency, then the quotation is called as Indirect Quote

Eg:- For India

1₹ = 0.0125 $

1₹ = 0.0111 £

1₹ = 1.667 ¥

For America

1$ = ₹ 80

1$ = 0.8333 £

1$ = 140 ¥

Note:- Direct Quote is reciprocal of Indirect Quote or vice-versa

(2.) Conversion of Amount from One Currency to Another Currency :-

Example :-

1 Pen = ₹ 50

- Convert 100 Pen in ₹ (i.e. Price of 100 Pen)

100 Pen = ₹ 50 × 100 = ₹ 5,000

- Convert 250 ₹ in Pen (i.e. No. of Pen in 250 ₹)

$$\frac{250\ ₹}{50\ ₹} = 5 \text{ pen}$$

Similarly, 1 $ = ₹ 80

- Convert 100 $ in ₹

⇒ 100 × ₹ 80 = ₹ 8,000

- Convert 1600 ₹ in $

⇒ $\frac{1600\ ₹}{80\ ₹} = 20\ \$$

CRUX:- If Base Currency in Exchange Rate & the Currency in which Amount is given is

- Same ⇓ Amount × Exchange Rate
- Different ⇓ $\frac{\text{Amount}}{\text{Exchange Rate}}$

(3.) Presentation of Exchange Rate :-

1 $ = ₹ 80	1 ₹ = 0.0125 $
₹/$ = 80	$/₹ = 0.0125
80 ₹/$	0.0125 $/₹
INR/USD = 80	USD/INR = 0.0125
₹/USD = 80	USD/₹ = 0.0125

But sometimes it is wrongly given in question as follows :

USD/₹ = 80

80, in above example, we will read it as 1 $ = ₹80 irrespective of its presentation

In this scenario, Remember that following Currencies have Higher Value in descending order :-

£ → सबसे बड़ा
$ → Pound से छोटा
₹ → Dollar से भी छोटा
¥ → सबसे छोटी Value Yen की

Process in Foreign Exchange Market

RBI
↓ Regulate for foreign Currency Transactions

Shopkeeper (दुकानदार) ← Banks [Authorised Dealers]

↑ To Buy or Sell foreign Currency

Customers [Importer, Exporter, Company, Firm, etc.]

Types of Exchange Rate in Forex Market

(1.) Bid Rate and Offer (Ask) Rate :-

- Bid Rate is the Rate at which Dealer is willing to Buy the Base Currency (i.e. Lower Rate because Dealer always want to buy anything at low price)

- Offer Rate is the Rate at which Dealer is willing to Sell the Base Currency (i.e. Higher Rate because Dealer always want to sell anything at High Price)

Eg:- 1$ = ₹80 | ₹81
(₹80 ⇓ Bid Rate; ₹81 ⇓ Offer Rate)

- CRUX:-

→ Dealer Base Currency को
- सस्ते में खरीदता है (1$ = ₹80)
- महंगे में बेचता है (1$ = ₹81)

→ Then, It means Customer को Base Currency
- महंगे में Buy करनी पड़ती है (1$ = ₹81)
- सस्ते में Sell करनी पड़ती है (1$ = ₹80)

[Adverse Rate is applied to the Customer]

Note:-

(i) From Exam Point of view, We will always think from Customer's Point of view, i.e. Whether Customer is

Buying Base Currency ⇓ High Rate Applied

Selling Base Currency ⇓ Low Rate Applied

Eg:- 1£ = $1.2 | 1.25

Customer wants to
- Buy £ ⇒ 1£ = 1.25 $
- Sell £ ⇒ 1£ = 1.2 $

Eg:- 1₹ = 100 ¥ | 110 ¥

Customer wants to

Buy ¥	Sell ¥
↓	↓
Sell ₹	Buy ₹
↓	↓
1₹ = 100 ¥	1₹ = 110 ¥

(ii) Only in Case of Fate of Forward Contract Questions, We will think from Dealer's point of view for ease of solving the question

(iii) Sometimes, Dealer will go to Another Dealer in Inter Bank Market for Buying or Selling the Currency; In that Case, Our Dealer will be treated as Customer

(iv.) Spread means difference between Bid Rate & Offer Rate.

Eg- 1$ = ₹ 80 / 81

Spread = 81 − 80 = ₹ 1

(2.) Spot Rate and Forward Rate :-

- Spot Rate is the Rate at which delivery will be made at Spot Date (Same day)
- Forward Rate is the Rate at which delivery will be made at future Date

Example 1 :-

Dealer		
10th Sept.	1$ = ₹ 80 / 81	⟹ Spot Rate
10th Dec. (After 3 Months)	1$ = ₹ 83 / 84.50	⟹ Forward Rate

Note :- Difference blw Spot Rate & Forward Rate is called as Premium or Discount

∴ Forward Rate = Spot Rate + Premium

OR

Spot Rate − Discount

In above example,

Bid Rate Premium = 83 − 80 = ₹ 3

Offer Rate Premium = 84.50 − 81 = ₹ 3.50

Example 2 :-

Dealer		
10th Sept	1$ = ₹ 80 / 81	
10th Dec. (After 3 Months)	1$ = ₹ 79 / 80.50	

∴ Bid Rate Discount = 79 − 80 = ₹ 1

Offer Rate Discount = 80.50 − 81 = ₹ 0.50

Note :- Premium / Discount is presented as follows :-

Premium = first Low, Then High

Eg = ₹ 3 / 3.50

Discount = first High, Then Low

Eg. = ₹ 1 / 0.50

(3) Merchant Rate and Inter Bank Rate :-

Merchant Rate is the Rate at which Transaction is done by the Dealer with the Customers

⇓

Merchant Rate = Inter Bank Rate ± Exchange Margin

Inter Bank Rate is the Rate at which Transaction is done by the Dealer with Another Dealer in Market

⇓

It is regulated by RBI

Example :-

Spot Rate	1 $ = ₹ 80 | 80.50
1 Month forward Premium	₹ 0.30 | 0.35
2 Month forward Premium	₹ 0.55 | 0.73
3 Month forward Premium	₹ 0.72 | 0.91

Exchange Margin is 0.10%

Round off Rates to 4 decimals wherever required

Solution :-

(a) Calculate Spot Buying Rate of $ for Dealer [i.e. Spot Selling Rate of $ for Customer]

Spot Rate (Low)	1 $ =	₹ 80
Less :- Exchange Margin @ 0.10%		₹ 0.08
	1 $ =	₹ 79.92

(b) Calculate Spot Selling Rate of $ for Dealer [i.e. Spot Buying Rate of $ for Customer]

Spot Rate (High)	1 $ =	₹ 80.50
Add :- Exchange Margin @ 0.10%		₹ 0.0805
	1 $ =	₹ 80.5805

(c) Calculate 2 Month forward Buying Rate of $ for Dealer [i.e. 2 M F Selling Rate of $ for Customer]

Spot Rate (Low)	1 $ =	₹ 80
Add :- Premium (Low)		₹ 0.55
	1 $ =	₹ 80.55
Less :- E.M. @ 0.10%		₹ 0.0806
	1 $ =	₹ 80.4694

(d) Calculate 2 Month forward Selling Rate of $ for Dealer [i.e. 2 Mf Buying Rate of $ for Customer]

Spot Rate (High)	1$ =	₹ 80.50
Add:- Premium (High)		₹ 0.73
	1$ =	₹ 81.23
Add:- E.M. @ 0.10%		₹ 0.0812
	1$ =	₹ 81.3112

* If in above example, Instead of forward Premium, Discount is given as:-

1 Month forward Discount	=	₹ 0.35 / 0.30
2 Month forward Discount	=	₹ 0.73 / 0.55
3 Month forward Discount	=	₹ 0.91 / 0.72

(e) Calculate 2 Month forward Buying Rate of $ for Dealer [i.e. 2 Mf Selling Rate of $ for Customer]

Spot Rate (Low)	1$ =	₹ 80
Less:- Discount (High)		₹ 0.73
	1$ =	₹ 79.27
Less:- E.M. @ 0.10%		₹ 0.0793
	1$ =	₹ 79.1907

(f) Calculate 2 Month forward Selling Rate of $ for Dealer [i.e. 2 Mf Buying Rate of $ for Customer]

Spot Rate (High)	1$ =	₹ 80.50
Less:- Discount (Low)		₹ 0.55
	1$ =	₹ 79.95
Add:- E.M. @ 0.10%		₹ 0.0799
	1$ =	₹ 80.0299

Notes:-

(i) If in the question, Contracted Rate or Rate Booked with Customer is given, then it means it is the final Rate decided after considering the Exchange Margin [i.e. No Adjustments will be done in this Rate]

(ii) If forward Rate is required for a BROKEN PERIOD (i.e. Period for which forward Premium | Discount or forward Rate is not given)

↓

Then Premium | Discount of such required BROKEN PERIOD is calculated using Interpolation

&

forward Rate is then calculated accordingly

Example :-

Spot Rate 1$ = ₹ 80

1 MF Premium ₹ 0.25
2 MF Premium ₹ 0.30
3 MF Premium ₹ 0.50

Calculate forward Rate for 2 Months 15 days.

Solution :-

Premium for 15 days after 2 Months is $\Rightarrow \frac{₹0.50 - ₹0.30}{30 \text{ days}} \times 15 \text{ days}$

$\Rightarrow$ ₹ 0.10

∴ Prem. for 2 Months 15 days is $\Rightarrow$ ₹ 0.30 + ₹ 0.10 = ₹ 0.40

∴ forward Rate for 2 Months 15 day is $\Rightarrow$ ₹ 80 + ₹ 0.40 $\Rightarrow$ ₹ 80.40

(iii) Interpretation of different Types of Presentation of Rates given in Questions :-

Example 1 :-

On 10th September, following Rates are quoted

Spot Rate for 10th September ⇐ Spot	1$	= ₹ 80 / 80.50
forward Rate for Any Other Day of September ⇐ Spot | September	1$	= ₹ 80.25 | 80.70
forward Rate for Any Day of October ⇐ Spot / October	1$	= ₹ 80.60 | 80.75
forward Rate for 20th Nov ⇐ Spot / 20th November	1$	= ₹ 80.80 / 80.90

Example 2 :-

Spot Rate	1$ = ₹ 80.3011 / 25	$\Rightarrow$ 1$ = ₹ 80.3011 / 80.3025
1 Month forward Rate	1$ = ₹ 80.3017 | 120	$\Rightarrow$ 1$ = ₹ 80.3017 / 80.3120
2 Month forward Rate	1$ = ₹ 80.3021 | 3025	$\Rightarrow$ 1$ = ₹ 80.3021 / 80.3025

i.e. Replace the Points give from Last digits in Decimal

Example 3 :-

Sometimes Premium | Discount in Question is given in Points (Swap Points), then Premium | Discount will be added or deducted from last digits in Decimals.

Eg:- 1$ = ₹ 80 | 80.50

1MF Premium 25 | 75

Dealer Buying Rate ($)

1$ = ₹ 80.00

(+) Prm. .25

1$ = ₹ 80.25

Dealer Selling Rate ($)

1$ = ₹ 80.50

(+) Prm. .75

1$ = ₹ 81.25

Eg:- 1$ = ₹ 80.1525 / 80.3575

1MF Prm. 120 | 150

Dealer Buying Rate ($)

1$ = ₹ 80.1525

(+) Prm. .0120

1$ = ₹ 80.1645

Dealer Selling Rate ($)

1$ = ₹ 80.3575

(+) Prm. .0150

1$ = ₹ 80.3725

(iv.) If Transit Period is given in question, then Exchange Rate will be Rate of Lower Month or Upper Month whichever is Beneficial to Dealer

Example:-

Spot Rate	1$ = ₹ 80.80 / 80.81
1 Month forward	₹ 0.10 / 0.11
2 Month forward	₹ 0.21 / 0.22
3 Month forward	₹ 0.32 / 0.33

Transit Period is 20 days. Bill Submitted by Customer of 60 days for selling of $

Solution:-

Calculation of Rate for Buying of $ by Dealer [i.e. Selling of ₹ by Customer]

Spot Rate 1$ = ₹ 80.80

Add:- Premium (Lower Month) ₹ 0.21

1$ = ₹ 81.01

Methods for Calculating Annual Premium or Discount (%)

Method I :- Using Exchange Rate Differential :-

$$\text{Annual Prm. / Disc. for Base Currency} = \frac{\text{Forward Rate} - \text{Spot Rate}}{\text{Spot Rate}} \times 100 \times \frac{365/12}{n}$$

Here, n = No. of days or Months for which forward Rate is given

- If Above Answer is
  - Positive ⇓ then it is Premium in Base Currency
  - Negative ⇓ then it is Discount in Base Currency

Example :-

Spot Rate 1 $ = ₹ 80

1 Year forward Rate 1 $ = ₹ 84

$$\therefore \text{Annual Prm. for \$} = \frac{84-80}{80} \times 100 \times \frac{1}{1} \Rightarrow 5\%$$

- Above formula provides Prm. / Disc. for Base Currency (i.e. If Quotation is given in $, then Prm. / Disc. will be calculated for $)
- If We have to Calculate Prm. / Disc. for Other Currency / Price Currency i.e. ₹, then Convert Quotation in ₹

Example :-

Spot Rate 1 ₹ = 0.0125 $

1 Year forward Rate 1 ₹ = 0.0119 $

$$\therefore \text{Annual Disc. for ₹} = \frac{0.0119 - 0.0125}{0.0125} \times 100 \times \frac{1}{1} \Rightarrow 4.8\%$$

Method II :- Using Interest Rate Differential or Inflation Rate Differential

$$\text{Annual Prm. / Disc. for Base Currency} = \frac{Int_O - Int_B}{1 + Int_B} \quad \text{OR} \quad \frac{Inf_O - Inf_B}{1 + Inf_B}$$

- Here, Assume Base Currency as the one for which you want to calculate Prm. / Disc.

- If Above Answer is

Positive ⇓ then it is Premium in Base Currency

Negative ⇓ then it is Discount in Base Currency

Example:-

Interest Rate : India = 10% p.a.
USA = 4% p.a.

$$\therefore \text{Annual Prm. for \$} = \frac{10\% - 4\%}{1 + 4\%} \Rightarrow \frac{0.10 - 0.04}{1 + 0.04} \Rightarrow \frac{0.06}{1.04} \Rightarrow 5.77\%$$

$$\text{Annual Disc. for ₹} = \frac{4\% - 10\%}{1 + 10\%} \Rightarrow \frac{0.04 - 0.10}{1.10} \Rightarrow \frac{-0.06}{1.10} \Rightarrow 5.45\%$$

Notes:-

(i.) If 1 Currency is in Premium, then Other Currency will always be at Discount or vice-versa

(ii.) If Both Bid & Offer Rate is given for Spot & forward, then Prm./Disc. is to be calculated for Both Bid & Offer Rate Separately

Calculation of forward Rate on the basis of Annual Premium / Discount

We will do following Steps:-

(i.) Take Annual Prm./Disc. % as given

(ii.) Convert it into Prm./Disc.(%) for required Period

$$\frac{\text{Annual Prm./Disc \%}}{365/12} \times n$$

Here, n = No. of days or Months of forward Rate

(iii.) Now, Calculate forward Rate for the required period

Forward Rate = Spot Rate + Premium

OR

Spot Rate - Discount

Example :-

Spot Rate 1 $ = ₹ 80

Annual Prm. for $ is 5%

Cal. Forward Rate for 3 Months

Solution :-

$ Prm. for 3 months = $5\% \times \frac{3}{12} = 1.25\%$

F.R. for 3 months :

Spot Rate	1 $ =	₹ 80
(+) Prm. @ 1.25%		₹ 1
	1 $ =	₹ 81

Example :-

Spot Rate 1 ₹ = 0.0125 $

Annual Disc. for ₹ is 4.8%

Cal. FR for 3 Months

Solution :-

₹ Disc. for 3 Months = $4.8\% \times \frac{3}{12} = 1.2\%$

FR for 3 Months :

Spot Rate	1 ₹ =	0.0125 $
(-) Dis. @ 1.2%		0.00015 $
	1 ₹ =	0.01235 $

Note :- If in question, Prm. / Disc. % is given for particular period, then Calculate forward Rate accordingly.

Eg :- 3 Months Premium (%) = 1.3%

⇓

Then it means Prm. is for 3 Months Only → Not Annual

Methods for Calculating Estimated Forward Rate OR Expected Spot Rate

(i) **Probability Based Forecasting :-**

$$\text{Expected Spot Rate}_1 \times P_1 + \text{Expected Spot Rate}_2 \times P_2 + \dots + \text{Expected Spot Rate}_n \times P_n$$

(ii) **Appreciation | Depreciation OR Gain | Decline (%) in Rate is given in Question :-**

Eg :- 1st Jan 1$ = ₹ 80

30th June Expected Spot Rate = ?

- If gain | appreciation in $ is 5%

  1$ = ₹ 80 × 1.05

  1$ = ₹ 84

- If decline | depreciation in $ is 5%

  1$ = ₹ 80 × 0.95

  1$ = ₹ 76

- If gain in ₹ is 5%

  ⇓

  So, it means decline in $ by 5%

  1$ = ₹ 80 × 0.95

  1$ = ₹ 76

- If decline in ₹ is 5%

  ⇓

  So, it means gain in $ by 5%

  1$ = ₹ 80 × 1.05

  1$ = ₹ 84

CRUX:-

If Gain / Appreciation % is given for
- Base Currency ⇓ Add such %ge in Spot Rate
- Other Currency ⇓ Less such %ge in Spot Rate

If Decline / Depreciation % is given for
- Base Currency ⇓ Less such %ge in Spot Rate
- Other Currency ⇓ Add such %ge in Spot Rate

(iii.) **Interest Rate Parity (IRP) Theory:-**

Let us understand this by an example

Spot Rate	1 $	=	₹ 80
Interest Rate	4% p.a.		10% p.a.

$1\$ (1+0.04) = ₹ 80 (1+0.10)$

$1\$ (1.04) = ₹ 80 (1.10)$

$1\$ = \frac{₹ 80 (1.10)}{1.04}$

$\boxed{1\$ = ₹ 84.62}$

$₹ 84.62 = \frac{₹ 80 (1.10)}{1.04}$

$\boxed{\frac{₹ 84.62}{₹ 80} = \frac{1.10}{1.04}}$

⇓

$$\frac{\text{Expected Spot Rate}_t}{\text{Spot Rate}} = \frac{1 + \text{Interest Rate}_{\text{other Currency}}}{1 + \text{Interest Rate}_{\text{Base Currency}}}$$

Now, formula will be as follows:-

If Expected Spot Rate is to be calculated for less than 1 Year ⇓

$$\frac{f_t}{s} = \frac{1 + R_o \times t}{1 + R_B \times t}$$

If Expected Spot Rate is to be calculated for More than 1 Year ⇓

$$\frac{f_t}{s} = \frac{(1 + R_o)^t}{(1 + R_B)^t}$$

Here,

f_t = Expected forward Rate or Expected Spot Rate

S = Spot Rate of Today

R_o = Interest Rate of Other Currency

R_B = Interest Rate of Base Currency

t = Required Time, i.e. $\frac{\text{No of days/Months}}{365/12}$

Here,

f_t = Expected forward Rate or Expected Spot Rate

S = Spot Rate of Today

R_o = Interest Rate of Other Currency

R_B = Interest Rate of Base Currency

t = Required Time, i.e. No. of Years

(iv) Purchasing Power Parity (PPP) Theory :-

$$\frac{f_t}{S} = \frac{1 + \text{Inflation Rate}_{\text{other Currency}}}{1 + \text{Inflation Rate}_{\text{Base Currency}}}$$

Now, from IRP & PPP Theory, following Interpretation can be done :-

$$\frac{f_t}{S} = \frac{1 + Int_o}{1 + Int_B} = \frac{1 + Inf_o}{1 + Inf_B}$$

$$\frac{F - S}{S} = \frac{(1 + Int_o) - (1 + Int_B)}{1 + Int_B} = \frac{(1 + Inf_o) - (1 + Inf_B)}{1 + Inf_B}$$

$$\frac{F - S}{S} = \frac{1 + Int_o - 1 - Int_B}{1 + Int_B} = \frac{1 + Inf_o - 1 - Inf_B}{1 + Inf_B}$$

$$\frac{F - S}{S} = \frac{Int_o - Int_B}{1 + Int_B} = \frac{Inf_o - Inf_B}{1 + Inf_B}$$

$\Downarrow$ Exchange Rate Differential | $\Downarrow$ Interest Rate Differential | $\Downarrow$ Inflation Rate Differential

$\Downarrow$

This is known as International fishes Effect

$\downarrow$

It reflects Change in Exchange Rate

Notes:-

(i) Lower Interest Rate / Inflation Rate Currency will always be at Premium

&

Higher Interest Rate / Inflation Rate Currency will always be at Discount

(ii) Assumption regarding Interest Rate in SFM:-

- Interest Rate given in question will always be Annual Interest Rate unless specifically given
- Sometimes, following is given in question
  - → x months Borrowing Rate
  - → x months Interest Rate
  - → x months LIBOR / MIBOR / PLR
  - → Mature in x months Rate

  then it does not mean that Interest Rate is not Annual

  ⇓

  It is Annual Rate

Examples:-

Interest Rate 10% p.a. ⇒ Annual

Interest Rate 1% p.m. ⇒ Monthly

Interest Rate 10% ⇒ Annual

Interest Rate for 6 Months Borrowing is 10% ⇒ Annual

Fate of forward Contract (Forward Contract Settlement)

DELIVERY

- Due Date
- Early
- Late (Within 3 days of Maturity)

CANCELLATION

- Due Date
- Early
- Late (Within 3 days of Maturity)
- Automatic (On 3rd Day after Maturity if Customer does not come)

EXTENSION

- Due Date
- Early
- Late (Within 3 days of Maturity)

- Exact Execution ⇒ Delivery on Due Date
- Default by Customer ⇒ All Cases except Delivery on Due Date
- In Case of Default by Customer, Profit due to default will be given to Customer or Loss due to default will be charged from Customer.

But In case of Automatic Cancellation, Loss will be charged from Customer & Profit will not be given to Customer

- Profit / Loss due to default by Customer will include following :-

(i.) SWAP GAIN / LOSS :-

→ It is difference between two transaction done with Inter Bank Market by Dealer on same day having Reverse Nature (i.e. one transaction of Buy & another of Sale) & for different time frame

(ii.) Exchange Difference (Cancellation Gain / Loss) :-

→ Gain or Loss due to Cancellation request by Customer

→ It is difference between Initial Transaction entered with Customer by Dealer & Transaction entered with Inter Bank Market by Dealer due to Cancellation request from Customer

→ As per FEDAI Rule, Exchange Margin will be considered on the transaction entered by Dealer in the Inter Bank Market due to Cancellation request from Customer

(iii.) Interest :-

→ Interest will be in Early Settlement (Only Early Delivery) or Late Settlement (Late Delivery, Late Cancellation, Automatic Cancellation, Late Extension) Cases Only

→ In Case of Early Settlements :-
- Find Cash Inflow & Outflow on Early Date
- Charge Interest on Net Inflow or Net Outflow from Early Date to Due Date

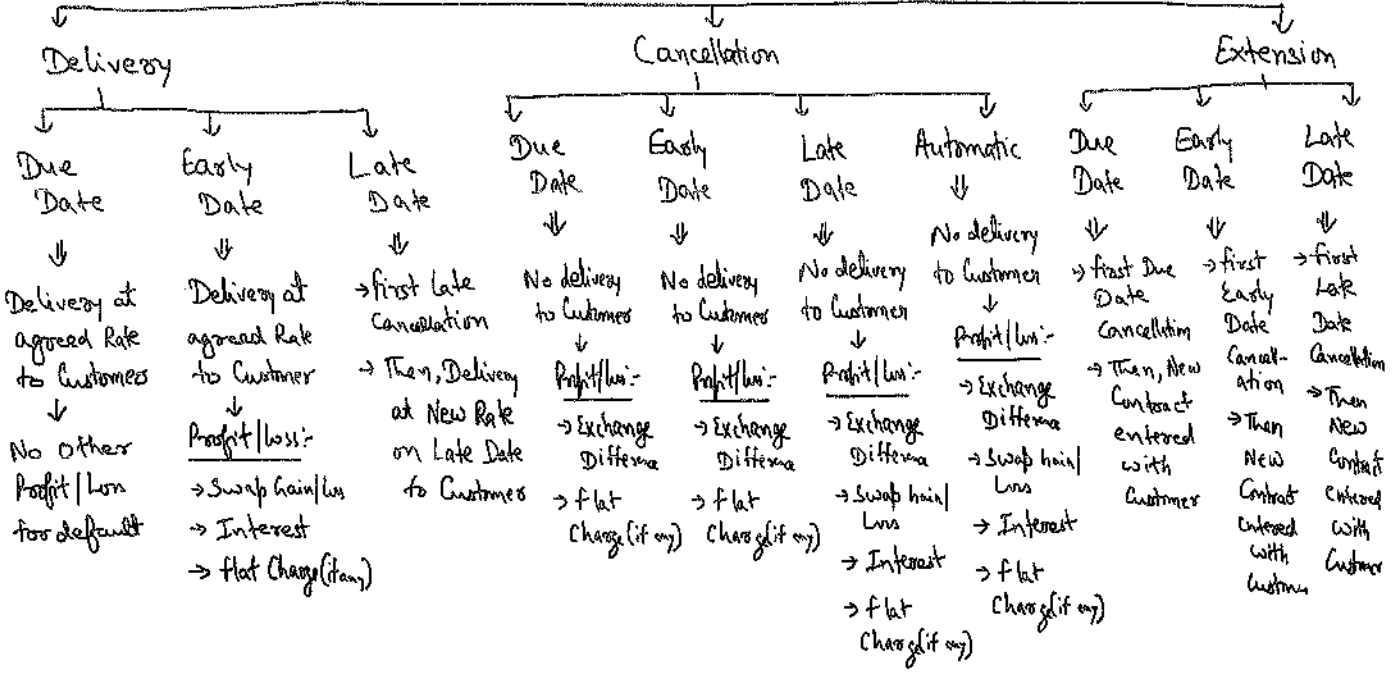
→ In Case of Late Settlements :-
- find Cash Inflow & Outflow on Due Date
- Charge Interest on Net Inflow or Net Outflow from Due Date to Late Date

(iv.) Flat Charge :-

→ fix Amount Charged by Dealer due to default of Customer

→ Consider it only if given in question

- Summary of Process in Each Case :-



Note :- If Customer comes to Dealer after Automatic Cancellation for Delivery or Extension, then New Contract for such request will be entered with Customer on such date.

Foreign Currency Risk Hedging Techniques

(1.) Forward Contract :-

(i.) Should forward Contract to be done or not

OR

Advise the Company on forward Covers

⇓

Compare the Payment under forward Rate with Expected Spot Rate of Settlement Date

(ii.) Profit / Loss to Co. if it wants to hedge through forward Contract

⇓

Calculate difference between Payment under forward Rate and Expected Spot Rate of Settlement Date

(iii.) Calculation of Expected Loss & How it can be hedged by forward Contract
OR
How position will change by forward Contract

- For Expected Loss ⇓ Calculate difference between Payment under Expected Spot Rate of Settlement Date and Starting Spot Rate
- For Hedging by forward Contract ⇓ Calculate difference between Payment under forward Rate and Starting Spot Rate

(iv.) Is decision to take forward Cover Justified

- Calculate difference between Payment under forward Rate and Starting Spot Rate
- Calculate difference between Payment under Actual Spot Rate of Settlement Date and Starting Spot Rate

↓

Compare both differences & then give answer accordingly

(2.) Leading OR Lagging Payment Decision :-

- It is a choice given by Supplier. It is not a case of default
- **Leading Payment (Early Payment):**
  - → Take Invoice Amount & Less Discount given by Supplier (if any)
  - → Then Convert it into Home Currency at Leading Payment Date Exchange Rate
  - → Assume No Money in hands with Importer, So he will borrow money from the Bank to make the payment and Interest will be charged on it.
    [It is Opportunity Loss. Hence, Interest will be charged from Leading Payment Date to Lagging Payment Date]
- **Lagging Payment (Late Payment):**
  - → Take Invoice Amount & Add Interest charged by supplier (if any)
  - → Then Convert it into Home Currency at Lagging Payment Date Exchange Rate

(3) Money Market Cover / Hedging :-

In this technique →
- If We have foreign Currency Liability ⇒ Then We have to Create foreign Currency Asset
- If We have foreign Currency Asset ⇒ Then We have to Create foreign Currency Liability

(i) Money Market Cover Process in case of foreign Currency Liability [i.e. Process for Importer who has to pay in foreign Currency] :-

- Since It is foreign Currency Liability ⇒ Hence, We have to Creak foreign Currency Asset
- At Spot :-
  - → Borrow Home Currency
  - → Convert it into foreign Currency
  - → Invest it into foreign Country
- At Maturity :-
  - → Withdraw foreign Currency Investment with Interest and Pay foreign Currency Liability
  - → Repay Home Currency Borrowing with Interest ⇒ This is the Actual Outflow
- Steps for Solving Practical Questions :-

Example :- Mr. A (Indian Importer) who has to pay $ 1 Lakh after 3 months

Spot Rate : 1 $ = ₹ 70 | 70.50

Interest Rate : India ⇒ 10% | 12%

USA ⇒ 4% | 5%

Step 1 :- Find Amount of foreign Currency (Eg. $) to be paid

Eg :- $ 1 Lakh after 3 months

Step 2 :- Calculate Amount to be deposited in foreign Currency (Eg $) on Spot Date so that on Maturity its value become equals to Amount of foreign Currency Liability

Eg :- $MV = P(1+R)$

$$P = \frac{MV}{1+R}$$

$$P = \frac{\$\ 1,00,000}{1 + 0.04 \times \frac{3}{12}} \Rightarrow \frac{\$\ 1,00,000}{1+0.01} \Rightarrow 99,009.90\ \$$$

Step 3:- Calculate Amount to be Borrowed in Home Currency (Eg. ₹) on Spot Date to buy Foreign Currency (Eg. $) to be deposited as calculated in above step (Eg. 99009.90 $)

Eg:- ₹ Amt. to be borrowed ⇒ 99,009.90 $ × ₹ 70.50
⇒ ₹ 69,80,198

Step 4:- Calculate Amount of Home Currency (Eg. ₹) Borrowing to be Repaid with Interest on Maturity Date (This is the Actual Outflow)

Eg:-

Principal Borrowed	₹ 69,80,198
Add:- Interest @ 12% for 3 Months	₹ 2,09,406
Actual Outflow	₹ 71,89,604

(ii) Money Market Cover Process in case of foreign Currency Asset [i.e. Process for Exporter who has to receive in foreign Currency]

- Since It is foreign Currency Asset ⇒ Hence, We have to Create foreign Currency Liability
- At Spot:-
  - → Borrow foreign Currency
  - → Convert it into Home Currency
  - → Invest it into Home Country
- At Maturity:-
  - → Receive foreign Currency Asset and Repay foreign Currency Borrowing with Interest
  - → Withdraw Home Currency Investment with Interest ⇒ This is the Actual Inflow
- Steps for Solving Practical Questions:-

Example:- Mr. A (Indian Exporter) will get $ 1 Lakh after 3 months

Spot Rate: 1$ = ₹ 70 / 70.50

Interest Rate: India ⇒ 10% / 12%

USA ⇒ 4% / 5%

Step 1:- Find Amount of foreign Currency (Eg. $) to be received

Eg:- $ 1 Lakh after 3 months

Step 2:- Calculate Amount to be Borrowed in foreign Currency (Eg. $) on Spot Date so that on Maturity its value become equals to Amount of foreign Currency Asset.

Eg:- $MV = P(1+R)$

$$P = \frac{MV}{1+R}$$

$$P = \frac{\$\ 1,00,000}{1+0.05\times\frac{3}{12}} \Rightarrow \frac{\$\ 1,00,000}{1+0.0125} \Rightarrow \$\ 98765.43$$

Step 3:- Convert Amount Borrowed in Foreign Currency (Eg. $) into Home Currency (Eg ₹) on Spot Date and Invest it into Home Country

Eg:- ₹ to be Invested ⇒ 98765.43 $ × ₹ 70

⇒ ₹ 69,13,580

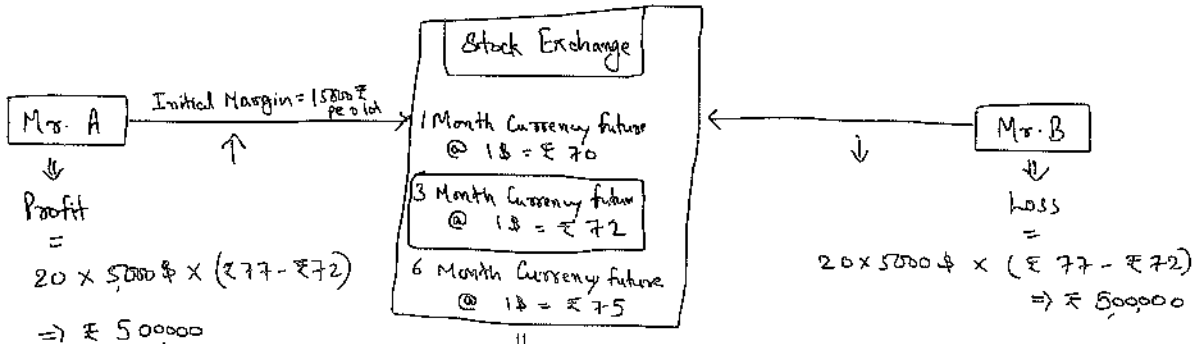
Step 4:- Withdraw Home Currency (Eg. ₹) Investment with Interest on Maturity Date (This is the Actual Inflow)

Eg:-

Principal Invested	₹ 69,13,580
Add:- Interest @ 10% for 3 months	₹ 1,72,840
Actual Inflow	₹ 70,86,420

Note:- If Two Interest Rates of a Country is given, then It means Lower Interest Rate is for Deposit (Investment) & Higher Interest Rate is for Borrowing (Loan)

(4) Currency Futures:-



Lot Size ⇒ 5000 $

No. of Lot ⇒ $\frac{1,00,000\ \$}{5,000\ \$}$ = 20 Lots

On Maturity, Currency future Price 1$ = ₹ 77

Total Initial Margin = 15,000 ₹ × 20 ⇒ ₹ 3,00,000

Steps for Solving Practical Question :-

Step 1 :- Which Currency to Buy or Sell

Eg :- Indian Co. needs to pay $ 1 Lakh after 3 months

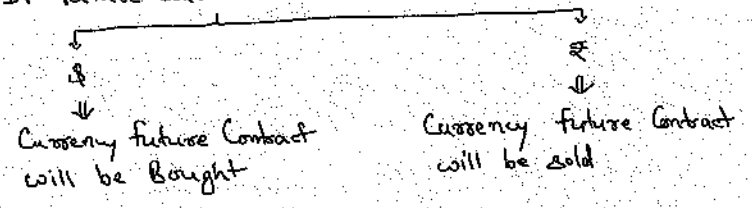
$ ⇒ Buy , ₹ ⇒ Sell

Step 2 :- Now, Check whether Currency future Contract to be Bought or Sold

Eg :- In Continuation to above example

↓

If future Contract Lot Size is in



Step 3 :- Selection of Rate at which future Contract coill be done Initially

⇓

It will be the Rate Currently Trading on Spot Date for the Currency future Contract of the required period

Step 4 :- No. of future Contracts to be Bought or Sold

⇓

$$\frac{\text{Total Exposure Amount}}{\text{Lot Size}}$$

Eg :- 1 Lakh $ to be paid , Lot Size = 1000 $

∴ No. of future Contracts or Lots = $\frac{100000\ \$}{1000\ \$}$ = 100 Lots

Note :- If Exposure Amount Currency is different than Lot Size Currency, then Convert Total Exposure Amount into Lot Size Currency using Currency future Contract Rate Selected in Step 3

Eg :- 1 Lakh $ to be paid after 3 months, Lot Size = ₹ 40000 ,

3 Months future Rate @ 1$ = ₹ 72

∴ No. of Lots = $\frac{100000\ \$ \times ₹\ 72}{₹\ 40000} \Rightarrow \frac{₹\ 7200000}{₹\ 40000} \Rightarrow$ 180 Lots

Note :- Any fraction Part in Contracts | Lots is ignored

Step 5 :- Calculation of Initial Margin to be deposited :-

→ Select Initial Margin for the required period of Currency future Contract

→ It is assumed as Margin Per Contract or Lot

→ It will be refunded on Maturity of future Contract

Step 6:- Calculations on Maturity / Settlement Date :-

Total 3 Calculations will be done as follows ⇒

Actual Buying / Selling of Exposure Amount Currency	×××
Interest Cost on Initial Margin Amount deposited with Stock Exchange	×××
Profit / Loss on Currency future Contract	×××
Final Amount through future Contract	×××

(i) Actual Buying / Selling of Exposure Amount Currency will be done at Actual Spot Rate of Maturity Date

(ii) Interest Cost on Initial Margin will be charged at Borrowing Rate for the future Contract Period

⇒ Initial Margin Amount as calculated in Step 5 × Interest Rate p.a. × Time Period of future Contract

(iii) Profit / Loss on Currency future Contract

If Initially future Contract is

- **Bought** → Then We will Sell it at future Rate on Maturity Date
- **Sold** → Then We will Buy it at future Rate on Maturity Date

* Difference between these Initial & Maturity Date Buying & Selling Rate will be Profit / Loss on future Contract

- **If Lot Size is in Company's Home Currency**
  - Profit / Loss = No. of Lots × Contract Size × Difference in Sell & Buy Rate of future
  - ⇓ then Convert this Profit / Loss in Company's Home Currency at Actual Spot Rate of Maturity Date
- **If Lot Size is Not in Company's Home Currency**
  - Profit / Loss = No. of Lots × Contract Size × Difference in Sell & Buy Rate of future

Note:- If Selling Rate of future is Higher than Buying Rate of future, then it is Profit. Otherwise, It is Loss.

(5) Currency Options :-

Option Premium →

	Option Buyer (Customer)	Option Seller (Dealer)
Call Option	Right to Buy Currency at Strike Price	Obligation to Sell Currency at Strike Price
Put Option	Right to Sell Currency at Strike Price	Obligation to Buy Currency at Strike Price

- Features of Option Contract :-
  - → Fix Lot Size
  - → Different Strike Price with different Premium possible
  - → Strike Price / Exercise Price : Price at which Option can be exercised on Maturity
  - → Option Premium / Option Price : It is paid by Option Buyer at beginning to buy the option
  - → Exercise of option by Option Buyer

Call Option
⇓
It will be exercised by Option Buyer only if Price at Maturity > Strike Price under option

Put option
⇓
It will be exercised by Option Buyer only if Price at Maturity < Strike Price under Option

- Steps for Solving Practical Questions :-

Step 1 :- Which Currency to Buy or Sell

Eg :- Indian Co. needs to pay $ 1 Lakh after 3 Months

$ Buy , ₹ Sell

Step 2 :- Now, Check Whether to Buy Call Option Contract or Put Option Contract

Eg :- In Continuation to above Example

⇓

If Option Contract Lot Size is in

$ ⇓ Buy Call Option

₹ ⇓ Buy Put Option

Step 3 :- Calculate No. of Option Contracts to be bought

$$\Downarrow$$

$$\frac{\text{Total Exposure Amount}}{\text{Lot Size}}$$

Eg :- 1 Lakh $ to be paid, Lot Size = 200 $

$$\therefore \text{No. of Lots} = \frac{1,00,000\ \$}{200\ \$} = 500 \text{ Lots}$$

Note :-

→ If Exposure Amount Currency is different than Lot Size Currency, then Convert Total Exposure Amount into Lot Size Currency using Option Strike Price

Eg :- 1 Lakh $ to be paid after 3 months, Lot Size = ₹ 2,500, Strike Price ⇒ 1₹ = 0.0125 $

$$\therefore \text{No. of Lots} = \frac{1,00,000\ \$ \ / 0.0125}{₹\ 2,500} = \frac{₹\ 80,00,000}{₹\ 2,500} = 3,200 \text{ Lots}$$

→ We will consider only Whole No. of Option Contracts (i.e. Any fractional Part in Contracts / Lots is ignored)

→ For fraction Part, Forward Contract is taken

→ If Lot / Contract Size is not given, Assume it as 1

→ If Lot Size is in which Currency not given, then check Premium on Option

$$\Downarrow$$

If Premium is
- 1 $ = ₹ 10 ⇒ then it means Lot Size is in $
- ₹ 10 ⇒ It means it is per $ ⇒ then it means Lot Size is in $

Step 4 :- Calculate Covered & Uncovered Amount :-

→ Amount Covered through Option Contracts

⇒ No. of Lot × Contract Size

→ Amount Uncovered (for which Forward Contract is to be taken)

If Exposure Amount Currency is Same as Lot Size Currency	If Exposure Amount Currency is different than Lot Size Currency
$\Downarrow$	$\Downarrow$
Total Exposure Amount	Total Exposure Amount
−	−
Amount Covered through Option	Amount Covered through Option Converted at Option Strike Price

Step 5 :- Calculation of Final Payment through Option Contract Hedging :-

Total 4 Calculations will be done as follows:

Premium on Currency Options	xxx
Interest Cost on Option Premium	xxx
Payment of Amount Covered through Option Contract	xxx
Payment of Uncovered Amount	xxx
Final Payment through Option Contract	xxx

(i) Premium on Option Contracts :-

- If Lot Size is in Company's Home Currency
  - ⇓
  - No. of Lot × Lot Size × Premium Amount
  - ⇓
  - Then Convert this Premium in Company's Home Currency at Beginning Spot Rate
- If Lot Size is Not in Company's Home Currency
  - ⇓
  - No. of Lot × Lot Size × Premium Amt.

(ii) Interest Cost on Premium will be charged at Borrowing Rate for option Maturity Period

⇓

Premium Amount × Interest Rate p.a. × Time Period of Option Contract

(iii) Payment of Amount Covered through Option Contract

- If Option is Exercised on Maturity Date
  - If Lot Size is in Company's Home Currency
    - ⇓
    - No. of Lot × Lot Size
  - If Lot Size is Not in Company's Home Currency
    - ⇓
    - No. of Lot × Lot Size × Strike Price
- If Option is Not Exercised on Maturity Date
  - ⇓
  - Payment for Covered Amount will be done at Spot Rate of Maturity Date

Note:-

→ If Spot Rate of Maturity Date is not given in question, then it is assumed that Option is Exercised

→ If Range of Expected Prices on Maturity Date is given in question, then Compare Strike Price with each Expected Price & Calculate Payment accordingly

Eg:- 1 Lakh $ to be paid after 3 months, Lot Size = 200 $,

No. of Lots ⇒ $\frac{1 \text{ Lakh } \$}{200 \$} = 500$ Lots

Buy Call Option, Strike Price ⇒ 1$ = ₹ 40

Expected Prices on Maturity:

Price	Probability
1$ = ₹ 35	0.3
1$ = ₹ 38	0.2
1$ = ₹ 40	0.4
1$ = ₹ 43	0.1

Sol:-

Expected Price	Option Exercise or Not	Payment Rate	Total Expected Payment (₹)	Prob.	Total Exp. Payt × Prob.
35	No	35	3,50,00,000	0.3	10,50,000
38	No	38	38,00,00,000	0.2	76,00,000
40	No	40	40,00,00,000	0.4	16,00,000
43	Yes	40	40,00,000	0.1	4,00,000
					₹ 38,10,000

(iv.) Payment of Uncovered Amount will be done at forward Rate using Forward Contract

Arbitrage Process in Forex

It is a process to earn Riskless Profits

(1) Geographical Arbitrage:-

- It is possible due to different exchange Rate of Same Currency in different Markets
- It is of Two Types as follows:-

(i.) Two Point Arbitrage:-

In this, Arbitrageur will Buy in Market having Low Rate and will Sell in Market having High Rate.

Example :-

I^st Market : 1$ = ₹ 40.25 | 40.50

II^nd Market : 1$ = ₹ 40.52 | 40.62

Solution :-

Arbitrageur will Buy $ in I^st Market @ 1$ = ₹ 40.50

Arbitrageur will Sell $ in II^nd Market @ 1$ = ₹ 40.52

Profit 1$ = ₹ 0.02

(ii.) Three Point (Triangular) Arbitrage :-

- It contains 3 Markets

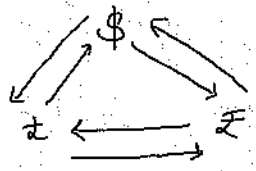
Example :- Suppose Initially Arbitrageur has 1 Lakh $

Rates in 3 Markets

1$ = ₹ 80 in Mumbai

1£ = ₹ 100 in London

1£ = $ 1.20 in New York



Solution :- Arbitrageur will

Either → Convert $ → ₹ → £ → $

OR → Convert $ → £ → ₹ → $

- If Profit in One Side, then there will be Loss in Another Side
- If on Selection of a Side Loss comes, then Solve it by Another Side Also

(2.) Covered Interest Arbitrage :-

- It is possible due to Interest Rate difference and Exchange Rate difference between two currencies.
- In this, Arbitrageur will Borrow in One Currency & Invest in Another Currency

Arbitrage Process :-

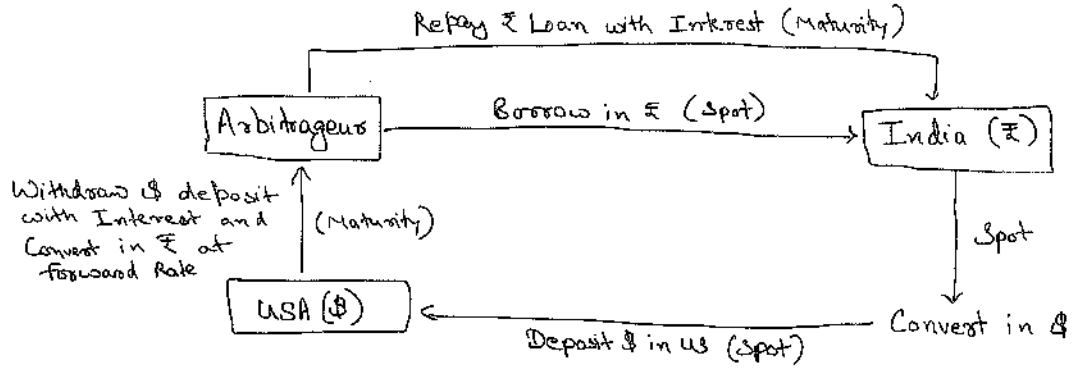
Example :-

Spot Rate 1$ = ₹ 40

1 Year forward Rate 1$ = ₹ 45

Interest Rate : India = 12% p.a.
USA = 4% p.a.

Assume Arbitrageur will borrow ₹ 4000000 or $ 100000



At Spot (0 time) :-

Step 1 :- Identify the Currency in which Arbitrageur should Borrow :-

(i) Calculate Interest Rate Differential (i.e. Difference between Interest Rate of Both Currencies)

Eg:- Interest Rate Differential = 12% - 4% = 8%

(ii) Calculate Exchange Rate Differential (i.e. Annual Premium / Discount)

Eg:- Exchange Rate Differential = $\frac{45-40}{40} \times 100 \times \frac{12}{12}$

$\Rightarrow$ 12.50%

(iii) Compare Interest Rate Differential with Exchange Rate Differential

↓

Decision will be made on the basis of High Differential

↓

If High Differential is of

Interest Rate	Exchange Rate
⇓	⇓
Borrow in Currency having Low Interest Rate	Borrow in Currency having High Interest Rate

Eg: Since High Differential is of Exchange. Hence we will borrow in currency having High Interest Rate, i.e. ₹

Step 2 :- Convert it into Other Currency [Eg. $] at Spot Rate

Eg :- Convert in $ ⇒ ₹ 40,00,000 / ₹ 40 = $ 1,00,000

Step 3 :- Deposit Converted Currency [Eg. $] in its Country [Eg. USA]

Eg :- Deposit 1,00,000 $ in US

Step 4 :- Enter into forward Contract to Convert above Deposited Currency [Eg. $] into Initially Borrowed Currency [Eg. ₹] on Maturity

Eg :- Enter in forward @ 1 $ = ₹ 45

At Maturity :-

Step 5 :- Withdraw Initially Deposited Currency [Eg. $] with Interest and Convert it into Initially Borrowed Currency [Eg. ₹] using forward Rate as per forward Contract entered in Step 4

⇓

Inflow

Eg :- Withdraw $ with Interest ⇒ 1,00,000 $ (1 + 0.04) ⇒ $ 1,04,000

Convert in ₹ at forward Rate ⇒ $ 1,04,000 × ₹ 45 ⇒ ₹ 46,80,000

Step 6 :- Repayment of Initially Borrowed Currency [Eg. ₹] with Interest

⇓

Outflow

Eg :- Repay ₹ with Interest ⇒ ₹ 40,00,000 (1 + 0.12) ⇒ ₹ 44,80,000

Step 7 :- Gain due to Arbitrage = Inflow in Step 5 − Outflow in Step 6

Eg :- Gain ⇒ ₹ 46,80,000 − ₹ 44,80,000 ⇒ ₹ 2,00,000

Cross Rates

- Cross Rate is required to be calculated when we are doing foreign exchange transaction between two currencies for which direct exchange rate is not given
- Cross Rate will be calculated using following Steps :-

Step 1 :- Determine Base Currency for which Quotation is required against Other Currency. Here, Base Currency will be that for which Currency Amount is given in question for Purchase or Sale against Others Currency

Step 2 :- If two way quotes are given in question, then Choose Applicable Exchange Rate by Linking the Currencies (Start from the Currency which we are Selling)

Step 3 :- Make a Equation & Solve it

Eg. 1 :- 1$ = ₹ 80 , 1 GBP = 1.25 $, 1 GBP = ₹ ??

Sol. 1 :- By using Mathematics :-

1 GBP = 1.25 $

1 GBP = 1.25 × $

1 GBP = 1.25 × ₹ 80

1 GBP = ₹ 100

By using Technique :-

$$\frac{₹}{GBP} = \frac{\$}{GBP} \times \frac{₹}{\$}$$

$$\frac{₹}{GBP} = 1.25 \times 80$$

$$\frac{₹}{GBP} = 100$$

₹/GBP = 100

1 GBP = ₹ 100

Eg 2 :- 1$ = ₹ 80 , 1$ = 0.80 GBP , 1 GBP = ₹ ??

Sol. 2 :- By using Mathematics :-

1$ = 0.80 GBP

$$1 GBP = \frac{1}{0.80} \$$$

$$1 GBP = \frac{1}{0.80} \times ₹ 80$$

1 GBP = ₹ 100

By Using Technique :-

$$\frac{₹}{GBP} = \frac{₹}{\$} \times \frac{\$}{GBP}$$ ↳ Reverse

$$\frac{₹}{GBP} = 80 \times \frac{1}{0.80}$$

$$\frac{₹}{GBP} = 100$$

₹/GBP = 100

1 GBP = ₹ 100

Eg 3:- 1₹ = 0.0125 $, 1$ = 0.80 GBP, 1GBP = ₹??

Sol.3:- By Using Mathematics:-

1$ = 0.80 GBP

$1GBP = \frac{1}{0.80}\$$

$1GBP = \frac{1}{0.80} \times \frac{1}{0.0125}₹$

1GBP = ₹ 100

By using Technique:-

$\frac{₹}{GBP} = \frac{₹}{\$} \times \frac{\$}{GBP}$ → Reverse → Reverse

$\frac{₹}{GBP} = \frac{1}{0.0125} \times \frac{1}{0.80}$

₹|GBP = 100

1GBP = ₹ 100

Eg 4:- 1$ = ₹ 45.90, 1£ = 1.7850 $, 1£ = SGD 3.1575, 1SGD = ₹??

Sol.4:- By Using Mathematics:-

1£ = SGD 3.1575

$1SGD = \frac{1}{3.1575}£$

$1SGD = \frac{1}{3.1575} \times 1.7850\$$

$1SGD = \frac{1}{3.1575} \times 1.7850 \times ₹45.90$

1SGD = ₹ 25.9482

By Using Technique:-

$\frac{₹}{SGD} = \frac{₹}{\$} \times \frac{\$}{£} \times \frac{£}{SGD}$ → Reverse

$\frac{₹}{SGD} = 45.90 \times 1.7850 \times \frac{1}{3.1575}$

₹|SGD = 25.9482

1SGD = ₹ 25.9482

Step 4:- Exchange Margin is Added / Deducted in Final Gross Rate

International Cash Management

- In this, A Multinational Company with Multiple Subsidiaries / Branches having Surplus Cash wants to take decision that Whether

  - Each Subsidiary should Invest its own Surplus Cash in their respective Currency
  - **OR**
  - Surplus Cash of All Subsidiaries should be pooled immediately in Company's Home Currency & Invested there

- For this, Compare Amount Received on Maturity in Company's Home Currency between Both 'Immediate Cash Pooling Method' & 'Acting Independently Method'

- **Acting Independently Method :-**

Country	Initial Principal Investment (Surplus Cash) in their respective Currency	Interest in respective Currency	Amount received on Maturity in respective Currency	Convert this Total Amt. received on Maturity in Company's Home Currency using forward Rate
A (Home Country)	xxx	xxx	xxx	xxx
B (foreign Country)	xxx	xxx	xxx	xxx
C (foreign Country)	xxx	xxx	xxx	xxx
				xxx

- **Immediate Cash Pooling Method :-**

Country	Surplus Amount in respective Currency to be Invested	Convert Surplus Amount in Company's Home Currency on Spot Date using Spot Rate
A (Home Country)	xxx	xxx
B (foreign Country)	xxx	xxx
C (foreign Country)	xxx	xxx
Total Principal Amount to be Invested in Company's Home Currency		xxx
Add :- Interest in Company's Home Currency		xxx
Amount Received on Maturity in Company's Home Currency		xxx

Where to Borrow

(i) When Both Interest Rates & Exchange Rates are given in Question :-

- Compare Amount Payable on Maturity in Home Currency in Both Home Currency Loan and Foreign Currency Loan
- To Solve Practical Question, First Check Whether Company need funds in Home Currency or Foreign Currency

(i) If Company need funds in foreign Currency :-

→ Calculation of Outflow under Home Currency Loan on Maturity :-

Equivalent Amount Borrowed in Home Currency (It is Calculated by Selling Home Currency at Spot Rate)	xxx
Add:- Interest & Any Other Charges in Home Currency	xxx
Outflow under Home Currency Loan on Maturity (Repayment)	xxx

→ Calculation of Outflow under foreign Currency Loan on Maturity :-

Amount Borrowed in foreign Currency	xxx
Add:- Interest & Any Other Charges in foreign Currency	xxx
Outflow in Foreign Currency on Maturity	xxx

↓

Convert it in Home Currency by Buying foreign Currency on Maturity at forward Rate

↓

Outflow in Home Currency under foreign Currency Loan on Maturity	xxx
Add:- Any Other Charges (Eg. L.C) in Home Currency	xxx
Total Outflow in Home Currency under foreign Currency Loan on Maturity (Repayment)	xxx

(ii) If Company need funds in Home Currency :-

→ Calculation of Outflow under Home Currency Loan on Maturity :-

Amount Borrowed in Home Currency	xxx
Add:- Interest & Any Other Charges in Home Currency	xxx
Outflow under Home Currency Loan on Maturity (Repayment)	xxx

→ Calculation of Outflow under foreign Currency Loan on Maturity :-

Equivalent Amount Borrowed in foreign Currency (It is calculated by Selling foreign Currency at Spot Rate)	xxx
Add:- Interest & Any Other Charges in foreign Currency	xxx
Outflow in foreign Currency on Maturity	xxx

↓

Convert it in Home Currency by Buying foreign Currency on Maturity at forward Rate

↓

Outflow in Home Currency under foreign Currency Loan on Maturity	xxx
Add:- Any Other Charges (Eg. L.C.) in Home Currency	xxx
Total Outflow in Home Currency under foreign Currency Loan on Maturity (Repayment)	xxx

(2.) When Only Interest Rates are given in question (Exchange Rates are not given) :-

- Compare Net Cost in % in Both Home Currency Loan & foreign Currency Loan
- Calculation of Net Cost (%) under Home Currency Loan :-

Interest Rate	xxx
Add:- Any Other Additional Charges (Eg. Loan Servicing fee etc.)	xxx
	xxx

- Calculation of Net Cost (%) under foreign Currency Loan :-

Effective Interest Rate including Witholding Tax $\left[\frac{\text{Int. Rate required by foreign Bank}}{1 - \text{Witholding Tax Rate}}\right]$	xxx
Add/(Less):- Premium / (Discount) on foreign Currency (using Interest Rate Differential)	xxx
	xxx

Where to Invest

Compare Amount Receivable on Maturity in Home Currency under Both Home Currency Investment and foreign Currency Investment

&

Then Take Decision Accordingly

Exchange Position and Cash Position (Nostro A/c)

(1.) Exchange Position :-

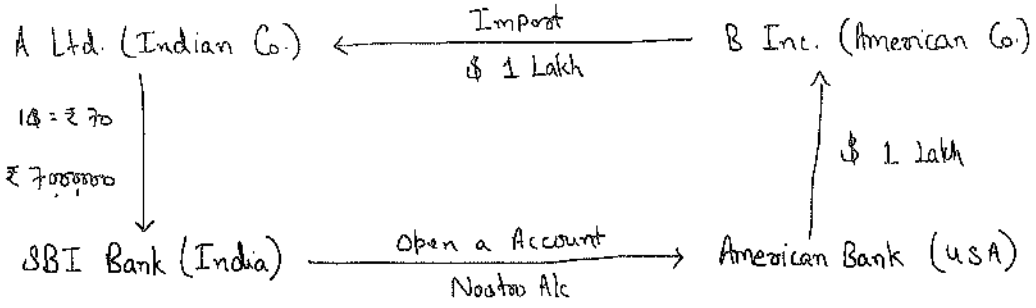
- It is a statement prepared by a Bank which reflects All Spot & Forward foreign Currency Purchases (i.e. Inflow) and Sales (i.e. Outflow) transactions of the Bank for a particular period.
- It is prepared as follows :-

Particulars	Purchase of foreign Currency	Sale of foreign Currency
Opening Balance Overbought	xxx	
Opening Balance Oversold		xxx
Spot Purchase	xxx	
Spot Sale		xxx
Forward Purchase	xxx	
Forward Sale		xxx
Forward Purchase Cancel		xxx
Forward Sale Cancel	xxx	
Remittance by TT [Spot Sale]		xxx
Bill Purchased [Forward Purchase]	xxx	
DD / Draft Purchased [Forward Purchase]	xxx	
DD / Draft Issued [Forward Sale]		xxx
DD / Draft Cancelled [Forward Purchase]	xxx	
	xxx	xxx
Closing Balance [Blf]	-	-
Total	xxx	xxx

(2.) Cash Position (Nostro A/c) :-

- First Understand Nostro, Vostro and Loro Accounts :-

(i) Nostro A/c :- Our Account with You



(ii) Vostro A/c :- Your Account with us

(iii) Loro A/c :- Their Account with Them

- It is like a Pass Book for our Foreign Currency A/c opened in foreign Bank (i.e. Nostro A/c)
- It is credited when Bank made Spot Purchase of foreign Currency (i.e. Cash Inflow) and debited when Bank made Spot Sale of foreign Currency (i.e. Cash Outflow)
- It is prepared as follows :-

Particulars	Credit [Purchase]	Debit [Sale]
Opening Balance	xxx	
Spot Purchase	xxx	
Spot Sale		xxx
Remittance by TT [Spot Sale]		xxx
	xxx	xxx
Closing Balance [B/f]	–	–
Total	xxx	xxx

Foreign Exchange Exposure

(1.) Translation Exposure (Accounting Exposure) :-

It is profit or loss due to translation of foreign Currency Assets or Liabilities in financial Statements

(2.) Transaction Exposure :-

- It is Profit or Loss due to Transaction in foreign Currency entered on Spot Date but it will be settled on future Date
- Calculation of Profit / Loss due to Transaction Exposure :-

Net Inflow / Outflow on Spot Date Exchange Rate	xxx
Less:- Net Inflow / Outflow on Settlement Date Exchange Rate	xxx
	xxx

(3.) Operating / Economic Exposure :-

- It is Profit or Loss due to Change in Demand of Product because of Change in Spot Date Exchange Rate
- It is calculated as Profit or Loss on increased or decreased Units at Settlement Date Exchange Rate

Note:- If in question, Profit or Loss due to Transaction and Operating Exposure is required, then it means Total Profit / Loss due to Both Exposures

⇓

Profit / Loss due to Transaction Exposure	xxx
Add / (Less) :- Profit / Loss due to Operating Exposure	xxx
	xxx

Currency Swap

- It is an agreement in which 2 Parties exchange the Principal & Interest in One Currency for Principal & Interest in Another Currency.
- If One Party wants to borrow in 1 Currency & Other Party wants to borrow in Another Currency, then they can reduce their borrowing cost by use of Currency Swap.

- Steps to be followed to solve the Question :

Step 1 : Calculate Amount received at beginning on Loan due to use of Swap

	Party 1	Party 2
Principal Amount borrowed from Lender	xxx	xxx
(–) Principal Amount transferred to Other Party	(xxx)	(xxx)
(+) Principal Amount received from Other Party	xxx	xxx
Amount received at beginning	xxx	xxx

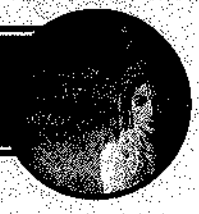
Step 2 : Calculate Interest Cost on Loan due to use of Swap

	Party 1	Party 2
Interest Amount received from Other Party	xxx	xxx
(–) Interest Amount paid to Lender	(xxx)	(xxx)
Gain / (Loss)	xxx / (xxx)	xxx / (xxx)
Gain / (Loss) Converted in Party's required Currency	xxx / (xxx)	xxx / (xxx)
Interest Amount paid to Other Party	(xxx)	(xxx)
Interest Cost (in Amount)	xxx	xxx
Interest Cost (in %)	✓	✓

$$\left[\frac{\text{Interest Cost (in Amount)}}{\text{Amount received at beginning}} \times 100\right]$$

Step 3 : Calculate Opportunity Gain (Saving) on Interest Cost due to use of Swap

	Party 1	Party 2
Interest Cost (in %) if required loan taken directly	✓	✓
(–) Interest Cost (in %) due to use of Swap	(✓)	(✓)
Opportunity Gain (Saving)	✓	✓



International Financial Management

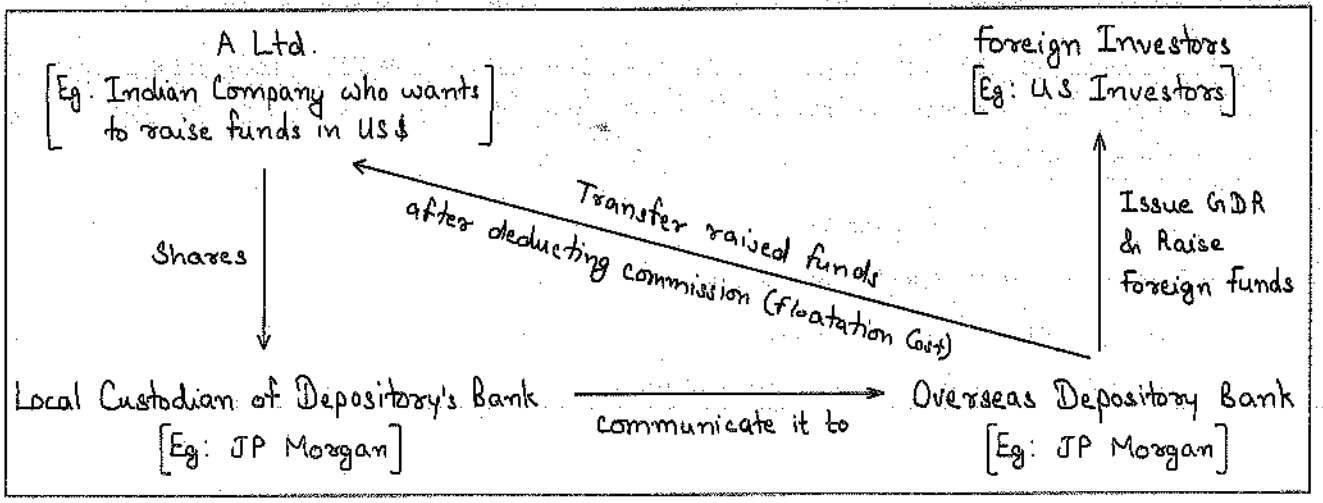
- **Part I: International Sources of finance**
  - Global Depository Receipts (GDRs)
- **Part II: International Capital Budgeting**
  - International Capital Budgeting Decisions
  - Decision making for foreign Company developing Product (Software) in India
- **Part III: Investment in International Securities Market**
  - Return on Investment in International Securities Market

Part I: International Sources of finance

Global Depository Receipts [GDRs]

(i) Meaning of GDR :

- GDR is a depository receipt underlying shares of the company.
- Company issue GDRs to foreign investors to raise money in foreign currency.
- GDR issued in US are called ADR & GDR issued in India are called IDR.
- Process of issuing GDR :



(2) Cost of GDR (Ke):

$$\text{Cost of GDR (Ke)} = \left[\frac{D_1}{P_0} \times 100\right] + g$$

Here, g = Growth Rate

D_1 = Expected Dividend per GDR at the end of 1st Year

⇒ No. of shares underlying per GDR × Expected Dividend per underlying share at the end of 1st Year

P_0 = Net Proceeds per GDR

⇒ Issue Price per GDR × (100% - floatation Cost %)

$$\text{Issue Price per GDR} = \text{No. of shares underlying per GDR} \times \text{Market Price per underlying share} \times \left(\frac{100\%}{\text{Discount on issue \%}}\right)$$

(3) Number of GDR to be issued:

$$\Rightarrow \frac{\text{Amount required for Investment in the Project}}{\text{Net Proceeds per GDR}}$$

Part II: International Capital Budgeting

International Capital Budgeting Decisions

- It is the process of evaluating & selecting long term investments | projects in foreign country.
- Techniques used for International Capital Budgeting Decisions are exactly same as for Domestic Capital Budgeting Decisions, i.e. NPV Method, MIRR Method, etc. as discussed in Advanced Capital Budgeting Decisions Chapter.
- While Calculating NPV of the Project in International Capital Budgeting, Cash Flows & Discount Rate should be of Same Currency. So, NPV can be calculated using following 2 Approaches:

(i) Foreign Currency Approach:

→ Calculate Cash flows in foreign Currency.

→ Use Discount Rate of foreign Currency.

$$\Rightarrow \left[\frac{1 + \text{Required Return in Home Currency}}{1 + \text{Risk free Rate in Home Currency}} \times (1 + \text{Risk Free Rate in foreign Currency})\right] - 1$$

→ NPV calculated will be in foreign Currency ⇒ Convert NPV in Home Currency using Spot Exchange Rate at beginning

(ii) Home Currency Approach :

→ Calculate Cash flows in Home Currency [By converting foreign Currency Cash Flows into Home Currency using Estimated Exchange Rate of different years].

* Estimated Exchange Rate is calculated using IRP or PPP Theory as discussed in Forex Chapter.

→ Use Discount Rate of Home Currency.

→ NPV calculated will be in Home Currency.

Note: In Silent Situation, Discount Rate given in question is assumed to be of Home Currency of Company.

Decision making for foreign Company developing Product (Software) in India

- Calculation of Repatriation Amount :

Particulars	Amount (in ₹)
Transfer Price	xxx
(-) Costs [Example: Rent, Manpower, Administration Cost, etc.]	(xxx)
EBT	xxx
(-) Corporate Tax	(xxx)
EAT	xxx
(-) Withholding Tax [Only if it is not eligible for Tax Credit]	(xxx)
Repatriation Amount [in ₹]	xxx
Repatriation Amount [Converted in Currency of foreign Company]	xxx

- Calculation of Total Cost incurred on Product development [Minimum Amount to be charged for Product from foreign Customer] :

Particulars	Amount (in Currency of foreign Company)
Transfer Price	xxx
(-) Repatriation Amount	(xxx)
	xxx

- Advice on viability of the Project :

Particulars	Amount (in Currency of foreign Company)
Selling Price of Product to Customer	xxx
(-) Total Cost incurred on Product development	(xxx)
Profit / (Loss)	xxx / (xxx)

Part III : Investment in International Securities Market

Return on Investment in International Securities Market

(1) If Appreciation / Depreciation % in Currency is given in question :

Step 1 : Calculate Return on Investment in Security for Domestic Investor

$$\text{Return for Domestic Investor} = \frac{D + P_1 - P_0}{P_0} \times 100$$

Here, D = Dividend / Interest Income on Security for the year
P_1 = Market Price of Security at end of the year
P_0 = Market Price of Security at beginning of the year

Step 2 : Calculate Return on Investment in Security for foreign Investor

- If Appreciation / Depreciation % in foreign Currency is given

$$\text{Return for foreign Investor} = \left[1 + \text{Return for Domestic Investor}\right] \times \left[1 \pm \text{Appreciation / (Depreciation) \% in Foreign Currency}\right] - 1$$

- If Appreciation / Depreciation % in Home Currency is given

$$\text{Return for foreign Investor} = \left[1 + \text{Return for Domestic Investor}\right] \times \left[1 \pm \text{(Appreciation) / Depreciation \% in Home Currency}\right] - 1$$

(2) If Exchange Rate is given in question :

Step 1 : Calculate Investment Amount in foreign Currency at beginning of the Year
⇒ Convert Investment Amount (given in Home Currency) into foreign Currency using Spot Exchange Rate at beginning of the year.

Step 2 : Calculate No. of units purchased of security

$$\Rightarrow \frac{\text{Investment Amount in foreign Currency}}{\text{Market Price of Security at beginning of the Year}}$$

Step 3: Calculate Value of Investment in Foreign Currency at end of the Year

⇒ No. of units purchased of security × Market Price of Security at end of the Year

Step 4: Calculate Value of Investment in Home Currency at end of the Year

⇒ Convert Value of Investment in foreign Currency at end of the year (Step 3 Amount) into Home Currency using Exchange Rate at end of the Year

Step 5: Calculate Return on Investment in Security for Foreign Investor

$$\Rightarrow \frac{\text{Value of Investment in Home Currency at end of the Year} - \text{Investment Amount in Home Currency at beginning of the Years}}{\text{Investment Amount in Home Currency at beginning of the Year}} \times 100$$

Interest Rate Risk Management



Interest Rate Risk Management [IRRM]

Part I: Introduction to IRRM
- Types of Interest Rates

Part II: Forward Rate Agreements [FRA]
- Meaning of FRA
- Final Settlement [Profit or Loss] on FRA
- Theoretical (Fair) FRA Rate

Part III: Interest Rate Futures [IRF]
- Interest Rate Futures having Zero Coupon Bond as Underlying
- Interest Rate Futures having Coupon Bearing Bond as Underlying

Part IV: Interest Rate Options [IRO]
- Interest Rate Guarantee
- Cap Option & Floor Option

Part V: Interest Rate Swaps [IRS]
- Meaning of Interest Rate Swap
- Types of Interest Rate Swaps
- Use of Interest Rate Swap to Reduce the Cost of Borrowing

Part I: Introduction to IRRM

This Chapter covers Concept of Interest Rate Derivatives [i.e. Derivative Contract in which Underlying Asset is Interest Rate]. This Chapter mainly focuses on use of Interest Rate Derivatives for Hedging Interest Rate Risk.

Types of Interest Rates

(1) **Fixed Interest Rate**:

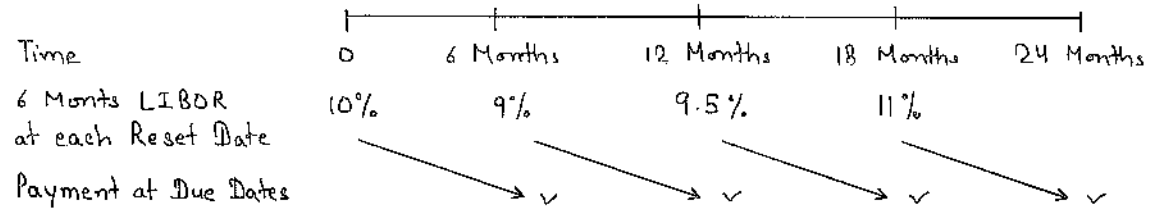
Interest Rate remains same during the whole life of Loan.
Example: 8%, 10%, 12% etc.

(2) **Floating Interest Rate**:

Interest Rate varies according to Benchmark Rate (i.e. BPLR, MIBOR, LIBOR etc.) on each Reset Date.

Reset Date means the Date on which Interest Rate is revised for the upcoming period to the Benchmark Rate.

Example: Loan for 2 Years at 6 Months LIBOR



Note :- Sometimes Interest Rate can be given as follows :

LIBOR + (3%)
LIBOR + (5%) etc.

↘ It is Fixed Interest Component

So, If LIBOR becomes 10%, then Interest Rate will be

LIBOR + 3% = 10% + 3% = 13%

LIBOR + 5% = 10% + 5% = 15% etc.

Part II : Forward Rate Agreements [FRA]

Meaning of FRA

- It is a Contract with Bank for Betting on Interest Rate for a Loan of Certain Maturity after a specified period. [Cash Settlement]
- If as per our expectations

Interest Rate will Rise in future	Interest Rate will Fall in Future
⇓	⇓
Do Upside Betting on Interest Rate [i.e. Buy FRA]	Do Downside Betting on Interest Rate [i.e. Sell FRA]

Example :

A Bank is offering a FRA for a Loan of 3 Months after 6 Months from now at 10% p.a. [6x9 FRA]

So, if as per our expectations Interest Rate will Rise after 6 Months from now, then we should Buy FRA at 10% p.a. (i.e. Upside Betting on this Rate).

But, if as per our expectations Interest Rate will fall after 6 Months from now, then we should Sell FRA at 10% p.a. (i.e. Downside Betting on this Rate).

- FRA Quotation :

6 x 9 FRA ⇒ FRA for a Loan of 3 Months after 6 Months from now
3 x 9 FRA ⇒ FRA for a Loan of 6 Months after 3 Months from now
3 x 6 FRA ⇒ FRA for a Loan of 3 Months after 3 Months from now
2 V 3 FRA ⇒ FRA for a Loan of 1 Year after 2 Years from now

Note :- Interpretation of FRA when 2 Rates are given :

6 x 9 FRA 9% – 10%

9%	10%
⇓	⇓
Low Rate is applicable for Selling FRA [i.e. Downside Betting]	High Rate is applicable for Buying FRA [i.e. Upside Betting]

Final Settlement [Profit or Loss] on FRA

- Final Settlement Amount $= \dfrac{N \times (RR - FR) \times t}{1 + (RR \times t)}$

Here, N = Notional Principal Amount of Loan
RR = Reference Rate i.e. Actual Interest Rate after the specified period
FR = Contracted FRA Rate
$t = \dfrac{\text{No. of Days or Months of FRA Loan}}{365/12}$

- Above Calculated Amount [Profit or Loss] is settled in Cash as follows:

If Initially Bought FRA [Upside Betting]	If Initially Sold FRA [Downside Betting]
RR > FR = Profit	RR > FR = Loss
RR < FR = Loss	RR < FR = Profit

Theoretical (Fair) FRA Rate

- Theoretical (Fair) FRA Rate is the Rate at which Company is indifferent between 2 short period borrowings & full long period borrowing at once.
- Theoretical (Fair) FRA Rate for 2nd Short Period Borrowing is calculated as follows:

$$\Rightarrow \frac{1 + \text{Interest Rate applicable for full Long Period Borrowing}}{1 + \text{Interest Rate applicable for 1st Short Period Borrowing}} - 1$$

* Answer will be in decimals, Multiply by 100 to Convert it into %.

Example 1:

A Ltd. can take 3 Months Borrowing at 12% p.a. & 6 Months Borrowing at 11.50% p.a. What should be the Interest Rate after 3 Months to make Company indifferent between 3 Months Borrowing & 6 Months Borrowing [i.e. Calculate 3x6 FRA Theoretical Rate]

Solution:

Total Period = 6 Months ; 1st Period = 3 Months

$\therefore$ 3x6 FRA Theoretical Rate $= \dfrac{1 + 0.115 \times \frac{6}{12}}{1 + 0.12 \times \frac{3}{12}} - 1 \Rightarrow \dfrac{1 + 0.0575}{1 + 0.03} - 1$

$\Rightarrow 0.0267$ or 2.67% for 3 Months

$\Downarrow$

Annualised $= 2.67 \times \frac{12}{3} \Rightarrow 10.68\%$ p.a.

Example 2:

A Ltd. can take 2 Years Borrowing at 4.20% p.a. & 3 Years Borrowing at 4.48% p.a. What should be the Interest Rate after 2 years to make Company indifferent between 2 Years Borrowing & 3 Years Borrowing [i.e. Calculate 2V3 FRA Theoretical Rate]

Solution:

Total Period = 3 Years ; 1st Period = 2 Years

$$\therefore \text{2V3 FRA Theoretical Rate} = \frac{(1+0.0448)^3}{(1+0.0420)^2} - 1 \Rightarrow 5.04\% \text{ p.a.}$$

Part III: Interest Rate Futures [IRF]

Interest Rate Futures having Zero Coupon Bond as Underlying

- It is a Contract on Stock Exchange for Betting on Price of Zero Coupon Bond on a specified future date at a pre fixed price. [Cash Settlement]
- Price of IRF on a particular date = 100 − Interest Rate on that date
- It is used to Hedge Interest Rate Risk as follows:

Step 1: Decide whether IRF to be bought or sold

If Company is Borrower	If Company is Lender
↓	↓
It means Company has fear of Interest Rate Rising [i.e. expectation of fall in Price of IRF]	It means Company has fear of Interest Rate falling [i.e. expectation of Rise in Price of IRF]
↓	↓
Do Downside Betting on IRF [i.e. Sell IRF]	Do Upside Betting on IRF [i.e. Buy IRF]

Step 2: Calculate Number of IRF Contracts to be bought or sold

$$\Rightarrow \frac{\text{Loan Amount}}{\text{Future Contract Size}} \times \frac{\text{Loan Duration in Months}}{\text{Future Contract Period in Months}}$$

Step 3: Calculate Net Interest paid / received on maturity after Hedging

Actual Interest (Paid) / Received on Loan Borrowed / Lended [Loan Amount × Actual Interest Rate × Loan Duration in Months / 12]	xxx / (xxx)
Gain / (Loss) on IRF Contracts [Refer Note]	xxx / (xxx)
Net Interest (Paid) / Received	xxx / (xxx)

Note : Gain / (Loss) on IRF Contracts

- If Initially Bought IRF
  - If Price of IRF on Maturity
    - Rises → Gain
    - Falls → Loss
- If Initially Sold IRF
  - If Price of IRF on Maturity
    - Rises → Loss
    - Falls → Gain

Calculation of Gain / Loss on IRF Contracts

$$\Rightarrow \text{Number of IRF Contracts} \times \text{Future Contract Size} \times \left[\begin{array}{l}\text{Difference between Price of IRF on Maturity (Settlement Price) \&} \\ \text{Initially Contracted Price}\end{array}\right] \% \times \frac{\text{Future Contract Period}}{12}$$

Step 4 : Calculate Net Interest Rate locked by Company due to Hedging

$$\Rightarrow \frac{\text{Net Interest Amount as calculated in Step 3}}{\text{Loan Amount}} \times \frac{12}{\text{Loan Duration in Months}} \times 100$$

Interest Rate Futures having Coupon Bearing Bond as Underlying

- It is a Contract on Stock Exchange to Buy or Sell Coupon Bearing Bond on a specified future date at a pre fixed price. [Settlement by Physical Delivery]
- This Contract is done for a Notional Bond. So, Seller of a IRF Contract can deliver any available Bond from the basket of deliverable bonds at NSE on maturity.
- Since Seller of IRF Contract can deliver any Bond on maturity, he will choose Cheapest to Deliver (CTD) Bond as follows :

Step 1 : Calculate Profit / (Loss) on each available Bond that can be delivered

$$\Rightarrow \left[\begin{array}{l}\text{Future Contract} \\ \text{Settlement Price}\end{array} \times \begin{array}{l}\text{Conversion} \\ \text{Factor}\end{array}\right] - \text{Quoted Price of Bond on Maturity}$$

Note :- Conversion factor for each Bond is determined by the Stock Exchange. It will be given in question.

Step 2 : Select that Bond for Delivery which provides Maximum Profit (as calculated in above Step) among all available Bonds.

Part IV: Interest Rate Options [IRO]

Interest Rate Guarantee

- It is a Contract with the Bank to Buy the Right to take Loan at Strike Rate for a Loan of certain maturity after a specified period.
- Interest Rate Guarantee Premium is paid to the Bank at beginning for Buying the Right to take Loan at Strike Rate.
- If after the specified period

Actual Interest Rate > Strike Rate	Actual Interest Rate < Strike Rate
↓	↓
Exercise the Option & Take Loan at Strike Rate	Do not Exercise the Option & Take Loan at Actual Interest Rate

- **Calculation of Total Interest Amount Payable on Loan :**

Interest Amount on Loan as per above selected rate	xxx
(+) Interest Rate Guarantee Premium Amount	xxx
	xxx

Cap Option & Floor Option

(1) Cap Option [Call Option] :-

- On each Reset Date, If Benchmark Rate of Floating Interest Rate Loan exceeds the Strike Rate of Cap Option, then Option Buyer will receive Payoff in Cap Option from Option Sellers on next Interest Payment Date.

$$\text{Pay off in Cap Option} = \text{Loan Amount} \times \left[\text{Benchmark Rate on Reset Date} - \text{Strike Rate}\right] \times \frac{\text{No. of days / months from Reset Date to Interest Payment Date}}{365 \,/\, 12}$$

- If Benchmark Rate on a Reset Date does not exceed the Strike Rate, then Payoff in Cap Option will be 'Zero' (0) for next Interest Payment Date. [It cannot be negative in any case.]

(2) Floor Option [Put Option] :-

- On each Reset Date, If Benchmark Rate of Floating Interest Rate Loan goes below the Strike Rate of Floor Option, then Option Buyer will receive Payoff in Floor Option from Option Sellers on next Interest Payment Date.

$$\text{Pay off in Floor Option} = \text{Loan Amount} \times \left[\text{Strike Rate} - \text{Benchmark Rate on Reset Date}\right] \times \frac{\text{No. of days / months from Reset Date to Interest Payment Date}}{365 \,/\, 12}$$

- If Benchmark Rate on a Reset Date does not go below the Strike Rate, then Payoff in Floor Option will be 'Zero' (0) for next Interest Payment Date. [It cannot be negative in any case.]

Note:-

(i) Option Premium is paid by the Option Buyer to Option Seller at beginning to buy the Option.

Option Premium = Loan Amount × Option Premium %

(ii) Interest Rate Collars:

→ It is a strategy in which we Buy Cap Option & Sell floor Option on a Loan.

→ So, Pay off in Cap Option will be received on Interest Payment Dates & Pay off in Floor Option will be paid on Interest Payment Dates.

(iii) If Question is asking to Show how much Interest Rate Risk is hedged through Option, then Calculate Net Pay off from Option on each Interest Payment Date as follows:

⇒ Pay off from Option on a Payment Date − Option Premium allocated to that Payment Date

* Option Premium allocated to each Payment Date $= \frac{\text{Option Premium Paid at Beginning}}{\text{PVAF @ fixed Interest Rate for all Payment Dates}}$

Example:

A Ltd. took a Loan of ₹ 1 Crore at 6 Months LIBOR for 2 Years. It buys a Cap Option from its Bank with Strike Rate of 8%. Cap Option Premium is 1%.
Fixed Interest Rate is 7% p.a.
Calculate Option Premium allocated to each Interest Payment Date.

Solution:

Option Premium paid at beginning = 1 Crore × 1% ⇒ ₹ 1,00,000
There are 4 Interest Payment Dates of 6 Months each.
∴ PVAF @ 7% p.a. for 4 Periods of 6 Months each ⇒ PVAF (3.5%, 4) ⇒ 3.673
Now, Option Premium allocated to each Payment Date $\Rightarrow \frac{₹\ 1,00,000}{3.673} \Rightarrow ₹\ 27,226$

Part V: Interest Rate Swaps [IRS]

Meaning of Interest Rate Swap

- It is exchange of Interest Payment between 2 Parties on Notional Principal Amount.
- One Party will pay Interest as per fixed Interest Rate known as Fixed Rate Payer & Other Party will pay Interest as per floating Interest Rate known as Floating Rate Payer.

Types of Interest Rate Swaps

(1) Plain Vanilla Swap [Generic Swap or Coupon Swap] :-

- In this Swap, Interest Amounts are calculated assuming 360 Days in a Year.
- Steps to be followed to Calculate Net Settlement Amount :

Step 1 : Calculate Interest Payment by Fixed Rate Payer

$$\Rightarrow N \times AIC \times \frac{\text{No. of Days till Settlement Date}}{360}$$

Here, N = Notional Principal Amount
AIC = All In Cost i.e. Fixed Interest Rate
No. of days are taken by assuming 30 days in a Month

Step 2 : Calculate Interest Payment by Floating Rate Payer

$$\Rightarrow N \times \text{Floating Interest Rate} \times \frac{\text{No. of Actual Days till Settlement Date}}{360}$$

Here, N = Notional Principal Amount
No. of Actual Days are taken without any assumption

Step 3 : Calculate Net Settlement Amount
⇒ Difference between Interest Payment by Fixed Rate Payer & Floating Rate Payer [i.e. Step 1 - Step 2]

(2) Plain Vanilla Overnight Index Swap (OIS) :-

It is Same as Plain Vanilla Swap with an additional feature that Interest Payment by floating Rate Payer will be compounded on daily basis.

Note : If Question is asking to assume 365 days in a year, then do calculations accordingly.

Use of Interest Rate Swap to Reduce the Cost of Borrowing

- If One Party wants to take Loan at Fixed Interest Rate & Other Party wants to take Loan at floating Interest Rate, then they can Reduce their Borrowing Cost by use of Interest Rate Swap.
- Steps to be followed to solve the Question :

Step 1 : Determine whether a Beneficial Swap can be arranged

	Total Interest Rate %
If Both Parties take required loan directly	
(-) If Both Parties go for Swap [i.e. Interest Rate of Other Loans]	(Total Interest Rate %)
Total Gain / (Loss)	✓ / (✓)
(-) Swap Commission	(✓)
Net Gain / (Loss)	✓ / (✓)

If it is Net Gain, then Beneficial Swap can be arranged, Otherwise Not.
This Net Gain is shared by Both Parties in Swap Deal.

Step 2: Calculate Net Interest Rate Cost of Loan by using Swap

→ For Party who wants to take Loan at fixed Interest Rate
= Fixed Interest Rate applicable to this Party - Share in Net Gain

→ For Party who wants to take Loan at Floating Interest Rate
= Floating Interest Rate applicable to this Party - Share in Net Gain

Example:

A ltd. & B ltd. can take Loan at following Interest Rates:

	A ltd.	B ltd.
Fixed Rate Loan	7%	8.20%
Floating Rate Loan	L + 0.50%	L + 0.70%

A ltd. wishes to borrow floating Rate loan & B ltd. wishes to borrow fixed Rate loan. Swap Bank may arrange a Swap & requires 20 Basis Points as Commission. Gain in Swap is to be shared by Both Companies equally.
Determine whether Beneficial Swap can be arranged & if yes, then Calculate Net Interest Rate Cost of Loan to both companies by using Swap.

Solution:

Step 1: Determining whether Swap is Beneficial:

Total Interest Rate on required loan directly [L + 0.50% + 8.20%]	L + 8.70%
(-) Total Interest Rate on Swap [7% + L + 0.70%]	(L + 7.70%)
Total Gain	1.00%
(-) Swap Bank Commission	(0.20%)
Net Gain	0.80%

∴ Swap is Beneficial. Net Gain Shared by both companies equally, i.e. 0.40%

Step 2: Calculation of Net Interest Rate Cost of Loan by using Swap

for A Ltd.:

Floating Interest Rate applicable to it	L + 0.50%
(-) Share in Net Gain	(0.40%)
	L + 0.10%

for B Ltd.:

Fixed Interest Rate applicable to it	8.20%
(-) Share in Net Gain	(0.40%)
	7.80%

Business Valuation

Business Valuation

- **Part I: Introduction to Business Valuation**
  - Meaning of Business Valuation
  - Basics of Business Valuation
- **Part II: Approaches of Valuation**
  - Market Based Models
  - Asset Based Models
  - Income (Earning) Based Models
  - Cash flow Based Models
  - Relative Valuation Models
- **Part III: EVA & MVA**
  - Economic Value Added
  - Market Value Added
- **Part IV: Other Topics**
  - Valuation of Digital Platforms
  - Valuation of Distressed Companies
  - Valuation of Start ups

Part I: Introduction to Business Valuation

Meaning of Business Valuation

It is a process of determing value of business for various purpose like Mergers & Acquisitions, Sale of business, Strategic decision making, etc.

Basics of Business Valuation

(1) Value of firm [Enterprise Value or Value of Business] :-

Value of firm = Value of Equity + Value of Debt − Surplus funds (Cash & Cash Equivalents)

↓

There are various methods to calculate Value of Equity

(2) Value of Equity :-

Value of Equity = Value of firm − Value of Debt + Surplus funds (Cash & Cash Equivalents)

↓

There are various methods to calculate Value of firm

(3) Value of Equity per share = $\frac{\text{Value of Equity}}{\text{No. of Equity Shares}}$

(4) If there is No debt & Surplus funds (Cash & Cash Equivalents), then
Value of firm = Value of Equity

(5) Cost of Capital of Company [Weighted Average Cost of Capital (WACC)] :-

$$WACC\ (K_o) = K_e \times W_e + K_d \times W_d$$

Here,
K_e = Cost of Equity [Using CAPM] $\Rightarrow R_f + \beta_e (R_m - R_f)$
K_d = Post Tax Cost of Debt $\Rightarrow$ Interest Rate on Debt $(1 - \text{Tax Rate})$
W_e = Weight of Equity $\Rightarrow \frac{E}{E+D}$
W_d = Weight of Debt $\Rightarrow \frac{D}{E+D}$
E = Equity Share Capital + Reserves & Surplus + Intangible Asset [Eg: Patent] which is not recorded in Books
D = Long Term Debt [Eg: Debentures, Long Term Loans / Borrowings, etc.]

Note :- If there is Long Term Debt but Cost of Debt (K_d) is not given in question, then calculate WACC (K_o) using CAPM as follows:

$$WACC\ (K_o) = R_f + \beta_A (R_m - R_f)$$

Here, β_A = Asset Beta

* In general, we do not apply CAPM formula to calculate WACC since WACC will not be same from both the formula.

Part II : Approaches of Valuation

Market Based Models

(1) Market Price Method :-

Value of Equity = MPS × No. of Equity Shares

(2) PIE Ratio Method :-

Value of Equity (Per Share) = PIE Ratio × EPS

OR

Value of Equity (Total) = PIE Ratio × EATESH

Asset Based Models

(1) Net Asset Value Method [Book Value Method] :-

Value of Equity = Net Assets at Book Value

⇒ Equity Share Capital + Reserves & Surplus − Contingent Liability [If Any]

(2) Net Realizable Value Method [Liquidation Value Method] :-

Value of Equity = Net Assets at Realizable Value

⇒ Net Assets at Book Value + Extra Amount realising from an Asset than its Book Value − Less Amount realising from an Asset than its Book Value

Income (Earning) Based Models

(1) Dividend Growth Method :-

$$\text{Value of Equity} = \frac{D_1}{K_e - g}$$

Here,

$D_1 = D_0 (1+g)$

g = Growth Rate after Merger (Acquisition)

K_e = Cost of Equity

1st Priority ⇓ Using CAPM =

$$R_f + B_e (R_m - R_f)$$

2nd Priority ⇓

$$K_e = \left[\frac{D_1 = D_0 (1+g)}{\text{Current Market Price}} \times 100\right] + g$$

Here, g = Current Growth Rate

Note :- If Dividend is taken per share in this formula, then it will give Value of Equity (Per Share)

&

If Total Dividend is taken in this formula, then it will give Value of Equity (Total)

(2) Earnings Capitalisation Method :-

Value of Business [Earning Value of the Company] is calculated using following Steps :

Step 1 : Calculate Future Maintainable Profit

Particulars	Amount
Profit Before Tax [Recent Previous Year]	xx
(-) Extraordinary Income included in above Profit	(xx)
(+) Extraordinary Loss included in above Profit	xx
	xx
(+) Profit from Launch of New Products [Sales - Material Cost - Labour Cost - fixed Cost - Any Other Cost]	xx
	xx
(-) Taxes	(xx)
Future Maintainable Profit	xx

Step 2 : Calculate Capitalization Rate :

1st Priority ⇓ Specifically Given in Question

2nd Priority ⇓ Use Cost of Capital of Company [WACC]

Step 3 : Value of Business = $\frac{\text{Future Maintainable Profit}}{\text{Capitalization Rate}}$

Step 4 : Per Share Earning Value of the Company (if asked in question)

$\Rightarrow \frac{\text{Value of Business as calculated in Step 3}}{\text{No. of Equity Shares}}$

Cash Flow Based Models

(1) Free Cash Flow to Firm [FCFF] Method :-

Value of firm is calculated using following Steps :

Step 1 : Calculate free Cash Flow to Firm [FCFF]

Particulars	Amount
EBIT	xx
(-) Tax on EBIT	(xx)
Net Operating Profit After Tax [NOPAT]	xx
(-) Net Capex [Capital Expenditure - Depreciation]	(xx)
(±) Decrease / (Increase) in Working Capital	xx / (xx)
FCFF	xx

Step 2: Calculate Value of firm by discounting the FCFF using Cost of Capital of Company [WACC (K_o)]

→ If there is Perpetual FCFF with Constant Growth

$$\text{Value of firm} = \frac{FCFF_1}{K_o - g}$$

Here, $FCFF_1$ = Expected FCFF at the end of 1st Year ⇒ $FCFF_0(1+g)$

→ If there is Perpetual FCFF with Variable Growth

PV of Uneven FCFF for certain period by K_o [Calculated using PV Table]	xxx
(+) PV of Perpetual FCFF by K_o [i.e. Calculate PV of Terminal Value]	xxx
Value of Firm =	xxx

(2.) Free Cash Flow to Equity [FCFE] Method :-

Value of Equity is calculated using following Steps :

Step 1: Calculate Free Cash Flow to Equity [FCFE]

Particulars	Amount
Profit After Tax [PAT]	xx
(–) Net Capex [Capital Expenditure – Depreciation] × [1 – Debt Ratio]	(xx)
(±) Decrease / (Increase) in Working Capital × [1 – Debt Ratio]	xx / (xx)
FCFE	xx

Step 2: Calculate Value of Equity by discounting the FCFE using Cost of Equity (K_e)

→ If there is Perpetual FCFE with Constant Growth

$$\text{Value of Equity} = \frac{FCFE_1}{K_e - g}$$

Here, $FCFE_1$ = Expected FCFE at the end of 1st Year ⇒ $FCFE_0(1+g)$

→ If there is Perpetual FCFE with Variable Growth

PV of Uneven FCFE for certain period by K_e [Calculated using PV Table]	xxx
(+) PV of Perpetual FCFE by K_e [i.e. Calculate PV of Terminal Value]	xxx
Value of Equity =	xxx

Note :-

(i) If there is No debt, then

PAT = NOPAT

&

FCFE = FCFF

(ii) Incremental Value due to adoption of New Strategy :

Value of firm after adoption of New Strategy [Using FCFF Method]	xxx
(–) Existing Value of firm before strategy $\left[\frac{\text{Existing NOPAT}}{K_o}\right]$	(xxx)
	xxx

Relative Valuation Models

(1) Sales [Revenue] Multiple Method :-

- In this Method, Value of firm is calculated using Sales [Revenue] Multiple of a Similar Company.
- $\text{Sales Multiple} = \frac{\text{Enterprise Value}}{\text{Sales}}$

$$\therefore \underset{[\text{Our}]}{\text{Enterprise Value}} = \underset{[\text{Similar Company}]}{\text{Sales Multiple}} \times \underset{[\text{Our}]}{\text{Sales}}$$

(2) EBITDA Multiple Method :-

- In this Method, Value of firm is calculated using EBITDA Multiple of a Similar Company.
- $\text{EBITDA Multiple} = \frac{\text{Enterprise Value}}{\text{EBITDA}}$

$$\therefore \underset{[\text{Our}]}{\text{Enterprise Value}} = \underset{[\text{Similar Company}]}{\text{EBITDA Multiple}} \times \underset{[\text{Our}]}{\text{EBITDA}}$$

Note :- EBITDA [Our] should be adjusted for use in above formula as follows

EBITDA (As given in question)	xxx
(–) Extraordinary Gain included in above EBITDA	(xxx)
(+) Extraordinary Loss included in above EBITDA	xxx
(–) Expense pending to be written off [Eg: Sales Promotion Cost]	(xxx)
(+) Income pending to be recognised	xxx
Adjusted EBITDA	xxx

(3) Comparable Companies Multiple [CCM] Method :-

- In this Method, Value of Equity is calculated using following 4 Ratios of a Similar Company

(i) Market Value to Book Value = $\frac{\text{Market Value}}{\text{Book Value}}$

(ii) Market Value to Replacement Cost = $\frac{\text{Market Value}}{\text{Replacement Cost}}$

(iii) Market Value to Sales = $\frac{\text{Market Value}}{\text{Sales}}$

(iv) Market Value to Net Income = $\frac{\text{Market Value}}{\text{Net Income}}$

Note :- If the above 4 Ratios are given for 2 Similar Companies in the question, then Average each ratio of these 2 Similar Companies firstly.

- Value of Equity is calculated using following Steps :

Step 1 : Calculate 4 different Value of Equity using each Ratio

(i) Market Value [Our] = MV to BV [Similar Company] × Book Value [Our]

(ii) Market Value [Our] = MV to RC [Similar Company] × Replacement Cost [Our]

(iii) Market Value [Our] = MV to Sales [Similar Company] × Sales [Our]

(iv) Market Value [Our] = MV to NI [Similar Company] × Net Income [Our]

Step 2 : Value of our Equity = Average of all 4 Market Value as calculated in Step 1

(4) Chop Shop Approach [Break up Value Approach] :-

- This Method is used to Calculate Value of firm having various business segments.
- In this Method, Value of Firm is calculated using following 3 Ratios for each business segment of a Similar Company

(i) Capitalization to Sales = $\frac{\text{Capitalization}}{\text{Sales}}$

(ii) Capitalization to Assets = $\frac{\text{Capitalization}}{\text{Assets}}$

(iii) Capitalization to Operating Income = $\frac{\text{Capitalization}}{\text{Operating Income}}$

- Value of firm is calculated using following Steps :

Step 1: Calculate 3 different Value of Firm using each Ratio

(i) Capitalization [Our] = Capitalization to Sales [Similar Company] × Sales [Our]

(ii) Capitalization [Our] = Capitalization to Assets [Similar Company] × Assets [Our]

(iii) Capitalization [Our] = Capitalization to OI [Similar Company] × Operating Income [Our]

Step 2: Value of our firm = Average of all 3 Capitalization as calculated in Step 1

Part III: EVA & MVA

Economic Value Added [EVA]

(1) Meaning of EVA :-

- It measures company's financial performance based on Excess Return earned by the company over minimum required return.
- EVA calculation was invented & registered by a US Consulting firm (Stern Stewart & Co.).

(2) Calculation of EVA :-

EVA = NOPAT − [Invested Capital × WACC]

- NOPAT [Net Operating Profit After Tax] need to be adjusted for EVA calculation as follows :

Particulars	Amount
EBIT	xx
(-) Tax on EBIT	(xx)
Net Operating Profit After Tax [NOPAT]	xx
(+) Non Cash Expenses [Eg: Provision for Bad Debts]	xx
Adjusted NOPAT	xx

Note:- If EBIT is not given in question but

Profit After Tax [Net Income] is available, then EBIT =

PBT $\left[\frac{PAT}{1-\text{Tax Rate}}\right]$	xxx
(+) Interest Expense	xxx
	xxx

Financial Leverage is available, then EBIT =

$$\frac{\text{Financial Leverage} \times \text{Interest Expense}}{\text{Financial Leverage} - 1}$$

$\left[\text{Since, FL} = \frac{EBIT}{EBIT - I}\right]$

- Invested Capital is calculated as follows:

Particulars – Liability Side Approach	Amount
Equity Share Capital	xx
(+) Reserves & Surplus	xx
(+) Long Term Debt [Eg: Debentures, Long Term Loans / Borrowings, etc.]	xx
(+) Intangible Asset [Eg: Patent] which is not recorded in Books	xx
(+) Non Cash Adjustment done in NOPAT [Eg: Provision for Bad Debts]	xx
Invested Capital	xx

OR

Particulars – Asset Side Approach	Amount
Total Assets	xx
(–) Current Liabilities	xx
(+) Intangible Asset [Eg: Patent] which is not recorded in Books	xx
(+) Non Cash Adjustment done in NOPAT [Eg: Provision for Bad Debts]	xx
Invested Capital	xx

(3) Other Points Related to EVA :-

- Company having Higher EVA is considered as best for investment.
- EVA Dividend:
  - → $\text{EVA Dividend} = \frac{EVA}{\text{No. of Equity Shares}}$
  - → It is the amount of dividend that Company can pay before its value starts declining because If Company does not pay any dividend, then Value of firm increases. Since, amount can be used for investments which will increase EBIT growth. Hence, If EBIT becomes higher, Value of firm will also increase.

Market Value Added [MVA]

(1) Meaning of MVA :-

It measures the wealth that company is able to create for its stakeholders since its foundation.

(2) Calculation of MVA :-

- If Market Value of firm (Company) is given in question :

Market Value of firm	xxx
(-) Invested Capital	(xxx)
	xxx

- If Market Value of Equity Shares is given in question :

Market Value of Equity [MPS x No. of Equity Shares]	xxx
(-) Shareholder's funds [Equity Share Capital + Reserves & Surplus]	(xxx)
	xxx

(3) Calculation of Value of firm using MVA :-

Value of firm = MVA + Invested Capital

Here, MVA = PV of All future EVA using WACC

Part IV : Other Topics

Valuation of Digital Platforms

(1) Meaning of Digital Platforms :-

- Digital Platform is a software based online infrastructure for interactions & transaction between users.
- Example of Digital Platforms are Amazon, Uber, Google, Youtube, Whatsapp, Telegram, Linkedin, Paytm, Netflix, etc.

(2) Methods for Valuation of Digital Platforms :-

Income (Earning) Based Models	Cash Flow Based Models	Relative Valuation Models	Cost Approach
Same as for Other Companies except → find Cash flows / Profit by estimating share of our Digital Platform (SAM) in TAM → Company Specific Risk Premium is to be added in Cost of Equity		⇓ Same as for Other Companies	⇓ Value of Digital Platform is based on Total Cost of building the Platform [i.e. Development / Coding Cost of the Platform]

Valuation of Distressed Companies

(1) Meaning of Distressed Companies :-

- Distressed Company is a company which is unable to meet its financial obligations (i.e. debt payments & operating expenses) that may lead it to bankruptcy.
- It does not mean that Distressed Company is worthless, it may also have some value.

(2) Methods for Valuation of Distressed Companies :-

- Modified Discounted Cash Flow Method :
  Same as Cash Flow Based Models for Other Companies except that Expected future Cash Flows are calculated as follows :
  $$\text{Expected future Cash Flow}_t = \text{Cash Flow}_t \times (1 - \text{Probability of Distress}_t)$$

- Cash Flow Based Valuation + Distress Sale Value Method :

Value as per Cash flow Based Model [Same as for Other Companies] × (1 − Probability of Distress)		xxx
(+) Distress Sale Value × Probability of Distress		xxx
		xxx

- Adjusted Present Value [APV] Method :

Value of Company without Debt [i.e. Calculate fCFF & Discount it by Ke]	xxx
(±) Effect of Debt [PV of Tax Shield on Interest − Expected Bankruptcy Cost]	xxx
	xxx

Here,

$$\text{Expected Bankruptcy Cost} = \begin{bmatrix}\text{Value of Company}\\ \text{without Debt}\end{bmatrix} - \begin{bmatrix}\text{Distress}\\ \text{Sale Value}\end{bmatrix} \times \begin{matrix}\text{Probability}\\ \text{of Distress}\end{matrix}$$

- Relative Valuation Models :
  Same as for Other Companies

Valuation of Startups

(1) Meaning of Startups :-

Startup is a Company (which is in the Initial Stage of Business) established to create unique products or services.

(2) Methods for Valuation of Startups :-

- Cost to Duplicate Approach :
  Value of Startup is based on Total Costs & Expenses of Startup & its Product development including Purchase of Physical Assets.

- Berkus Approach :
  Value of Startup is based on Total Estimated Value of 5 Key Success Factors [i.e. Basic Value, Technology, Execution, Strategic Relationship, Production & Sales]

- Comparable Transactions Method :
  Value of Startup is based on Valuation of similar startup.

  Example :

  A Ltd. is a Startup having 10 Lakh users. B Ltd. [similar business startup] has 2 Crore users & it is valued at ₹ 26 Crores.

  Solution :

  Value per user in B Ltd. [Similar Startup] ⇒ $\frac{₹\ 26\ \text{Crores}}{2\ \text{Crores}}$ = ₹ 13 per user

  ∴ Value of A Ltd. ⇒ 10 Lakh users × ₹ 13 per user ⇒ ₹ 1.3 Crores

- Scorecard Valuation Method:

Step 1: Calculate Scorecard Multiplier %

Qualities of Startup	Assign Quality % for comparison with similar Startup [1]	Weights of each qualities [2]	[1] × [2]
Strength of Team	✓	0.30	✓
Size of Opportunity	✓	0.25	✓
Product or Service	✓	0.15	✓
Competitive Environment	✓	0.10	✓
Marketing	✓	0.10	✓
Additional Investment Need	✓	0.05	✓
Others	✓	0.05	✓
		Multiplier %	✓

Step 2: Value of Startup = Valuation of Similar Startup × Multiplier %

- First Chicago Method:

Same as Cash Flow Based Models for Other Companies except that Expected future Cash Flows are calculated as follows:

Expected future Cash Flow$_t$ ⇒

Worst Scenario Cash Flow$_t$ × Probability of Worst Scenario$_t$		xxx
	+	
Normal Scenario Cash Flow$_t$ × Probability of Normal Scenario$_t$		xxx
	+	
Best Scenario Cash Flow$_t$ × Probability of Best Scenario$_t$		xxx
		xxx

- Venture Capital Method:

Step 1: Estimate Value of Startup at the time of Exit.

Step 2: Value of Startup = PV of estimated value at the time of exit using Investor's required rate of return



Mergers, Acquisitions & Corporate Restructuring

- **Part I: Introduction to Mergers, Acquisitions & Corporate Restructuring**
  - Meaning of Corporate Restructuring
  - Basics of Mergers & Acquisitions (M&A)
- **Part II: M&A through Shares Offer**
  - No. of Equity Shares to be issued to Shareholders of Target Company
  - Post Merger Book Value
  - Post Merger Earnings
  - Post Merger Market Value
  - Impact of Merger
  - Value of Original Shareholders
  - Maximum Exchange Ratio
  - Minimum Exchange Ratio
- **Part III: M&A through Cash Offer**
  - Cash to be paid to Shareholders of Target Company
  - Post Merger Book Value
  - Post Merger Earnings
  - Post Merger Market Value
  - Impact of Merger
  - Maximum Exchange Ratio
  - Minimum Exchange Ratio
- **Part IV: Other Calculations in M&A**
  - Value of Acquisition
  - Financial feasibility of Acquisition
- **Part V: Other Types of Corporate Restructuring**
  - Demerger
  - Reconstruction
  - Stock Split up
  - Bonus Issue
  - Equity Buyback

Part I: Introduction to Mergers, Acquisitions & Corporate Restructuring

Meaning of Corporate Restructuring

It is the process of reorganising company's operations to improve its efficiency by following ways (Types of Corporate Restructuring) :-

- Mergers & Acquisitions
- Demerger
- Reconstruction [Financial Restructuring]
- Stock Split Up
- Bonus Issue
- Equity Buyback [Ownership Restructuring]

Basics of Mergers & Acquisitions (M&A)

(1) Meaning of Mergers & Acquisitions :-

- It occurs when one company buys another company [i.e. Unification of 2 Entities into 1]
- Purchasing Company is known as 'Acquirer' & Selling Company is known as 'Target' [Target Company will cease to exist after merger]
- Consideration to shareholders of Target Company can be discharged

By Issuing Equity Shares of Acquirer Company [Shares Offer] **OR** By Paying Cash [Cash Offer]

(2) Promoters & Non Promoters Holding in a Company :-

No. of Equity Shares outstanding in Co. = No. of Equity Shares held by Promoters + No. of Equity Shares held by Non Promoters (Minority)

(i) Promoters Holding % = $\frac{\text{No. of Equity Shares held by Promoters}}{\text{No. of Equity Shares Outstanding in Co.}} \times 100$

(ii) Non Promoters Holding % = $\frac{\text{No. of Equity Shares held by Non Promoters}}{\text{No. of Equity Shares Outstanding in Co.}} \times 100$

(3) Types of Market Capitalization :-

(i) Market Capitalization = Market Value of All Equity Shareholders [Both Promoters & Non Promoters]

= MPS × No. of Equity Shares Outstanding in Company

OR

EATESH × P/E Ratio

(ii) Free Float Market Capitalization = Market Value of Non Promoters Equity Shareholders

= MPS × No. of Equity Shares held by Non Promoters

Part II : Mergers & Acquisitions through Shares Offer

No. of Equity Shares of Acquirer to be issued to shareholders of Target

Step 1 : Calculate Exchange Ratio or Swap Ratio [ER] :-

Exchange Ratio can be based on

Positive Parameter	Negative Parameter
[Eg : EPS, MPS, BVPS, etc.]	[Eg : NPA]
$ER = \frac{\text{Parameter of Target}}{\text{Parameter of Acquirer}}$	$ER = \frac{\text{Parameter of Acquirer}}{\text{Parameter of Target}}$

Note : If Exchange Ratio is to be calculated using more than one parameter, then Weighted Exchange Ratio is calculated by applying the Weights to each Exchange Ratio arrived using a paramater as follows :

$$\text{Exchange Ratio} = ER_1 \times W_1 + ER_2 \times W_2 + \ldots + ER_n \times W_n$$

Example :

	Acquirer Co.	Target Co.
No. of Equity Shares outstanding	1,00,000	1,00,000
MPS	₹ 50	₹ 40

Calculate Exchange Ratio on the basis of MPS.

Solution :

$$ER = \frac{40}{50} \Rightarrow \frac{4}{5} \Rightarrow 0.80 : 1$$

i.e. 0.80 Share of Acquirer will be issued for every 1 share of Target.

Step 2 : Calculate No. of Equity Shares of Acquirer Company to be issued to shareholders of Target Company :-

$\Rightarrow N_T \times ER$

Here, N_T = No. of Equity Shares outstanding in Target Co. (Pre Merger)

ER = Exchange Ratio

Note :-

(i) Sometimes, Amount of Consideration to be discharged to shareholders of Target Company is given in question, then

→ No. of Equity Shares of Acquirer Company to be issued to shareholders of Target Company are calculated as follows :

$$= \frac{\text{Amount of Consideration}}{MPS_A}$$

Here, MPS_A = MPS of Acquirer Company (Pre Merger)

$$\rightarrow ER = \frac{\text{No. of Equity Shares issued to shareholders of Target}}{\text{No. of Equity Shares outstanding in Target (Pre Merger)}}$$

(ii) Calculation of No. of Equity Shares outstanding in Merged Entity :-

$$N_{AT} = N_A + [N_T \times ER]$$

Here, N_{AT} = No. of Equity Shares outstanding in Merged Entity

N_A = No. of Equity Shares outstanding in Acquirer Co. (Pre Merger)

(iii) Promoters Holding % in Merged Entity :-

$$= \frac{\text{No. of Equity Shares held by Promoters in Acquirer} + \text{No. of Equity Shares issued to Promoters of Target}}{N_{AT}} \times 100$$

Post Merger Book Value [Book Value After Merger]

(1) Post Merger Book Value :-

Share Capital [N_{AT} × Face Value Per Share of Acquirer]	××
(+) Reserves [Reserves of Acquirer + Capital Reserve on Acquisition of Target]	××
	××

Here, Capital Reserve on acquisition of Target = Book Value of Target − [($N_T \times ER$) × Face Value Per Share of Acquirer]

(2) Post Merger Book Value Per Share (BVPS) :-

$$BVPS_{AT} = \frac{\text{Post Merger Book Value}}{N_{AT}}$$

Here, $BVPS_{AT}$ = Post Merger BVPS, i.e. BVPS of Merged Entity

Post Merger Earnings [Earnings After Merger]

(1) **Post Merger Earnings** :-

$$E_{AT} = E_A + E_T + \text{Synergy in Earnings (if any)}$$

Here, E_{AT} = Post Merger Earnings, i.e. EATESH of Merged Entity
E_A = EATESH of Acquirer Company (Pre Merger)
E_T = EATESH of Target Company (Pre Merger)

(2) **Post Merger Earnings Per Share (EPS)** :-

$$EPS_{AT} = \frac{E_{AT}}{N_{AT}}$$

Here, EPS_{AT} = Post Merger EPS, i.e. EPS of Merged Entity

Post Merger Market Value [Market Value After Merger]

(1) **Post Merger Market Price Per Share (MPS)** :-

- If P/E Ratio of Merged Entity is given in question :

$$MPS_{AT} = EPS_{AT} \times \text{P/E Ratio of Merged Entity}$$

Here, MPS_{AT} = Post Merger MPS, i.e. MPS of Merged Entity

- If P/E Ratio of Merged Entity is not given in question :

$$MPS_{AT} = \frac{V_A + V_T + \text{Synergy in Market Value (if any)}}{N_{AT}}$$

Here, V_A = Market Capitalization of Acquirer (Pre Merger or Calculated using valuation approach)
V_T = Market Capitalization of Target (Pre Merger or Calculated using valuation approach)
Synergy in Market Value = PV of future Gains or Savings

(2) **Post Merger Market Value (Market Capitalization)** :-

$$V_{AT} = MPS_{AT} \times N_{AT}$$

Here, V_{AT} = Post Merger Market Capitalization, i.e. Market Value of Merged Entity

Impact [Effect] of Merger for the shareholders
OR
Gain | Loss to shareholders from Merger
OR
Benefit [Profit] to shareholders from Merger
OR
Are shareholders Better or Worse Off than before Merger
OR
Accretion | Dilution due to Merger

(1) On the basis of EPS :-

Particulars	Acquirer	Target
Post Merger EPS	EPS_{AT}	
Equivalent EPS [Post Merger EPS × Exchange Ratio]		$EPS_{AT} \times ER$
(-) Pre Merger EPS	(EPS_A)	(EPS_T)
Gain | Loss Per Share	×××	×××
×	×	×
No. of Equity Shares Outstanding (Pre Merger)	N_A	N_T
Total Gain | Loss to shareholders	×××	×××

Here, EPS_A = EPS of Acquirer (Pre Merger)
EPS_T = EPS of Target (Pre Merger)

(2) On the basis of MPS :-

Particulars	Acquirer	Target
Post Merger MPS	MPS_{AT}	
Equivalent MPS [Post Merger MPS × Exchange Ratio]		$MPS_{AT} \times ER$
(-) Pre Merger MPS	(MPS_A)	(MPS_T)
Gain | Loss Per Share	×××	×××
×	×	×
No. of Equity Shares Outstanding (Pre Merger)	N_A	N_T
Total Gain | Loss to shareholders	×××	×××

Here, MPS_A = MPS of Acquirer (Pre Merger)
MPS_T = MPS of Target (Pre Merger)

Note :-

(i) In silent situation, Calculate Gain/Loss to shareholders on the basis of MPS.

(ii) Total Gains from Merger (Acquisition) :

⇒ Total Gain/Loss to shareholders of Acquirer on the basis of MPS + Total Gain/Loss to shareholders of Target on the basis of MPS

(iii) True Cost of Merger [Net Cost of Acquisition OR Cost of Takeover] :

⇒ Total Gain/Loss to shareholders of Target on the basis of MPS

Value of Original Shareholders

- It means Value of shareholders of Acquirer & Target in the Merged Entity, if there is No Synergy in Market Value.
- Steps to be followed to Calculate Value of Original Shareholders :-

Step 1 : Calculate Value per share of original shareholder in merged entity :

⇒ $\frac{V_A + V_T}{N_{AT}}$

Step 2 : Calculate Value of Original Shareholders :

Shareholders of Acquirer = Value per share (Step 1) × N_A

Shareholders of Target = Value per share (Step 1) × $[N_T \times ER]$

Maximum Exchange Ratio Acceptable to Acquirer Company

- It means Maximum Exchange Ratio that Acquirer can offer [without dilution of its EPS or MPS] to the shareholders of Target.
- It is calculated as follows :-

(i) Maximum Exchange Ratio without dilution of EPS [i.e Acquirer wants to maintain same EPS in Merged Entity as before merger] :

Post Merger EPS $[EPS_{AT}]$ = Pre Merger EPS of Acquirer $[EPS_A]$

$$\frac{E_{AT}}{N_{AT}} = EPS_A$$

$$\boxed{\frac{E_{AT}}{N_A + [N_T \times ER]} = EPS_A}$$

In this formula, Exchange Ratio is calculated as Balancing figure

(ii) Maximum Exchange Ratio without dilution of MPS [i.e. Acquirer wants to maintain same MPS in Merged Entity as before merger]:

Post Merger MPS $[MPS_{AT}]$ = Pre Merger MPS of Acquirer $[MPS_A]$

→ If P/E Ratio of Merged Entity is given in question

$$EPS_{AT} \times \text{P/E Ratio of Merged Entity} = MPS_A$$

$$\frac{E_{AT}}{N_{AT}} \times \text{P/E Ratio of Merged Entity} = MPS_A$$

$$\boxed{\frac{E_{AT} \times \text{P/E Ratio of Merged Entity}}{N_A + [N_T \times ER]} = MPS_A}$$

→ If P/E Ratio of Merged Entity is not given in question

$$\frac{V_A + V_T + \text{Synergy in Market Value (if any)}}{N_{AT}} = MPS_A$$

$$\boxed{\frac{V_A + V_T + \text{Synergy in Market Value (if any)}}{N_A + [N_T \times ER]} = MPS_A}$$

In these formula, Exchange Ratio is calculated as Balancing figure

Note:- In silent situation, Calculate Maximum Exchange Ratio without dilution of MPS.

Minimum Exchange Ratio Acceptable to Target Company

- It means Minimum Exchange Ratio that shareholders of Target can accept [without dilution of its EPS or MPS].
- It is calculated as follows:-

(i) Minimum Exchange Ratio without dilution of EPS [i.e. Target wants to maintain same EPS in Merged Entity as before merger]:

Equivalent EPS $[EPS_{AT} \times ER]$ = Pre Merger EPS of Target $[EPS_T]$

$$\frac{E_{AT}}{N_{AT}} \times ER = EPS_T$$

$$\boxed{\frac{E_{AT}}{N_A + [N_T \times ER]} \times ER = EPS_T}$$

In this formula, Exchange Ratio is calculated as Balancing figure

(ii) Minimum Exchange Ratio without dilution of MPS [i.e. Target wants to maintain same MPS in Merged Entity as before merger] :

Equivalent MPS $[MPS_{AT} \times ER]$ = Pre Merger MPS of Target $[MPS_T]$

→ If P/E Ratio of Merged Entity is given in question

$$EPS_{AT} \times \text{P/E Ratio of Merged Entity} \times ER = MPS_T$$

$$\frac{E_{AT}}{N_{AT}} \times \text{P/E Ratio of Merged Entity} \times ER = MPS_T$$

$$\boxed{\frac{E_{AT} \times \text{P/E Ratio of Merged Entity}}{N_A + [N_T \times ER]} \times ER = MPS_T}$$

→ If P/E Ratio of Merged Entity is not given in question

$$\frac{V_A + V_T + \text{Synergy in Market Value (if any)}}{N_{AT}} \times ER = MPS_T$$

$$\boxed{\frac{V_A + V_T + \text{Synergy in Market Value (if any)}}{N_A + [N_T \times ER]} \times ER = MPS_T}$$

In these formula, Exchange Ratio is calculated as Balancing figure

Note :- In silent situation, Calculate Minimum Exchange Ratio without dilution of MPS.

Part III : Mergers & Acquisitions through Cash Offer

Cash to be paid to shareholders of Target Company

- It is calculated as follows :-

  ⇒ Cash per share × N_T

- In case of Cash Offer, No. of Equity Shares Outstanding in Merged Entity will be equal to No. of Equity Shares Outstanding in Acquirer Company [Since No Shares are issued to shareholders of Target Company].

Post Merger Book Value [Book Value After Merger]

(1) **Post Merger Book Value** :-

Share Capital [N_A × Face Value Per Share of Acquirer]	××
(+) Reserves [Reserves of Acquirer + Capital Reserve on Acquisition of Target]	××
	××

Here, Capital Reserve on acquisition of Target = Book Value of Target − [Cash Per Share × N_T]

(2) **Post Merger Book Value Per Share (BVPS)** :-

$$BVPS_{AT} = \frac{\text{Post Merger Book Value}}{N_A}$$

Post Merger Earnings [Earnings After Merger]

(1) **Post Merger Earnings** :-

$$E_{AT} = E_A + E_T + \text{Synergy in Earnings (if any)} - \left[\text{Cash Per Share} \times N_T \times \text{Interest Rate \%} \ (1 - \text{Tax Rate})\right]$$

(2) **Post Merger Earnings Per Share (EPS)** :-

$$EPS_{AT} = \frac{E_{AT}}{N_A}$$

Post Merger Market Value [Market Value After Merger]

(1) **Post Merger Market Price Per Share (MPS)** :-

- If P/E Ratio of Merged Entity is given in question :

$$MPS_{AT} = EPS_{AT} \times \text{P/E Ratio of Merged Entity}$$

- If P/E Ratio of Merged Entity is not given in question :

$$MPS_{AT} = \frac{V_A + V_T + \text{Synergy in Market Value (if any)} - [\text{Cash Per Share} \times N_T]}{N_A}$$

(2) **Post Merger Market Value (Market Capitalization)** :-

$$V_{AT} = MPS_{AT} \times N_A$$

Impact [Effect] of Merger for the shareholders
OR
Gain | Loss to shareholders from Merger
OR
Benefit [Profit] to shareholders from Merger
OR
Are shareholders Better or Worse Off than before Merger
OR
Accretion | Dilution due to Merger

It is calculated as follows :-

Particulars	Acquirer	Target
Post Merger MPS	MPS_{AT}	
Cash Paid per share		Cash Per Share
(-) Pre Merger MPS	(MPS_A)	(MPS_T)
Gain | Loss Per Share	xxx	xxx
× No. of Equity Shares Outstanding (Pre Merger)	× N_A	× N_T
Total Gain | Loss to shareholders	xxx	xxx

Note :-
True Cost of Merger [Net Cost of Acquisition OR Cost of Takeover] :
⇒ Total Gain | Loss to shareholders of Target

Maximum Cash Per Share Acceptable to Acquirer Company

- It means Maximum Cash (Price) per share that Acquirer can offer [without dilution of its EPS or MPS] to the shareholders of Target.
- It is calculated as follows :-

(i) Maximum Cash Per Share without dilution of EPS [i.e. Acquirer wants to maintain same EPS in Merged Entity as before merger] :

$$\text{Post Merger EPS } [EPS_{AT}] = \text{Pre Merger EPS of Acquirer } [EPS_A]$$

$$\frac{E_{AT}}{N_A} = EPS_A$$

$$\frac{E_A + E_T + \text{Synergy in Earnings (if any)} - \left[\text{Cash Per Share} \times N_T \times \text{Interest Rate \%} \ (1 - \text{Tax Rate})\right]}{N_A} = EPS_A$$

In this formula, Cash Per Share is calculated as Balancing figure

(ii) Maximum Cash Per Share without dilution of MPS [i.e. Acquirer wants to maintain same MPS in Merged Entity as before merger]:

Post Merger MPS $[MPS_{AT}]$ = Pre Merger MPS of Acquirer $[MPS_A]$

→ If P/E Ratio of Merged Entity is given in question

$$EPS_{AT} \times \text{P/E Ratio of Merged Entity} = MPS_A$$

$$\frac{E_{AT}}{N_A} \times \text{P/E Ratio of Merged Entity} = MPS_A$$

$$\frac{\left[E_A + E_T + \text{Synergy in Earnings (if any)} - \left(\text{Cash Per Share} \times N_T \times \text{Interest Rate \%} \ (1 - \text{Tax Rate})\right)\right] \times \text{P/E Ratio of Merged Entity}}{N_A} = MPS_A$$

→ If P/E Ratio of Merged Entity is not given in question

$$\frac{V_A + V_T + \text{Synergy in Market Value (if any)} - [\text{Cash Per Share} \times N_T]}{N_A} = MPS_A$$

In these formula, Cash Per Share is calculated as Balancing figure

Note:- In silent situation, Calculate Maximum Cash Per Share without dilution of MPS.

Minimum Cash Per Share Acceptable to Target Company

- It means Minimum Cash (Price) Per Share that shareholders of Target can accept.
- It is calculated as follows:-

⇒ Pre Merger MPS of Target $[MPS_T]$ + Loss of Remuneration Per Share to Shareholders of Target (if any)

Part II : Other Calculations in Mergers & Acquisitions

Value of Acquisition

- It means addition in value of Acquirer after acquisition of Target.
- Value of Acquisition = $V_{AT} - V_A$

Financial Feasibility of Acquisition

- It is calculated as follows :-

PV of Cash Inflows from Target Company after acquisition	xx
(–) Net Outflow at beginning to acquire the Target Company	(xx)
NPV	xx/(xx)

Here, Net Outflow at beginning to acquire the Target Company ⇒

Value of Equity Shares issued by Acquirer [No. of Shares issued × MPS_A]	xx
(+) Amount of Debentures issued by Acquirer	xx
(+) External Liabilities [Current Liabilities] Settlement Amount	xx
(–) Amount Realised from Assets of Target [i.e. Debtors, Inventory & Cash]	(xx)
	xx

- Advise on Financial Feasibility of Acquisition :-

If NPV is Positive ⇓ Acquisition is advantageous

If NPV is Negative ⇓ Acquisition is not advantageous

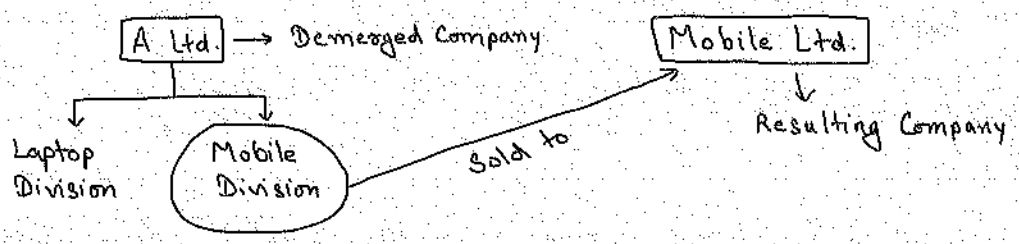
Part V: Other Types of Corporate Restructuring

Demerger

(1) **Meaning of Demerger** :-

- It is an arrangement where some part (division) of a Company [Demerged Company] is sold to another Company [Resulting Company].

Example:



- Generally, Resulting Company issue Equity Shares to existing shareholders of Demerged Company [i.e. Spin Off].

(2) **Effect of Demerger** :-

- Assets & Liabilities of sold division in Demerged Company are transferred to Resulting Company.
  Hence, Only Assets & Liabilities related to unsold division remains in Demerged Company.
- No. of Equity Shares Outstanding in Demerged Company will remain same after Demerger.

Reconstruction [Financial Restructuring]

Steps to be followed to Calculate Impact of financial Restructuring :-

Step 1: Calculate Benefits from Reconstruction:

Reduction in Equity Share Capital	xx
(+) Reduction in Preference Share Capital	xx
(+) Waiver (forego) of Debt Claims [Eg: Debentures, Interest accrued on Debentures, Trade Creditors]	xx
(+) Appreciation in Value of Assets [Eg: Upward Revaluation in fixed Assets]	xx
	xx

Step 2: Calculate Amount utilized out of above benefits:

Write off fictitious Assets [Eg: Preliminary Expenses, Cost of Issue of Debentures, etc.]	xx
(+) Write off Debit Balance of P&L A/c [Loss in P&L]	xx
(+) Creation of Provisions [Eg: Provision for Bad Debts]	xx
(+) Write down in value of assets [Eg: Downward Revaluation in fixed Assets]	xx
	xx

Step 3: Calculate Capital Reserve:

Step 1 − Step 2

Stock Split Up

- It is a process in which Company increases the No. of Equity Shares Outstanding by decreasing the Face Value of each share but Total Amount of Share Capital remains same even after split up.

- No. of Equity Shares Outstanding after Split up $= \frac{\text{Existing Amount of Share Capital}}{\text{New face Value per share after split up}}$

Bonus Issue

(1) Meaning of Bonus Issue :-

It is a process in which shares are issued to existing shareholders without any consideration by capitalisation of Reserves.

Example: Bonus Ratio ⇒ 1:4

It means 1 Bonus Share for every 4 Existing Shares

(2) Effect of Bonus Issue :-

- No. of Equity Shares Outstanding will increase after Bonus Issue.

No. of Equity Shares Outstanding After Bonus = No. of Equity Shares Outstanding Before Bonus + Bonus Shares

- Amount of Share Capital will also increase after Bonus Issue.

Amount of Share Capital After Bonus = No. of Equity Shares Outstanding After Bonus × Face Value Per Share

- Amount of Reserves will decrease after Bonus Issue [Since Bonus Issue is made out of Reserves]

$$\text{Amount of Reserves After Bonus} = \text{Amount of Reserves Before Bonus} - \left[\begin{matrix}\text{Bonus Shares} \\ \times \\ \text{Face Value Per Share}\end{matrix}\right]$$

- $\text{EPS after Bonus Issue} = \dfrac{\text{EATESH Before Bonus}}{\text{No. of Equity Shares Outstanding After Bonus}}$
- MPS after Bonus Issue = EPS after Bonus Issue × P/E Ratio
- $\text{Market Capitalization after Bonus Issue} = \text{MPS after Bonus Issue} \times \text{No. of Equity Shares Outstanding After Bonus}$

Equity Buyback OR Share Repurchase [Ownership Restructuring]

(1) Meaning of Equity Buyback :-

- It is a process in which Company buys its own Equity Shares from the Market to reduce the No. of Equity Shares Outstanding.
- Buyback Price [Price at which shares are bought back] is generally at a Premium over Current Market Price of Share.
  - (i) Buyback Price Per Share = Current MPS + Buyback Premium Per Share
  - (ii) $\text{Total Amount required for Buyback} = \text{No. of Equity Shares Bought Back} \times \text{Buyback Price Per Share}$

(2) Effect of Equity Buyback :-

- $\text{No. of Equity Shares Outstanding after Buyback} = \text{No. of Equity Shares Outstanding Before Buyback} - \text{No. of Equity Shares Bought Back}$
- $\text{EPS after Buyback} = \dfrac{\text{EATESH before Buyback} - \text{Interest on Loan taken for Buyback}\,(1 - \text{Tax Rate})}{\text{No. of Equity Shares Outstanding after Buyback}}$

Here, $\text{Interest on Loan taken for Buyback} = \text{Total Amount required for Buyback} \times \text{Interest Rate on Loan (\%)}$

- MPS after Buyback = EPS after Buyback × P/E Ratio
- $\text{Market Capitalization after Buyback} = \text{MPS after Buyback} \times \text{No. of Equity Shares Outstanding after Buyback}$



No practical concepts in this chapter.

Theory concepts of this chapter are covered in Section B of this book.

SECTION B

Theory Concepts

Financial Policy and Corporate Strategy



Advanced Role of CFO in Various Matters including Value Creation

- Traditionally, main role of CFO was concentrated to wealth maximisation for shareholders.
- However, in current scenario of globalization and growth in information and communication technologies etc., responsibilities of CFOs have been drastically expanded. Their role has been advanced in following areas:
  - (i) Risk management
  - (ii) Supply chain
  - (iii) Mergers, acquisitions, and corporate restructuring
  - (iv) Environmental, Social and Governance (ESG) financing
- Thus, CFOs are taking leadership role in value creation for the organisation.

Strategic Financial Decision-Making Framework

- Three fundamentals of a business are Strategy, Finance and Management.
- **Key decisions falling within scope of financial strategy [Key financial decisions]:**
  - (i) Financing decisions
  - (ii) Investment decisions
  - (iii) Dividend decisions
  - (iv) Portfolio decisions

Strategy at Different Hierarchy Levels

There are 3 levels of strategy as follows:	
Corporate Level Strategy	▪ It is concerned with selection of businesses in which a company should compete. ▪ It should be able to answer three basic questions: ➢ Suitability ➢ Feasibility ➢ Acceptability
Business Unit Level Strategy	▪ It is about practical coordination of operating units.
Functional Level Strategy	▪ It is related to functional business processes and value chain. ▪ It involves development of resources in operating departments through which business unit level strategies can be executed effectively and efficiently.

Financial Planning

Meaning	Financial planning is a systematic approach which helps a person to maximize his existing financial resources by utilizing financial tools to achieve his financial goals.
Components	▪ Financial resources ▪ Financial tools ▪ Financial goals
Outcomes	▪ Financial objectives Need to be consistent with corporate mission. ▪ Financial decision making Helps in analyzing financial problems and accordingly deciding course of action. ▪ Financial measures Ratio analysis, analysis of cash flow statement etc. are used to evaluate performance.

Interface of Financial Policy and Strategic Management

- It is the fact that starting point of an organization is money and end point of that organization is also money.
- Sources of finance and capital structure are the most important dimensions of a strategic plan.
- Another important dimension of strategic management and financial policy interface is the investment and fund allocation decisions.
- Dividend policy is another area for making financial policy decisions affecting the strategic performance of company.
- Hence, financial policy of company cannot be worked out in isolation of other functional policies.

Sustainable Growth

Balancing Financial Goals vis-a-vis Sustainable Growth	▪ Sustainable growth can be helpful for planning healthy corporate growth. ▪ This requires managers to set sales growth goals consistent with operating and financial policies of the firm. Often, a conflict can arise if growth objectives are not consistent with the value of the organization's sustainable growth. ▪ Sustainable growth is important to enterprise long-term development. Too fast or too slow growth will go against enterprise growth and development. So, adopt suitable financial policy to make enterprise growth speed close to sustainable growth rate.

Sustainable Growth Rate (SGR)	▪ It is the maximum rate of growth in sales that can be achieved at given level of firm's profitability. ▪ It is a measure of how much a firm can grow without borrowing more money. After the firm has passed this rate, it must borrow funds from another source to facilitate growth. ▪ SGR = ROE x (1 – Dividend payment ratio) ▪ Sustainable growth model assume that business wants to: ➢ Maintain a target capital structure. ➢ Maintain a target dividend payment ratio. ➢ Increase sales.
What makes an Organisation Financially Sustainable?	To be financially sustainable, organisation must have: ▪ More than one source of income. ▪ More than one way of generating income. ▪ Adequate financial systems. ▪ Good public image. ▪ Financial autonomy.
What makes an Organisation Sustainable?	To be sustainable, organisation must: ▪ have clear strategic direction. ▪ have adequate administrative and financial infrastructure. ▪ be able to scan its environment to identify opportunities. ▪ be able to attract and retain competent staff. ▪ get community support for its work.

Risk Management



Types of Risk Faced by an Organization

A business organization faces many types of risks as below:	
Strategic Risk	It is a risk in which company's strategy becomes less effective and it struggles to achieve its goal.
Compliance Risk	Every business needs to comply with rules and regulations. Non-compliance leads to penalties.
Operational Risk	It relates to internal risk i.e. failure on the part of company to cope with day-to-day operational problems. It also relates to 'people' as well as 'process'.
Financial Risk	It is referred as unexpected changes in financial conditions such as prices, exchange rate, credit rating, and interest rate etc.

Evaluation of Financial Risk

Financial risk can be evaluated from different point of views [i.e. it can be viewed from different perspectives] as follows:	
From Stakeholder's Point of View	They view financial gearing [ratio of debt in capital structure] as risk.
From Company's Point of View	If company borrows excessively, then it can be forced to go into liquidation
From Government's Point of View	Financial risk can be viewed as failure of any bank.

Methods for Identification and Management of Financial Risk [Classification of Financial Risk]

(1) **Counter Party Risk**

Meaning	It occurs due to non-honoring of obligations by counter party [Eg: failure to deliver goods, repayment of borrowings etc.]. Thus, it also covers credit risk.
Assessment/ Identification	Hints that provide indication of counter party risk are as follows: ▪ Failure to obtain necessary resources to complete the transaction. ▪ Regulatory restrictions from government. ▪ Hostile action of foreign government. ▪ Let down by third party. ▪ Have become insolvent.

Management/ Mitigation	Techniques/ways to manage counter party risk are as follows: ▪ Carrying out due diligence before dealing with any third party. ▪ Do not over commit. ▪ Know your exposure limits. ▪ Review credit limits regularly. ▪ Rapid action in event of defaults. ▪ Use of performance guarantee.

(2) Political Risk [Country Risk]

Meaning	It is faced by overseas investor, as the adverse action by government of host country may lead to huge loses.
Assessment/ Identification	Political risk can be identified from following actions by government of host country: ▪ Confiscation of overseas properties. ▪ Rationing of remittance to home country. ▪ Restriction on conversion of currency. ▪ Restriction as to borrowings. ▪ Price control of products. Organization interested in making investment in foreign country can assess country risk by: ▪ Referring political ranking. ▪ Evaluating macro-economic conditions. ▪ Analyzing popularity of current government. ▪ Taking advises from embassies.
Management/ Mitigation	Techniques/ways to manage political risk are as follows: ▪ Local sourcing of raw materials and labour. ▪ Entering in joint ventures. ▪ Local financing. ▪ Prior negotiations.

(3) Interest Rate Risk

Meaning	It occurs due to change in interest rate resulting in change in assets and liabilities.
Assessment/ Identification	Interest rate risk is identified from following: ▪ Monetary policy of government. ▪ Any action by Government such as demonetization. ▪ Economic growth.

	▪ Investment by foreign investors. ▪ Stock market changes.
Management/ Mitigation	Techniques/ways to manage interest rate risk are discussed in Interest Rate Risk Management chapter.

(4) Currency Risk

Meaning	It mainly affects the organization dealing with foreign exchange as their cash flows changes with movement in currency exchange rates.
Assessment/ Identification	Parameters to identify currency risk are as follows: ▪ Government action. ▪ Nominal interest rate. ▪ Inflation rate. ▪ Natural calamities. ▪ War, coup, rebellion etc. ▪ Change of government.
Management/ Mitigation	Techniques/ways to manage currency risk are discussed in Foreign Exchange Exposure and Risk Management chapter.

Value At Risk [VAR]

Meaning	▪ It is a measure of risk of investment. ▪ It estimates how much an investment might lose in a set of period (say 1 day) in normal market condition.
Features	▪ Components of calculations VAR calculation is based on following 3 components: ➢ Time period ➢ Confidence level [Generally 95% and 99%] ➢ Loss in percentage or in amount ▪ Statistical method Based on standard deviation. ▪ Time horizon For different time horizons say 1 day, 1 week, 1 month and so on. ▪ Probability Probability of maximum loss can be predicted. ▪ Risk control By setting limits for maximum loss.

	▪ Z score Indicates how many standard deviations is away from mean value.
Applications/ Significance	VAR can be applied: ▪ to measure maximum possible loss on any portfolio. ▪ to fix limits for individuals dealing in treasury department. ▪ to enable the management to decide trading strategies. ▪ as a benchmark for performance measurement. ▪ as a tool for asset and liability management.

Advanced Capital Budgeting Decisions



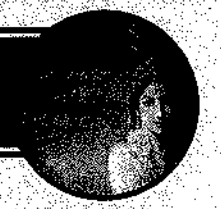
Sensitivity Analysis

Meaning	It helps in assessing information as to how sensitive are the estimated parameters of project (cash flows, discount rate, project life, etc.) to estimation errors.
Advantages	▪ Critical issues ▪ Simplicity
Disadvantages	▪ Assumption of independence ▪ Ignore probability

Simulation Analysis

Meaning	It is a technique in which infinite calculations are made to obtain the possible outcomes and probabilities for any given action.
Steps	Steps involved in simulation analysis are as follows: (i) Modelling the project [it shows relationship of NPV with parameters and exogenous variables]. (ii) Specify values of parameters and probability distributions of exogenous variables. (iii) Select value at random from probability distribution of each of exogenous variables. (iv) Determine NPV from randomly generated value of exogenous variables. (v) Repeat steps (iii) & (iv) to get large number of simulated NPVs. (vi) Plot probability distribution of NPVs and compute mean & standard deviation of returns.

Security Analysis



Meaning and Approaches of Security Analysis

- Security analysis involves systematic analysis of prices of securities so that an investor can take decision regarding purchase/sale of a security.
- Two approaches used for carrying out security analysis are fundamental analysis and technical analysis.

Fundamental Analysis

Fundamental Analysis is based on the assumption that share prices depend on future dividends. It involves:

(1) Economic Analysis

Factors affecting Economic Analysis	▪ Growth rates of national income and related measures ▪ Growth rates of industrial sector ▪ Inflation ▪ Monsoon
Techniques used in Economic Analysis	Indicators used to assess performance of economy are as follows: ▪ Anticipatory surveys ▪ Barometer/Indicator approach Indicators have been classified as under: ➢ Leading indicators ➢ Roughly coincidental indicators ➢ Lagging indicators ▪ Economic model building approach

(2) Industry Analysis

Factors affecting Industry Analysis	▪ Product life cycle ▪ Demand supply gap ▪ Barriers to entry ▪ Government attitude
Techniques used in Industry Analysis	Indicators used to assess performance of industry are as follows: ▪ Regression analysis ▪ Input-Output analysis

(3) Company Analysis

Factors affecting Company Analysis	▪ Net worth and book value ▪ Sources and uses of funds ▪ Growth record ▪ Financial analysis
Techniques used in Company Analysis	Indicators used to assess performance of company are as follows: ▪ Decision tree analysis ▪ Trend analysis ▪ Correlation & regression analysis

Technical Analysis

(1) Meaning of Technical Analysis

It is a method of share price movements based on study of price graphs or charts.

(2) Principles of Technical Analysis

(i) Market discounts everything

(ii) Price moves in trends

(iii) History tends to repeat itself

(3) Theories of Technical Analysis

The Dow Theory [Dow Jones Theory]	▪ It was originated by Charles Dow. ▪ It is helpful for determining relative strength of stock market. It can also be used as barometer of business. ▪ It is based upon the movements of two indices, DJIA and DJTA. ▪ The movements of market are divided into 3 classifications; primary movement, secondary movement, and daily fluctuations.
Elliot Wave Theory	▪ Ralph Elliot formulated Elliot Wave Theory. ▪ It is based on analysis of 75 years stock price movements and charts. ▪ It defines price movements in terms of waves. Wave is a movement of market price in same direction. ▪ As per this theory, waves can be classified into 2 parts: (i) Impulsive patterns (Basic waves) (ii) Corrective patterns (Reaction waves)
Random Walk Theory	▪ It states that the behaviour of stock market prices is unpredictable [i.e. past price trends do not reliably predict future price movements] because price trends represent statistical expression of past data.

(4) Market Indicators

▪ Breadth index	It is computed by dividing net advances or declines in market by number of issues traded. It either supports or contradicts the movement of dow jones averages.
▪ Volume of transactions	Volume of shares traded in market reflects how market would behave in near future.
▪ Confidence index	Example: Loan.
▪ Relative strength analysis	It suggests that prices of some securities rise relatively faster in bull market or decline more slowly in bear market than others [i.e. some securities exhibit relative strength].
▪ Odd-lot theory	It assumes that average person is usually wrong. Hence, wise course of action is to pursue strategies contrary to popular opinion.

(5) Evaluation of Technical Analysis

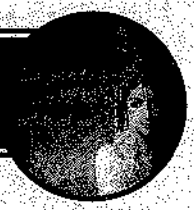
In a rational, well ordered and efficient market, technical analysis may not work well/perfectly. However, with imperfections which characterises the real world, technical analysis may be helpful. Thus, technical analysis has several supporters as well several critics.	
Arguments for Technical Analysis	▪ It helps in identifying trends early. ▪ It helps in detecting shift in demand and supply early.
Arguments against Technical Analysis	▪ Technical analysts are not able to provide convincing explanation for tools used by them. ▪ Evidence in support of random walk hypothesis cast its shadow on it.

Efficient Market Theory (Efficient Market Hypothesis)

Meaning	▪ It was developed by Eugen Fama. ▪ As per this theory, all available price sensitive information is fully reflected in securities prices i.e. no one can beat the market. ▪ Hence, it is impossible to outperform the overall market because stocks are always traded at their fair value.
Misconception	Major misconceptions about efficient market theory are: ▪ It is not possible for investor to earn consistent long term returns. ▪ Although price tends to fluctuate, they cannot reflect fair value. ▪ It is not possible to achieve superior investment performance since market efficiency exists. ▪ Random movement of stock prices suggests that stock market is irrational.

Level of Market Efficiency	▪ Weak form efficiency Price reflects all information found in record of past prices and volumes. ▪ Semi strong form efficiency Price reflects not only all information found in record of past prices and volumes but also all other publicly available information. ▪ Strong form efficiency Price reflects all available information in public as well as private.
Empirical Evidence on Weak form	3 types of tests are employed to empirically verify weak form of efficient market theory [i.e. there is no relationship between past and future price movements] as follows: ▪ Serial correlation test ➢ Price change in one period has to be correlated with price change in some other period using correlation coefficients for different lag periods. ➢ Analyze whether past price changes exhibit any significant correlation with future price changes. ▪ Run test ➢ Analyze sequence of daily price changes by counting number of runs where price changes are consistently positive or negative. ➢ Upon comparing observed number of runs with expected number based on randomness, determine whether it is statistically different. ▪ Filter rules test ➢ The rule involves buying when the price crosses a moving average of N% threshold and selling when it crosses another N% threshold. ➢ If behaviour of stock price changes is random, filter rule test should not be applied for buy and hold strategy. In this case, returns generated by trading strategy over period of testing will not be better than random chance.
Challenges	▪ Information inadequacy ▪ Limited information processing capabilities ▪ Irrational behaviour ▪ Monopolistic influence

Security Valuation



Duration of Bond

- Duration is the weighted average time within which an investor gets back the promised principal and YTM.
- Coupon bearing bond always has a duration which is lesser than its maturity. Higher the coupon rate, lesser would be the duration.

Zero Coupon Bonds (ZCB)

- These bonds do not pay interest. Instead, these are issued at discounted price to their face value.
- When it matures, investor will receive one lump sum (face value). Maturity of these bonds is usually long term.
- These bonds are issued by banks, government and private sector companies.

Role of Valuers

Valuations are required for following purposes:

(i) Mergers/Acquisitions/Demergers/Takeovers

(ii) Slump sale/Asset sale/IPR sale

(iii) Conversion of debt/security

(iv) Capital reduction

(v) Strategic financial restructuring

Responsibilities of Valuers

Code of conduct for registered valuers is as follows:

(i) Integrity and fairness

(ii) Professional competence and due care

(iii) Independence and disclosure of interest

(iv) Confidentiality

(v) Information management

Portfolio Management



Objectives of Portfolio Management

(i) Security/Safety of principal amount

(ii) Stability of income

(iii) Capital growth

(iv) Marketability

(v) Liquidity

(vi) Diversification

(vii) Favourable tax status

Capital Asset Pricing Model (CAPM)

Meaning	▪ It provides framework for evaluating any investment decision. ▪ It is developed to formulate the return required by investors. Required rate of return is the minimum expected return.
Assumptions	▪ Efficient market. ▪ Rational investment goals. ▪ All assets are liquid. ▪ Investors are able to borrow freely at a risk less rate of interest.
Advantages	▪ Risk adjusted return ▪ No dividend company
Disadvantages/ Limitations	▪ Reliability of beta ▪ Other risks ▪ Information available

Factors Affecting Decision of Investment in Fixed Income Securities

Following factors have to be evaluated in selecting fixed income avenues:

▪ Yield to maturity	Return earned by investor if he invests in fixed income avenues and holds it till its maturity.
▪ Risk of default	Look at the credit rating of securities as well as financial ratios such as interest coverage, earning power etc. and general prospect of industry.
▪ Tax shield	Several fixed income avenues offer tax shields.
▪ Liquidity	Fixed income avenues can be converted into cash at fairly short notice.

Portfolio Revision and Rebalancing

Meaning	It means the value of portfolio as well as its composition. The relative proportion of bond and stocks may change as stock prices fluctuate.
Policies	There are 3 policies of portfolio rebalancing as follows: ▪ Buy and hold policy [Do nothing policy] No rebalancing is required. ▪ Constant mix policy [Do something policy] Investor maintains exposure to stock at constant percentage of total portfolio. This strategy involves periodic rebalancing to required (desired) proportion by purchasing and selling stocks as and when their prices go down and up respectively. ▪ Constant proportion insurance policy [CPPI] Investor sets a floor which is invested in non-fluctuating assets such as Bonds. Value of portfolio under this strategy shall not fall below this specified floor. Following equation is used to determine equity allocation: Target Investment in Shares = Multiplier (Portfolio Value – Floor Value)

Asset Allocation Strategies

(i) Integrated asset allocation

(ii) Strategic asset allocation

(iii) Tactical asset allocation

(iv) Insured asset allocation

Alternative Investment Avenues

Meaning	Investments other than traditional investments (stock, bond and cash).
Types	Some of the important alternative investments are real estates, gold, mutual funds, hedge funds, exchange traded funds and commodities.
Features	Features of alternative investments that make them different from other investment avenues: ▪ High fees ▪ Limited historical rate ▪ Illiquidity ▪ Less transparency ▪ Extensive research required

Securitization



Features of Securitization

Securitization is the process of repackaging of illiquid assets into marketable securities. It has following features:	
▪ Creation of financial instruments	Process of creation of additional financial product of securities in market.
▪ Bundling and unbundling	When all assets are combined in one pool, it is bundling and when these are broken into instruments of fixed denomination it is unbundling.
▪ Tool of risk management	Risk management as risk of default is shifted.
▪ Structured finance	Tailor structured to meet risk return trade of profile of investor.
▪ Trenching	Portfolio of different receivable are split into several parts based on risk and return, they carry called 'Trenche'.
▪ Homogeneity	Securities issued are of homogenous nature.

Benefits of Securitization

Benefits of securitization can be viewed from angle of various parties involved as follows:	
From the Angle of Originator	Originator (entity which sells assets collectively to Special Purpose Vehicle) achieves the following benefits from securitization: ▪ Off balance sheet financing ▪ More specialization in main business ▪ Helps to improve financial ratios ▪ Reduced borrowing cost
From the Angle of Investor	Following benefits accrue to the investors of securitized securities: ▪ Diversification of risk ▪ Regulatory requirement ▪ Protection against default

Participants in Securitization

Participants in process of securitization are divided into following 2 categories:

(1) Primary Participants

Primary Participants are main parties to this process. Primary participants in process of securitization are as follows:

Originator	Initiator of deal or can be termed as securitizer. It is entity which sells assets lying in its books and receives funds from sale of such assets.
Special Purpose Vehicle (SPV)	Created especially for the purpose of securitization only. Originator transfers all rights in assets to SPV.
Investors	Buyers of securitized papers (individual or institutional investors).

(2) **Secondary Participants**

Other parties involved in securitization process are as follows:	
Obligors	Parties who owe money to the firm and are assets in balance sheet of originator.
Rating Agency	Assess credit quality of securitized assets.
Receiving and Paying Agent (RPA)	Also called as Servicer or Administrator, it collects payment due from obligors and passes it to SPV.
Agent or Trustee	Takes care of interest of investors who acquires the securities.
Credit Enhancer	Investors require additional comfort (credit rating of issued securities) which empowers marketability of securities. So, credit enhancer [Originator itself or third party like bank] provides additional comfort in form of collateral, letter of credit or surety bonds.
Structurer	Investment bankers also called arranger of the deal who brings together all parties to deal of securitization.

Mechanism of Securitization

Various steps in securitization mechanism are discussed as below:	
▪ Creation of pool of assets	By segregation of assets backed by similar type of mortgages.
▪ Transfer to SPV	Once assets have been pooled, they are transferred to Special Purpose Vehicle (SPV).
▪ Sale of securitized papers	SPV designs instruments based on pool of assets [Eg: PTC & PTS].
▪ Administration of assets	Collects principal and interest from underlying assets.
▪ Recourse to originator	Performance of securitized papers depends on performance of underlying assets & in case of default they go back to originator.
▪ Repayment of funds	SPV will repay funds to investors from assets pooled.
▪ Credit rating to instruments	Before sale of securitized instruments, credit rating can be done to assess risk of issuer.

Problems in Securitization [Reasons for Dismal Growth of Securitization]

Though the concept of securitization has become popular in India as a source of off balance sheet source of financing but its level of growth is still far behind. Following are main problems faced in growth of securitization of instruments in Indian context:	
▪ Stamp duty	Mortgage debt stamp duty which even goes upto 12%
▪ Taxation	SPV as a trustee is liable to be taxed in representative capacity. Investors will be taxed on their share of income.
▪ Accounting	Problem arises when assets are transferred without recourse.
▪ Lack of standardization	Every originator following his own format for documentation.
▪ Inadequate debt market	Lack of existence of well-developed debt market in India.
▪ Ineffective foreclosure laws	Foreclosure laws are not supportive to lending institutions.

Securitization Instruments

On the basis of different maturity characteristics, securitized instruments are divided into following 3 categories:	
Pass Through Certificates (PTCs)	▪ Originator transfers entire receipt of cash in form of interest or principal repayment from the asset sold. ▪ It represents direct claim of investors on all assets securitized by SPV [i.e. all cash flows are passed to investors on immediate basis].
Pay Through Security (PTS)	▪ SPV debt securities are backed by the assets and hence, SPV can restructure different tranches from varying maturities of receivables. ▪ It also permits the SPV to reinvest surplus funds for short term due to desynchronization in servicing of securities from cash flows.
Stripped Securities	▪ <u>These are created by dividing cash flows into 2 new securities as follows</u>: (i) Interest Only (IO) Securities (ii) Principle Only (PO) Securities ▪ Holder of IO securities receive only interest while PO security holder receives only principal. ▪ When yield to maturity in market rises, price of PO securities tends to fall. Value of IO securities increases when interest rate goes up.

Pricing of Securitized Instruments

Pricing should be acceptable to both originators and investors. Pricing of securities are divided into following two categories:

From Originator's Angle	Instruments can be priced at a rate at which originator has to incur an outflow.
From Investor's Angle	Security price can be determined by discounting best estimate of expected future cash flows using rate of yield to maturity.

Risks in Securitization

Investors are exposed to various types of risks in any securitization transaction as follows:	
Credit/ Counterparty Risk	Investors are prone to risk of bankruptcy and non-performance of servicer.
Legal Risks	There is absence of statutory provisions on securitization transactions in India. As a result, any dispute over legal ownership of assets can result in uncertainty of investor pay-outs.
Market Risks	▪ Macroeconomic risks Performance of underlying loan contracts depends on macroeconomic factors such as industry downturns. ▪ Prepayment risks Reduction in market interest rate results in prepayment of loans, resulting in reinvestment risk for investors to reinvest the amount at same yield. ▪ Interest rate risks If loans in the pool are based on floating rate and investor pay-outs are based on fixed rate or vice versa, it results in interest rate mismatch which can lead to a situation where pool cash inflows are not sufficient to meet investor pay-outs.

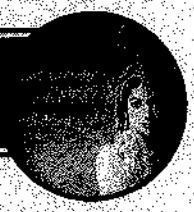
Tokenization

Meaning	It is a process of converting tangible and intangible assets into blockchain tokens.
Similarities Between Tokenization and Securitization	▪ Tokenization of illiquid assets attempts to convert illiquid assets into liquid product and hence, it resembles process of securitization. ▪ Following are some similarities between tokenization and securitization: ➢ Liquidity ➢ Diversification ➢ Trading ➢ New opportunities

Blockchain [Distributed Ledger Technology (DLT)]

Meaning	It is a shared, peer-to-peer, and decentralized open ledger of transactions with no trusted third parties in between. This ledger database has every entry as permanent which cannot be changed or altered.
Applications	▪ Financial services ▪ Healthcare ▪ Government ▪ Travel industry ▪ Economic forecasts
Risks	Risks associated with blockchain technology are as follows: ▪ There may be questions about who is responsible for managing risks and how proper accountability is to be achieved in a blockchain. ▪ If underlying technology has been tampered with, it could render the financial information stored in the ledger to be inaccurate and unreliable. ▪ In absence of any central authority, there could be a challenge in development and maintenance of process control activities. ▪ As blockchain involves humongous data, risk related to information overload could potentially challenge the level of monitoring required.

Mutual Funds



Establishment of Mutual Fund

- Mutual fund is required to be registered with SEBI.
- It is established through sponsor. Role of sponsor is same as promoter, who provides the initial capital and appoints trustees. Sponsor should be a body corporate in business of financial services for minimum 5 years.
- Mutual fund has to be established as trustee company or trust. At least 2/3rd of directors of trustee company must be independent.
- Asset management company (AMC) with minimum net worth of ₹ 100 crores, is to be appointed to manage the affairs of mutual fund. Sponsor should contribute at least 40% in net worth of AMC. Also, 50% of directors of AMC must be independent. AMC may charge management and advisory fees from mutual fund.
- Mutual fund also appoints a custodian to have custody of securities held by mutual fund.

Advantages & Disadvantages of Mutual Funds

Advantages	▪ Professional management ▪ Diversification ▪ Convenient administration ▪ Higher returns ▪ Highly regulated
Disadvantages/Drawbacks	▪ No guarantee of return ▪ Diversification ▪ Selection of proper fund ▪ Cost factor

Special Funds

Special funds are of following types:	
Index Funds	Invest funds in stocks exactly in same weightage which it bears in Index.
International Funds	Raises money in India but invests globally.
Offshore Funds	Located outside India which raises money globally for investing in India.
Sector Funds	Invest entire fund in particular sector like infrastructure, technology, etc.
Money Market Funds	Investment in short term debt instruments like commercial papers etc.

Fund of Funds	Invest in other mutual fund schemes.
Capital Protection Oriented Fund	Designed to protect capital invested through suitable orientation of portfolio structure [Major portion invested in debt and remaining in equity].
Gold Funds	Represent value of gold in form of ETF.
Quant Funds	Works on data driven approach for stock selection and investment based on pre-determined rules using statistics or mathematics models.

Exchange Traded Funds [ETF]

Meaning	▪ These funds are hybrids product that combine the features of listed stocks and index fund. These funds are listed on the stock exchanges and their prices are linked to the underlying index. ▪ ETFs can be bought or sold any time during market hours at prices which are closer to NAV at end of the day. ▪ There is no paper work involved for investing in ETF.
Types	Following types of ETF are available in market: ▪ Index ETFs ▪ Commodity ETFs ▪ Bond ETFs ▪ Currency ETFs

Side Pocketing

Meaning	It is separation of risky assets from other investments and cash holdings to make sure that money invested in stressed assets gets locked until the fund recovers the money.
Process	Whenever the rating of a mutual fund decreases, the fund shifts illiquid assets into a side pocket so that current unitholders can be benefitted from the liquid assets. Thus, it helps to enhance the value of fund for investors.

Tracking Error

- It is divergence or deviation of fund's return from the benchmarks return it is following.
- It is calculated on the basis of corresponding benchmark return vis a vis average NAV.
- Reasons for tracking error are transaction cost, fees charged by AMCs, fund expenses, etc.
- Thus, tracking error should be near to zero to replicate the return to any benchmark index.

Evaluation of Mutual Funds

Following parameters are used to evaluate performance of mutual funds:	
Quantitative Parameters	▪ Risk adjusted returns ▪ Benchmark returns ▪ Comparison to peers ▪ Comparison of returns across different economic and market cycles ▪ Financial measures: (i) Expense ratio [It is % of assets spent to run mutual fund that includes management fees, travel costs, audit fees, custodian fees, registrar fees, consultancy fees etc. but does not include brokerage costs for trading of portfolio] (ii) Sortino ratio [It is variation of sharpe ratio that uses downside deviation instead of total standard deviation in denominator] (iii) Sharpe ratio (iv) Treynor ratio
Qualitative Parameters	▪ Quality of portfolio ▪ Track record and competence of fund manager ▪ Credibility of fund house team

Role of Fund Managers in Mutual Funds

(i) Compliances

(ii) Constant monitoring the performance of fund

(iii) Creation of wealth and protection

(iv) Control over works outsourced to third parties



Marking to Market

- It is the process of recording investments in traded securities at market value.
- Futures contracts are marked to market on daily basis. Marking to market means that at the end of a trading session, all outstanding contracts are repriced at the settlement price.
- Any loss or profit resulting from repricing would be debited or credited to margin account.

Advantages of Stock Index Futures Trading Vs. Stock Futures Trading

Stock index futures is popular financial derivatives over stock futures due to following reasons:

(i) It adds flexibility.

(ii) It creates possibility of speculative gains.

(iii) It is the most cost-efficient hedging device.

(iv) It cannot be easily manipulated.

(v) It is settled in cash.

(vi) Regulatory complexity is much less in it.

(vii) It provides hedging for a stock portfolio.

Moneyness of Options

In the Money	Exercising of option would result in profit.
At the Money	Exercising of option would result in neither profit nor loss.
Out of the Money	Exercising of option would result in loss.

Assumptions of Black Scholes Model

(i) European Options are considered.

(ii) No transaction costs.

(iii) Short term interest rates are constant.

(iv) Variance of return is constant.

Options Greeks

- **Meaning of options greeks**

  Greeks are collection of statistical values that give overall view of how a stock has been performing.

It is helpful in deciding options strategies. Statistics show trends based on past performance.

- **Greeks used in option valuation**

Delta	It reflects change in option value upon 1 rupee change in price of underlying share.
Gamma	It reflects change in delta upon 1 rupee change in price of underlying share.
Theta	It reflects change in option value upon 1 day change in time to expiration.
Rho	It reflects change in option value upon 1% change in risk free interest rate.
Vega	It reflects change in option value upon 1% change in volatility.

Exotic Options

- **Meaning of exotic options**

Exotic options are option contracts with structure and features different from plain vanilla options. These are hybrid of american & european options and are traded in OTC market.

- **Types of exotic options**

Chooser Options	Right to decide whether purchased option is call or put option, after a specified period.
Compound/Split Fee Options	Right to buy another option at specific price on expiry of maturity date. Hence, also known as 'option on option'.
Barrier Options	Contract will activate only if the price of underlying reaches certain level during predetermined period.
Binary/Digital Options	Guarantees payoff based on happening of specific event. If event has occurred, payoff shall be pre decided amount and if event has not occurred, then there will be no payoff.
Asian Options	Payoff is based on average price of underlying during the lifetime of option.
Bermuda Options	Option can be exercised on certain dates before expiry or on expiration.
Basket Options	Value of option depends on the value of portfolio instead of one underlying.
Spread Options	Payoff depends on difference between prices of two underlying.
Look Back Options	Right to choose strike price on maturity date, depending on minimum and maximum price of underlying achieved during the lifetime of option.

Necessary Conditions of Commodity Derivatives

Commodity characteristic approach defines feasible commodities for derivatives trading based on an extensive list of required commodity attributes. Following attributes are required for derivatives trade:

(i) Commodity should be durable.

(ii) Units must be homogeneous.

(iii) Commodity must be subject to frequent price fluctuations.

(iv) Supply must flow naturally to market.

Credit Derivatives

- **Meaning of credit derivatives**

  It is a mechanism used by lender of loan to mitigate the credit risk (default by borrower on loan).

- **Types of credit derivatives**

(i) Collateralized Debt Obligations (CDO)

Meaning	Same as securitization except that CDO are backed by pool of bonds and asset backed securities.
Types	▪ Cash flow collateralized debt obligations It is backed by cash market debt/securities normally having low risk weight. ▪ Synthetic collateralized debt obligations Similar to cash flow CDOs but with the difference that instead of transferring ownerships of collateral to SPV, it is structured in a manner that credit risk is transferred by originator without actual transfer of assets. ▪ Arbitrage collateralized debt obligations Issuer captures spread between the return realized collateral underlying CDO and cost of borrowing to purchase these collaterals.
Risks	▪ Default risk [Credit risk] ▪ Interest rate risk [Basis risk] ▪ Liquidity risk ▪ Prepayment risk ▪ Reinvestment risk ▪ Foreign exchange risk

(ii) Credit Default Swaps (CDS)

Meaning	▪ Buyer of CDS (needing protection against default risk on loan given to initial borrower called reference entity) pays periodic premium to seller of CDS, who in turn assumes the default risk. ▪ Seller of CDS makes settlement (payment to buyer) only if reference entity defaults on loan, otherwise no cash flow will accrue to buyer.
Features	▪ It is a non-standardized private contract between buyer and seller. ▪ It is not traded on any exchange. ▪ It can be purchased from third party to protect from default of borrowers.

	▪ Premium of CDS has positive relationship with risk attached with loans. ▪ International swap and derivative association (ISDA) publishes guidelines and rules for conducting CDS transactions.
Calculations	▪ Total premium payable by buyer of CDS to seller of CDS = Loan amount x Premium % p.a. x Loan period in years ▪ If default occurs on loan, then seller of CDS will pay buyer of CDS = Par value of loan (Original loan amount) - Market value of loan

Weather Derivatives

- It is a derivative contract on weather patterns like rainfall, temperature, humidity etc.
- Seller of weather derivative receives premium from buyer with the understanding that seller will provide settlement amount in case buyer suffers any financial loss due to adverse weather conditions, otherwise seller makes profit through premium received.

Electricity Derivatives

Meaning	It is a derivative contract in which underlying asset is electricity prices.
Types	▪ Electricity forwards & futures Contract to buy or sell fixed amount of electricity on a specified future date at a pre fixed price. ▪ Electricity swaps Contract to pay fixed price for electricity regardless of floating electricity price, or vice versa, over the period of contract.

Derivative Mishaps and Lessons

Derivative Mishaps	Derivatives can be used for hedging purpose and also for speculation purpose. Due to this attribute of financial derivatives, derivatives are believed as financial weapons of mass destruction. There are many cases where derivatives have proven very fatal for organizations and even brought them to their knees.
Lessons from Derivative Mishaps	▪ Don't buy any derivative product that you don't understand. ▪ Due diligence before making treasury department as a profit centre. ▪ Specify the risk limits. ▪ Separation of front, middle and back offices. ▪ Ensure that hedger should not become speculator. ▪ Carry out simulation test, scenario analysis etc.



Money Market Hedging

Meaning	It is agreement to exchange certain amount of one currency for fixed amount of another currency at a particular date.
Advantages	▪ Fixes the future rate, eliminating downside risk. ▪ It is a way of hedging where forward contracts are not available.
Disadvantages	▪ More complicated to organize. ▪ Fixes the future rate, no benefit from favorable movements in exchange rates.

Nostro, Vostro and Loro Accounts

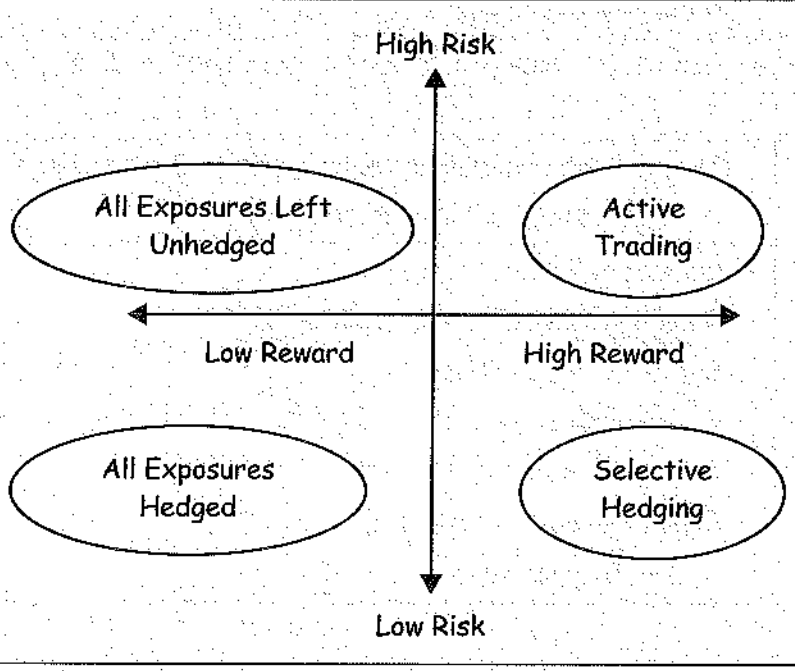
- In interbank transactions, Foreign exchange is transferred from one account to another account. Therefore, banks maintain 3 types of current accounts in different currencies. These accounts are Nostro, Vostro and Loro accounts meaning "our", "your" and "their".
- Foreign currency account maintained by bank in foreign country is known as Nostro Account or "our account with you".
- Vostro account is local currency account maintained by foreign bank. It is called "your account with us".
- Loro account is an account wherein bank remits funds in foreign currency to another bank for credit to account of third bank.

Foreign Exchange Exposure

Operations in foreign exchange market are exposed to a number of risks as follows:	
Transaction Exposure	It measures effect of exchange rate change on outstanding obligations that were settled after the exchange rate changes.
Translation/ Accounting Exposure	It refers to gains or losses caused by translation of foreign currency assets and liabilities into the currency of parent company for consolidation purposes.
Economic Exposure	It refers to the extent to which economic value of company can decline due to changes in exchange rate. Exchange rate changes alter the cost of firm's inputs and prices of its outputs.

Strategies for Exposure Management

Four strategy options are feasible for exposure management:	
Low Risk: Low Reward	It involves automatic hedging of exposures in forward market as soon as they arise [i.e. immediately covering position in forward or future market and never leave exposure open even for single day].
Low Risk: Reasonable Reward	It requires selective hedging of exposures whenever forward rates are attractive but keeping exposures open whenever they are not.
High Risk: Low Reward	It is the worst strategy as it leaves all exposures unhedged. It does not involve any time and effort.
High Risk: High Reward	It involves active trading in currency market through continuous cancellation and extension of forward contracts. It requires trading function to become a profit centre.





International Sources of Finance

There are various instruments of international finance as follows:	
Foreign Currency Convertible Bonds (FCCBs)	▪ It is a convertible bond issued in currency different than issuer's domestic currency [i.e. money raised by issuing company in foreign currency].
Global Depository Receipts (GDRs)	▪ Depository receipt is a negotiable certificate, denominated in currency not native to issuer, that represents the company's equity shares. ▪ Depository receipts issued in USA are called American Depository Receipts (ADRs), which are denominated in USD and outside of USA, these are called GDRs.
American Depository Receipts (ADRs)	▪ Depository receipts issued by a company in USA.
Euro Convertible Bonds (ECBs)	▪ It is a debt instrument which gives holders of bond an option to convert bond into equity shares of company.
Other Sources	▪ Euro Convertible Zero Bonds ▪ Euro Bonds with Equity Warrants ▪ Syndicated Bank Loans ▪ Euro Bonds ▪ Foreign Bonds ▪ Euro Commercial Papers ▪ Credit Instruments

Advantages & Disadvantages of Foreign Currency Convertible Bonds (FCCBs)

Advantages of FCCBs	▪ It gives investor the flexibility to convert bond into equity. ▪ It leads to delayed dilution of equity. ▪ FCCBs are easily marketable.
Disadvantages of FCCBs	▪ Exchange risk is more in FCCBs. ▪ Creation of more debt and outgo of interest in foreign exchange.

Impact of GDRs on Indian Capital Market

(i) Indian stock market is shifting from Bombay to Luxemburg.

(ii) Arbitrage possibility in GDR.

(iii) Indian stock market is no longer independent.

(iv) Indian retail investors are completely side lined.

(v) Foreign investment has flown into India.

International Financial Centre

Meaning	▪ Financial center that cater needs of customers outside their own jurisdiction. ▪ Deals with flow of funds, financial products and financial services even though in own land but with different set of regulations and laws. ▪ Thus, these centers provide flexibility in currency trading, insurance, banking and other financial services.
Benefits	There are numberless direct and indirect benefits of setting up IFC but some major benefits emanating from establishing IFC are as follows: ▪ Opportunity for qualified professionals working outside India come here and practice their profession. ▪ Platform for qualified professionals to pursue global opportunities without leaving their homeland. ▪ Stops brain drain from India. ▪ Bringing back financial services transactions carried abroad by overseas financial institutions of Indian financial market. ▪ Trading of complicated financial derivative can be started from India.
Constituents	Although there are many constituents for IFC but some of the important constituents are as follows: ▪ Highly developed infrastructure ▪ Stable political environment ▪ Strategic location ▪ Quality life ▪ Rationale regulatory framework ▪ Sustainable economy
Gift City	▪ Since foreign investors resist to get registered in India. ▪ GIFT city provides a separate jurisdiction where it is easy to do business because of relaxed tax and other laws. ▪ Accordingly, Government of India operationalized International Financial Services Centre (IFSC) at GIFT Multi Services SEZ in April 2015.

Sovereign Funds [Sovereign Wealth Fund (SWF)]

Meaning	▪ State owned investment fund comprised of money generated by government. ▪ This money derived by Government from country's own surplus reserves. ▪ Legal basis for SWF is constitutive law, fiscal law, constitution & company law. ▪ Popular sources for funding SWF are: ➢ Surplus reserves from state owned natural resource revenues. ➢ Bank reserves. ➢ Foreign currency operations. ➢ Money from privatizations.
Purpose/ Objectives	▪ Protection & stabilization of economy from excess volatility. ▪ Earn better returns than returns on foreign exchange reserves. ▪ Increase savings for future generations. ▪ Fund social and economic development.
Classifications	Depending on assets and objectives, SWF risk management can range from very conservative to high tolerance for risk. Traditional classifications of SWFs include: ▪ Stabilization funds. ▪ Savings funds. ▪ Public benefit pension reserve funds. ▪ Reserve investment funds.
Types of Sovereign Investment Vehicles	▪ Sovereign wealth funds (SWF). ▪ Public pension funds. ▪ State owned enterprises. ▪ Sovereign wealth enterprises (SWE).

Objectives of International Cash Management

Main Objectives	Main objectives of effective system of international cash management are: ▪ Minimise currency exposure risk. ▪ Minimise overall cash requirements of company. ▪ Minimise transaction costs. ▪ Minimise country's political risk. ▪ Advantage of economies of scale.
Basic Objectives	International cash management also has two basic objectives: ▪ Optimising cash flow movements. ▪ Investing excess cash.

Interest Rate Risk Management



Types of Interest Rate Risk

Various types of interest rate risk faced by companies are as follows:	
Net Interest Position Risk	Where banks have more earning assets than paying liabilities, interest rate risk arises when market interest rates adjust downwards. Thus, banks with positive net interest positions will experience reduction in Net Interest Income (NII) as market interest rate declines.
Price Risk	It occurs when assets are sold before their stated maturities because bond prices and yields are inversely related.
Reinvestment Risk	Uncertainty of interest rate at which cash flows could be reinvested.
Basis Risk	Risk that interest rate of different assets and liabilities may change in different magnitude.
Yield Curve Risk	Movements in yield curve are frequent when economy moves through business cycles.
Embedded Option Risk	Changes in market interest rates create risk to banks' profitability by encouraging prepayment of loan & exercise of options on loan.
Gap Exposure/ Mismatch Risk	It arises from holding assets & liabilities with different amounts or maturity creating exposure to unexpected changes in interest rates.

Methods of Hedging Interest Rate Risk

Methods of hedging interest rate risk are divided into following two categories:	
Traditional Methods	▪ Asset and Liability Management (ALM) It is a framework for measuring, monitoring and managing market risk of bank. It is the management of structure of balance sheet so that net earnings from interest are maximized. It enables institutions to measure and monitor risk, and provide suitable strategies for their management. ▪ Forward Rate Agreement (FRA) It is an agreement between two parties through which borrower/lender protects itself from changes in interest rate.
Modern Methods	▪ Interest Rate Futures (IRF) Contract between buyer & seller for future delivery of interest-bearing asset. ▪ Interest Rate Options (IRO)/Interest Rate Guarantee (IRG) It is a right allowing businesses to protect themselves against adverse interest rate

	movements while allowing them to benefit from favourable movements. ▪ Interest Rate Swaps In this, parties to agreement (swap counterparties) agree to exchange payments indexed to two different interest rates. ▪ Swaptions It is an option on interest rate swap.

Forward Rate Agreements (FRA)

Meaning of FRA	It is an agreement between two parties through which borrower/lender protects itself from changes in interest rate.
Features of FRA	Following are main features of FRA: ▪ It is used to fix interest costs. ▪ It is an Off Balance Sheet instrument. ▪ It does not involve any transfer of principal. ▪ It is settled at maturity in cash. ▪ Final settlement amount is determined by following formula: $\text{Final Settlement} = \frac{(N)(RR - FR)(dtm/DY)}{[1 + RR\ (dtm/DY)]}$ If RR > FR, seller owes the payment to buyer and if RR < FR, buyer owes the payment to seller.

Swaptions

Meaning	▪ It is an option on interest rate swap. ▪ It gives holder the right to enter into interest rate swap at specific date in future, at fixed rate and for specified term. ▪ There are 2 types of swaption contracts: (i) Fixed rate payer swaption (also called Call Swaption). (ii) Fixed rate receiver swaption.
Principal Features	▪ It is an option on a forward start interest rate swap. ▪ Option period refers to time between transaction date and expiry date. ▪ Swaption premium is expressed as basis points. ▪ Swaptions can be cash settled.
Uses [Areas of Application]	▪ It can be applied for both active traders as well as corporate treasurers. ▪ It can be used for speculation purposes.

	▪ It is a useful tool for hedging. ▪ It is useful to borrowers targeting an acceptable borrowing rate. ▪ It is useful to businesses tendering for contracts. ▪ It provides protection on callable/puttable bond.



Relative Valuation

- It is the method to arrive at 'relative' value using 'comparative' analysis to its peers or similar enterprises.
- Financial analysts are using relative valuation to validate the intrinsic value.
- It is also referred as 'Valuation by multiples' because it uses financial ratios to derive at 'multiple' and then compares the same to that of comparable firms.

Differentiate between Economic Value Added (EVA) and Market Value Added (MVA)

Economic Value Added (EVA)	▪ EVA is holistic method of evaluating company's financial performance. As per EVA, company generates 'value' only if there is creation of wealth in terms of returns in excess of its cost of capital. The formula is as below: ▪ EVA = NOPAT – [Invested Capital x WACC] = NOPAT – Capital Charge
Market Value Added (MVA)	▪ MVA means Current Market Value of firm minus Invested Capital. It is a way to gauge performance efficiencies of an enterprise. ▪ Hence, MVA is true value added while EVA is a derived value added.

Going Concern and Non-Going Concern Valuation

- Valuation of business entity is made on assumption that it is going concern and will continue for foreseeable future. Thus, valuation based on non-going concern assumption should be applied only when investors are of the view that firm is not a going concern.
- Going concern value is known as total value because ongoing firm will continue to earn profit which contributes to its value in addition to its liquation value.
- Non-going concern valuation is known as liquidation valuation because it is the net value realised after disposing off all assets and discharging all liabilities.

Valuation of Professional or Consultancy Firms (Chartered Accountants, Advocates, Management Consultancy Firms)

- Valuation experts look at the firm's historical data to compare it with industry key performance indicators (KPIs) and benchmarks. Further, they compare the company against its competitors.
- When using income approach, there is risk associated in calculation of terminal value due to estimation of projected growth. Hence, this risk should be factored into overall calculation.
- Also, normalisation of cash flows is done by adding back non-cash items and certain specific items

which might not apply to a new firm. Then, these normalized cash flows are used in valuation methods to calculate overall value.

Impact of ESG on Valuation

Impact of ESG factors can be incorporated in computation of expected cash flows as follows:	
E of ESG	Risk of this factor (Environment) can be incorporated by carrying out 2-degree scenario analysis i.e. if temperature of the plant is increased by 2 degrees. Similarly, adjustment in cash flows can be made by considering carbon points.
S of ESG	Risk of this factor (Social) can be considered by adjusting impact of social measures cost (such as better labour working conditions) on the revenue.
G of ESG	Risk of this factor (Governance) can be considered by adjusting impact of poor governance on revenue in the form of penalty, fines, taxes etc.



Synergy in Mergers and Acquisitions

- Synergy is defined as follows: $V(AB) > V(A) + V(B)$.
- It means combined value of two firms shall be more than their individual value.
- It is increase in performance of combined firm as a result of economics of scale.

Forms (Types) of Mergers

Following are the major types of mergers:	
Horizontal Merger	It happens when two companies which have merged are in same industry and it may move closer to monopoly.
Vertical Merger	It happens when two companies that have 'buyer-seller' relationship come together.
Conglomerate Merger	It happens when firms engaged in unrelated type of business operations come together.
Congeneric Merger	In this, acquirer and target companies are related through basic technologies, production processes or markets.
Reverse Merger	▪ In this, smaller company gains control of larger one. ▪ <u>Following 3 tests should be fulfilled before arrangement can be termed as reverse merger</u>: ➢ Assets of transferor are greater than transferee. ➢ Equity capital to be issued by transferee exceeds its original issued capital. ➢ Change of control in transferee company. ▪ This type of merger is also known as 'back door listing'. ▪ <u>Reverse merger leads to following benefits for acquiring company</u>: ➢ Easy access to capital market. ➢ Tax benefits on carry forward losses. ➢ Cheaper and easier route to become a public company.

Takeover Strategies and Defensive Tactics

Meaning of Takeover	Acquisition is takeover if process of acquisition is unfriendly (hostile).
Takeover Strategies/ Techniques	▪ Street sweep ▪ Bear hug

	▪ Strategic alliance ▪ Brand power
Takeover Defensive Tactics	▪ Divestiture ▪ Crown jewels ▪ Poison pill ▪ Poison put ▪ Greenmail ▪ White knight ▪ White squire ▪ Golden parachutes ▪ Pac-man defence

Divestment/Divestiture/Demerger

- **Meaning of divestment/divestiture/demerger**

  It means a company selling one of its divisions to another company or creating a separate company.

- **Forms/ways of divestment**

Spin Off	▪ In this, part of business is separated and created as a separate firm. Existing shareholders of the firm get proportionate ownership. ▪ Spin off does not bring fresh cash.
Equity Carve Outs	▪ This is like spin off. However, some shares of new company are sold in market by public offer, so this brings cash. ▪ Parent keeps a controlling stake in newly traded subsidiary.
Split Up	▪ It involves breaking up of entire firm into a series of spin off by creating separate legal entities. ▪ Parent firm no longer exists and only newly created entities survive.
Sell Off	▪ It is sale of an asset by one entity to another for purchase consideration.

Unlocking Value through Mergers, Acquisitions & Business Restructuring

(i) Horizontal growth helps to enlarge market share and curb competition.

(ii) Vertical combination helps to economise costs.

(iii) Diversification of business.

(iv) Business restructuring helps in:

- ➢ Positioning company to be more competitive and into entirely new direction.
- ➢ Surviving company in adverse economic climate.

Startup Finance



Startup India Initiative

Startup Conditions/ Criteria	An entity needs to satisfy following conditions/criteria to be considered as a startup to avail the benefits of government scheme: (i) Entity shall be considered as startup upto 10 years from date of incorporation, if it is incorporated as private limited company or partnership firm or limited liability partnership. (ii) Turnover for any financial year since incorporation has not exceeded 100 crore rupees. (iii) Entity is working towards innovation, development or improvement of products or services, or if it is scalable business with high potential of employment generation or wealth creation.
Not Considered as Startup	Entity formed by splitting up or reconstruction of existing business is not considered as startup.

Innovative Ways to Finance a Startup

Non-bank financial sources are becoming popular to finance startups. Some of the innovative sources for funding a startup are as follows:	
▪ Personal financing	Example: Savings.
▪ Personal credit lines	Example: Credit cards.
▪ Family and friends	Example: Loan.
▪ Peer-to-peer lending	It is in existence for many years. In this, group of people come together and lend money to each other.
▪ Crowdfunding	It is contemporary source of finance. In this, small amounts of capital from large number of individuals through social media and crowdfunding websites is raised to finance a new business initiative.
▪ Microloans	Small loans given by individuals at lower interest rate to new business venture.
▪ Vendor financing	Manufacturers and distributors defer the payment terms.
▪ Purchase order financing	Purchase order financing companies advance the required funds to supplier to complete a large new order.
▪ Factoring accounts receivables	Facility is given to seller who sold goods on credit to fund his receivables.

Pitch Presentation

Meaning of Pitch Presentation	▪ Pitch presentation is short and brief presentation (not more than 20 minutes) to investors explaining about the prospects the company and why they should invest into the startup business. ▪ It provides quick overview of business plan and convincing investors to put money into business. ▪ It can be made in face-to-face meetings or online meetings.
Methods for Approaching Pitch Presentation	Points to be kept in mind while preparing pitch presentation are as follows: ▪ Introduction Introduction of startup. ▪ Team Introduce the people behind the scenes. ▪ Problem Promoter should explain the problem he is going to solve. ▪ Solution Describe how company is planning to solve the problem. ▪ Marketing or Sales Market size of product must be communicated to investors. Promoter can brief investors about the growth and forecast future revenue. ▪ Projections or Milestones Projected financial statements can be presented like, income statement, cash flow statement, balance sheet etc. ▪ Competition Highlight how the products or services are different from their competitors. ▪ Business model It denotes core aspect of business including purpose, business process, target customers, infrastructure, sourcing, operational processes and policies. ▪ Financing Talk about how much money has already been raised, who invested money into the business and what they did about it.

Concept of Unicorn

- A startup is referred as a Unicorn if it has following features:

(i) A privately held startup.

(ii) Valuation of startup reaches US$ 1 billion.

(iii) Emphasis is on the rarity of success of such startup.

(iv) Other common features are new ideas, innovation, consumer focus, high on technology etc.

- However, if valuation of any startup slips below US$ 1 billion it can lose its status of Unicorn.
- InMobi (ad-tech startup) became first Unicorn of India [SoftBank invested US$ 200 million in it].
- Decacorn is a company which has attained valuation of more than US$ 10 billion.

Modes of Financing for Startups

(1) Bootstrapping

Meaning of Bootstrapping	An individual is said to be boot strapping when he attempts to found and build a company from personal finances or from the operating revenues of new company.
Methods of Bootstrapping	Methods in which a startup firm can bootstrap: ▪ Trade credit When a person is starting his business, suppliers are reluctant to give trade credit. In this situation, prepare a well-crafted financial plan and convince the supplier. ▪ Factoring Account receivable is sold to commercial finance company to raise capital. ▪ Leasing Take equipment on lease rather than purchasing it.

(2) Angel Investors

- Angel investors invest in small startups or entrepreneurs. They are entrepreneur's family and friends. The capital angel investors provide is one-time investment to help the business propel in difficult early stages.
- Angel investors provide more favorable terms compared to other lenders, since they invest in entrepreneur starting the business rather than the viability of business. Essentially, angel investors are opposite of venture capitalists.
- Angel investors are also called informal investors, angel funders, private investors, seed investors or business angels.
- Angel investors use their own money, unlike venture capitalists who take care of pooled money from many other investors.
- Though angel investors represent individuals but entity that actually provides the fund may be a company, business, trust or investment fund.

(3) Venture Capital Fund

- **Basics**

Meaning	▪ Venture capital fund means investment vehicle that manage funds of investors seeking to invest in startup firms with exceptional growth potential. ▪ Venture capitalists (VC) generally: ➢ Finance new and rapidly growing companies. ➢ Purchase equity securities. ➢ Assist in development of new products or services. ➢ Add value to the company through active participation.
Characteristics	Venture capital financing is a unique way of financing startup. Basic characteristics of venture capital financing are as follows: ▪ Long time horizon Minimum period of investment would be 3 years and maximum period can be 10 years. ▪ Lack of liquidity There would be less liquidity on equity venture capitalists gets. ▪ High Risk It works on principle of high risk and high return. ▪ Equity Participation Venture capitalists invest in form of equity of company.
Advantages	Advantages of bringing venture capital in company: ▪ It injects long-term equity finance. ▪ Venture capitalist is business partner, sharing both risks and rewards. ▪ Venture capitalist is able to provide practical advice and assistance to company. ▪ Venture capitalist also has network of contacts that can add value to company. ▪ Venture capitalist are capable of providing additional rounds of funding. ▪ Venture capitalist are experienced in preparing company for initial public offering (IPO). ▪ They can also facilitate a trade sale.

- **Stages of venture capital funding**

Venture capital funding passes through various stages. For venture capitalist, while risk is different in each stage of financing, so the risk perception and activity to be financed. Indicative Risk Matrix of each stages of funding for venture capital financing is given below:

Stages	Period (Funds locked in years)	Risk Perception	Activity to be financed
Seed Money	7-10	Extreme	For supporting an idea and involves low level of financing.
Start Up	5-9	Very high	For initializing prototype operations or developing products and its marketing.
First Round	3-7	High	For starting commercial production and marketing.
Second Round	3-5	Sufficiently high	For growing working capital need, though company is not earning profit.
Third Round	1-3	Medium	For market expansion & product development for profit making company [Mezzanine financing].
Fourth Round	1-3	Low	For facilitating public issue [Bridge financing].

- **Venture capital investment process**

Venture capital investment process can be segregated into following steps:	
Deal Origination	➢ VC operates directly or through intermediaries (CA). ➢ Company would give a detailed business plan, financial plan and exit plan. All these aspects are covered in a document which is called Investment Memorandum (IM).
Screening	➢ Once deal is sourced, it is sent for screening to senior level people. ➢ Once screening happens, it would select the company for further processing.
Due Diligence	➢ Once decision is taken to proceed further, VC verify the veracity of documents taken using external bodies (consultants).
Deal Structuring	➢ Once case passes through due diligence, deal is structured in such a way that both parties win. ➢ In many cases, convertible structure is used to ensure that promoter retains the right to buy back share. ➢ To facilitate exit, VC may put a condition that promoter must sell a part of his stake along with VC. Such clause is called tag-along clause.

Post Investment Activity	➢ VC nominates its nominee in the board of company.
Exit Plan	➢ At time of investing, VC would ask the promoter to spell out exit plan in detail. ➢ Exit happens in 2 ways as follows: (i) Sell to third party [IPO or Private placement to other VC]. (ii) Promoter would give buy back commitment at pre agreed rate (generally between IRR of 18% to 25%).

- **Structure of venture capital fund in India**

3 types of fund structure exist [1 for domestic and 2 for offshore funds] as follows:	
Domestic Funds	➢ One which raises funds domestically are structured as: (i) Domestic vehicle for pooling of funds from investor, and (ii) Separate investment adviser that carries duties of asset manager. ➢ Choice of entity for pooling vehicle falls between trust and company.
Offshore Funds	2 common alternatives available to offshore investors are: (i) Offshore structure Investment vehicle (LLC or LP organized outside India) makes investments directly into Indian companies. Assets are managed by offshore manager. (ii) Unified structure When domestic investors are also expected to participate in fund, unified structure is used. Overseas investors pool their assets in offshore vehicle that invests in locally managed trust, whereas domestic investors directly contribute to the trust.

Why India became Sustainable Environment for Startups to Thrive in

Some of the major reasons are as follows:

(i) Pool of talent

(ii) Cost effective workforce

(iii) Increasing use of internet

(iv) Technology

(v) Variety of funding options available

Succession Planning in Business

Meaning of Succession Planning	▪ Succession planning is process of identifying critical positions within organization and developing action plans for individuals to assume those positions. ▪ This ensures that the right people are available for right jobs today and in the years to come. ▪ It is a good way for companies to ensure that businesses are fully prepared to promote and advance all employees, not just those who are at management or executive levels.
Need for Succession Planning	▪ Risk mitigation ▪ Cause removal ▪ Talent pipeline ▪ Conflict resolution mechanism ▪ Aligning
Business Succession Strategy	▪ Step 1: Evaluate key leadership positions ▪ Step 2: Map competencies required for above positions ▪ Step 3: Identify competencies of current workforce ▪ Step 4: Bridge leader
Challenges in Implementing Succession Planning	▪ Founder mindset might be different than corporate mindset. ▪ Premature for startups to implement business succession. ▪ Founders are face of startups and in his absence succession planning can become difficult.