Time Value of Money

LOS 1: Introduction

- Time value of Money is the first and the most important chapter of Finance.
- Anything connected with Finance is based on the “TIME VALUE OF MONEY”
- ₹ 100 today is Not Equal to ₹ 100 a year later.
- Three Factors determines the Time Value of Money:

\[
\text{Expected Inflation Rate} + \text{Real Rate of Return on Risk free Investment} + \text{Risk Premium}
\]

TVM TECHNIQUES

PRESENT VALUE / DISCOUNTING TECHNIQUES

\[ PV = \frac{FV}{(1 + r)^n} \]

FUTURE VALUE / COMPOUNDING TECHNIQUES

Normal Compounding

\[ FV = PV \left(1 + \frac{r}{m}\right)^{mn} \]

Continuous Compounding

\[ FV = PV \times e^{rt} \]

LOS 2: Future Value of a Single Cash Flow

\[ FV = PV \times (1 + r)^n \]

Example:

You invest ₹ 15,000 for two years that pays you 12% p.a. how much will you have at the end of two years?
1.2 TIME VALUE OF MONEY

**Solution:**

\[ FV = PV \times (1 + r)^n \]

\[ = 15,000 \times (1 + 0.12)^2 \]

\[ = 18,816 \]

**Example:**

You need ₹ 10,000 for buying a mobile next year. You can earn 10% on your money. How much do you need to invest today?

**Solution:**

\[ FV = 10,000 \]

\[ r = 10\% \]

\[ n = 1 \text{ year} \]

\[ PV = \frac{FV}{(1+r)^n} \Rightarrow \frac{10,000}{(1+0.10)^1} = 9090.91 \]

**LOS 4 : Future Value of a Multiple Unequal Cash Flow**

**Example:**

Suppose you receive ₹ 1000 today, another ₹ 1200 a year later and ₹ 1300 two year later. How much will you have three years from today? Interest Rate @ 10%

**Solution:**

\[ 1000 \times (1 + 0.10)^3 = 1331 \]

\[ 1200 \times (1 + 0.10)^2 = 1452 \]

\[ 1300 \times (1 + 0.10)^1 = 1430 \]

\[ 4213 \]

**Example:**

Mr. X receives ₹ 1000, 1500, 1100, 1400 & 400 at the end of year 1, 2, 3, 4 & 5. Rate = 10%, Calculate PV.

\[ \frac{1000}{(1+0.10)^2} + \frac{1500}{(1+0.10)^3} + \frac{1100}{(1+0.10)^4} + \frac{1400}{(1+0.10)^5} + \frac{400}{(1+0.10)^5} \]

\[ PV = 4179.30 \]
LOS 6: Present Value of a Multiple Equal Cash Flow (Period Defined)

a) **Present Value of Multiple Equal Cash Flow (Period Defined) :- (at the end of each year)**

**Example:**
Mr. X will receive ₹ 1000 at the end of each year upto 5 years, Rate = 10%. Find Present Value.

\[
\begin{align*}
\text{PV} &= \frac{1000}{(1+0.10)^1} + \frac{1000}{(1+0.10)^2} + \frac{1000}{(1+0.10)^3} + \frac{1000}{(1+0.10)^4} + \frac{1000}{(1+0.10)^5} \\
&= 1000 \text{ [PVAF @ 10% for 5 years]} \Rightarrow 1000 \times 3.791 \Rightarrow 3791
\end{align*}
\]

Or

\[
\text{PV} = 1000 \times 3.791 \Rightarrow 3791
\]

**Note:** If question is silent always assume Deferred Annuity.

b) **Present Value of Multiple Equal Cash Flow (Period Defined) :- (at the Beginning of each year)**

**Example:**
Mr. X will receive ₹ 1000 starts from today upto 5 years, Rate = 10%. Find Present Value.

\[
\begin{align*}
\text{PV} &= \frac{1000}{(1+0.10)^0} + \frac{1000}{(1+0.10)^1} + \frac{1000}{(1+0.10)^2} + \frac{1000}{(1+0.10)^3} + \frac{1000}{(1+0.10)^4} \\
&= 1000 \times [1 + 3.17] \Rightarrow 4170
\end{align*}
\]

**LOS 7: Present Value of Equal Cash Flow upto infinity (Perpetuity/ Indefinite): (Series of equal Cash Flow arising upto infinite or forever)**

\[
\text{PV} = \frac{\text{Annual Cash Flow}}{\text{Discount Rate}}
\]

**Example:**
Mr. X will receive ₹ 1000 at the end of each year upto infinity, Rate = 10%. Find Present Value.
1.4 Solution:

\[ PV = \frac{1000}{0.10} \Rightarrow 10,000 \]

LOS 8: Present Value of Growing Cash Flow upto Infinity (Growing Perpetuity)

\[ PV = \frac{CF_1}{\text{Discount Rate} - \text{Growth Rate}} \]

Where \( CF_1 = \text{Cash Flow at the end of year 1.} \)

Example:

Mr. X will receive ₹ 1000 at the end of year 1, thereafter cash flow will grow by 8% every year up to infinity, Rate = 10%. Find Present Value.

Solution:

\[ PV = \frac{1000}{0.10 - 0.08} \Rightarrow 50,000 \]
Security Valuation

LOS 1: Introduction

**TOTAL EARNINGS**

- Retained Earnings
- Dividends

**Note:** Total Earnings mean Earnings available to equity share holders

**Income Statement**

|-------|---------------------|--------------|---------------------------------|--------|-------------------------------------|------|----------------|------|----------|-----|----------------------------|--------------------------------------------|---------------------|----------|

**LOS 2: SOME BASIC RATIOS**

- **EPS** = \( \frac{\text{Total earning available to equity shareholders}}{\text{Total number of equity shares}} \)
- **DPS** = \( \frac{\text{Total dividend paid to equity shareholders}}{\text{Total number of equity shares}} \)
- **MPS** = \( \frac{\text{Total Market Value/ Market Capitalization/ Market Cap}}{\text{Total number of equity shares}} \)
- **REPS** = \( \frac{\text{Total Retained earnings}}{\text{Total number of equity shares}} \) OR \( \text{EPS} - \text{DPS} \)
- **Dividend Yield** = \( \frac{\text{Dividend per share}}{\text{Market price per share}} \times 100 \)
2.2 Dividend pay-out Ratio = \(\frac{\text{Dividend per share}}{\text{Earning per share}} \times 100\)

Dividend Rate = \(\frac{\text{Dividend per share}}{\text{Face value per share}} \times 100\)

Earning Yield = \(\frac{\text{Earning per share}}{\text{Market Price per share}} \times 100\)

P/E Ratio = \(\frac{\text{MPS}}{\text{EPS}}\)

Retention Ratio = \(\frac{\text{Retained Earning per share}}{\text{Earning per share}} \times 100\)

OR

Retention Ratio = \(1 - \text{Dividend Payout Ratio}\)

\[\text{RR + DPR = 100\% or 1}\]

Note:

Relationship Between DPR & RR:

Dividend yield and Earning Yield is always calculated on annual basis.

Dividend is 1st paid to preference share holder before any declaration of dividend to equity shareholders.

Dividend is always paid upon FV(Face Value) not on Market Value.

LOS 3: Define Cash Dividends, Stock Dividend, Stock Split

Cash Dividends: As the name implies, are payments made to shareholders in cash. They come in 3 forms:

(i) Regular Dividends: Occurs when a company pays out a portion of profits on a consistent basis. E.g. Quarterly, Yearly, etc.

(ii) Special Dividends: They are used when favourable circumstances allow the firm to make a one-time cash payment to shareholders, in addition to any regular dividends. E.g. Cyclical Firms

(iii) Liquidating Dividends: Occurs when company goes out of business and distributes the proceeds to shareholders.

Stock Dividends (Bonus Shares):

Stock Dividend are dividends paid out in new shares of stock rather than cash. In this case, there will be more shares outstanding, but each one will be worth less.

Stock dividends are commonly expressed as a percentage. A 20% stock dividend means every shareholder gets 20% more stock.

Stock Splits:

Stock Splits divide each existing share into multiple shares, thus creating more shares. There are now more shares, but the price of each share will drop correspondingly to the number of shares created, so there is no change in the owner’s wealth.

Splits are expressed as a ratio. In a 3-for-1 stock split, each old share is split into three new shares.

Stock splits are more common today than stock dividends.
Effects on Financial ratios:

- Paying a cash dividend decreases assets (cash) and shareholders’ equity (retained earnings). Other things equal, the decrease in cash will decrease a company’s liquidity ratios and increase its debt-to-assets ratio, while the decrease in shareholders’ equity will increase its debt-to-equity ratio.
- Stock dividends, stock splits, and reverse stock splits have no effect on a company’s leverage ratio or liquidity ratios or company’s assets or shareholders’ equity.

LOS 4: RETURN CONCEPTS

- A sound investment decision depends on the correct use and evaluation of the rate of return. Some of the different concepts of return are given as below:

Required Rate of Return:

An asset's required return is the minimum return an investor requires given the asset's risk. A more risky asset will have a higher required return. Required return is also called the opportunity cost for investing in the asset. If expected return is greater (less) than required return, the asset is undervalued (overvalued).

Price Convergence

If the expected return is not equal to required return, there can be a “return from convergence of price to intrinsic value.”

Letting \( V_0 \) denote the true intrinsic value, and given that price does not equal that value (i.e., \( V_0 \neq P_0 \)), then the return from convergence of price to intrinsic value is \( \frac{V_0 - P_0}{P_0} \).

If an analyst expects the price of the asset to converge to its intrinsic value by the end of the horizon, then \( \frac{V_0 - P_0}{P_0} \) is also the difference between the expected return on an asset and its required return:

\[
\text{Expected Return} = \text{Required Return} + \frac{V_0 - P_0}{P_0}
\]

Example:

Suppose that the current price of the shares of ABC Ltd. is ₹30 per share. The investor estimated the intrinsic value of ABC Ltd.’s share to be ₹35 per share with required return of 8% per annum. Estimate the expected return on ABC Ltd.

Solution:

Intel's expected convergence return is \( \frac{35 - 30}{30} \times 100 = 16.67\% \), and let's suppose that the convergence happens over one year. Thus, adding this return with the 8% required return, we obtain an expected return of 24.67%.

Discount Rate

Discount Rate is the rate at which present value of future cash flows is determined. Discount rate depends on the risk free rate and risk premium of an investment.

Internal Rate of Return

Internal Rate of Return is defined as the discount rate which equates the present value of future cash flows to its market price. The IRR is viewed as the average annual rate of return that investors earn over their investment time period assuming that the cash flows are reinvested at the IRR.
**LOS 5: EQUITY RISK PREMIUM**

Equity risk premium is the excess return that investment in equity shares provides over a risk free rate, such as return from tax free government bonds. This excess return compensates investors for taking on the relatively higher risk of investing in equity shares of a company.

**Calculating the Equity Risk Premium**

To calculate the equity risk premium, we can begin with the capital asset pricing model (CAPM), which is usually written:

\[
R_x = R_f + \beta_x (R_m - R_f)
\]

Where:
- \(R_x\) = required return on investment in "x" (company x)
- \(R_f\) = risk-free rate of return
- \(\beta_x\) = beta of "x"
- \(R_m\) = required return of market

**Equity Risk Premium = \(R_x - R_f = \beta_x (R_m - R_f)\)**

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**LOS 6: Concept of Nominal Cash Flow and Real Cash Flow**

**Inflation Rate Effect**

- **Cash Flow**
- **Discount Rate**
- **NPV**

**Cash Flow:**

**CASH FLOWS**

- **Real Cash Flows**
  - It excludes inflation

- **Money / Nominal Cash Flows**
  - It includes inflation

**Conversion of Real Cash Flow into Money Cash Flow & Vice-versa**

\[
\text{Money Cash Flow} = \text{Real Cash Flow} (1 + \text{Inflation Rate})^n
\]

Or

\[
\text{Real Cash Flow} = \frac{\text{Money Cash Flow}}{(1+\text{Inflation Rate})^n}
\]
Discount Rate:

Conversion of Real Discount Rate into Money Discount Rate & Vice-versa

\[(1 + \text{Money Discount Rate}) = (1 + \text{Real Discount Rate})(1 + \text{Inflation Rate})\]

PV:

PV may either be calculated:
- By discounting real cash flow by real discount rate.
- By discounting money cash flow by money discount rate.

Discount rate selection in Equity Valuation

- While valuing equity shares, only nominal cash flows are considered. Therefore, only nominal discount rate is considered. The reason is that the tax applying to corporate earnings is generally stated in nominal terms. Therefore, using nominal cash flow in equity valuation is the right approach because it reflects taxes accurately.
- Moreover, when the cash flows are available to Equity Share Holders only, nominal cost of Equity is used. And when cash flows are available to all the companies capital providers, nominal after tax weighted average cost of capital is used.

LOS 7: Ex-Dividend and Cum-Dividend Price of a share

- If Question is Silent, always Assume Ex-Dividend price of share.
- If cum-dividend price is given, we must deduct dividend from it.
- It may be noted that in all the formula, we consider Ex-Dividend & not Cum-Dividend.

LOS 8: Valuation Models based on Earnings & Dividends

Walter’s Model:

Walter’s supports the view that the dividend policy plays an important role in determining the market price of the share.
He emphasises two factors which influence the market price of a share:
(i) Dividend Payout Ratio.
(ii) The relationship between Internal return on Retained earnings (r) and cost of equity capital (K_e)
2.6 SECURITY VALUATION

Walter classified all the firms into three categories:-

a) **Growth Firm:**
   - If \( r > K_e \). In this case, the shareholder’s would like the company to retain maximum amount i.e. to keep payout ratio quite low.
   - In this case, there is negative correlation between dividend and market price of share.
   - If \( r > K_e \), lower the Dividend Pay-out Ratio, higher the Market Price per Share & vice-versa.

b) **Declining Firm:**
   - If \( r < K_e \). In this case, the shareholder’s won’t like the firm to retain the profits so that they can get higher return by investing the dividend received by them.
   - In this case, there is positive correlation between dividend and market price of share.
   - If \( r < K_e \), higher the Dividend Pay-out Ratio, higher the Market Price per Share & vice-versa.

c) **Constant Firm:**
   - If rate of return on Retained earnings \( r \) is equal to the cost of equity capital \( K_e \) i.e. \( r = K_e \). In this case, the shareholder’s would be indifferent about splitting off the earnings between dividend & Retained earnings.
   - If \( r = K_e \), any Retention Ratio or any Dividend Payout Ratio will not affect Market Price of share. MPS will remain same under any Dividend Payout or Retention Ratio.

**Note:** Walter concludes:-

- The optimum payout ratio is NIL in case of growth firm.
- The optimum payout ratio for declining firm is 100%
- The payout ratio of constant firm is irrelevant.

**Summary:** Optimum Dividend as per Walter’s

<table>
<thead>
<tr>
<th>Category of the Firm</th>
<th>( r ) Vs. ( K_e )</th>
<th>Correlation between DPS &amp; MPS</th>
<th>Optimum Payout Ratio</th>
<th>Optimum Retention Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>( r &gt; K_e )</td>
<td>Negative</td>
<td>0 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Constant</td>
<td>( r = K_e )</td>
<td>No Correlation</td>
<td>Every payout is Optimum</td>
<td>Every retention is Optimum</td>
</tr>
<tr>
<td>Decline</td>
<td>( r &lt; K_e )</td>
<td>Positive</td>
<td>100%</td>
<td>0 %</td>
</tr>
</tbody>
</table>

**Valuation of Equity as per Walter’s**

Current market price of a share is the present value of two cash flow streams:-

a) Present Value of all dividend.

b) Present value of all return on retained earnings.

In order to testify the above, Walter has suggested a mathematical valuation model i.e.,

\[
P_0 = \frac{\text{DPS}}{K_e} + \frac{r}{K_e} \frac{(\text{EPS} - \text{DPS})}{K_e}
\]

**When**

- \( P_0 \) = Current price of equity share (Ex-dividend price)/ Fair or Theoretical or Intrinsic or Equilibrium or present Value Price per Share
- \( \text{DPS} \) = Dividend per share paid by the firm
- \( r \) = Rate of return on investment of the firm / IRR / Return on equity
- \( K_e \) = Cost of equity share capital / Discount rate / expected rate of return/opportunity cost / Capitalization rate
EPS = Earnings per share of the firm
EPS – DPS = Retained Earning Per Share

Assumptions:
- DPS & EPS are constant.
- Ke & r are constant.
- Going concern assumption, company has infinite life.
- No external Finance

LOS 9: Gordon’s Model/Growth Model/ Dividend discount Model

- Gordon’s Model suggest that the dividend policy is relevant and can effect the value of the share.
- Dividend Policy is relevant as the investor’s prefer current dividend as against the future uncertain Capital Gain
- Current Market price of share = PV of future Dividend, growing at a constant rate

\[ P_0 = \frac{D_0 (1+g)}{K_e - g} \quad \text{OR} \quad P_0 = \frac{D_1 (\text{next expected dividend})}{K_e - g} \quad \text{OR} \quad P_0 = \frac{EPS_1 (1-b)}{K_e - br} \]

- \( P_0 \) = Current market price of share.
- \( K_e \) = Cost of equity capital/ Discount rate/ expected rate of return/ Opportunity cost/ Capitalization rate.
- \( g \) = Growth rate
- \( D_1 \) = DPS at the end of year / Next expected dividend / Dividend to be paid
- \( D_0 \) = Current year dividend / dividend as on today / last paid dividend
- \( EPS_1 \) = EPS at the end of the year
- \( b \) = Retention Ratio
- \( 1-b \) = Dividend payout Ratio

Note:
Watch for words like ‘ Just paid ’ or ‘ recently paid ’, these refers to the last dividend \( D_0 \) and words like ‘ will pay ’ or ‘ is expected to pay ’ refers to \( D_1 \).

Assumptions:
(i) No external finance is available.
(ii) \( K_e \) & \( r \) are constant.
(iii) ‘\( g \)’ is the product of its Retention Ratio ‘\( b \)’ and its rate of return ‘\( r \)’

\[ g = b \times r \quad \text{OR} \quad g = RR \times ROE \]

(iv) \( K_e > g \)
(v) \( g \) & RR are constant.
(vi) Firm has an infinite life

Applications
1. \( EPS_1 (1-b) = DPS_1 \)

   \[ \text{Proof} : \]
   \[ EPS_1 (1-b) = EPS_1 \times \text{Dividend payout Rate} \]
   \[ = EPS_1 \times \frac{DPS_1}{EPS_1} \]
2.8 SECURITY VALUATION

Study Session 2

= \text{DPS}_1

We know that \text{DPR} + \text{RR} = 1 or 100%

2. **If \text{EPS} = \text{DPS}, \text{RR} = 0 then \text{g} = 0**

\[ P_0 = \frac{\text{D}_0 (1+g)}{\text{K}_e - g} \]
\[ P_0 = \frac{\text{D}_0}{\text{K}_e} \text{ as } g = 0 \]
\[ P_0 = \frac{\text{EPS}}{\text{K}_e} \quad (\because \text{EPS} = \text{DPS}) \]

3. **Calculation of \text{P}_1 (\text{Price at the end of year 1})**

Price at the beginning = PV of Dividend at end + PV of market price at end

\[ P_0 = \frac{\text{D}_1 + \text{P}_1}{(1 + \text{K}_e)} \]

4. \[ \text{K}_e = \frac{1}{\text{P.E Ratio}} \]

Note:
The above equation for calculating \text{K}_e should only be used when no other method of calculation is available.

**LOS 10: Determination of Growth rate**

The sustainable growth rate is the rate at which equity, earnings and dividends can continue to grow indefinitely assuming that ROE is constant, the dividend payout ratio is constant, and no new equity is sold.

**Method 1:** Sustainable growth \( g \) = \( (1 - \text{Dividend payout Ratio}) \times \text{ROE} \)

**Or \ g = \text{RR} \times \text{ROE}**

**Method 2:** \( \text{D}_n = \text{D}_0 (1 + g)^{n-1} \)

\( \text{D}_0 \) = Base year dividend
\( \text{D}_n \) = Latest (Current year dividend)
\( n-1 \) = No. Of times \( \text{D}_0 \) increases to \( \text{D}_n \)

**LOS 11: Calculation of \text{K}_e \text{ in case of Floating cost is given}**

Floating Cost are costs associated with the issue of new equity. E.g. Brokerage, Commission, underwriting expenses etc.

✓ If issue cost is given in question, we will take \( P_0 \) net of issue cost (Net Proceeds).

✓ If floating Cost is expressed in % i.e. \( P_0 (1 - f) = \frac{\text{D}_1}{\text{K}_e - g_c} \)

✓ If floating Cost is expressed in Absolute Amount i.e. \( P_0 - f = \frac{\text{D}_1}{\text{K}_e - g_c} \)

Note:
✓ \text{K}_e \text{ of new equity will always be greater than } \text{K}_e \text{ of existing equity.}
✓ Floatation Cost is only applicable in case of new equity and not on existing equity (or retained earnings).
LOS 12: Return on Equity (ROE) and Book Value Per Share (BVPS)

\[ \text{EPS} = \text{BVPS} \times \text{ROE} \]

Note: Calculate P/E Ratio at which Dividend payout will have no effect on the value of the share.

When \( r = K_e \), dividend payout ratio will not affect value of share.

Example:

If \( r = 10\% \) then \( K_e = 10\% \) and \( K_e = \frac{1}{P/\text{ERatio}} \Rightarrow 0.10 = \frac{1}{P/\text{ERatio}} \)

\( \Rightarrow P/E \text{ Ratio} = 10 \) times

LOS 13: Over – Valued & Under – Valued Shares

<table>
<thead>
<tr>
<th>Cases</th>
<th>Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Market Price &lt; Actual Market Price</td>
<td>Over – Valued</td>
<td>Sell</td>
</tr>
<tr>
<td>PV Market Price &gt; Actual Market Price</td>
<td>Under – Valued</td>
<td>Buy</td>
</tr>
<tr>
<td>PV Market Price = Actual Market Price</td>
<td>Correctly Valued</td>
<td>Buy / Sell</td>
</tr>
</tbody>
</table>

LOS 14: Holding Period Return (HPR)

\[ \text{HPR} = \frac{(P_1 - P_0) + D_1}{P_0} \]

\[ \text{HPR} = \frac{P_1 - P_0}{P_0} + \frac{D_1}{P_0} \]

(Capital gain Yield / Return) (Dividend Yield / Return)
LOS 15: Multi-stage Dividend discount Model [ If \( g > K_e \)]/ Variable Growth Rate Model

- Growth model is used under the assumption of \( g = \text{constant} \).
- When more than one growth rate is given, then we will use this concept.
  
  or
  
  If \( g > K_e \)

- A firm may temporarily experience a growth rate that exceeds the required rate of return on firm’s equity but no firm can maintain this relationship indefinitely.

Value of a dividend-paying firm that is experiencing temporarily high growth =

\[
\text{PV of dividends expected during high growth period.} + \\
\text{PV of the constant growth value of the firm at the end of the high growth period.}
\]

\[
\text{Value} = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \ldots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}
\]

When \( P_n = \frac{D_n(1+g_c)}{K_e-g_c} \)

LOS 16: IRR Technique & Growth Model

IRR is the discount rate that makes the present values of a project’s estimated cash inflows equal to the present value of the project’s estimated cash outflows.

- At IRR Discount Rate => PV (inflows) = PV (outflows)
- The IRR is also the discount rate for which NPV of a project is equal to Zero.
- IRR technique is used when, \( K_e \) is missing in the Question.
- \( \text{IRR} = \frac{\text{Lower Rate}}{\text{NPV}} \times \frac{\text{Lower Rate}_{\text{NPV}} - \text{Higher Rate}_{\text{NPV}}}{\text{Difference in Rate}} \)

LOS 17: Price at the end of each year

\[
P_0 = \frac{P_1+D_1}{(1+K_e)^1}
\]

\[
P_1 = \frac{P_2+D_2}{(1+K_e)^1}
\]

\[
P_2 = \frac{P_3+D_3}{(1+K_e)^1}
\]

\[
P_3 = \frac{P_4+D_4}{(1+K_e)^1}
\]

\[
\ldots
\]

So on
Los 18: Negative Growth

If Positive Growth, then \( P_0 = \frac{D_0 (1+g)}{K_e - g} \)

If Negative Growth, then \( P_0 = \frac{D_0 (1-g)}{K_e + g} \)

**Note:** We Know \( g = RR \times ROE \)

<table>
<thead>
<tr>
<th>Case</th>
<th>EPS</th>
<th>DPS</th>
<th>Retention</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&gt;</td>
<td></td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>II</td>
<td>&lt;</td>
<td></td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>III</td>
<td>=</td>
<td></td>
<td>No Retention</td>
<td>0</td>
</tr>
</tbody>
</table>

LOS 19: Valuation Using the H-Model

The earnings growth of most firms does not abruptly change from a high rate to a low rate as in the two-stage model but tends to decline over time as competitive forces come into play. The H-model approximates the value of a firm assuming that an initially high rate of growth declines linearly over a specified period. The formula for this approximation is:

\[
P_0 = \frac{D_0 \times (1 + g_L)}{K_e - g_L} + \frac{D_0 \times H \times (g_S - g_L)}{K_e - g_L}
\]

where:
- \( H = \frac{t}{2} \) = half-life (in years) of high-growth period
- \( t \) = length of high growth period
- \( g_S \) = short-term growth rate
- \( g_L \) = long-term growth rate
- \( r \) = required return

LOS 20: Preference Dividend Coverage Ratio & Equity Dividend Coverage Ratio

**Interest Coverage Ratio**

\[
\frac{\text{Earning Before Interest and Tax}}{\text{Interest}}
\]

**Preference Dividend Coverage Ratio**

\[
\frac{\text{Profit After Tax}}{\text{Preference Dividend}}
\]

**Equity Dividend Coverage Ratio**

\[
\frac{\text{Profit After Tax} - \text{Preference Dividend}}{\text{Dividend payable to equity share holders}}
\]

**Note:**

The Higher the Better. These Ratios indicates the surplus profit left after meeting all the fixed obligation.
LOS 21 : Cash Flow Base Models

Calculation of FCFF

<table>
<thead>
<tr>
<th>EBITDA</th>
<th>xxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less : Depreciation &amp; Amortisation (NCC)</td>
<td>xxx</td>
</tr>
<tr>
<td>EBIT</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Tax</td>
<td>xxx</td>
</tr>
<tr>
<td>NOPAT</td>
<td>xxx</td>
</tr>
<tr>
<td>Add : Depreciation (NCC)</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Increase in Working Capital (WCInv)</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Capital Expenditure (FCInv)</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Free Cash Flow For Firm (FCFF) xxx

a) Based on its Net Income:
FCFF = Net Income + Interest expense * (1 - tax) + Depreciation -/+ Capital Expenditure -/+ Change in Non-Cash Working Capital

b) Based on Operating Income or Earnings Before Interest and Tax (EBIT):
FCFF = EBIT * (1 - tax rate) + Depreciation -/+ Capital Expenditure -/+ Change in Non-Cash Working Capital

c) Based on Earnings before Interest, Tax, Depreciation and Amortisation (EBITDA):
FCFF = EBITDA* (1-Tax) +Depreciation* (Tax Rate) -/+ Capital Expenditure – /+Change in Non-Cash Working Capital

d) Based on Free Cash Flow to Equity (FCFE):
FCFF = FCFE + Interest* (1-t) + Principal Prepaid - New Debt Issued + Preferred Dividend

e) Based on Cash Flows:
FCFF = Cash Flow from Operations (CFO) + Interest (1-t) -/+ Capital Expenditure
Calculation of FCFE

**Method 1 : If Debt financing ratio is given:**

<table>
<thead>
<tr>
<th>Expression</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBITDA</td>
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</tr>
<tr>
<td>Less : Depreciation &amp; Amortisation</td>
<td>xxx</td>
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</tr>
<tr>
<td>Less : Interest</td>
<td>xxx</td>
</tr>
<tr>
<td>EBT</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Tax</td>
<td>xxx</td>
</tr>
<tr>
<td>PAT</td>
<td>xxx</td>
</tr>
<tr>
<td>Add : Depreciation × % Equity Invested</td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Increase in Working Capital × % Equity Invested</td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Capital Expenditure × % Equity Invested</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Free Cash Flow for Equity (FCFE) xxx

**Method 2 : If Debt financing ratio is not given:**

<table>
<thead>
<tr>
<th>Expression</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBITDA</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Depreciation &amp; Amortisation</td>
<td>xxx</td>
</tr>
<tr>
<td>EBIT</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Interest</td>
<td>xxx</td>
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</tr>
<tr>
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<td>xxx</td>
</tr>
<tr>
<td>PAT</td>
<td>xxx</td>
</tr>
<tr>
<td>Add : Depreciation (NCC)</td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Increase in Working Capital (WClInv)</td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Capital Expenditure (FCInv)</td>
<td>xxx</td>
</tr>
<tr>
<td>Add : Net Borrowings</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Free Cash Flow for Equity (FCFE) xxx

a) **Calculating FCFE from FCFF**

\[
\text{FCFE} = \text{FCFF} - [ \text{Interest} \times (1 - \text{tax rate}) ] + \text{Net borrowing}
\]

b) **Calculating FCFE from net income**

\[
\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WClInv} + \text{net borrowing}
\]

c) **Calculating FCFE from CFO**

\[
\text{FCFE} = \text{CFO} - \text{FCInv} + \text{net borrowing}
\]

**LOS 22 : Valuation Based on Multiples**

1. **P/E Multiple Approach**

   MPS = EPS × P/E Ratio

2. **Enterprise Value to Sales**

   \[
   \frac{\text{EV}}{\text{Sales}}
   \]

3. **Enterprise Value to EBITDA**

   \[
   \frac{\text{EV}}{\text{EBITDA}}
   \]

\[
\text{EV} = \text{market value of common stock} + \text{market value of preferred equity} + \text{market value of debt} + \text{minority interest} - \text{cash & cash equivalents and Equity investments, investment in any co.} \& \text{also Long term investments.}
\]

\[
\text{EBITDA} = \text{EBIT} + \text{depreciation} + \text{amortization}
\]
Corporate Valuation

LOS 1: Introduction

VALUATION MODELS

Absolute Valuation Models
Present Value Models
Dividend Discount Models
Free Cash Flow Models
Residual Income Models

Relative Valuation Models
Asset-based Valuation
Enterprise Value based Multiples
EV / EBITDA
P/E Ratio

LOS 2: Dividend Yield Valuation Method

\[ \text{Dividend Yield} = \frac{\text{DPS}}{\text{MPS}} \]

\[ \text{MPS} = \frac{\text{DPS}}{\text{Dividend Yield}} \]

Note:

\[ \text{DPS} = \frac{\text{Total dividend paid}}{\text{Total number of equity shares}} \]

Total Market Value = MPS × Total Number of Equity share

LOS 3: Earning Yield Valuation Method

\[ \text{Earning Yield} = \frac{\text{EPS}}{\text{MPS}} \]

\[ \text{MPS} = \frac{\text{EPS}}{\text{Earning Yield}} \]

Therefore, \[ \text{EPS} = \frac{\text{Earning available to Equity Share holders}}{\text{Total number of equity shares}} \]
LOS 4: P/E Ratio Valuation Model

\[ P / E \text{ Ratio} = \frac{\text{MPS}}{\text{EPS}} \]

\[ \text{MPS} = \text{EPS} \times P/E \text{ Ratio} \]

LOS 5: Value Based on Future Maintainable Profits (FMP’s)

\[ \text{Value of Business} = \frac{\text{Future Maintainable Profit}}{\text{Relevant Capitalisation Rate}} \]

Value of Business – Market Value of Debt = Value of Equity

**Calculation of Future Maintainable Profits:**

<table>
<thead>
<tr>
<th>Description</th>
<th>xxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Past Year Profits before tax</td>
<td></td>
</tr>
<tr>
<td>Add: All Profit likely to arise in Future</td>
<td></td>
</tr>
<tr>
<td>All Actual Expenses &amp; Losses not likely to occur in future</td>
<td></td>
</tr>
<tr>
<td>Less: All Profit not likely to occur in Future</td>
<td></td>
</tr>
<tr>
<td>All Actual Expenses &amp; Losses likely to occur in future</td>
<td></td>
</tr>
<tr>
<td>Future Maintainable Profits (FMP’s) before tax</td>
<td></td>
</tr>
<tr>
<td>Less: Tax</td>
<td></td>
</tr>
<tr>
<td>FMP’s after tax</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

**Treatment of Sunk Cost**

Sunk Cost are those cost which are not relevant for decision making. These cost must be totally ignored. Example: Allocated Fixed Cost, R & D cost already incurred.

LOS 6: Net Asset Valuation Method (For Equity)

\[ \text{NAV per Share} = \frac{\text{Total Assets} – \text{Total External Liability}}{\text{Total number of equity shares}} \]

**Note:**

1. **The following external liabilities should be deducted**
   - All short term (Current Liabilities) and Long Term Liabilities (Debenture, Loans, etc) including outstanding and accrued interest.
   - Provision for Taxation
   - Liabilities not provided for in the accounts i.e. Contingent Liabilities which have crystallized now.
   - Liabilities arising out of prior period adjustment
   - Preference Share Capital including Arrears of dividend and proposed preferred Dividend
   - Proposed Equity Dividend (If the objective is to determine ex-dividend value of equity share).
2. Total assets doesn’t include Miscellaneous Expenditure to the extend not yet written-off, fictitious assets, accumulated losses, profit & Loss (Dr.) Balance.
3. NAV may be calculated by using
3.3

a) **Book Value (BV):** The BV of an asset is an accounting concept based on the historical data given in the balance sheet of the firm.

b) **Market Value (MV):** The MV of an asset is defined as the price which is prevailing on the market.

c) **Liquidating Value (LV):** The LV refers to the net difference between the realizable value of all assets and the sum total of external liabilities. This net difference belongs to the owners/shareholders and is known as LV.

4. **If question is silent always prefer Market Value weights.**

**LOS 7: Economic Value Added (EVA)**

It is excess return over minimum return which is expected by the company on its Capital employed.

\[
\text{EVA} = \text{NOPAT} - K_0 \times \text{Average Capital Invested}
\]

**Calculation of NOPAT:**

- NOPAT means, **Net Operating Profit After Tax** but before any distribution of Interest, Preference Dividend and Equity Dividend.

  i.e. \(\text{NOPAT} = \text{EBIT} \times (1 - \text{Tax Rate})\)

**Note:** It excludes non-operating income & expenses/losses like

- Profit/Loss on Sale of Fixed Assets
- Interest on non-trade investment
- Profit/Loss on trading in shares & bonds
- Interest income from Loans & Advances

**Calculation of Cost of Overall Capital:**

\[
K_0 = \text{Cost of Overall Capital} = \text{WACC} = \text{Weighted Average Cost of Capital}
\]

\[
K_e W_e + K_d W_d + K_p W_p
\]

**Note:**

1. \(K_d = \text{Interest} \times (1 - \text{Tax Rate})\)
2. \(K_e = R_f + \beta (R_m - R_f)\) \(\text{Or } K_e = \frac{D_1}{P_0} + g\)
3. \(K_p = \text{Preference Dividend} \times (1 + \text{CDT})\)
4. Calculation of Average Capital Invested:

\[
\frac{\text{Capital at the beginning} + \text{Capital at the End of Year}}{2}
\]

**5. Calculation of Capital Invested:**

<table>
<thead>
<tr>
<th>Add</th>
<th>Less</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity share capital</td>
<td>P/L (Dr. Balance)</td>
</tr>
<tr>
<td>Preference share capital</td>
<td>Preliminary Expenses</td>
</tr>
<tr>
<td>Reserve &amp; Surplus</td>
<td>Miscellaneous Expenditure</td>
</tr>
<tr>
<td>Debenture/Bonds</td>
<td>Long-Term Loan</td>
</tr>
</tbody>
</table>
**Note:** It excludes:
- Investment in Equity shares & Bonds
- Loans & Advances
- Non-Trade Investment

6. **Financial Leverage**
\[ \text{EBIT} \times \frac{\text{EBIT}}{\text{EBT}} \quad \text{Or} \quad \frac{\text{EBIT}}{\text{EBIT} - \text{Interest}} \]

7. **EBIT = EBT + Interest**
\[ \text{EBIT} = \frac{\text{PAT}}{(1 - \text{tax rate})} + \text{Interest} \]
\[ \text{EBIT} = \frac{\text{Earning for equity+Pref Div}}{(1 - \text{tax rate})} + \text{Interest} \]

**Note:**
- Operating profits may have to be adjusted using matching concept.
- There might be some intangible assets such as patents, trademark etc. which is not shown in balance sheet, we need to include that in invested capital.
- The balance sheet figures of assets & liabilities are at book value. If replacement cost is provided, take invested capital at replacement cost instead of Book Value.

**LOS 8: Value of Business using EVA Method**

Valuation of Business using EVA Method (Assume Constant growth after 2 years):

\[ \text{MVA} = \frac{\text{EVA}_1}{(1 + K_0)^1} + \frac{\text{EVA}_2}{(1 + K_0)^2} + \frac{\text{EVA}_2 (1 + g)}{K_0 - g} \]

\[ \text{MVA} = \text{Value of Business} - \text{Total Capital Employed} \]

Value of Business = Total Capital Employed + MVA

**LOS 9: Discounted Cash Flow approach or Free Cash Flow Approach or Value of Business using FCFE & FCFF**

Under this approach, we will calculate value of business by discounting the future cash flows.

**Steps Involved:**

1. **Calculation of Free Cash Flow of each Year.**
2. **Calculate Terminal Value at the end of forecast period.**
3. **Compute Discount Rate**
4. **Calculate Present Value of Business/Equity by discounting the Cash Flows & Terminal Value.**

**Calculation of Terminal Value / Continuing Value / Salvage Value**

Terminal Value is calculated at the end of the Project Life or at the end of the forecasted period.

**Note:**
- Given in the Question.
- Assumption of Growth Model (Let’s assume Growing Cash Flow after 3 Years)
3.5

\[ P_0 = \frac{CF_1}{(1+K_0)^1} + \frac{CF_2}{(1+K_0)^2} + \frac{CF_3}{(1+K_0)^3} + \frac{CF_3(1+g)}{K_0-g} \]

- **Assumption of Constant Model/ Perpetuity Approach (Let’s assume Constant Cash Flow after 3 Years)**

\[ P_0 = \frac{CF_1}{(1+K_0)^1} + \frac{CF_2}{(1+K_0)^2} + \frac{CF_3}{(1+K_0)^3} \]

- Continuing value/ Terminal Value is calculated because it is not easy to estimate realistic cash flows, so we take uniform assumption of Constant Model or Growth Model.

**Calculation of FCFF**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBITDA</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Depreciation(NCC)</td>
<td>xxx</td>
</tr>
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<td>xxx</td>
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<td>Less : Tax</td>
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</tr>
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<td>NOPAT</td>
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<td>xxx</td>
</tr>
<tr>
<td><strong>Free Cash Flow For Firm (FCFF)</strong></td>
<td>xxx</td>
</tr>
</tbody>
</table>

**Calculation of FCFE**

**Method 1 : When Debt-financing ratio is given:**

<table>
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<tr>
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<tbody>
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<td>EBITDA</td>
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<td>EBIT</td>
<td>xxx</td>
</tr>
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<td>Less : Interest</td>
<td>xxx</td>
</tr>
<tr>
<td>EBT</td>
<td>xxx</td>
</tr>
<tr>
<td>Less : Tax</td>
<td>xxx</td>
</tr>
<tr>
<td>PAT</td>
<td>xxx</td>
</tr>
<tr>
<td>Add : Depreciation × % Equity Invested</td>
<td>xxx</td>
</tr>
</tbody>
</table>
### Method 2: When Debt-financing ratio is not given:

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBITDA</td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Depreciation &amp; Amortisation</td>
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<td>xxx</td>
</tr>
<tr>
<td><strong>Free Cash Flow for Equity (FCFE)</strong></td>
<td>xxx</td>
</tr>
</tbody>
</table>

### LOS 10: Valuation with NPV decision

\[
\text{Revised MPS} = \text{Existing MPS} \pm \frac{\text{Total NPV}}{\text{Total number of Equity Shares}}
\]

### LOS 11: Market Value Added (MVA)

**From Equity Point of View**

\[
\text{MVA} = \left\{ \frac{\text{Value of Equity} - \text{Value of the Equity as per market as per Books of A/c’s}}{\text{Number of Equity Share}} - \text{Equity Shareholder’s Fund.} \right\}
\]

**Note:**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity share capital</td>
<td></td>
</tr>
<tr>
<td>Add</td>
<td>Reserve &amp; Surplus</td>
</tr>
<tr>
<td>Less</td>
<td>P/L (Dr. Balance)</td>
</tr>
<tr>
<td></td>
<td>Preliminary Expenses</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous Expenditure</td>
</tr>
</tbody>
</table>

**From Overall company’s Point of View**

\[
\text{MVA} = \text{Value of the company based on Free Cash Flows} - \text{Total Capital Employed}
\]
### Note: Total Capital Employed

<table>
<thead>
<tr>
<th>Add</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity share capital</td>
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<td></td>
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</tbody>
</table>
Mergers, Acquisition & Corporate Restructuring

LOS 1: Introduction

Merger & Acquisition

MERGER (A + B = A)
ACQUISITION (Stake Buyout)
AMALGAMATION (A + B = C)

Reasons for Merger & Acquisition

- Economies of Scale
- Efficiency Improvement
- Power of Market Share – Reduced Competition
- Tax Consideration
- Combining resources that are complementary.

LOS 2: Share Exchange Ratio/Swap Ratio

Swap Ratio may be defined as No. of equity shares issued by Acquiring Company to Target Company for every one share held by Target Company.

Example:

If Swap Ratio = 2, it means that for every 1 share held by Target company, Acquiring Company will issue 2 shares.

Methods of Calculating the Swap Ratio:

1. On the basis of MPS
   \[ \text{Swap Ratio} = \frac{\text{MPS of Target Company}}{\text{MPS of Acquiring Company}} \]

2. On the basis of EPS
   \[ \text{Swap Ratio} = \frac{\text{EPS of Target Company}}{\text{EPS of Acquiring Company}} \]

3. On the basis of NAV per Share
   \[ \text{Swap Ratio} = \frac{\text{NAV of Target Company}}{\text{NAV of Acquiring Company}} \]

4. On the basis of Book Value per share
   \[ \text{Swap Ratio} = \frac{\text{BVPS of Target Company}}{\text{BVPS of Acquiring Company}} \]

5. On the basis of P/E Ratio
   \[ \text{Swap Ratio} = \frac{\text{P/E Ratio of Target Company}}{\text{P/E Ratio of Acquiring Company}} \]

Note:

\[ \text{EPS} = \frac{\text{Earning available to Equity Shareholder}}{\text{Total number of equity shares}} \]

\[ \text{NAV} = \frac{\text{Total Assets – Total External Liability}}{\text{Total number of equity shares}} \]
P / E Ratio = \( \frac{\text{Market Price per Share}}{\text{Earning Price per Share}} \)

**Note:**
If question is silent regarding the basis of calculation of swap ratio, Swap Ratio may be calculated using EPS or MPS as per the requirement of the question.

**Negative SWAP Ratio**

Swap Ratio = \( \frac{\text{Acquiring Co.}}{\text{Target Co.}} \)

e.g. Swap Ratio = \( \frac{\text{NPA of Acquiring Co.}}{\text{NPA of Target Co.}} \)

**LOS 3 : Some Basic Concepts**

1. **Total Number of Equity Shares after Merger**

   Number of Shares \( A+B = N_A + N_B \times ER \)

   **Example:**

<table>
<thead>
<tr>
<th>A Ltd.</th>
<th>B Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Shares</td>
<td>100000</td>
</tr>
</tbody>
</table>

   Calculate total no. of Equity Shares after Merger if Swap Ratio/ Exchange Ratio = 0.50?

   **Solution:**

   Number of Shares \( A+B (T_{A+B}) \) = \( N_A + N_B \times ER \)
   
   = 1,00,000 + 50,000 × 0.50
   
   = 1,00,000 + 25,000
   
   = 1,25,000 shares

2. **EPS after Merger or EPS\(_{A+B}\) or EPS of a Merged Firm/ Combined Firm**

   \( \text{EPS}_{A+B} = \left[ \frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times ER} \right] \)

   **Example:**

<table>
<thead>
<tr>
<th>A Ltd.</th>
<th>B Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings</td>
<td>5,00,000</td>
</tr>
<tr>
<td>No. of Shares</td>
<td>100000</td>
</tr>
<tr>
<td>Synergy Gain</td>
<td>1,00,000</td>
</tr>
<tr>
<td>E/R</td>
<td>0.50</td>
</tr>
</tbody>
</table>

   Calculate:
   a) EPS of A Ltd. before Merger.
   b) EPS of B Ltd. before Merger.
   c) Total Earnings after Merger.
   d) Total No. of Equity Shares after Merger.
   e) EPS after Merger or \( \text{EPS}_{A+B} \).
Solution:

a) \( \text{EPS}_A \text{ Ltd.} = \frac{5,00,000}{1,00,000} = \text{₹} 5 \text{ per share} \)

b) \( \text{EPS}_B \text{ Ltd.} = \frac{2,00,000}{50,000} = \text{₹} 4 \text{ per share} \)

c) Total Earnings \( A+B = 5,00,000 + 2,00,000 + 1,00,000 = 8,00,000 \)

d) Total No. of Shares \( A+B = 1,00,000 + 50,000 \times 0.50 = 1,25,000 \)

e) \( \text{EPS}_{A+B} = \frac{5,00,000 + 2,00,000 + 1,00,000}{1,00,000 + 50,000 \times 0.50} = 6.40 \)

3. **MPS after Merger or MPS\(_{A+B}\) or MPS of a Merged Firm**

   **Alternative 1: If P/E Ratio is given**

\[ \text{MPS}_{A+B} = \text{EPS}_{A+B} \times \text{P/E}_{A+B} \]

   **Alternative 2: If P/E Ratio is not given**

\[ \text{MPS}_{A+B} = \left(\frac{\text{Total MV after Merger}}{\text{Total No. of Equity Shares after Merger}}\right) \]

or

\[ \text{MPS}_{A+B} = \left[\frac{\text{MV}_A + \text{MV}_B + \text{Synergy Gain}}{N_A + N_B \times \text{ER}}\right] \]

**Note:**
- Answer by both alternative will be different.
- Alternative 1 should be preferred whenever any hint regarding P/E after merger is given in question.

4. **Market Value of Merged Firm or MV\(_{A+B}\)**

   **Alternative 1:**

\[ \text{MV}_{A+B} = \text{MPS}_{A+B} \times [N_A + N_B \times \text{ER}] \]

   **Alternative 2:**

\[ \text{MV}_{A+B} = \text{MV}_A + \text{MV}_B + \text{Synergy} \]

**Note:**
- Answer by both alternative will be different.
- Alternative 1 should be preferred

5. **Equivalent EPS of Target Co. in Merged Firm**

\[ \text{Equivalent EPS of Target Co. in Merged Firm} = \text{EPS}_{A+B} \times \text{ER} \]

**Example:**

\( \text{EPS}_{A+B} = 15; \ E/R \) (given to B Ltd.) = 0.40

Calculate Equivalent EPS of B Ltd. in Merged Firm?
Solution:
Equivalent EPS of B Ltd. in Merged Firm = 15 × 0.40 = ₹ 6 per share

6. **Equivalent MPS of Target Co. in Merged Firm**

Equivalent MPS of Target Co. in Merged Firm = MPS \(_{A+B} \times ER\)

**LOS 4 : Gain or Loss**

- Merger may result into Gain/Loss for acquiring company & target Company.
- On the basis of EPS/MPS/Market Value (MV)

<table>
<thead>
<tr>
<th>A Ltd.</th>
<th>B Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPS / EPS / MV after Merger</td>
<td>XXX</td>
</tr>
<tr>
<td>MPS / EPS / MV before Merger</td>
<td>XXX</td>
</tr>
<tr>
<td>Gain/ Loss</td>
<td>XXX</td>
</tr>
</tbody>
</table>

**LOS 5 : Maximum Exchange Ratio and Minimum Exchange Ratio**

A= Acquiring Company → will try to keep exchange ratio as low as possible. Hence, we calculate maximum ER for acquiring company.
B= Target Company → will try to keep exchange ratio as high as possible. Hence, we calculate minimum ER for Target Company.

**Case 1:** On the basis of EPS:

a) **Maximum Exchange ratio for A Ltd.**

\[
\text{EPS before Merger} = \text{EPS after Merger} \\
\text{EPS}_A = \frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio} \times \text{ER}}
\]

Solve for ER
b) Minimum Exchange ratio for B Ltd.

**Case 2:** On the basis of MPS (If P/E Ratio after merge is given i.e. P/E(A+B) is given)

a) **Maximum Exchange ratio for A Ltd.**

\[
\text{MPS before Merger} = \text{MPS after Merger} \\
\text{MPS}_A = \text{MPS}_A + B \\
\text{MPS}_A = \left(\frac{\text{E}_A + \text{E}_B + \text{Synergy Gain}}{\text{N}_A + \text{N}_B \times \text{Exchange Ratio}} \right) \times \text{P/E (A+B)} \times \text{ER}
\]

b) **Minimum Exchange ratio for B Ltd.**

\[
\text{MPS before Merger} = \text{Equivalent MPS after Merger} \\
\text{MPS}_B = \text{MPS}_A + B \times \text{ER} \\
\text{MPS}_B = \left(\frac{\text{E}_A + \text{E}_B + \text{Synergy Gain}}{\text{N}_A + \text{N}_B \times \text{Exchange Ratio}} \right) \times \text{P/E (A+B)} \times \text{ER}
\]

**Case 3:** On the basis of MPS (If P/E Ratio after merge is not given):

a) **Maximum Exchange ratio for A Ltd.**

\[
\text{MPS before merger} = \text{MPS after merger} \\
\text{MPS}_A = \text{MPS}_A + B \\
\text{MPS}_A = \left(\frac{\text{MV}_A + \text{MV}_B + \text{Synergy Gain}}{\text{N}_A + \text{N}_B \times \text{Exchange Ratio}} \right) \times \text{ER}
\]
b) Minimum Exchange ratio for B Ltd.

\[
\text{MPS before merger} = \text{Equivalent MPS after merger} \\
\text{MPS}_B = \text{MPS}_A + B \times \text{ER} \\
\text{MPS}_B = \left( \frac{\text{MV}_A + \text{MV}_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio} \times \text{ER}} \right) \times \text{ER}
\]

**Solve for ER**

**LOS 6 : Calculation of % of Holding in New Company**

For A Ltd. = \( \frac{\text{Total Number of shares of A Ltd.}}{\text{Total Number of share of A Ltd.} + \text{Total Number of Shares issued to B Ltd.}} \)

For B Ltd. = \( \frac{\text{Total Number of Shares issued to B Ltd}}{\text{Total Number of share of A Ltd.} + \text{Total Number of Shares issued to B Ltd.}} \)

**Example:**

<table>
<thead>
<tr>
<th></th>
<th>A Ltd.</th>
<th>B Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Shares</td>
<td>200000</td>
<td>50000</td>
</tr>
<tr>
<td>E/R</td>
<td>0.50</td>
<td></td>
</tr>
</tbody>
</table>

Calculate % of holding of A Ltd. & B Ltd. after Merger.

**Solution:**

New No. of Equity shares issued to B Ltd. = \( 50,000 \times 0.50 \Rightarrow 25,000 \) shares

Total No. of equity shares after Merger = \( 2,00,000 + 25,000 \Rightarrow 2,25,000 \) shares

% of Holding A Ltd. in merged entity = \( \frac{2,00,000}{2,25,000} \times 100 \Rightarrow 88.89\% \)

% of Holding B Ltd. in merged entity = \( \frac{25,000}{2,25,000} \times 100 \Rightarrow 11.11\% \)

**LOS 7 : Free Float Market Capitalization (Value)**

- “Free Float” means shares which are freely available or freely tradable in the market. Shares held by promoters are not freely tradable in the market. There shares are subject to certain restrictions as placed by SEBI.
- A Firm’s market float is the total value of the shares that are actually available to the investing public and excludes the value of shares held by controlling shareholders because they are unlikely to sell their shares.
- Sensex and Nifty is based on Free-Float market Capitalization.
Free Float Mkt Capitalization = Free float No. of equity shares × MPS

Total No. of Equity Shares

\[ \text{Promotors Holding / Management Holding} \]
\[ \text{/ Govt. Holding / Strategic Holding} \]

LOS 8: Calculation of \( \text{EPS}_{A+B} \) and \( \text{MPS}_{A+B} \) in case of CASH TAKEOVER

**CASH TAKEOVER**

**1. \( \text{EPS}_{A+B} \) in case of cash take-over & cash is paid out of borrowed money**

\[
\text{EPS}_{A+B} = \frac{E_A + E_B + \text{Synergy Gain} - \text{Interest} (1-\text{tax})}{N_A}
\]

**2. \( \text{EPS}_{A+B} \) in case of cash take-over & money is arranged from Business itself**

\[
\text{EPS}_{A+B} = \frac{E_A + E_B + \text{Synergy Gain} - \text{Cash Paid} \times \text{Opportunity cost of interest}}{N_A}
\]

**3. \( \text{MPS}_{A+B} \) (If P/E ratio after merger is given)**

\[
\text{MPS}_{A+B} = \text{EPS}_{A+B} \times \frac{P}{E_{A+B}}
\]

**Case 1:** Cash is paid from Borrowed Capital

**Case 2:** Cash is paid from Business itself

**4. \( \text{MPS}_{A+B} \) (If P/E ratio after merger is NOT given)**

\[
\text{MPS}_{A+B} = \frac{MV_A + MV_B + \text{Synergy Gain} - \text{Cash Paid}}{N_A}
\]

**Case 1:** Cash is paid from Borrowed Capital

**Case 2:** Cash is paid from Business itself
**LOS 9 : Purchase Price Premium**

*Purchase Price Premium = \( \frac{\text{Offer Price to target Co.} - \text{MPS of target Co. before Merger}}{\text{MPS of target Co. before Merger}} \times 100\)*

**Example:**

MPS of B Ltd. = ₹ 80
A Ltd. has offered ₹120 to B Ltd. for the purpose of exchange.
Calculate Purchase Price Premium?

**Solution:**

\[
\text{Purchase Price Premium} = \frac{120 - 80}{80} \times 100 = 50\%
\]

**LOS 10 : Purchase Consideration / Cost of Acquisition**

- **PC** = Net Payment made by Acquiring Co. to Target Co.

<table>
<thead>
<tr>
<th>Calculation of PC/ COA</th>
<th>XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Value of Equity Shares Issued by A Ltd. to B Ltd.</td>
<td>XXX</td>
</tr>
<tr>
<td>(+) Debentures, Preference shares Capital Issued by A Ltd. to B Ltd.</td>
<td>XXX</td>
</tr>
<tr>
<td>(+) Current Liability paid or Taken over</td>
<td>XXX</td>
</tr>
<tr>
<td>(+) Any other expenses incurred</td>
<td>XXX</td>
</tr>
<tr>
<td>(-) Cash in hand or Bank</td>
<td>XXX</td>
</tr>
<tr>
<td>(-) Sale of any other asset not required in business</td>
<td>XXX</td>
</tr>
</tbody>
</table>

**Cost of Acquisition / Purchase Consideration**

**Note:**

- Cash and current Liabilities must be taken, even if question is Silent.
- Sale of any other asset not required should be taken only if clear indication in the Question.

**LOS 11 : Components of MPS**

- **EPS** = \( \frac{\text{Earnings available for ESH's}}{\text{Total No. of Equity Shares}} \)
- **P/E Ratio** = \( \frac{\text{MPS}}{\text{EPS}} \)

**BVPS** = \( \frac{\text{Equity Shareholder's Fund}}{\text{Total No. of Equity Shares}} \)

**ROE** = \( \frac{\text{Earnings available for ESH's Equity Share holder's fund}}{\text{Equity Share holder's fund}} \)
**LOS 12 : Maximum MPS & Minimum MPS**

Minimum MPS offered by A Ltd. To B Ltd. = \( \frac{\text{Value of Equity of B Ltd.}}{\text{No. of Equity Shares of B Ltd.}} \)

Maximum MPS offered by A Ltd. To B Ltd. = \( \frac{\text{Value of Equity of B Ltd.} + \text{Value of Synergy}}{\text{No. of Equity Shares of B Ltd.}} \)

**LOS 13 : Calculation of \( \text{EPS}_{A+B} \) when Synergy Gain is Given in Question**

**SYNERGY GAIN**

- **In Absolute Amount**
- **In % Term**

1. **\( \text{EPS}_{A+B} \) when Synergy Gain is Expressed in %**
   
   \[
   \text{ESP}_{A+B} = \left[ \frac{(E_{A} + E_{B})(1 + \text{Synergy Gain})}{N_{A} + N_{B} \times ER} \right]
   \]

2. **\( \text{EPS}_{A+B} \) when Synergy Gain is Expressed in Absolute Amount**

   \[
   \text{ESP}_{A+B} = \left[ \frac{E_{A} + E_{B} + \text{Synergy Gain}}{N_{A} + N_{B} \times ER} \right]
   \]

**Note:**
If question is silent regarding Synergy Gain, assume it to be NIL.

**Synergy Gain – In terms of Earnings & Market Value**

Synergy means extra – benefit/ advantage.

1. **Synergy In terms of Earnings**
   
   \[
   \text{Synergy} = E_{A+B} - (E_{A} + E_{B})
   \]

2. **Synergy In terms of Market Value**

   \[
   \text{Synergy} = MV_{A+B} - (MV_{A} + MV_{B})
   \]
**LOS 14: True Cost & True Benefit of Merger**

<table>
<thead>
<tr>
<th>Case 1: When Merger is Financed by Cash</th>
<th>Case 2: When Merger is Financed by Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For Acquiring company (A Ltd.)</strong></td>
<td><strong>For Acquiring company (A Ltd.)</strong></td>
</tr>
<tr>
<td>Cost to A Ltd.</td>
<td>Cost to A Ltd.</td>
</tr>
<tr>
<td>= Cash paid to B Ltd. − MV_B Ltd. received</td>
<td>= MV_A+B × % Holding of B Ltd. − MV_B Ltd. received</td>
</tr>
<tr>
<td><strong>Benefit of Merger (Synergy Gain)</strong></td>
<td><strong>Benefit of Merger (Synergy Gain)</strong></td>
</tr>
<tr>
<td>= MV_A+B − (MV_A Ltd. + MV_B Ltd.)</td>
<td>= MV_A+B − (MV_A Ltd. + MV_B Ltd.)</td>
</tr>
<tr>
<td><strong>Net Benefit (NPV)</strong></td>
<td><strong>Net Benefit (NPV)</strong></td>
</tr>
<tr>
<td>= Benefit − Cost</td>
<td>= Benefit − Cost</td>
</tr>
<tr>
<td><strong>For Target Company (B Ltd.)</strong></td>
<td><strong>For Target Company (B Ltd.)</strong></td>
</tr>
<tr>
<td>Benefit (Net Benefit)</td>
<td>Benefit (Net Benefit)</td>
</tr>
<tr>
<td>= Cash Received − MV_B Ltd. sacrificed</td>
<td>= MV_A+B × % Holding of B Ltd. − MV_B Ltd. sacrificed</td>
</tr>
</tbody>
</table>

**Note:**
Cost of A Ltd. = Benefit for B Ltd.

**LOS 15: Financial Restructuring/ Internal Re-Construction**

- Financial restructuring refers to a kind of internal changes made by the management in Assets and Liabilities of a company with the consent of its various stakeholders. This is a suitable mode of restructuring for corporate entities who have suffered from sizeable losses over a period of time. Consequent upon losses, the share capital or net worth of such companies get substantially eroded. In fact, in some cases, the accumulated losses are even more than the share capital and thus leading to negative net worth, putting the firm on the verge of liquidation.

- In order to revive such firms, financial restructuring is one of the techniques to bring into health such firms who are having potential and promise for better financial performance in the years to come. To achieve this desired objective, such firms need to re-start with a fresh balance sheet free from losses and fictitious assets and show share capital at its real true worth.

- Impact of Financial Restructuring
  1. Benefits to XYZ Ltd.
     a) Reduction in Liabilities
     b) Revaluation of Assets
     **Total Benefits**
  2. Amount of Benefit will be utilized to Written Off Fictitious Assets, Profit & Loss Dr. Bal., Provision for Doubtful Debts and over-valued Assets.
Mutual Funds

**LOS 1 : Introduction**

A mutual fund is a common pool of money into which investors place their contributions that are to be invested in accordance with a stated objective.

A Mutual Fund is the most suitable investment for the cautious investors as it offers an opportunity to invest in a diversified professionally managed basket of securities at a relatively low cost.

Mutual fund is a type of passive investment. If investors directly investment in market is known as active investment.

**LOS 2 : NAV (Net Asset Value) per unit**

As per SEBI Regulation, every mutual fund company should calculate its NAV on a daily basis (excluding holidays)

\[
NAV = \frac{\text{Net Assets of the Scheme}}{\text{No. Of units Outstanding}}
\]

Net Assets i.e. Total Assets – Total External Liabilities

\[
= \left[\text{Market Value of Investments} + \text{Receivables} + \text{Accrued Income} + \text{Other Assets}\right]
\]

\[
- \left[\text{Accrued Expenses} + \text{Payables} + \text{Other liabilities}\right]
\]
Note:
- NAV signifies the realizable value that the investor will get for each unit that one is holding, if the scheme is liquidated on that date.
- NAV is calculated for each Scheme & not for whole Company.
- While using NAV, we should always give preference to market value, if market value is not given then use book value.

**LOS 3: Calculation of Return (HPR)**

*Investors derive three type of Return:*

(i) Cash Dividend
(ii) Capital Gain Disbursements
(iii) Change in the Fund’s NAV per unit (Unrealized Capital Gain) \([\text{Closing NAV} – \text{Opening NAV}]\)

\[
\text{Return} = \frac{\text{[Closing NAV – Opening NAV]} + \text{Dividend received} + \text{Capital Gain Received}}{\text{Opening NAV}} \times 100
\]

**LOS 4: Different Plans Under Mutual Fund**

1. **Dividend Payout Plan**: Under this plan, Mutual Fund Co. declares & distributes dividend to its unitholders on regular basis.
   - **Impact**: NAV will fall & no. of units will remain same.

2. **Bonus Plan**: Free units are distributed to the unitholders like bonus shares.
   - **Impact**: NAV will fall & no. of units will increase.

3. **Growth Plan**: Neither dividend is distributed nor are bonus units given. NAV will be increase to the extent of growth.
   - **Impact**: NAV will change according to the mkt only & no. of units will remain same.

4. **Dividend Re-investment Plan**: Although dividend is declared but it is not paid. Amount of dividend is again re-invested at the ex-Dividend NAV price prevailing at the time of declaration.
   - **Impact**: NAV will fall & no. of units will increase.

**LOS 5: Expense Ratio**

\[
\text{Expense ratio} = \frac{\text{Expense Incurred per unit}}{\text{Average NAV}}
\]

**Note:**

Average NAV = \(\frac{\text{Opening NAV} + \text{Closing NAV}}{2}\)

**LOS 6: Relationship between Return of Mutual Fund, Recurring Expenses, Issue Expenses & Return Desire by Investors (Indifference Point)**

**Required return by investors**

\(= (\text{Return of Mutual fund} – \text{Recurring Expenses}) (1 – \text{Issue Expenses})\)
**LOS 7: Entry Load & Exit Load**

**Entry Load** is paid by the investor at the time of purchase of Mutual Fund unit.

\[
\text{Sale Price of NAV} = \text{NAV} \times (1 + \text{Entry Load})
\]

**Exit Load** is paid by the investor at the time of selling of mutual fund units.

\[
\text{Realized value of NAV} = \text{NAV} \times (1 - \text{Exit Load})
\]
Derivatives Analysis & Valuation (Futures)

LOS 1: Introduction

**Forward Contract**, In Forward Contract one party agrees to buy, and the counterparty to sell, a physical asset or a security at a specific price on a specific date in the future. If the future price of the assets increases, the buyer (at the older, lower price) has a gain, and the seller a loss.

**Futures Contract** is a standardized and exchange-traded. The main difference with forwards are that futures are traded in an active secondary market, are regulated, backed by the clearing house and require a daily settlement of gains and losses.

**Future Contracts differ from Forward Contracts in the following ways:**

<table>
<thead>
<tr>
<th>Future Contracts</th>
<th>Forward Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized Exchange</td>
<td>Private Contracts</td>
</tr>
<tr>
<td>Highly Standardized</td>
<td>Customized Contracts</td>
</tr>
<tr>
<td>Lot size requirement</td>
<td></td>
</tr>
<tr>
<td>Expiry Date</td>
<td></td>
</tr>
<tr>
<td>MTM</td>
<td></td>
</tr>
<tr>
<td>No Counterparty default risk</td>
<td>Counterparty default risk exists</td>
</tr>
<tr>
<td>Government Regulated</td>
<td>Usually not Regulated</td>
</tr>
</tbody>
</table>
**LOS 2: Position to be taken under Future Market**

- **Future Market**
  - **Long Position**
    - Buying Position
  - **Short Position**
    - Selling Position

**How to settle / square-off / covering / closing out a position to calculate Profit/ Loss**

- **To Square Off**
  - **Long Position** → Short position
  - **Short Position** → Long position

**LOS 3: Gain or Loss under Future Market**

<table>
<thead>
<tr>
<th>Position</th>
<th>If Price on Maturity/ Settlement Price</th>
<th>Gain/ Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Position</td>
<td>Increase</td>
<td>Gain</td>
</tr>
<tr>
<td></td>
<td>Decrease</td>
<td>Loss</td>
</tr>
<tr>
<td>Short Position</td>
<td>Increase</td>
<td>Loss</td>
</tr>
<tr>
<td></td>
<td>Decrease</td>
<td>Gain</td>
</tr>
</tbody>
</table>

**Note:**
- Gain/Loss is net of brokerage charge. Brokerage is paid on both buying & selling.
- Security Deposit is not considered while calculating Profit & Loss A/c.
- Interest paid on borrowed amount must be deducted while calculating Profit & Loss.
- A Future contract is ZERO-SUM Game. Profit of one party is the loss of other party.
LOS 4: How Future Contract can be terminated at or prior to expiration?

- A short can terminate the contract by delivering the goods, and a long can terminate the contract by accepting delivery and paying the contract price to the short. This is called **Delivery**. The location for delivery (for physical assets), terms of delivery, and details of exactly what is to be delivered are all specified in the contract.
- In a **cash-settlement contract**, delivery is not an option. The futures account is marked-to-market based on the settlement price on the last day of trading.
- You may make a **reverse**, or **offsetting**, trade in the future market. With futures, however, the other side of your position is held by the clearinghouse - if you make an exact opposite trade (maturity, quantity, and good) to your current position, the clearinghouse will net your positions out, leaving you with a zero balance. This is how most futures positions are settled.

LOS 5: Difference between Margin in the cash market and Margin in the future markets and Explain the role of initial margin, maintenance margin

In **Cash Market**, margin on a stock or bond purchase is 100% of the market value of the asset.
- Initially, 50% of the stock purchase amount may be borrowed and the remaining amount must be paid in cash (Initial margin).
- There is interest charged on the borrowed amount.

In **Future Markets**, margin is a performance guarantee i.e. security provided by the client to the exchange. It is money deposited by both the long and the short. There is no loan involved and consequently, no interest charges.
- The exchange requires traders to post margin and settle their account on a daily basis.

**Note:**
- Any amount, over & above initial margin amount can be withdrawn.
- If Initial Margin is not given in the question, then use:

\[
\text{Initial Margin} = \text{Daily Absolute Change} + 3 \text{ Standard Deviation}
\]
LOS 6: Concept of Compounding

Example: Computing EAR for Range of compounding frequency.

Using a stated rate of 6%, compute EARs for semi-annual, quarterly, monthly and daily compounding.

Solution:

EAR with:

<table>
<thead>
<tr>
<th>Compounding Frequency</th>
<th>EAR Calculation</th>
<th>EAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-annual</td>
<td>((1 + 0.03)^2 - 1)</td>
<td>0.06090 = 6.090%</td>
</tr>
<tr>
<td>Quarterly</td>
<td>((1 + 0.015)^4 - 1)</td>
<td>0.06136 = 6.136%</td>
</tr>
<tr>
<td>Monthly</td>
<td>((1 + 0.005)^{12} - 1)</td>
<td>0.06168 = 6.168%</td>
</tr>
<tr>
<td>Daily</td>
<td>((1 + 0.00016438)^{365} - 1)</td>
<td>0.06183 = 6.183%</td>
</tr>
</tbody>
</table>

Notice here that the EAR increases as the compounding frequency increases.

Concept of \(e^r\) & \(e^{-r}\) (Continuous Compounding)

Most of the financial variable such as Stock price, Interest rate, Exchange rate, Commodity price change on a real time basis. Hence, the concept of Continuous compounding comes in picture.

Continuous Compounding means compounding every moment. Instead of \((1 + r)\) we will use \(e^r\)

**Calculation of \(a^b\)**

1. \(\sqrt[a]{a}\) 12 Times
2. - 1
3. \(\times b\)
4. + 1
5. \(\times = 12\) Times

**Calculation of \(e^b\)**

1. \(\sqrt[e]{e}\) 12 Times
2. - 1
3. \(\times b\)
4. + 1
5. \(\times = 12\) Times

Hint: \(e^1 = 2.71828\)

**Example:**

\[e^0 = 1\]
\[e^{-25} = 0.77880\]
\[\frac{1}{1.28403} = 0.77880\]
\[e^{25} = 1.28403\]
\[e^{20} = 1.22140\]
\[e^{21} = 1.23368\]
\[\frac{1.22140 + 1.23368}{2} \Rightarrow 1.22754\]
\[ e^{0.357} = ? \]
\[ e^{0.35} = 1.41907 \]
\[ e^{0.36} = 1.43333 \]
Since 3\textsuperscript{rd} digit is not 5, in this case we have to use interpolation technique:
when power of \( e \) increases by 0.01, then value increase by \( 0.01 \times 0.01426 \) \[ [1.43333 - 1.41907] \]
when power of \( e \) increases by 1, then value increases by \( 0.00998 \)
when power of \( e \) increases by 0.007, then value increases by \( 0.00998 \times 0.007 = 0.00998 \)
Value of \( e^{0.357} = 1.41907 + 0.00998 = 1.42905 \)

**LOS 7 : Fair future price of security with no income**

**In case of Normal Compounding**

\[ \text{Fair future price} = \text{Spot Price} \times (1 + r)^n \]

**In case of Continuous Compounding**

\[ \text{Fair future price} = \text{Spot Price} \times e^{rt} \]

Where
\[ r = \text{risk free interest p.a. with Continuous Compounding.} \]
\[ t = \text{time to maturity in years/ days. (No. of days / 365) or (No. of months / 12)} \]

**LOS 8 : Fair Future Price of Security with Dividend Income**
In case of Normal Compounding

Fair Future Price = \([\text{Spot Price} – \text{PV of Expected Dividend}] \times (1+r)^n\)

In case of Continuous Compounding

Fair Future Price = \([\text{Spot Price} – \text{PV of Expected Dividend}] \times e^{rt}\)

PV of DI = Present Value of Dividend Income = \(\text{Dividend} \times e^{-rt}\)

Where \(t = \) period of dividend payments

LOS 9: Fair Future Price of security when income is expressed in percentage or when dividend yield is given

In case of Normal Compounding

Fair Future Price = \(\text{Spot Price} \times [1+(r-y)]^n\)

In case of Continuous Compounding

Fair Future Price = \(\text{Spot Price} \times e^{(r-y)t}\)

Where \(y = \) income expressed in % or dividend Yield

LOS 10: Fair Future Price of Commodity with storage cost

In case of Normal Compounding

Fair Future Price = \([\text{Spot Price} + \text{PV of S.C}] \times (1+r)^n\)

In case of Continuous Compounding

Fair Future Price = \([\text{Spot Price} + \text{PV of S.C}] \times e^{rt}\)

Where PV of S.C = Present Value of Storage Cost

Note: Fair Future Price when Storage Cost is given in percentage(%) .

FFP = \(\text{Spot Price} \times e^{(r + s) t}\)

Where \(s = \) Storage cost expressed in percentage.

LOS 11: Fair Future Price of commodities with Convenience yield expressed in % (Similar to Dividend Yield)

The benefit or premium associated with holding an underlying product or physical good rather than contract or derivative product i.e. extra benefit that an investor receives for holding a commodity.
In case of Continuous Compounding

\[
\text{Fair Future Price} = \text{Spot Price} \times e^{(r-c)t}
\]

Note: Fair Future Price when convenience income is expressed in Absolute Amount.

\[
\text{Fair Future Price} = [\text{Spot Price} - \text{PV of Convenience Income}] \times e^{rt}
\]

**LOS 12: Arbitrage Opportunity between Cash and Future Market**

- Arbitrage is an important concept in valuing (Pricing) derivative securities. In its Purest sense, arbitrage is riskless.
- Arbitrage opportunities arise when assets are mispriced. Trading by Arbitrageurs will continue until they effect supply and demand enough to bring asset prices to efficient (no arbitrage) levels.
- Arbitrage is based on “Law of one price”. Two securities or portfolios that have identical cash flows in future, should have the same price. If A and B have the identical future pay offs and A is priced lower than B, buy A and sell B. You have an immediate profit.

**Difference between Actual Future Price and Fair Future Price?**

Fair Future Price is calculated by using the concept of Present Value & Future Value. Actual Future Price is actually prevailing in the market.

<table>
<thead>
<tr>
<th>Case</th>
<th>Value</th>
<th>Future Market</th>
<th>Cash Market</th>
<th>Borrow/ Invest</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFP &lt; AFP</td>
<td>Over-Valued</td>
<td>Sell or Short Position</td>
<td>Buy</td>
<td>Borrow</td>
</tr>
<tr>
<td>FFP &gt; AFP</td>
<td>Under-Valued</td>
<td>Buy or Long Position</td>
<td>Sell #</td>
<td>Investment</td>
</tr>
</tbody>
</table>

# Here we assume that Arbitrager already hold shares

**LOS 13: Complete Hedging by using Index Futures & Beta**

Hedging is the process of taking an opposite position in order to reduce loss caused by Price fluctuation.

- The objective of Hedging is to reduce Loss.
- Complete Hedging means profit/ Loss will be Zero.

**Position to be taken:**

a) Long Position should be hedged by Short Position.
b) Short Position should be hedged by Long Position.

**Value of Position to be taken:**

Value of Position for Complete hedge should be taken on the basis of Beta through index futures.

**Value of Position for Complete Hedge = Current Value of Portfolio \times Existing Stock Beta**

**LOS 14: Value of Position for Increasing & Reducing Beta to a Target Level**
Alternative 1 (Hedging Using Index Future)

Step 1: Decide Position

Case 1: To Reduce Risk

| Long Position | Short Index Future |
| Short Position | Long Index Future |

Case 2: To Increase Risk

| Long Position | Long Index Future |
| Short Position | Short Index Future |

Step 2: Value of Position

Case I: When Existing Beta > Target Beta

Objective: Reducing Risk

Value of Index Position = Value of Existing Portfolio × [Existing Beta – Desired Beta]

Action: Take Short Position in Index & keep your current position unchanged.

Case II: When Existing Beta < Target Beta

Objective: Increase Risk

Value of Index Position = Value of Existing Portfolio × [Desired Beta – Existing Beta]

Action: Take Long Position in Index & keep your current position unchanged.

Step 3: No. of future contracts to be sold or purchased for increasing or reducing Beta to a Desired Level using Index Futures.

\[
\text{No. of Future Contract to be taken} = \frac{\text{Value of Index Position}}{\text{Value of one Future Contract}}
\]

Alternative 2 (Hedging Using Risk free Investment or Borrowing)

Case 1: Reducing Risk

SELL SOME SECURITIES AND REPLACE WITH RISK-FREE INVESTMENT

Step1: Equate the weighted Average Beta formulae to the new desired Beta

Target Beta = Beta_1 × W_1 + Beta_2 × W_2  \hspace{1cm} (Beta of Risk free investment is Zero)

Step2: Use the weights and decide

Case 2: Increasing Risk

BUY SOME SECURITIES AND BORROW AT RISK-FREE RATE

Step1: Equate the weighted Average Beta formulae to the new desired Beta

Target Beta = Beta_1 × W_1 + Beta_2 × W_2  \hspace{1cm} (Beta of Risk free investment is Zero)

Step2: Use the weights and decide
**LOS 15 : Partial Hedge**

Value of position in Index Future =
Value of existing Portfolio × Existing beta × percentage (%) to be Hedge

- It results into Over-Hedged or Under-Hedged Position
- There may be profit or loss depending upon the situation.

**LOS 16 : Beta of a Cash and Cash Equivalent**

Beta of a cash and Risk free security is Zero.

**LOS 17 : Hedging Commodity Risk Through Futures**

**LOS 18 : Calculation of Rate of Return**

<table>
<thead>
<tr>
<th>(+)</th>
<th>Increase or Decrease in Stock Price ( (P_1 - P_0) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-)</td>
<td>Dividend Received</td>
</tr>
<tr>
<td></td>
<td>Transaction Cost</td>
</tr>
<tr>
<td>(-)</td>
<td>Interest Paid on Borrowed Amount</td>
</tr>
<tr>
<td></td>
<td><strong>Net Amount Received</strong></td>
</tr>
</tbody>
</table>

Rate of return = \( \frac{\text{Net Amount Received}}{\text{Total Initial Equity Investment}} \) × 100

**LOS 19 : Hedge Ratio**

The Optional Hedge Ratio to minimize the variance of Hedger’s position is given by:-

\[
\text{Hedge Ratio} = \text{Corr.} \ (r) \ \frac{\sigma_S}{\sigma_F}
\]

- \( \sigma_S \) = S.D of \( \Delta S \)
- \( \sigma_F \) = S.D of \( \Delta F \)
- \( r \) = Correlation between \( \Delta S \) and \( \Delta F \)
- \( \Delta S \) = Change in Spot Price
- \( \Delta F \) = Change in Future Price
Derivatives Analysis & Valuation (Options)

LOS 1: Introduction

Definition of Option Contract:
An option contract gives its owner the right, but not the legal obligation, to conduct a transaction involving an underlying asset at a pre-determined future date (the exercise date) and at a pre-determined price (the exercise price or strike price).

There are four possible options positions:
1) **Long call**: The buyer of a call option has the right to buy an underlying asset.  
2) **Short call**: The writer (seller) of a call option has the obligation to sell the underlying asset.  
3) **Long put**: The buyer of a put option has the right to sell the underlying asset.  
4) **Short put**: The writer (seller) of a put option has the obligation to buy the underlying asset.

Note:
- **Meaning of Long position & Short position under Option Contract**

Note:
- If question is silent always assume **Long Position**.
- **Exercise Price/Strike Price**:
The fixed price at which buyer of the option can exercise his option to buy/ sell an underlying asset. It always remain constant throughout the life of contract period.

- **Option Premium:**
  - To acquire these rights, owner of options must buy them by paying a price called the Option premium to the seller of the option.
  - Option Premium is paid by buyer and received by Seller.
  - Option Premium is non-refundable, non-adjustable deposit.

**Note:**
- The option holder will only exercise their right to act if it is profitable to do so.
- The owner of the Option is the one who decides whether to exercise the Option or not.

**LOS 2 : Call Option**

**When Call Option Contract are exercised:**

- When CMP > Strike Price → Call Buyer Exercise the Option.
- When CMP < Strike Price → Call Buyer will not Exercise the Option.

**Note :**
- The call holder will exercise the option whenever the stock’s price exceeds the strike price at the expiration date.
- The sum of the profits between the Buyer and Seller of the call option is always Zero. Thus, Option trading is ZERO-SUM GAME. The long profits equal to the short losses.
- Position of a Call Seller will be just opposite of the position of Call Buyer.
- In this chapter, we first see whether the Buyer of Option opt or not & then accordingly we will calculate Profit & Loss.
**PAY-OFF DIAGRAM**

**LOS 3 : Put Option**

**When Put Option Contract are exercised:**

- When CMP > Strike Price → Put Buyer will not Exercise the Option.
- When CMP < Strike Price → Put Buyer will Exercise the Option.

**PAY-OFF DIAGRAM**

- If S = X = ₹ 1000
- If S = X = ₹ 1000

<table>
<thead>
<tr>
<th>Right to Sell</th>
<th>Obligation to Buy</th>
</tr>
</thead>
<tbody>
<tr>
<td>reliance share @ 1000 after 3 months</td>
<td>reliance share @ 1000 after 3 months if buyer approaches to do so.</td>
</tr>
<tr>
<td>LONG PUT</td>
<td>SHORT PUT</td>
</tr>
<tr>
<td>OP Paid</td>
<td>OP Received</td>
</tr>
</tbody>
</table>

**Note:**

- Put Buyer will only exercise the option when actual market price is less the exercise price.
- Profit of Put Buyer = Loss of Put Seller & vice-versa. Trading Put Option is a Zero-Sum Game.
**Profit or Loss/ Pay off of call Option & Put Option**

While calculating profit or loss, always consider option Premium,

<table>
<thead>
<tr>
<th>Call Buyers (Long Call)</th>
<th>Put Buyers (Long Put)</th>
</tr>
</thead>
<tbody>
<tr>
<td>If $S - X &gt; 0$</td>
<td>If $X - S &gt; 0$</td>
</tr>
<tr>
<td>Exercise the option</td>
<td>Exercise the option</td>
</tr>
<tr>
<td>Net Profit = $S - X - OP$</td>
<td>Net Profit = $X - S - OP$</td>
</tr>
<tr>
<td>If $S - X &lt; 0$</td>
<td>If $X - S &lt; 0$</td>
</tr>
<tr>
<td>Not Exercise</td>
<td>Not Exercise</td>
</tr>
<tr>
<td>Loss = Amount of Premium</td>
<td>Loss = Amount of Premium</td>
</tr>
</tbody>
</table>

**Calculation of Maximum Loss, Maximum Gain, Breakeven Point for Call & Put Option**

**Call Option**

<table>
<thead>
<tr>
<th>Buyer (Long)</th>
<th>Maximum Loss</th>
<th>Maximum Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option Premium</td>
<td>Unlimited</td>
<td></td>
</tr>
<tr>
<td>Seller (Short)</td>
<td>Unlimited</td>
<td>Option Premium</td>
</tr>
</tbody>
</table>

**Put Option**

<table>
<thead>
<tr>
<th>Buyer (Long)</th>
<th>Maximum Loss</th>
<th>Maximum Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option Premium</td>
<td>$X - Option Premium$</td>
<td></td>
</tr>
<tr>
<td>Seller (Short)</td>
<td>$X - Option Premium$</td>
<td>Option Premium</td>
</tr>
</tbody>
</table>

**LOS 4 : Concept of Moneyness of an Option**

Moneyness refers to whether an option is **In-the money or Out- of the money**.

- **Case I**: If immediate exercise of the option would generate a **positive pay-off**, it is in the money.
- **Case II**: If immediate exercise would result in loss (**negative pay-off**), it is out of the money.
- **Case III**: When current Asset Price = Exercise Price, exercise will generate **neither gain nor loss** and the option is at the money.

<table>
<thead>
<tr>
<th>Call Option</th>
<th>Put Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1 $S - X &gt; 0$</td>
<td><strong>In-the-Money</strong> $X - S &gt; 0$</td>
</tr>
<tr>
<td>Case 2 $S - X \leq 0$</td>
<td><strong>Out-of-the-Money</strong> $X - S \leq 0$</td>
</tr>
<tr>
<td>Case 3 $S = X$</td>
<td><strong>At-the-Money</strong> $X = S$</td>
</tr>
</tbody>
</table>

**Note:**
Do not consider option premium while Calculating Moneyness of the Option.

**LOS 5 : European & American Options**

- **American Option**: American Option may be exercised at any time up to and including the contract’s expiration date.
- **European Option**: European Options can be exercised only on the contract’s expiration date.

The name of the Option does not imply where the option trades – they are just names.
**LOS 6: Action to be taken under Option Market**

- **Long Call**
- **Short Call**
- **Long Put**
- **Short Put**

**If Market Prices are expected to rise**

**If Market Prices are expected to fall**

**LOS 7: Intrinsic Value & Time Value of Option**

**Option value (Premium) can be divided into two parts:-**

(i) Intrinsic Value

(ii) Time Value of an Option (Extrinsic Value)

**Option Premium = Intrinsic Value + Time Value of Option**

**Intrinsic Value:**
- An Option’s intrinsic Value is the amount by which the option is In-the-money. It is the amount that the option owner would receive if the option were exercised.
- Intrinsic Value is the minimum amount charged by seller from buyer at the time of selling the right.
- An Option has ZERO Intrinsic Value if it is At-the-Money or Out-of-the-Money, regardless of whether it is a call or a Put Option.
- The Intrinsic Value of a Call Option is the greater of \((S - X)\) or 0. That is \(C = \max\{0, S - X\}\)
- Similarly, the Intrinsic Value of a Put Option is \((X - S)\) or 0. Whichever is greater. That is: \(P = \max\{0, X - S\}\)

**Time Value of an Option (Extrinsic Value):**
- The Time Value of an Option is the amount by which the option premium exceeds the intrinsic Value.
- Time Value of Option = Option Premium – Intrinsic Value
- When an Option reaches expiration there is no “Time” remaining and the time value is ZERO.
- The longer the time to expiration, the greater the time value and, other things equal, the greater the option’s Premium (price).
Option Valuation

**Value of Option**

- Simple Valuation Rules
- Binomial Method
- Black - Scholes Model
- Put Call Parity Theory

**Strike Price and price of underlying asset is given.**

- Expected price of Underlying Assets will either high price or low price
- Standard Deviation with other information is given
- Information of Call Option is given and value of Put Option to be cal. and Vice-versa

**Using Risk Neutral Approach**

**Delta Hedge Situation i.e. using Hedge Ratio**

**Los 8 : Fair Option Premium/ Fair Value/ Fair Price of a Call on Expiration**

**Fair Premium of Call on Expiry** = Maximum of [(S – X), 0]

**Note:**
Option Premium can never be Negative. It can be Zero or greater than Zero.

**Los 9 : Fair Option Premium/ Fair Value/ Fair Price of a Put on Expiration**

**Fair Premium of Put on Expiry** = Maximum of [(X – S), 0]

**Los 10 : Fair Option Premium/ Theoretical Option Premium/ Price of a Call before Expiry or at the time of entering into contract or As on Today**

Fair Premium of Call = \( \left[ S - \frac{X}{(1 + \text{RFR})^T}, 0 \right] \text{Max} \)

Or

= \( \left[ S - \frac{X}{e^{rT}}, 0 \right] \text{Max} \)

RFR (r) = Risk-free rate
T = Time to expiration
LOS 11: Fair Option Premium/ Theoretical Option Premium/ Price of a Put before Expiry or at the time of entering into contract or As on Today

\[
\text{Fair Premium of Put} = \max \left[ \frac{X}{(1+RFR)^T} - S, 0 \right]
\]

Or

\[
= \max \left[ \frac{X}{e^{rt}} - S, 0 \right]
\]

LOS 12: Expected Value of an Option on expiry

Under this approach, we will calculate the amount of Option premium on the basis of Probability.

Expected value of an option at Expiry = \( \sum \text{Value of Option at expiry} \times \text{Probability} \)

LOS 13: Risk Neutral Approach for Call & Put Option (Binomial Model)

- Under this approach, we will calculate Fair Option Premium of Call & Put as on Today.
- The basic assumption of this model is that share price on expiry may be higher or may be lower than current price.

**Step 1: Calculate Value of Call or Put as on expiry at high price & low price**

Value of Call as on expiry = \( \max ([S - X], 0) \)
Value of Put as on expiry = \( \max ([X - S], 0) \)

**Step 2: Calculate Probability of High Price & Low Price**

Probability of High Price = \( \frac{\text{CMP} \cdot (1+r)^T - LP}{HP - LP} \) or Probability of High Price = \( \frac{\text{CMP} \cdot e^{rt} - LP}{HP - LP} \)

**Step 3: Calculate expected Value/ Premium as on expiry by using Probability**

**Step 4: Calculate Premium as on Today**

By Using normal Compounding = \( \frac{\text{Expected Premium as on expiry}}{(1+r)^T} \)

By Using Continuous Compounding = \( \frac{\text{Expected Premium as on expiry}}{e^{rt}} \)
**LOS 14: Two Period Binomial Model**

We divide the option period into two equal parts and we are provided with binomial projections for each path. We then calculate the value of the option on maturity. We then apply backward induction technique to compute the value of option at each node.

**LOS 15: Put Call Parity Theory (PCPT)**

Put Call Parity is based on Pay-offs of two portfolio combination, a fiduciary call and a protective put.

**Fiduciary Call**
A Fiduciary Call is a combination of a pure-discount, riskless bond that pays $X$ at maturity and a Call.

**Protective Put**
A Protective Put is a share of stock together with a put option on the stock.

\[
\text{PCPT} \rightarrow \text{Value of Call} + \frac{X}{(1+\text{RFR})^T} = \text{Value of Put} + S
\]

<table>
<thead>
<tr>
<th>Protective Put</th>
<th>If on Maturity $S &gt; X$</th>
<th>If on Maturity $S &lt; X$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put option is lapse i.e. pay off</td>
<td>$=\text{NIL}$</td>
<td>$=S-X$</td>
</tr>
<tr>
<td>Stock is sold in the Market</td>
<td>$=S$</td>
<td>$=S$</td>
</tr>
<tr>
<td>Bond is sold in the Market</td>
<td>$=X$</td>
<td>$=X$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fiduciary Call</th>
<th>If on Maturity $S &gt; X$</th>
<th>If on Maturity $S &lt; X$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call option is exercise i.e. pay off</td>
<td>$=S-X$</td>
<td>$=\text{NIL}$</td>
</tr>
<tr>
<td>Bond is sold in the Market</td>
<td>$=X$</td>
<td>$=X$</td>
</tr>
</tbody>
</table>

Through this theory, we can calculate either Value of Call or Value of Put provided other Three information is given.
Assumptions:

Exercise Price of both Call & Put Option are same.
Maturity Period of both Call & Put are Same.

**LOS 16 : Put - Call Parity Theory → ARBITRAGE**

As per PCPT,

\[
\text{Value of Call} + \frac{X}{(1+RFR)^T} = \text{Value of Put} + S
\]

**LHS**

**RHS**

**Case I** : If LHS = RHS, arbitrage is not possible.
**Case II** : If LHS ≠ RHS, arbitrage is possible.

A. If LHS > RHS, Call is Over-Valued & Put is Under-Valued

<table>
<thead>
<tr>
<th>Option Market</th>
<th>Cash Market</th>
<th>Net Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Call</strong></td>
<td><strong>Long Put</strong></td>
<td><strong>Buy</strong></td>
</tr>
<tr>
<td>i.e. Obligation to sell &amp; Option Premium Received</td>
<td>i.e. Right to sell &amp; Option Premium Paid</td>
<td>i.e. Buy one share</td>
</tr>
<tr>
<td><strong>Borrow</strong></td>
<td><strong>S + P - C</strong></td>
<td></td>
</tr>
</tbody>
</table>

B. If LHS < RHS, Call is Under-Valued & Put is Over-Valued

<table>
<thead>
<tr>
<th>Option Market</th>
<th>Cash Market</th>
<th>Net Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long Call</strong></td>
<td><strong>Short Put</strong></td>
<td><strong>Sell</strong></td>
</tr>
<tr>
<td>i.e. Right to Buy &amp; Option Premium Paid</td>
<td>i.e. Obligation to buy &amp; Option Premium Received</td>
<td>i.e. Sell one share</td>
</tr>
<tr>
<td><strong>Invest</strong></td>
<td><strong>S + P - C</strong></td>
<td></td>
</tr>
</tbody>
</table>

**LOS 17 : Option Strategies**

Combination of Call & Put is known as OPTION STRATEGIES.

**Types of Option Strategies:**

Some important Option Strategies are as follows:
1. Straddle Position
2. Strangle Strategy
3. Strip Strategy
4. Strap Strategy
5. Butterfly Spread

**1. Straddle Position :**

Straddle may be of 2 types :

<table>
<thead>
<tr>
<th>Long Straddle</th>
<th>Short Straddle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy a Call and Buy a Put on the same stock with both the options having the same exercise price.</td>
<td>Sell a Call and Sell a Put with same exercise price and same exercise date.</td>
</tr>
<tr>
<td><strong>Option</strong>: Buy One Call and Buy One Put</td>
<td><strong>Option</strong>: Sell One Call and Sell One Put</td>
</tr>
</tbody>
</table>
7.10 DERIVATIVES ANALYSIS & VALUATION (OPTIONS)

<table>
<thead>
<tr>
<th>Exercise Date:</th>
<th>Same of Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike Price / Exercise Price:</td>
<td>Same of Both</td>
</tr>
</tbody>
</table>

**Note:**
A Long Straddle investor pays premium on both Call & Put.

<table>
<thead>
<tr>
<th>Exercise Date:</th>
<th>Same of Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike Price / Exercise Price:</td>
<td>Same of Both</td>
</tr>
</tbody>
</table>

**Note:**
A Short Straddle investor receive premium on both Call and Put.

**Note:**
- When an investor is not sure whether the price will go up or go down, then in such case we should create a straddle position.
- If Question is Silent, always assume Long Straddle.

2. **Strangle Strategy**

- An option strategy, where the investor holds a position in both a call and a put with different strike prices but with the same maturity and underlying asset is called Strangles Strategy.
- Selling a call option and a put option is called seller of strangle (i.e. Short Strangle).
- Buying a call and a put is called Buyer of Strangle (i.e. Long Strangle).
- If there is a large price movement in the near future but unsure of which way the price movement will be, this is a Good Strategy.

3. **Strip Strategy (Bear Strategy)**

- Buy Two Put and Buy One Call Option of the same stock at the same exercise price and for the same period.
- Strip Position is applicable when decrease in price is more likely than increase.

4. **Strap Strategy (Bull Strategy)**

- Buy Two Calls and Buy One Put when the buyer feels that the stock is more likely to rise Steeply than to fall.
- Strap Position is applicable when increase in price is more likely than decrease.

5. **Butterfly Spread**

In Butterfly spread position, an investor will undertake 4 call option with respect to 3 different strike price or exercise price.

**It can be constructed in following manner:**
- Buy One Call Option at High exercise Price (S1)
- Buy One Call Option at Low exercise Price (S2)
- Sell two Call Option \( \left( \frac{S_1 + S_2}{2} \right) \)

**LOS 18 : Binomial Model (Delta Hedging / Perfectly Hedged technique) for Call Writer**

Under this concept, we will calculate option premium for call option.

It is assumed that expected price on expiry may be greater than Current Market Price or less than Current Market Price.
Steps involved:

**Step 1:** Compute the Option Value on Expiry Date at high price and at low price

Value of Call as on expiry = \( \text{Max} \left( (S - X), 0 \right) \)

**Step 2:** Buy ‘Delta’ No. of shares ‘\( \Delta \)’ at Current Market Price as on Today. Delta ‘\( \Delta \)’ also known as Hedge Ratio.

Hedge Ratio or ‘\( \Delta \)’ = \[
\frac{\text{Change in Option Premium}}{\text{Change in Price of Underlying Asset}}
\]

OR

\[
= \frac{\text{Value of call on expiry at High Price} - \text{Value of call on expiry at Low Price}}{\text{High Price} - \text{Low Price}}
\]

**Step 3:** Construct a Delta Hedge Portfolio i.e. Risk-less portfolio / Perfectly Hedge Portfolio

Sell one call option i.e. Short Call ,Buy Delta no. of shares and borrow net amount.

**Step 4:** Borrow the net Amount required for the above steps

\[
B = \frac{1}{1+r} \left[ \Delta \times HP - V_c \right]
\]

Or

\[
B = \frac{1}{1+r} \left[ \Delta \times LP - V_c \right]
\]

Where \( r \) = rate of interest adjusted for period

**Step 5:** Calculate Value of call as on today

Borrowed Amount = Amount required to purchase of share – Option Premium Received

\[
B = \Delta \times CMP - OP
\]

Or

\[
(\text{Option Premium} = \Delta \times CMP - \text{Borrowed Amount})
\]

**Note:** Calculation of Cash flow Position/ Value of holding after 1 year

- **If on Maturity Actual Market Price is HP**
  
  Cash Flow = \( \Delta \times HP - V_c \)

- **If on Maturity Actual Market Price is S_2**
  
  Cash Flow = \( \Delta \times LP - V_c \)

Cash Flow at HP and LP will always be same.
**LOS 19 : Black & Scholes Model**

The BSM Model uses five variables to value a call option:
1. The price of the Underlying Stock (S)
2. The exercise price of the option (X)
3. The time remaining to the expiration of the option (t)
4. The riskless rate of return (r)
5. The volatility of the underlying stock price ($\sigma$)

**Assumptions of BSM Model :**
- The price of underlying asset follows a log normal distribution
- Markets are frictionless. There is no taxes, no transaction cost, no restriction on short sale.
- The option valued are European options.
- Risk Free continuous compounding interest rate is known and constant.
- Annualized volatility of the stock is known and constant.
- The underlying asset has no cash flow as dividend, coupons etc.

**For Call:**

Value of a Call Option/ Premium on Call = $S \times N(d_1) - \frac{X}{e^{rt}} \times N(d_2)$

**Calculation of $d_1$ and $d_2$**

$$d_1 = \frac{\ln \frac{S}{X} + (r + 0.5\sigma^2)t}{\sigma \sqrt{t}}$$

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

Or

$$d_2 = \frac{\ln \frac{S}{X} + (r - 0.5\sigma^2)t}{\sigma \sqrt{t}}$$

where
- $S$ = Current Market Price
- $X$ = Exercise Price
- $r$ = risk-free interest rate
- $t$ = time until option expiration
- $\sigma$ = Standard Deviation of Continuously Compounded annual return

**For Put:**

Value of a Put Option/ Premium on Put = $\frac{X}{e^{rt}} \times [1 - N(d_2)] - S \times [1 - N(d_1)]$

**Calculation of $N(d_1)$ & $N(d_2)$**

$N(d_1)$ and $N(d_2)$ can be calculated by using 2 steps:
1. Calculate the value of $d_1$ and $d_2$
2. Calculate $N(d_1)$ and $N(d_2)$ by using

**Method 1:** $N(d_1)$ and $N(d_2)$ table

**Method 2:** Z- table or Normal Distribution Curve
**Method 1:**

**Example 1:**
- \( d_1 = 0.70 \), \( d_2 = 0.50 \)
- \( N(d_1) = N(0.70) = 0.758036 \)
- \( N(d_2) = N(0.50) = 0.691462 \)

**Example 2:**
- \( d_1 = -1.31 \), \( d_2 = -1.49 \)
- \( N(d_1) = N(-1.31) = 0.095098 \)
- \( N(d_2) = N(-1.49) = 0.068112 \)

**Example 3:**
- \( d_1 = 0.4539 \)
- \( 0.45 = 0.673645 \)
- \( 0.46 = 0.677242 \)

When \( d_1 \) increases by 0.01, the value increases by 0.003597

When \( d_1 \) increases by 1, the value increases by \( \frac{0.003597}{0.01} \)

When \( d_1 \) increases by 0.0039, the value increases by \( \frac{0.003597}{0.01} \times 0.0039 = 0.00140283 \)

\( N(d_1) = N(0.4539) \)  
= 0.673645 + 0.00140283  
= 0.675047

**Method 2:** Using Normal Distribution Table or Z-Table

<table>
<thead>
<tr>
<th><strong>Example 1:</strong></th>
<th><strong>Example 2:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>( d_1 = 0.70 ), ( d_2 = 0.50 )</td>
<td>( d_1 = -1.31 ), ( d_2 = -1.49 )</td>
</tr>
<tr>
<td>( d_1 = 0.70 )</td>
<td>( d_1 = -1.31 )</td>
</tr>
<tr>
<td>( Z)-value of 0.70 (Through table) = 0.258036</td>
<td>( Z)-value of 1.31 (Through table) = 0.404902</td>
</tr>
<tr>
<td>( N(d_1) = N(0.70) = 0.50 + 0.258036 )</td>
<td>( N(d_1) = N(-1.31) = 0.50 - 0.404902 )</td>
</tr>
<tr>
<td>( = 0.758036 )</td>
<td>( = 0.095098 )</td>
</tr>
<tr>
<td>( Z)-value of 0.50 = 0.191462</td>
<td>( Z)-value of 1.49 (Through table) = 0.431888</td>
</tr>
<tr>
<td>( N(d_2) = N(0.50) = 0.50 + 0.191462 )</td>
<td>( N(d_2) = N(-1.49) = 0.50 - 0.431888 )</td>
</tr>
<tr>
<td>( = 0.691462 )</td>
<td>( = 0.068112 )</td>
</tr>
</tbody>
</table>

**Calculation of Natural log (ln)**

<table>
<thead>
<tr>
<th><strong>Example 1:</strong></th>
<th><strong>Example 2:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>1.24</td>
</tr>
<tr>
<td>Natural log (0.75)</td>
<td>ln (1.24) = 0.21511</td>
</tr>
<tr>
<td>( \ln (0.75) = -0.28768 )</td>
<td></td>
</tr>
</tbody>
</table>

**LOS 20 : BSM \( \rightarrow \) when dividend amount is given in the question**

Adjust Spot Price (\( S \)) or CMP as \([\text{Spot Price} - \text{PV of Dividend Income}]\)

**Value of a Call Option** = \( [S - \text{PV of Dividend Income}] \times N(d_1) - \frac{X}{e^{rt}} \times N(d_2) \)
The ratio of the volume of put options traded to the volume of Call options traded, which is used as an indicator of investor’s sentiment (bullish or bearish)

The put-call Ratio to determine the market sentiments, with high ratio indicating a bearish sentiment and a low ratio indicating a bullish sentiment.

LOS 22 : Option Greek Parameters

Option price depends on 5 factors:

Option Price = f [S, X, t, r, σ], out of these factors X is constant and other causing a change in the price of option.

We will find out a rate of change of option price with respect to each factor at a time, keeping others constant.

1. Delta: It is the degree to which an option price will move given a small change in the underlying stock price. For example, an option with a delta of 0.5 will move half a rupee for every full rupee movement in the underlying stock.

The delta is often called the hedge ratio i.e. if you have a portfolio short ‘n’ options (e.g. you have written n calls) then n multiplied by the delta gives you the number of shares (i.e. units of the underlying) you would need to create a riskless position - i.e. a portfolio which would be worth the same whether the stock price rose by a very small amount or fell by a very small amount.

2. Gamma: It measures how fast the delta changes for small changes in the underlying stock price i.e. the delta of the delta. If you are hedging a portfolio using the delta-hedge technique described under "Delta", then you will want to keep gamma as small as possible, the smaller it is the less often you will have to adjust the hedge to maintain a delta neutral position. If gamma is too large, a small change in stock price could wreck your hedge. Adjusting gamma, however, can be tricky and is generally done using options.

3. Vega: Sensitivity of option value to change in volatility. Vega indicates an absolute change in option value for a one percentage change in volatility.

4. Rho: The change in option price given a one percentage point change in the risk-free interest rate. It is sensitivity of option value to change in interest rate. Rho indicates the absolute change in option value for a one percent change in the interest rate.

5. Theta: It is a rate change of option value with respect to the passage of time, other things remaining constant. It is generally negative.
LOS 1: Introduction

Globalization of Business

- Raising of Capital from International Capital Markets or easy access to External Commercial Borrowings for companies.
- Open Economy to Foreign Investments, Exports, Imports and making investments in Indian Economy like Infrastructure sector, medical science, etc.
- Participations of FIIs in Indian capital markets.
- Trade tie-ups between countries.
- Different countries have different currencies and the different currencies have different values, so there is a need of the rule for currency conversions for Global Business and Investments.

Three types of transactions associated with foreign exchange risk:

1. Loans (ECB)
2. Investments (Bonds & Equity)
3. Export & Import
8.2 FOREIGN EXCHANGE EXPOSURE & RISK MANAGEMENT

Note:
In India, Foreign Exchange Market is regulated by RBI.

What is Exchange Rate?

- The rate of conversion is the Exchange Rate.
- An exchange rate is the price of one country’s currency expressed in terms of the currency of another country. E.g. A rate of ₹ 50 per US $ implies that one US $ costs ₹ 50.

Rule 1: in an exchange rate two currencies are involved.
Rule 2: in any transaction involving Foreign Currency, you are selling one currency and buying another.

LOS 2: Home Currency & Foreign Currency

Home Currency: Country’s own currency.

Example:
For India ‘₹’/INR is home currency
For USA ‘US $‘ or ‘Dollar’ is a home currency
For UK ‘£‘ or ‘Pound’ or ‘GBP’ is home currency

Foreign Currency: Any currency other than home currency will be a Foreign Currency

Example:
For India, $, £, etc. will be a foreign currency.
For US ‘₹’, £ will be foreign currency.

LOS 3: Bid & Ask Rate

Bid Rate: Rate at which bank BUYS left hand side currency.
Ask Rate: Rate at which bank Sells left hand side currency.

One-way Quote: [when Bid and Ask Rate are same]

Example: 1$ = ₹ 65
Explanation:
Bank buys 1$ at ₹ 65.
Bank sells 1$ at ₹ 65.

Two-way Quote: [when Bid and Ask Rate are separately given]

Example:

1$ = ₹ 62 ............................................. ₹ 65

Left Hand Side Currency  Bid Rate / Bank Buying rate of left hand currency  Ask Rate/ Bank Selling rate of left hand currency

Note:
- Difference between Bid & Ask rate represents Profit Margin for the bank.
- Quotation / Bid & Ask rate or Exchange Rate is always quoted from the point of view of bank.
Bid Rate must always be less than Ask Rate.

Or

Ask Rate must always be greater than Bid Rate.

Always solve question from the point of view of investor/ Customer unless otherwise stated.

The difference between the Ask & Bid rates is called Spread, representing the profit margin of dealer.

\[ \text{Spread} = \text{Ask Rate} - \text{Bid Rate} \]

**LOS 4 : Direct Quote & Indirect Quote**

**Direct Quote:** Home Currency Price for 1 unit of foreign currency.

Example: 1$ = ₹ 50 is DQ for Rupee.

**Indirect Quote:** Foreign Currency Price for 1 unit of Home Currency.

Example: 1Re. = 0.0200$ is IDQ for Rupee.

**Note:**

- If a given quotation is direct for one country, then the same quotation will be indirect for another country and vice-versa.
- The concept of DQ and IDQ is only theoretical and don’t have any practical relevance.

**LOS 5 : Conversion of Direct Quote into Indirect Quote and vice-versa**

**Case 1:** One-way Quote [When bid & ask rates are same]

- Direct Quote can be converted into indirect quote by taking the reciprocal of direct quote.

\[ \text{IDQ} = \frac{1}{\text{DQ}} \]

**Case 2:** Two-way Quote [When bid & ask rates are separately given]

- Direct Quote (DQ) can be converted into Indirect Quote (IDQ) by taking the reciprocal of direct quote and switching the position.

**Example:** $1 = ₹ 47.25 --- ₹ 47.85 (1st Quote)

Convert DQ into the IDQ.

**Solution:**

DQ => $1 = ₹ 47.25 --- ₹ 47.85

IDQ => 1 Re. = \( \frac{1}{47.25} - \frac{1}{47.85} \)

OR 1 Re. = 0.02090 --- 0.02116 (2nd Quote)
Conversion Rules:

- Which currency is given in the question, we need that currency in the LHS of the quote.
- Decide whether to Buy that currency or Sell.
- If you Buy, Bank Sells, Use Ask Rate
- If you Sell, Bank Buys, Use Bid Rate
- Always Solve question from the point of view of Customer.

LOS 6: Spot Rate & Forward Rate

Spot Rate: Rate used for buying & selling of foreign currency at ‘As on Today or Immediately’

Forward rate: Rate used for buying & selling of foreign currency at some future Date i.e. Forward rate is the rate contracted today for exchange of currencies at a specified future date.

LOS 7: Premium or Discount

Premium: If the currency is costly or Expensive in future as compared to spot it is said to be at a premium.

\[
\text{SR} \Rightarrow 1\, \text{$_{US}$} = \text{\$\text{45}} \\
\text{FR} \Rightarrow 1\, \text{$_{US}$} = \text{\$\text{50}}
\]

In the above quote $ is at Premium.

Discount: If the currency is Cheaper in future as compared to spot it is said to be at a discount.

\[
\text{SR} \Rightarrow 1\, \text{Re.} = \frac{1}{45} \, \text{$_{US}$} = 0.0222 \\
\text{FR} \Rightarrow 1\, \text{Re.} = \frac{1}{50} \, \text{$_{US}$} = 0.02
\]

We can say that rupee is at discount.

Calculation of Premium or Discount

\[
\left[ \frac{\text{FR} - \text{SR}}{\text{SR}} \right] \times \frac{12}{\text{Forward Period}} \times 100
\]

Note: This formula is applicable only for left hand currency

Conclusion:

- If one currency is at a premium, then another currency must be at a discount. However, the rate of premium may not be equal to the rate of discount.
- On account of base effect, premium is slightly higher than the discount.

LOS 8: Calculation of Forward Rate when Spot Rate & Premium or Discount is given

Example:

SR \rightarrow 1\, \text{$_{US}$} = \text{\$\text{48.50}}
$ is at premium = 5%
Calculate FR?

**Solution:**
FR $\rightarrow$ 1$ = ₹ 48.50 (1 + 0.05)
1$ = ₹ 50.925

**LOS 9 : SWAP POINTS/ Forward Margin/ Forward-Spot Differential**

Difference between Forward Rate and Spot Rate is known as **Swap Points**.

**Example:**
SR $\rightarrow$ 1£ = $ 0.02594 --- $ 0.02599
FR $\rightarrow$ 1£ = $ 0.02598 --- $ 0.02608
Calculate Swap points?

**Solution:**
FR $\rightarrow$ 1£ = $ 0.02598 --- $ 0.02608
SR $\rightarrow$ 1£ = $ 0.02594 --- $ 0.02599
0.00004   0.00009
So, Swap Point = 4/9

**How to ADD or DEDUCT Swap Points**
- Swap Point should be Added or Deducted from the last decimal point in the Reverse Order.
- Premium $\rightarrow$ Add Swap Points
- Discount $\rightarrow$ Less Swap Points

If Premium / Discount is not mentioned, we observe the following rules:

**Case 1:** When Swap Points are in increasing order:
- It indicates premium on left hand currency.
- In this case, we will add swap points with spot rates to calculate forward rates.

**Case 2:** When Swap Points are in decreasing order:
- It indicates discount on left hand currency.
- In this case, we will deduct swap points from Spot Rate to calculate forward rates.

**Note:** Don’t apply the rule if Premium or Discount is used in the question.

**Example:**
SR $\rightarrow$ 1$ = 45.4500 ---- 45.4580
2 months Swap Point = 30/42
Calculate Forward Rate?

**Example:**
SR $\rightarrow$ 1£ = $ 1.4510 ---- 1.4620
1 months Swap Point = 55/44
Calculate Forward Rate?
8.6 FOREIGN EXCHANGE EXPOSURE & RISK MANAGEMENT

Solution:
1$ = 45.4500 ---- 45.4580
+ 00.0030 ---- 00.0042
FR 1$ = 45.4530 ---- 45.4622

Solution:
1£ = $ 1.4510 ---- 1.4620
(-) 0.0055 ---- 0.0044
FR 1£ = $ 1.4455 ---- 1.4576

LOS 10 : Cross Rate

Cross Rate between any two currencies is derived with the help of quotations between these currencies &
third currency.

- Cross Rate is normally used in finding out any missing exchange rate.
- The calculation of cross rate simply requires you to focus on cancellation of common currencies, to do
so you have to multiply with DQ & IDQ.
- Always check ASK Rate > BID Rate.

LOS 11 : Squaring-up the position or Covering the Position or Closing-out the
Position under FOREX

Covering the Position means taking an opposite or reverse position to calculate profit and loss i.e. we
cover our position to book Profit or Loss.

Long Position To Cover Short Position
Short Position Long Position

LOS 12 : Exchange Margin

Exchange Margin is the extra amount or percentage charged by the bank over and above the rate quoted
by it. Eg. Commission, transaction charges, etc.
Actual Selling Rate of Bank: (Add Exchange Margin)
= Ask Rate (1 + Exchange Margin)

Actual Buying Rate of Bank: (Deduct Exchange Margin)
= Bid Rate (1 – Exchange Margin)

LOS 13 : Triangular Arbitrage

It involves 3 currencies represented by 3 corner points of triangle. We will be starting with one currency,
pass through the other two currencies and come back to the original currency. There are two paths →
clockwise and Anticlockwise.

One path will result in profit while the other path will result in Loss.
LOS 14 : Purchasing Power Parity Theory (PPPT)

**Calculation of Spot Rate**
- PPPT is based on the concept of ‘Law of One Price’.
- PPPT is based on the fact that price of a commodity in two different market will always be same.
- If Price of a commodity in two different market are not same, there will be an arbitrage opportunity exists in the market.
- Suppose Price of a Commodity in India is ₹ X & In USA is $Y. Spot Rate is 1 $ = ₹ SR
  
  \[ SR = \frac{X}{Y} \]

\[ \text{Spot Rate (₹ / $)} = \frac{\text{Current Price (Rs.)}}{\text{Current Price ($)}} \]

- Exchange Rate = Price Ratio

**Calculation of Forward Rate**
PPPT is also applicable in case of inflation. Suppose Inflation Rate of India is I\(_{Rs}\) and in US is I\(_{S}\) Forward Rate 1 $ = ₹ F. Now as per PPPT, we have after 1 year:

\[ X \times (1 + I_{Rs}) = Y \times (1 + I_{S}) \times FR \]

\[ FR = \frac{X \times (1 + I_{Rs})}{Y \times (1 + I_{S})} \]

\[ FR = SR \times \frac{1 + I_{Rs}}{1 + I_{S}} \]

\[ \frac{FR (Rs./$)}{SR (Rs./$)} = \frac{1 + \text{Rupee Inflation}}{1 + \text{Dollar ($) Inflation}} \]

**Note:**
- The above equation is applicable for any two given currency.
- Determination of Premium or Discount with the help of Inflation Rate: If Inflation Rate of a country is higher, then the currency of that Country will be at a discount in future and Vice- Versa.

Inflation rate in above equation must be adjusted according to forward period.

<table>
<thead>
<tr>
<th><strong>Case1:</strong> When Period is less than 1 Year.</th>
<th><strong>Case2:</strong> When Period is more than 1 Year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \frac{FR (Rs./$)}{SR (Rs./$)} = \frac{1 + \text{Periodic Inflation Rate (Rs.)}}{1 + \text{Periodic Inflation Rate ($)}} ]</td>
<td>[ \frac{FR (Rs./$)}{SR (Rs./$)} = \left( \frac{1 + \text{Inflation Rate (Rs.)}}{1 + \text{Inflation Rate ($)}} \right)^n ]</td>
</tr>
</tbody>
</table>

**LOS 15 : Interest Rate Parity Theory (IRPT)**
- IRPT states that exchange rate between currencies are directly affected by their Interest Rate.
- **Assumption:** Investment opportunity in any two different market will always be same.

\[ \frac{FR (Rs./$)}{SR (Rs./$)} = \frac{1 + \text{Interest Rate (Rs.)}}{1 + \text{Interest Rate ($)}} \]
Note:

⚠️ The above equation is applicable for any two given currency.
⚠️ Interest Rate should be adjusted according to forward period.

<table>
<thead>
<tr>
<th>Case 1: When Period is less than 1 Year.</th>
<th>Case 2: When Period is more than 1 Year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \frac{\text{FR (Rs./$)}}{\text{SR (Rs./$)}} = \frac{1 + \text{Periodic Interest Rate (Rs.)}}{1 + \text{Periodic Interest Rate ($)}} ]</td>
<td>[ \frac{\text{FR (Rs./$)}}{\text{SR (Rs./$)}} = \left( \frac{1 + \text{Interest Rate (Rs.)}}{1 + \text{Interest Rate ($)}} \right)^n ]</td>
</tr>
</tbody>
</table>

Note:

⚠️ Determination of Premium or Discount with the help of Interest Rate: If Interest rate of a country is higher, than the currency of that country will be at a discount in future and vice-versa.
⚠️ If IRPT holds, arbitrage is not possible. In that case, it doesn’t matter whether you invest in domestic country or foreign country, your rate of return will be same.

LOS 16: Covered Interest Arbitrage (CIA)

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Bid and Ask rates are same.</td>
<td>If Bid &amp; Ask rates are given separately.</td>
</tr>
<tr>
<td>When Investment &amp; Borrowing rates are same in one country.</td>
<td>Investment &amp; Borrowing rate of a given currency is separately given.</td>
</tr>
<tr>
<td># (Short cut is available)</td>
<td># (Hit &amp; Trial method is used)</td>
</tr>
</tbody>
</table>

⚠️ When Investment opportunity in any two given countries are different, covered Interest Arbitrage is possible.
⚠️ When IRPT is not applicable, then covered interest arbitrage will be applicable.
⚠️ The rule is “Borrow from one country & Invest in another Country”.
⚠️ Suppose Interest Rate of India is INT\(_R\) And USA is INT\(_S\). Spot Rate is 1\$_ = \text{SR}, \text{Forward Rate} = 1\$_ = \text{FR}

Let assume Investor is having \(\text{A}\) for investment

**Option 1:** When investor invest \(\text{A}\) in India:
Amount of \(\text{A}\) Received after one year

\[ \text{A}_1 = \text{A} (1 + \text{INT}_R) \]

**Option 2:** When investor invest \(\text{A}\) in USA:
Amount of Equivalent \(\text{A}\) Received after one year

\[ \text{A}_2 = \left[ \frac{\text{A}}{\text{SR}} (1 + \text{INT}_S) \right] \times \text{FR} \]

<table>
<thead>
<tr>
<th>IF A1 = A2</th>
<th>IF A1 &gt; A2</th>
<th>IF A1 &lt; A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No arbitrage opportunity.</td>
<td>Arbitrage Opportunity is Possible. Arbitrager should invest in India (Home Country) &amp; borrow from USA (Foreign Country)</td>
<td>Arbitrage opportunity is possible. Arbitrager should invest in USA (Foreign Country) &amp; borrow from India (Home Country)</td>
</tr>
</tbody>
</table>

Note:

If in 1st try we have arbitrage profit, then no need to solve 2nd case.
If in 1st try we have arbitrage loss, then 2nd case must be solved.
LOS 17 : Forward Contract

- Transaction exposure arises when a firm has a known amount of foreign currency payable or receivable but home currency equivalent of which is unknown.
- Hedging is defined as an activity converted uncertainty into certainty. The simplest hedging strategy is hedging through forward contract.
- In case of foreign currency is to be received in future

![Diagram showing forward contract with currency exchange rates and gains/losses]

- In case of foreign currency is to be paid in future

![Diagram showing forward contract with currency exchange rates and gains/losses]

LOS 18 : Money Market Operations

**Case 1 : If Foreign Currency is to be received in future:**

- **Step 1:** Borrow in Foreign Currency: Amount of borrowing should be such that Amount Borrowed + Interest on it becomes equal to the amount to be received.
- **Step 2:** Convert the borrowed foreign currency into home currency by using spot Rate.
- **Step 3:** Invest this home currency amount for the required period.
- **Step 4:** Pay the borrowed amount of foreign currency with interest using the amount to be received in foreign currency. [May be Ignored]
**Case 2: When foreign currency is to be paid in future**

**Step 1:** Invest in Foreign currency. Amount of investment should be such that, “Amount Invested + Interest on it” becomes equal to amount to be paid

**Step 2:** Borrow in Home Currency, equivalent amount which is to be invested in foreign currency using Spot rate.

**Step 3:** Pay the borrowed amount with interest in Home Currency on Maturity.

**Step 4:** Pay the outstanding amount with the amount received from investment. [May be ignored]

**LOS 19: Adjusting Exchange rate quotation when exchange margin is attached to it**

**Example:**

1 Euro = £ 1.7846 ± 0.0004

**Solution:**

1 Euro = £ 1.7842 ---- 1.7850

**LOS 20: Foreign Capital Budgeting**

Two approaches are followed in case investment is undertaken in foreign country:

- Home Currency Approach
- Foreign Currency Approach

**Home Currency Approach:**

**Step 1:** Compute all cash inflows & outflows arising in foreign currency.

**Step 2:** Convert these cash Inflows & outflows into home currency by using appropriate exchange rates (i.e. Forward Rate) (Calculate through Swap Point or IRPT)

**Step 3:** Compute a suitable discount rate.

**Step 4:** Compute Home Currency (NPV)

**Foreign Currency Approach:**

**Step 1:** Compute all cash inflows & outflows arising in foreign currency.

**Step 2:** Compute a suitable discount rate ( RADR).

**Step 3:** Compute Foreign Currency (NPV)

**Step 4:** Convert foreign currency NPV into Home currency by using Spot Rate

**Note:**

- Answer by both approach will be same.
Discount Rate to be used should be risk-adjusted discount rate (RADR), since foreign project involves risk.

\[(1 + \text{RADR}) = (1 + \text{Risk-free rate}) \times (1 + \text{Risk Premium})\]

- Discount Rate or RADR of both the country are different.
- Risk Premium of both home country and foreign country are assumed to be same.

**LOS 21: Cancellation/Modification under Forward Contract**

Forward Contract are legal binding contracts, which must be fulfilled by each and every party. In case of cancellation of Forward Contracts, following rules must be followed:

**How to cancel Forward Contract**

Forward Contracts must be cancelled by entering into a reverse contract.

**Rate at which contract needs to be Cancelled**

<table>
<thead>
<tr>
<th>Case</th>
<th>Condition</th>
<th>Rate at Expiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>Cancelled before expiry</td>
<td>FR for Expiry</td>
</tr>
<tr>
<td>Case 2</td>
<td>Cancelled on expiry</td>
<td>Spot Rate of expiry</td>
</tr>
<tr>
<td>Case 3</td>
<td>Cancelled after expiry</td>
<td>Spot Rate of the date when customer contracted with the bank.</td>
</tr>
<tr>
<td>Case 4</td>
<td>Automatic Cancellation</td>
<td>Spot Rate prevailing on 15th day i.e. when grace period ends.</td>
</tr>
</tbody>
</table>
**Settlement of Profit/Loss:**

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Cancelled on or before expiry</th>
<th>Customer will be eligible for both profit/Loss.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 2</td>
<td>Cancelled after expiry or automatic cancellation</td>
<td>Customer will be eligible only for Loss</td>
</tr>
</tbody>
</table>

**LOS 22: Extension of Forward Contract**

**Step 1:** Cancellation of original Contract

**Step 2:** Entering into a new forward contract for the extended period.

**LOS 23: Early Delivery**

The bank may accept the request of customer of delivery at the before due date of forward contract provided the customer is ready to bear the loss if any that may accrue to the bank as a result of this. In addition to some prescribed fixed charges bank may also charge additional charges comprising of:

a) **Swap Difference:** This difference can be loss/gain to the bank. This arises on account of offsetting its position earlier created by early delivery as bank normally covers itself against the position taken in the original forward contract.

b) **Interest on Outlay of Funds:** It might be possible early delivery request of a customer may result in outlay of funds. In such bank shall charge from the customer at a rate not less than prime lending rate for the period of early delivery to the original due date. However, if there is an inflow of funds the bank at its discretion may pass on interest to the customer at the rate applicable to term deposits for the same period.
LOS 24: Cancellation after Due Date/Automatic Cancellation Late Delivery/Extension after due date

In these cases the following cancellation charges may be payable:

1. Exchange Difference
2. Swap Loss
3. Interest on outlay of funds

LOS 25: Centralized Cash Management & Decentralized Cash Management System

- Under Decentralized Cash Management, every branch is viewed as separate undertaking. Cash Surplus and Cash Deficit of each branch should not be adjusted.
- Under Centralized Cash Management, every branch cash position is managed by single centralized authority. Hence, Cash Surplus and Cash Deficit of each branch with each other is accordingly adjusted.

LOS 26: Contribution to Sales Ratio based decision under FOREX

\[
\text{Contribution to Sales Ratio} = \frac{\text{Contribution (Sales-VC)}}{\text{Sales}} \times 100
\]

Decision:

Higher the C/S Ratio, Better the position.

LOS 27: Leading & Lagging

- Leading means advancing the timing of payments and receipts.
- Lagging means postponing or delaying the timing of payments and receipts.
**LOS 28 : Exposure Netting**

Netting means adjusting receivable and payables (or inflows & Outflows)

Two conditions must be fulfilled:
1. Netting can be done for same currency.
2. Netting can be done for same period.

*Note:* In case of Netting, No. of forward contracts can be reduced.

**LOS 29 : Currency Pairs**

Currency Pairs are written by ISO Currency codes of the base currency and the counter currency, separating them with a slash character.

*Example:*

A price quote of EUR/USD at 1.30851 means

1 Euro = 1.30851 $

**LOS 30 : Gain/Loss under FOREX**
LOS 31: Evaluation of Quotation from two Banks

When quotations are received from two banks, customer should select that quotation which is more beneficial to him.

Example:

<table>
<thead>
<tr>
<th>Bank</th>
<th>£ to $ Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDFC Bank</td>
<td>1£ = $ 1.9650</td>
</tr>
<tr>
<td>Axis Bank</td>
<td>1£ = $ 1.9550</td>
</tr>
</tbody>
</table>

- Buy 1 £ = $ 1.9650 (HDFC)
- Sell 1 £ = $ 1.9550 (ICICI)

LOS 32: Expected Spot Rate

\[ \text{Expected Spot Rate} = \sum \text{Spot Rates} \times \text{Probability} \]

LOS 33: Currency Futures

Steps Involved:

**Step 1:** Decide Position
- Long Position
- Short Position

Note: First we will decide which currency will buy or which currency we will sell then check the currency on the LHS of the quotation & then accordingly decide Long Position & Short Position

**Step 2:** Calculation of Number of contracts/Lots

\[ \text{No. of Lots} = \frac{\text{Value of Position}}{\text{Value of one Contract}} = \frac{£}{£} = $ \]

Note: Convert exposure amount in the same currency as of Lot Size/Contract Size & it will be converted at CONTRACT RATE.
Step 3: Calculate Settlement Amount/ Total Outflow/Inflow under Future Contract

1. **Calculate Profit and Loss under Future Contract**
   
   
   \[ \text{Change in Future Price} \times \text{No. of Lots} \times \text{Value of One Contract} \]

2. **Calculate Total Receipt/Total Payment using SR on Expiry**

3. **Calculation of opportunity cost of initial margin if Given**
   
   \[ \text{Total Outflow / Inflow under Future Hedging} \]

**LOS 34: Currency Options**

**Steps Involved:**

**Step1:** Decide Position

- Long Call
- Short Call
- Long Put
- Short Put

**Note:** First we will decide which currency will buy or which currency we will sell then check the currency on the LHS of the quotation & then accordingly decide Long Call & Long Put
Step 2: Calculation of Number of contracts/Lots

\[
\text{No. of Lots} = \frac{\text{Value of Position}}{\text{Value of one Contract}} = \frac{\text{₹}}{\text{₹}} = 17.35 \text{ or 17 lots}
\]

**Note:** Convert exposure amount in the same currency as of Lot Size/Contract Size & it will be converted at CONTRACT RATE.

Step 3: Now the UNHEDGE POSITION should be hedge through forward market as there is no lot size requirement under forward market.

Step 4: Calculation of Option Premium paid as on today with opportunity cost on it.

Step 5: Calculate / Total Outflow/Inflow under Option Contract

(i) Option Premium paid as on today with opportunity cost on it.
(ii) Unhedged Position under forward contract
(iii) Under Option Contract using Exercise Price

Total Outflow / Inflow under Option Hedging

**LOS 35 : Calculation of Return under FOREX**

\[
\text{Return (In terms of Home Currency)} = \left[ 1 + \frac{P_1 - P_0 + I}{P_0} \right] (1 + C) - 1
\]

\(P_0 = \text{Price at the beginning}\)
\(P_1 = \text{Price at the End}\)
\(I = \text{Income from Interest/Dividend}\)
\(C = \text{Change in exchange rate.}\)

**LOS 36 : Broken Date Contracts**

A Broken Date Contract is a forward contract for which quotation is not readily available.

**Example:** If quotes are available for 1 month and 3 months but a customer wants a quote for 2 months, it will be a Broken Date Contract. It can be calculated by interpolating between the available quotes for the preceding and succeeding maturities.

**LOS 37 : Implied Differential in Interest Rate**

Interest rate is just another name of premium or discount of one country currency in relation to another country currency (As per IRPT).

\[\text{Premium or Discount} = \text{Difference in Interest Rate}\]
Equation:
\[
\frac{FR (Rs./$) - SR (Rs./$)}{SR} \times \frac{12}{\text{Forward Period}} \times 100 = \text{Interest Rate (₹)} - \text{Interest Rate($)}
\]

**LOS 38 : Savings due to Time Value (Discount) & Currency Fluctuation**

If the firm decides to pay today rather than in future he may get two types of benefits:
- Benefit on account of discount for pre-payment.
- Benefit on account of currency fluctuation.

**LOS 39 : Nostro Account, Vostro Account and LORO Account**

**Nostro Account [Ours account with you]**

This is a current account maintained by a domestic bank/dealer with a foreign bank in foreign currency. **Example:** Current account of SBI bank (an Indian Bank) with Swiss bank in Swizz Franc. (CHF) is a Nostro account.

**Vostro Account [Yours account with us]**

This is a current account maintained by a foreign bank with a domestic bank/dealer in Rupee currency. **Example:** Current account of Swiss bank in India with SBI bank in Rupee (₹) currency

**Loro Account [Our account of their Money with you]**

This is a current account maintained by one domestic bank on behalf of other domestic bank in foreign bank in a foreign currency.
In other words, Loro account is a Nostro account for one bank who opened the bank and Loro account for other bank who refers first one account.

**Example:** SBI opened Current account with Swiss bank. If PNB refers that account of SBI for its correspondence, then it is called Loro account for PNB and it is Nostro account for SBI.

**Note:**

1. Nostro Account of SBI
2. PNB refers account of SBI for its transaction then it is Loro Account for PNB
- SPOT purchase/sale of CHF affects both exchange position as well as Nostro account.
- However, forward purchase/sale affects only the exchange position.

1. **Nostro A/c (Cash A/c) in Foreign Currency**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Dr. [Debit] outflow of Dollars (FC)</th>
<th>Cr. [Credit] Inflow of Dollars (FC)</th>
</tr>
</thead>
</table>

2. **Exchange Position A/c**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Long Dollar Buy (FC)</th>
<th>Short Dollar Sell (FC)</th>
</tr>
</thead>
</table>

1. **Spot Buy**

   - Nostro (Cash) A/c
   - Exchange Position A/c
   - Inflow of Dollars (Credit)
   - Long Position

2. **Spot Sell**

   - Nostro (Cash) A/c
   - Exchange Position A/c
   - Outflow of Dollars (Debit)
   - Short Position

3. **Forward Buy**

   - Nostro (Cash) A/c
   - Exchange Position A/c
   - No Impact
   - Long Position

4. **Forward Sell**

   - Nostro (Cash) A/c
   - Exchange Position A/c
   - No Impact
   - Short Position

5. **Forward Buy Contact Cancelled**

   - Nostro (Cash) A/c
   - Exchange Position A/c
   - No Impact
   - Short Position

6. **Forward Sell Contact Cancelled**

   - Nostro (Cash) A/c
   - Exchange Position A/c
   - No Impact
   - Long Position
7. FC Draft Made
    - Nostro (Cash) A/c
      - No Impact
    - Exchange Position A/c
      - Short Position

8. DD Cancelled
    - Nostro (Cash) A/c
      - No Impact
    - Exchange Position A/c
      - Long Position

9. Bill Receivable
    - Nostro (Cash) A/c
      - No Impact
    - Exchange Position A/c
      - Long Position

10. BR Cancelled
    - Nostro (Cash) A/c
      - No Impact
    - Exchange Position A/c
      - Short Position

11. Remittance By TT
    - Nostro (Cash) A/c
      - Outflow of Dollars (Debit)
    - Exchange Position A/c
      - Short Position
A forward rate Agreement can be viewed as a forward contract to borrow/lend money at a certain rate at some future date.
These Contracts settle in cash.
The long position in an FRA is the party that would borrow the money. If the floating rate at contract expiration is above the rate specified in the forward agreement, the long position in the contract can be viewed as the right to borrow at below market rates & the long will receive a payment.
If reference rate at the expiration date is below the contract rate, the short will receive a cash from the long.
FRA helps borrower to eliminate interest rate risk associated with borrowing or investing funds.
Adverse movement in the interest rates will not affect liability of the borrower.
Payment to the long at settlement is:

\[
\text{Notional Principal} \times \frac{\text{Floating (LIBOR) \ - \ Forward Rate}}{1 + \text{Floating rate (LIBOR)}} \times \frac{\text{days}}{360} \times \text{Notional Principal} \times \frac{\text{days}}{360}
\]

**TYPE 2 : EFFECTIVE COST**

**FRA ARBITRAGE**

**Step 1 :** Calculation of Fair Forward Rate
6 Months Forward rate 3 months from now

**Step 2 :** Decide from where we should borrow and where should we invest

**Step 3 :** Calculation of Arbitrage Profit

**FRA Quotation:** Suppose 3 × 9 FRA (Quoted by Bank)
**LOS 2: Currency SWAP**

- Two parties exchange their interest rate obligation.
- The plain vanilla currency swap involves trading fixed interest rate payments for floating rate payments.
- The party who wants fixed-rate interest payments agrees to pay fixed-rate interest.
- The counterparty, who receives the fixed payments agrees to pay variable-rate interest/floating rate interest.
- The difference between the fixed rate payment and the floating rate payment is calculated and paid to the appropriate counterparty.
- Net interest is paid by the one who owes it.
- Swaps are zero-sum game. What one party gains, the other party loses.

The Net formulae for the Fixed-Rate payer, based on a 360-day year and a floating rate of LIBOR is:

\[
(\text{Net Fixed Rate Payment})_t = (\text{Swap Fixed Rate} - \text{LIBOR}_{t-1}) \times \frac{\text{No of Days}}{360} \times \text{National Principal}
\]

**LOS 3: Interest Rate Swap [Two Party]**

- Two parties exchange their interest rate obligation.
- The plain vanilla interest rate swap involves trading fixed interest rate payments for floating rate payments.
- The party who wants fixed-rate interest payments agrees to pay fixed-rate interest.
- The counterparty, who receives the fixed payments agrees to pay variable-rate interest/floating rate interest.
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The Net formulae for the Fixed-Rate payer, based on a 360-day year and a floating rate of LIBOR is: 

\[
(\text{Net Fixed Rate Payment})_t = (\text{Swap Fixed Rate} - \text{LIBOR}_{t-1}) \times \frac{\text{No of Days}}{360} \times \text{National Principal}
\]
Note:
- If this number is positive, fixed-rate payer pays a net payment to the floating-rate party.
- If this number is negative, then the fixed-rate payer receives a net flow from the floating-rate payer.

**LOS 4: Interest Rate Caps, Floor & Collar**

<table>
<thead>
<tr>
<th></th>
<th>Maximum Rate</th>
<th>Borrowings</th>
<th>Floating Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLOOR</td>
<td>Minimum Rate</td>
<td>Investments</td>
<td>Floating Rate</td>
</tr>
</tbody>
</table>

**Interest Rate Cap:** *(Maximum Rate For Borrowing @ Floating)*

If a firm borrows at floating rate, it is afraid of interest rate rising, to hedge against the same, it will buy an interest rate cap i.e. Long call at $X=\text{Cap rate}$
- It is a series/portfolio of interest rate Call option on interest rates.
- Each particular call option being called a CAPLET.
- Caps pay when rate rises above the cap rate.

**Interest Rate Floor:** *(Minimum Rate For Investment @ Floating)*

If a firm invest at floating rate, it is afraid of interest rate falling, to hedge against the same, it will buy an interest rate floor i.e. Long put at $X=\text{Floor rate}$
- It is a series/portfolio of Interest rate put Option on interest rate. Such particular put option being called a FLOORLET.
- Floor pays when rate falls below the Floor Rate.

**Interest Rate Collar:**
- It is a combination of a Cap and a Floor.
- Premium paid on one option would be compensated with the premium received on selling another option.
- If premium paid on caps is equal to the premium received on floor, then it would be called Zero Cost Collar.
A floating rate borrower may buy a cap \([C^+]\) & simultaneously sells a floor i.e.\([P^-]\). Initial outflow will reduce. \((C^+ = \text{Long Call} & P^- = \text{Short Put})\)

Similarly, a floating rate investor may buy a Floor \((P^+)\) & simultaneously sell a Cap \((C^-)\). Initial outflow will reduce. \((P^+ = \text{Long Put} & C^- = \text{Short Call})\)
Fixed Income Securities

LOS 1 : Introduction (Fixed Income Security)

Bonds are the type of long term obligation which pay periodic interest & repay the principal amount on maturity.

**Three types of Cash Flows**

(i) Interest  
(ii) Principal Repayment  
(iii) Re-Investment Income

**Purpose of Bond’s indenture & describe affirmative and negative covenants**

- The contract that specifies all the rights and obligations of the issuer and the owners of a fixed income security is called the Bond indenture.
- These contract provisions are known as covenants and include both negative covenants (prohibitions on the borrower) and affirmative covenants (actions that the borrower promises to perform) sections.

1. **Negative Covenants : This Includes**
   a) Restriction on asset sales (the company can’t sell assets that have been pledged as collateral).
   b) Negative pledge of collateral (the company can’t claim that the same assets back several debt issues simultaneously).
   c) Restriction on additional borrowings (the company can’t borrow additional money unless certain financial conditions are met).

2. **Affirmative Covenants: This Includes**
   a) Maintenance of certain financial ratios.
   b) Timely payment of principal and interest.

**Common Options embedded in a bond Issue, Options benefit the issuer or the Bondholder**

- Security owner options:  
  a) Conversion option  
  b) Put provision  
  c) Floors set a minimum on the coupon rate  
- Security issuer option:  
  a) Call provisions  
  b) Prepayment options  
  c) Caps set a maximum on the coupon rate

**LOS 2 : Terms used in Bond Valuation**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Face Value</td>
<td>₹ 1,000</td>
</tr>
<tr>
<td>(ii)</td>
<td>Maturity Year</td>
<td>10 Years</td>
</tr>
<tr>
<td>(iii)</td>
<td>Coupon rate</td>
<td>10%</td>
</tr>
<tr>
<td>(iv)</td>
<td>Coupon Amount</td>
<td>₹ 1,000 × 10% = ₹ 100 p.a.</td>
</tr>
<tr>
<td>(v)</td>
<td>B₀ / Value of the Bond as on Today/ Current Market Price/Issue Price/ Net Proceeds</td>
<td>₹ 950</td>
</tr>
</tbody>
</table>
(vi) Yield to Maturity / Kd / Discount Rate / Required return of investor / Cost of debt / Expected Return / Opportunity Cost / Market Rate of Interest

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Coupon Rate is used to calculate Interest Amount.</td>
</tr>
<tr>
<td>(ii) Face Value is always used to calculate Interest Amount.</td>
</tr>
<tr>
<td>(iii) If Maturity Value is not given, then it is assumed to be equal to Face Value.</td>
</tr>
<tr>
<td>(iv) If Face Value is not given, then it is assumed to be ₹ 100 or ₹ 1000 according to the Question.</td>
</tr>
<tr>
<td>(v) If Maturity Year is not given, then it is assumed to be equal to infinity.</td>
</tr>
</tbody>
</table>

LOS 3 : Valuation of Straight Bond / Plain Vanilla Bond

Straight Coupon Bonds are those bonds which pay equal amount of interest and repay principal amount on Maturity.

**Step 1:** Estimates the cash flows over the Life of the bond.

**Step 2:** Determine the appropriate discount rate.

**Step 3:** Calculate the present value of the estimated cash flow using appropriate discount rate.

\[
B_0 = \frac{\text{Interest}}{(1+\text{YTM})^1} + \frac{\text{Interest}}{(1+\text{YTM})^2} + \ldots + \frac{\text{Interest}}{(1+\text{YTM})^n} + \frac{\text{Maturity value or Par value}}{(1+\text{YTM})^n}
\]

Or

\[
\text{Interest} \times \text{PVAF (Yield \%, n year)} + \text{Maturity Value} \times \text{PVF (Yield \%, nth year)}
\]

\[n = \text{No. of years to Maturity}\]

LOS 4 : Coupon Rate Structures

1. **Zero – Coupon Bond (Pure Discount Securities)**
   a) They do not pay periodic interest.
   b) They pay the Par value at maturity and the interest results from the fact that Zero – Coupon Bonds are initially sold at a price below Par Value. (i.e. They are sold at a significant discount to Par Value).

2. **Step – up Notes**
   a) They have coupon rates that increase over time at a specified rate.
   b) The increase may take place one or more times during the life cycle of the issue.

3. **Deferred – Coupon Bonds**
   a) They carry coupons, but the initial coupon payments are deferred for some period.
   b) The coupon payments accrue, at a compound rate, over the deferral period and are paid as a lump sum at the end of that period.
   c) After the initial deferment period has passed, these bonds pay regular coupon interest for the rest of the life of the issue (to maturity).
4. **Floating – Rate Securities**
   
a) These are bonds for which coupon interest payments over the life of the security vary based on a specified reference rate.
   
b) Reference Rate may be LIBOR [London Interbank Offered Rate] or EURIBOR or any other rate and then adds or subtracts a stated margin to or from that reference rate.
   
\[
\text{New coupon rate} = \text{Reference rate} \pm \text{quoted margin}
\]

5. **Inflation – indexed Bond (TIPS)**
   
They have coupon formulas based on inflation.

**E.g.:** Coupon rate = 3% + annual change in CPI

**LOS 5 : Valuation of Perpetual Bond/ Irredeemable Bond/ Non – Callable Bond**

They are infinite bond, never redeemable, non-callable bond.

\[
\text{Value of Bond} = \frac{\text{Annual Interest}}{\text{YTM}}
\]

**LOS 6 : Valuation of Zero-Coupon Bond**

- Zero-coupon Bond has only a single payment at maturity.
- Value of Zero-Coupon Bond is simply the PV of the Par or Face Value.

\[
\text{Bond value} = \frac{\text{Maturity Value}}{(1 + \text{YTM})^n}
\]

**LOS 7 : Confusion regarding Coupon Rate & YTM**

- **YTM** → Required Return / Investor’s Expectation / Mkt. Rate of Interest.
- YTM is always subjected to change according to Market Conditions.

- **Coupon Rate** → Rate of Interest paid by the company.
- Coupon Rate is always constant throughout the life of the bond and it is not affected by change in market condition.
- Sometimes interest is expressed in terms of Basis Point i.e. 1% = 100 Basis Points

**LOS 8 : Valuation of Semi-annual Coupon Bonds**

Pay interest every six months

\[
a) \frac{\text{YTM p.a.}}{2} \quad b) \frac{\text{Coupon rate p.a}}{2} \quad c) n \times 2
\]

**Note:**

If quarterly use 4 instead of 2
If monthly use 12 instead of 2
LOS 9: Valuation of Bond with Changing Coupon Rate

Coupon rate changes from one year to another year as per the terms of bond-indenture.

LOS 10: Over – Valued & Under – Valued Bonds

<table>
<thead>
<tr>
<th>Case</th>
<th>Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV of MP of Bond &lt; Actual MP of Bond</td>
<td>Over – Valued</td>
<td>Sell</td>
</tr>
<tr>
<td>PV of MP of Bond &gt; Actual MP of Bond</td>
<td>Under – Valued</td>
<td>Buy</td>
</tr>
<tr>
<td>PV of MP of Bond = Actual MP of Bond</td>
<td>Correctly Valued</td>
<td>Either Buy/ Sell</td>
</tr>
</tbody>
</table>

LOS 11: Self – Amortization Bond

- They make periodic interest and principal payments over the life of the bond. i.e. at regular interval.
- Interest is calculated on balance amount.

LOS 12: Holding Period Return (HPR) for Bonds

\[
\text{HPR} = \frac{B_1 - B_0 + I_1}{B_0} = \frac{B_1 - B_0}{B_0} + \frac{I_1}{B_0}
\]

(Capital gain Yield/ Return)      (Interest Yield /Current Yield)

YIELDS OF BOND

- Ex-Ante (Based on Expectation)
  - Current Yield (CY)
  - Yield to Maturity (YTM)
- Ex-Post (Actual Realised Yield)
  - IRR Technique
  - Approximation Method
**LOS 13 : Calculation of Current Yield/ Interest Yield**

Current Yield = \( \frac{\text{Annual Cash Coupon Payment}}{\text{Bond Price or Market Price}} \)

**Note:** Current Yield is always calculated on per annum basis.

1. **If existing bond :-**
   - \( B_0 = \) Current Market Price of Bond (1st preference)
   - Or
   - Present value Market Price of Bonds (2nd preference)

2. **If new bond issued :-**
   - \( B_0 = \) Issue Price
   - Issue Price = Face value – Discount + Premium

3. **Company Point of view :-**
   - \( B_0 = \) Net Proceeds
   - Net Proceeds = Face value – Discount + Premium (-) Floating Cost

**LOS 14 : YTM (Yield to Maturity) / K_d / Cost of debt/ Market rate of Interest/ Market rate of return**

- YTM is an annualized overall return on the bond if it is held till maturity.
- YTM is the IRR of a Bond
- It is the annualized rate of return on the investment that the investor expect (on the date of investment) to earn from the date of investment to the date of maturity. It is also referred to as required rate of return.

**Alternative 1: By IRR technique.**

\[
B_0 = \frac{\text{Interest}}{(1 + \text{YTM})^1} + \frac{\text{Interest}}{(1 + \text{YTM})^2} + \cdots + \frac{\text{Interest}}{(1 + \text{YTM})^n} + \frac{\text{Maturity value or Par value}}{(1 + \text{YTM})^n}
\]

- YTM & price contain the same information
  - If YTM given, calculate Price.
  - If Price given, calculate YTM.

\[
\text{YTM} = \text{Lower Rate} + \frac{\text{Lower Rate}_{NPV}}{\text{Lower Rate}_{NPV} - \text{Higher Rate}_{NPV}} \times \text{Difference in Rate}
\]

**Alternative 2: By approximation formula**

\[
\text{YTM} = \frac{\text{Interest} + \frac{\text{Maturity Value} - \text{CMP}/B_0}{n}}{\frac{\text{Maturity Value} + \text{CMP}/B_0}{2}}
\]
**LOS 15 : YTM (Yield to Maturity) of Semi-Annual Bond**

YTM per 6 months = \[
\frac{\text{Interest for 6 months} + \frac{\text{Maturity Value} - \text{CMP}/B_0}{n \times 2}}{\text{Maturity Value} + \text{CMP}/B_0}
\]

YTM per annum = YTM of 6 month × 2

**LOS 16 : YTM of a Zero – Coupon Bond**

\[
\text{Bond value} = \frac{\text{Maturity Value}}{(1 + \text{YTM})^n}
\]

- If YTM is given, calculate B₀.
- If B₀ is given, Calculate YTM.

**LOS 17 : YTM of a Perpetual Bond**

\[
\text{Bond value} = \frac{\text{Annual Interest}}{\text{YTM}}
\]

- If YTM is given, calculate B₀.
- If B₀ is given, Calculate YTM.

**LOS 18 : Calculation of Kd in case of Floating Cost**

- Floating Cost is cost associated with issue of new bonds. e.g. Brokerage, Commission, etc
- We should take Bond value (B₀) Net of Floating Cost.

\[
K_d = \frac{\text{Interest (1 – tax rate)} + \frac{\text{Maturity Value} - \text{Net Proceeds}}{n}}{\text{Maturity Value} + \text{Net Proceeds}}
\]

**LOS 19 : Treatment of Tax**

Tax is important part for our analysis, it must be considered if it is given in question.

Two types of Tax rates are given :-

1. **Interest Tax rate/ Normal Tax Rate**

   We should take Interest Net of Tax i.e. Interest Amount (1 – Tax)

2. **Capital Gain Tax rate**

   Take Maturity value after Capital Gain Tax i.e. Maturity Value – Capital Gain Tax Amount
Maturity value – (Maturity value – B₀) × Capital gain tax rate

\[ \text{YTM} = \frac{\text{Interest}(1 - \text{Tax rate}) + \frac{\text{MV net of CG Tax} - B₀}{n}}{\frac{\text{MV net of CG Tax} + B₀}{2}} \]

**LOS 20 : Yield to call (YTC) & Yield to Put (YTP)**

1. **Yield to Call**
   
   Callable Bond: When company call its bond or Re-purchase its bond prior to the date of Maturity.
   
   Call Price: Price at which Bond will call by the Company.
   
   Call Date: Date on which Bond is called by the Company prior to Maturity.
   
   \[ \text{YTC} = \frac{\text{Interest} + \frac{\text{Call Price} - B₀}{n}}{\frac{\text{Call Price} + B₀}{2}} \]

2. **Yield to Put**
   
   Puttable Bond: When investor sell their bonds prior to the date of maturity to the company.
   
   Put Price: Price at which Bond will put/ Sell to the Company.
   
   Put Date: Date on which Bond is sold by the investor prior to Maturity.
   
   \[ \text{YTP} = \frac{\text{Interest} + \frac{\text{Put Price} - B₀}{n}}{\frac{\text{Put Price} + B₀}{2}} \]

**LOS 21 : Yield to worst**

- It is the lowest yield between YTM, YTC, YTP, Yield to first call.
- Yield to worst is lowest among all.

**LOS 22 : Return Calculation**

- When bonds are purchased and sold within time frame.

**LOS 23 : Conversion Value/ Stock Value of Bond**

- Converted into equity shares after certain period.
- Conversion Ratio = No. of share Received per Convertible Bond
- When Conversion Value > Bond value, option can be exercised otherwise not.

\[ \text{Conversion Value} = \text{No. of equity shares issued} \times \text{MPS at the time of Conversion} \]
LOS 24 : Credit Rating Requirement

- As per SEBI regulation, no public or right issue of debt/bond instruments shall be made unless credit rating from credit rating agency has been obtained and disclosed in the offer document.
- Rating is based on the track record, financial statement, profitability ratios, debt – servicing capacity ratios, credit worthiness & risk associated with the company.
- Higher rated Bonds means low risk and a lower rated bond means high risk.
- Higher the risk higher will be the expectation and higher will be the discount rate.

LOS 25 : Strips (Separate Trading of Registered Interest & Principal Securities) Program

Under this, Strip the coupons from the principal, repackage the cash flows and sell them separately as Zero – Coupon Bonds, at discount.

**VALUE OF BOND**

\[
\text{Value of Bond} = \frac{\text{Interest}}{1+k_d^1} + \frac{\text{Interest}}{(1+k_d)^2} + \ldots + \frac{\text{Interest}}{(1+k_d)^n} + \frac{\text{Maturity value}}{(1+k_d)^n}
\]

- **Coupon Strips**
- **Principal Strips**

LOS 26 : Relationship between Coupon Rate & YTM

<table>
<thead>
<tr>
<th>Bonding Selling At</th>
<th>Coupon Rate &amp; YTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Par</td>
<td>Coupon Rate = Yield to Maturity</td>
</tr>
<tr>
<td>Discount</td>
<td>Coupon Rate &lt; Yield to Maturity</td>
</tr>
<tr>
<td>Premium</td>
<td>Coupon Rate &gt; Yield to Maturity</td>
</tr>
</tbody>
</table>

LOS 27 : Cum Interest & Ex-interest Bond Value

- When Bond value include amount of interest it is known as Cum-Interest Bond Value, other -wise not.
- If question is Silent, we will always assume ex-interest.
- Assume value of Bond \((B_0)\) as ex – interest.
- If it is given Cum-Interest then deduct Interest and proceeds your calculations.

**Full Price** = Clean Price + Interest accrued

Or

**Cum - Interest Price** = Ex – Interest Price + Interest Accrued
Valuation of a Bond between two coupon dates

LOS 28: Relationship between Bond Value & YTM

- When the coupon rate on a bond is equal to its market yield, the bond will trade at its par value.
- If yield required in the market subsequently rises, the price of the bond will fall & it will trade at a discount.
- If required yield falls, the bond price will increase and bond will trade at a premium.

Crux:
- If YTM increases, bond value decreases & vice-versa, other things remaining same.
- YTM & Bond value have inverse relationship.

Convexity of a Bond

- However, this relationship is not a straight line relationship but it is convex to the origin.
- So, we find that price rise is greater than price fall, we call it positive convexity (i.e. % rise is greater than % fall)

LOS 29: Value of the Bond at the end of each Year

\[ B_0 = \frac{B_1 + I_1}{(1 + \text{YTM})^1} \]

\[ B_1 = \frac{B_2 + I_2}{(1 + \text{YTM})^2} \]

So on
**LOS 30 : Relationship between Bond Value & Maturity**

- Prior to Maturity, a bond can be selling at significant discount or premium to Par value.
- Regardless of its required yield, the price will converge to par value as Maturity approaches.
- Value of premium bond decreases to par value, value of Discount bond increases to Par value.
- Premium and discount vanishes.

**LOS 31 : Floating Rate Bonds**

- Floating Rate Bonds are those bonds where coupon rate is decided according to the Reference rate (Market Interest Rate).
- Coupon Rate should be changed with the change in Reference rate (Market Interest Rate).
- In this case

  \[
  \text{Coupon Rate} = \text{YTM}
  \]

**LOS 32 : Duration of a Bond (Macaulay Duration)**

- Duration of the bond is a weighted average of the time (in years) until each cash flow will be received i.e. our initial investment is fully recovered.
- Duration is a measurement of how long in years it takes for the price of a bond to be repaid by its internal cash flows.
- Duration of bond will always be less than or equal to maturity years.

\[
\text{Duration} = \frac{1 \times \text{Interest}}{(1+\text{YTM})^1} + 2 \times \frac{\text{Interest}}{(1+\text{YTM})^2} + \ldots + n \times \frac{\text{Interest}}{(1+\text{YTM})^n} + \frac{\text{Maturity value}}{(1+\text{YTM})^n}
\]

\[
\frac{\text{CMP}}{B_0}
\]
**LOS 33: Duration of a Zero-Coupon Bond**

Duration of a Zero-Coupon Bond will always be equal to its Maturity Years.

**LOS 34: Relationship between Duration of Bond & YTM**

- If YTM increases, Bond Value decreases so duration of the bond decreases (recovery is less) & vice versa.
- Higher the YTM, lower will be duration of a bond. Lower the YTM, higher will be duration of a bond, other things remaining constant.

**LOS 35: Calculation of yield when Coupon Payment is not available for Re-Investment**

\[
\begin{align*}
11 & \qquad 11 \\
11(1+0\times3)^2 & = 11 \\
11(1+0\times3)^1 & = 11 \\
11+100(1+0\times3)^0 & = 111 \\
B_0 & = \frac{133}{1+YTM^2} \\
\end{align*}
\]

- If YTM is given, calculate \( B_0 \).
- If \( B_0 \) is given, Calculate YTM.

**LOS 36: Modified Duration/ Sensitivity/ Volatility/ Effective Duration**

- Volatility measures the sensitivity of interest rate to bond prices.
- Duration of a bond can be used to estimate the price sensitivity. It can be calculated through below formula.
- Modified duration will always be lower than Macaulay’s Duration.
- Volatility measures the % change in the bond value with 1% change in YTM.

**Example:**

If Volatility is 5%, it means if YTM increases by 1% bond value will decrease by 5% or vice versa.

**Method 1:**

\[
\text{Modified Duration} = \frac{\text{Macaulay Duration}}{1+\text{YTM}}
\]

**Method 2:**

\[
\text{Effective Duration} = \frac{\text{BV}_-\Delta Y - \text{BV}_+\Delta Y}{2 \times \text{BV}_0 \times \Delta Y}
\]
**Convexity Adjustment**

As mentioned above, duration is a good approximation of the percentage of price change for a small change in interest rate. However, the change cannot be estimated so accurately of convexity effect as duration base estimation assumes a linear relationship. This estimation can be improved by adjustment on account of ‘convexity’. The formula for convexity is as follows:

\[ C^* \times (\Delta y)^2 \times 100 \]

\[ \Delta y = \text{Change in Yield} \]

\[ C^* = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta^2)} \]

\[ V_0 = \text{Initial Price} \]

\[ V_+ = \text{price of Bond if yield increases by } \Delta y \]

\[ V_- = \text{price of Bond if yield decreases by } \Delta y \]

**LOS 37: Ratios related to Convertible Bond**

1. **Conversion Premium/ Premium over Conversion Value**

   \[ \frac{\text{Conversion Premium}}{\text{Conversion Value}} = \text{Market value of Convertible bond} - \left( \frac{\text{CV (No. of Shares } \times \text{ MPS)}}{\text{Conversion Premium}} \right) \]

   \[ \% \text{ Conversion Premium} = \frac{\text{Conversion Premium}}{\text{Conversion Value}} \]

2. **Conversion Premium per share**

   \[ \frac{\text{Conversion Premium}}{\text{Conversion Ratio}} \]

3. **Conversion Parity Price/ No Gain No Loss / Market Conversion Price**

   When the market value of convertible bond = Conversion Value.

   \[ \frac{\text{Market value of Convertible bond}}{\text{No. of equity share issued on Conversion}} \]

   OR

   \[ \text{Current MPS} + \text{Conversion Premium per share} \]

4. **Premium Pay Back Period or Break Even Period of Convertible Bond**

   It is a time period, when bond would be converted into equity share so that the loss on conversion would be set-off by income from interest.
5. **Downside Risk or Premium over Non-Convertible Bond**

Downside Risk reflects the extent of decline in market value of convertible bonds at which conversion option become worthless.

\[
\text{Downside Risk} = \frac{\text{Market value of Convertible bond} - \text{Market value of Non-Convertible bond}}{\text{Market value of Non-Convertible bond}}
\]

\[
\% \text{Downside Risk/ Price Decline} = \frac{\text{Downside Risk}}{\text{Market value of Non-Convertible bond}}
\]

6. **Premium Over Investment Value of Non-Convertible bond / MV of NCB**

\[
\frac{\text{Market Price of CB} - \text{Investment Value}}{\text{MV of Non-Convertible Bond}} = \frac{\text{Investment Value}}{\text{MV of Non-Convertible Bond}}
\]

7. **Floor Value**

Floor Value is the maximum of:

a) Conversion Value
b) Market Value of Non-Convertible Bond.

**Note**: Market Value of Convertible Bond (Assume 5 Years)

\[
\text{Interest} = \frac{\text{Interest}}{(1+\text{YTM})^1} + \frac{\text{Interest}}{(1+\text{YTM})^2} + \ldots + \frac{\text{Interest}}{(1+\text{YTM})^5} + \frac{\text{Conversion Value (CV}_5)}{(1+\text{YTM})^5}
\]

\[
\text{CV}_5 = \text{MPS at the end of Year 5} \times \text{No. of Shares.}
\]

**LOS 38: Callable Bond**

Those bonds which can be called before the date of Maturity.

- **Step 1**: Calculate Net Initial Outflow.
- **Step 2**: Calculate Tax Saving on Call Premium & Unamortized Issue Cost.
- **Step 3**: Calculate Annual Saving on Cash Outflow.
- **Step 4**: Calculation of Overlapping Interest
- **Step 5**: Calculate Present Value of Total Net Savings by replacing Outstanding Bonds with New Bonds.
LOS 39: Spot Rate

- Yield to maturity is a single discount rate that makes the present value of the bond’s promised cash flow equal to its Market Price.
- The appropriate discount rates for individual future payments are called Spot Rate.
- Discount each cash flow using a discount rate i.e. specific to the maturity of each cash flow.

LOS 40: Relationship between Forward Rate and Spot Rate

Forward Rate is a borrowing/landing rate for a loan to be made at some future date.

- \( f_0 \) = Spot Rate or Current YTM (rate of 1 year loan)
- \( f_1 \) = Rate for a 1 year loan, one year from now
- \( f_2 \) = Rate for a 1 year loan to be made two years from now

Relationship:

\[
(1 + S_1)^1 = (1 + f_0)
\]

\[
(1 + S_2)^2 = (1 + f_0) (1 + f_1)
\]

Or \( S_2 = \{(1 + f_0)(1 + f_1)\}^{1/2} - 1 \)

\[
(1 + S_3)^3 = (1 + f_0) (1 + f_1) (1 + f_2)
\]

Or \( S_3 = \{(1 + f_0)(1 + f_1)(1 + f_2)\}^{1/3} - 1 \)

LOS 41: Duration of a Portfolio

It is simply the weighted average of the durations of the individual securities in the Portfolio.

\[
\text{Portfolio Duration} = W_1 D_1 + W_2 D_2 + W_3 D_3 + \ldots + W_n D_n
\]

\[
W_i = \frac{\text{Market value of bond } i}{\text{Market value of Portfolio}}
\]

\( D_i = \text{Duration of bond } (i) \)

N = No. Of bonds in the Portfolio

Note:

- Other factors are constant, Long term bonds are more volatile than Short term bonds.
- Other factors are constant, Lower coupon bonds are more volatile than Higher coupon bonds.
- Other factors are constant, Lower Yield bonds are more volatile than Higher Yield bonds.

LOS 42: Interest Rate anticipation Strategy (Active Portfolio Management)

<table>
<thead>
<tr>
<th>Bond Portfolio Management</th>
<th>Interest Rate is expected to Fall</th>
<th>Interest Rate is expected to Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond Price are expected to Rise</td>
<td>Bond Prices are expected to Fall</td>
<td>To Profit from the same, portfolio duration should be increased by shifting from Short Term Bonds to the Long Term Bonds</td>
</tr>
<tr>
<td>To Protect / Hedge against the same, portfolio duration should be decreased by shifting from Long Term Bonds to the Short Term Bonds</td>
<td>To Protect / Hedge against the same, portfolio duration should be decreased by shifting from Long Term Bonds to the Short Term Bonds</td>
<td></td>
</tr>
</tbody>
</table>
LOS 43: Passive Portfolio Management (Bond Immunization)

- Bond immunization is an investment strategy used to minimize the interest rate risk of bond investments by adjusting the portfolio duration to match the investor's investment time horizon.
- To immunize a bond portfolio, you need to know the duration of the bonds in the portfolio and adjust the portfolio so that the portfolio's duration equals the investment time horizon.
- Changes to interest rates actually affect two parts of a bond's value. One of them is a change in the bond's price, or price effect. When interest rates change before the bond matures, the bond's final value changes, too. An increase in interest rates means new bond issues offer higher earnings, so the prices of older bonds decline on the secondary market.
- Interest rate fluctuations also affect a bond's reinvestment risk. When interest rates rise, a bond's coupon may be reinvested at a higher rate. When they decrease, bond coupons can only be reinvested at the new, lower rates.
- Interest rate changes have opposite effects on a bond's price and reinvestment opportunities. While an increase in rates hurts a bond's price, it helps the bond's reinvestment rate. The goal of immunization is to offset these two changes to an investor's bond value, leaving its worth unchanged.
- A portfolio is immunized when its duration equals the investor's time horizon. At this point, any changes to interest rates will affect both price and reinvestment at the same rate, keeping the portfolio's rate of return the same. Maintaining an immunized portfolio means rebalancing the portfolio's average duration every time interest rates change, so that the average duration continues to equal the investor's time horizon.

LOS 44: Hedging Interest Rate Risk using Bond Futures

- Profit of seller of futures = (Futures Settlement Price \times Conversion factor) – Quoted Spot Price of Deliverable Bond
- Loss of Seller of futures = Quoted Spot Price of deliverable bond – (Futures Settlement Price \times Conversion factor)

An interest rate future is a contract between the buyer and seller agreeing to the future delivery of any interest-bearing asset. The interest rate future allows the buyer and seller to lock in the price of the interest-bearing asset for a future date.

Interest rate futures are used to hedge against the risk that interest rates will move in an adverse direction, causing a cost to the company.

For example, borrowers face the risk of interest rates rising. Futures use the inverse relationship between interest rates and bond prices to hedge against the risk of rising interest rates.
A borrower will enter to sell a future today. Then if interest rates rise in the future, the value of the future will fall (as it is linked to the underlying asset, bond prices), and hence a profit can be made when closing out of the future (i.e. buying the future).

**Bonds form the underlying instruments, not the interest rate. Further, IRF, settlement is done at two levels:**
- Mark-to-Market settlement done on a daily basis and
- physical delivery which happens on any day in the expiry month.

Final settlement can happen only on the expiry date. In IRF following are two important terms:

a) **Conversion factor**: All the deliverable bonds have different maturities and coupon rates. To make them comparable to each other, RBI introduced Conversion Factor. 
   \[
   \text{(Conversion Factor)} \times \text{(futures price)} = \text{actual delivery price for a given deliverable bond.}
   \]

b) **Cheapest to Deliver (CTD)**: It is called CTD bond because it is the least expensive bond in the basket of deliverable bonds.

**Profit & Loss =** the difference between cost of acquiring the bonds for delivery and the price received by delivering the acquired bond.
Portfolio Management

LOS 1 : Introduction

- **Portfolio** means combination of various underlying assets like bonds, shares, commodities, etc.
- **Portfolio Management** refers to the process of selection of a bundle of securities with an objective of maximization of return & minimization of risk.

Steps in Portfolio Management Process

- **Planning**: Determine Client needs and circumstances, including the client’s return objectives, risk tolerance, constraints and preferences. Create, and then periodically review and Update, an investment policy statement (IPS) that spells out these needs and Circumstances.
- **Execution**: Construct the client portfolio by determining suitable allocations to various asset classes and on expectations about macroeconomic variables such as inflation, interest rates and GDP Growth (top-down analysis). Identify attractive price securities within an asset class for client portfolios based on valuation estimates from security analysis (bottom-up analysis).
- **Feedback**: Monitor and rebalance the portfolio to adjust asset class allocations and securities holdings in response to market performance. Measure & report performance relative to the performance benchmark specified in the IPS.

LOS 2 : Major return Measures

(i) **Holding Period Return (HPR)**:

HPR is simply the percentage increase in the value of an investment over a given time period.

\[
\text{HPR} = \frac{\text{Price at the end} - \text{price at the beginning} + \text{Dividend}}{\text{price at the beginning}}
\]

(ii) **Arithmetic Mean Return (AMR)**:

It is the simple average of a series of periodic returns.

\[
\text{Average Return} = \frac{R_1 + R_2 + R_3 + R_4 + \ldots + R_n}{n}
\]

(iii) **Geometric Mean Return (GMR)**:

\[
\text{GMR} = \left(1 + R_1\right) \left(1 + R_2\right) \left(1 + R_3\right) \left(1 + R_4\right) \ldots \ldots \left(1 + R_n\right) - 1
\]
Example:
An investor purchased $1,000 of a mutual fund’s shares. The fund had the following total returns over a 3-year period: +5%, -8%, +12%. Calculate the value at the end of the 3 year period, the holding period return, the mean annual return.

Solution:
Ending value = (1,000) (1.05)(0.92)(1.12) = $ 1,081.92
Holding period return = \[
\frac{1081.92 - 1000}{1000} \times 100 = \frac{81.92}{3} = 2.73\%
\]
Arithmetic mean return = \[
\frac{5\% - 8\% + 12\%}{3} = 3\%
\]
**LOS 3 : Calculation of Return of an Individual Security**

**RETURN of an Individual Security**

- **Average Return (Based on Past Data)**
  \[ \overline{X} = \frac{\sum X}{n} \]

- **Expected Return (Based on Probability)**
  \[ E(x) = \overline{X} = \sum P_{Xi}X_i \]

**LOS 4 : Calculation of Risk of an Individual Security**

Risk of an individual security will cover under following heads:

**Risk of Individual Security**

- **Variance** \((\sigma^2)\)
- **Standard Deviation** \((\sigma)\)
- **Co-efficient Of variation**

1. **Standard Deviation of Security** \((S.D)\): \((S.D)\) or \(\sigma\) (sigma) is a measure of total risk / investment risk.

**Standard Deviation \((\sigma)\)**

- **Past Data**
  \[ \sigma = \sqrt{\frac{\sum(X - \overline{X})^2}{n}} \]

- **Probability Based Data**
  \[ \sigma = \sqrt{\sum \text{probability}(X - \overline{X})^2} \]

**Note:**
- For sample data, we may use \((n-1)\) instead of \(n\) in some cases.
- \(X = \text{Given Data}, \overline{X} = \text{Average Return}, n = \text{No. of events/year}\)
- \(\sum(X - \overline{X})\) will always be Zero (for Past Data)
- \(\sum(X - \overline{X})\) may or may not be Zero in this case. (for Probability Based Data)
- \(S.D\) can never be negative. It can be zero or greater than zero.
- \(S.D\) of risk-free securities or government securities or U.S treasury securities is always assumed to be zero unless, otherwise specified in question.

**Decision:** Higher the \(S.D\), Higher the risk and vice versa.
2. **Variance**

Variance (\(\sigma^2\))

\[
(\sigma^2) = \frac{\sum(X - \overline{X})^2}{n}
\]

**Decision:**
Higher the Variance, Higher the risk and vice versa.

3. **Co-efficient of Variation (CV):**

CV is used to measure the risk (variable) per unit of expected return (mean)

\[
CV = \frac{\text{Standard Deviation of X}}{\text{Average/Expected value of X}}
\]

**Decision:**
Higher the C.V, Higher the risk and vice versa.

**LOS 5: Rules of Dominance in case of an individual Security or when two securities are given**

**Rule No. 1:** For a given 2 securities, given same S.D or Risk, select that security which gives higher return

<table>
<thead>
<tr>
<th></th>
<th>X Ltd.</th>
<th>Y Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\sigma)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Return</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>

**Decision:** Select Y. Ltd.

**Rule No. 2:** For a given 2 securities, given same return, select which is having lower risk in comparison to other

<table>
<thead>
<tr>
<th></th>
<th>X Ltd.</th>
<th>Y Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\sigma)</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Return</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

**Decision** Select X. Ltd.

**Rule No. 3:**

<table>
<thead>
<tr>
<th></th>
<th>X Ltd.</th>
<th>Y Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\sigma)</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Return</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>

**Decision:** Based on CV (Co-efficient of Variation).
When Risk and return are different, decision is based on CV.
\[ CV_x = \frac{5}{10} = 0.50 \quad CV_y = \frac{10}{25} = 0.40 \]
**Decision:** Select Y. Ltd.

**LOS 6 : Calculation of Return of a Portfolio of assets**

It is the weighted average return of the individual assets/securities.

\[
\text{Portfolio Return} = \text{Based on Past Data} \quad \text{Based on Probability}
\]

\[
R_p = \text{Avg. Return}_A \times W_A + \text{Avg. Return}_B \times W_B
\]

\[
R_p = \text{Expected Return}_A \times W_A + \text{Expected Return}_B \times W_B
\]

Where, \( W_i = \frac{\text{Market Value of investments in asset}}{\text{Market Value of the Portfolio}} \)

Sum of the weights must always = 1 i.e. \( W_A + W_B = 1 \)

**LOS 7 : Risk of a Portfolio of Assets**

1. **Standard Deviation of a Two-Asset Portfolio**

\[
\sigma_{1,2} = \sqrt{\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2\sigma_1 \sigma_2 w_1 w_2 r_{1,2}}
\]

where
- \( r_{1,2} \) = Co-efficient of Co-relation
- \( \sigma_1 = \text{S.D of Security 1} \)
- \( \sigma_2 = \text{S.D of Security 2} \)
- \( w_1 = \text{Weight of Security 1} \)
- \( w_2 = \text{Weight of Security 2} \)

2. **Variance of a Two-Asset Portfolio = (SD)^2**

3. **Co-Variance**

\[
\text{Co-Variance} = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{n}
\]

\[
\text{Probability Based} = \sum \text{Prob.} (X - \bar{X})(Y - \bar{Y})
\]
\( X = \) Return on Asset 1  \( Y = \) Return on Asset 2
\( \bar{X} = \) mean return on Asset 1  \( \bar{Y} = \) mean return on Asset 2
\( n = \) No. of Period

Co-variance measures the extent to which two variables move together over time.
- A positive co-variance’s means variables (e.g. Rates of return on two stocks) are trend to move together.
- Negative co-variance means that the two variables trend to move in opposite directions.
- A co-variance of Zero means there is no linear relationship between the two variables.
- Co-Variance or Co-efficient of Co-relation between risk-free security & risky security will always be zero.

**4. Co-efficient of Correlation**

\[
\rho_{1,2} = \frac{\text{Cov}_{1,2}}{\sigma_1 \sigma_2}
\]
Or
\[
\text{Cov}_{1,2} = \rho_{1,2} \sigma_1 \sigma_2
\]
Or
\[
\text{S.D of two-asset Portfolio (} \sigma_{1,2} \text{)} = \sqrt{\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2 w_1 w_2 \text{Cov}_{1,2}}
\]

- The correlation co-efficient has no units. It is a pure measure of co-movement of the two stock’s return and is bounded by -1 and +1.
- +1 means that deviations from the mean or expected return are always proportional in the same direction, They are perfectly Positively Correlated. It is a case of maximum Portfolio risk.
- -1 means that deviation from the mean or expected values are always proportional in opposite directions. They are perfectly negatively correlated. It is a case of minimum portfolio risk.
- A correlation coefficient of ZERO means no linear relationship between the two stock’s return.

**LOS 8 : Portfolio risk as Correlation varies**

**Example:**

Consider 2 risky assets that have return variance of 0.0625 and 0.0324, respectively. The assets standard deviation of returns are then 25% and 18%, respectively. Calculate standard deviations of portfolio returns for an equal weighted portfolio of the two assets when their correlation of return is 1, 0.5, 0, -0.5, -1.

**Solution:**

\[
\sigma_{\text{portfolio}} = \sqrt{\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2 w_1 w_2 \text{Cov}_{1,2}} = \sqrt{(\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2)^2}
\]

\( r = \) correlation = +1

\( \sigma_{\text{portfolio}} = w_1 \sigma_1 + w_2 \sigma_2 \)

\( \sigma = \) portfolio standard deviation = 0.5(25%) + 0.5(18%) = 21.5%

\( r = \) correlation = 0.5

\( \sigma = \sqrt{(0.5)^2 0.0625 + (0.5)^2 0.0324 + 2(0.5)(0.5)(0.5)(0.25)(0.18)} = 18.70\%

\( r = \) correlation = 0
\[ \sigma = \sqrt{(0.5)^2 0.0625 + (0.5)^2 0.0324} = 15.40\% \]

\[ r = \text{correlation} = (-) 0.5 \]

\[ \sigma = \sqrt{(0.5)^2 0.0625 + (0.5)^2 0.324 + 2(0.5)(0.5)(-0.5)(0.25)(0.18)} = 11.17\% \]

\[ r = \text{correlation} = -1 \]

\[ \sigma_{\text{portfolio}} = w_1\sigma_1 - w_2\sigma_2 \]

\[ \sigma = \text{portfolio standard deviation} = 0.5(25\%) - 0.5(18\%) = 3.5\% \]

**Note:**

- The portfolio risk falls as the correlation between the asset’s return decreases.
- The lower the correlation of assets return, the greater the risk reduction (diversification) benefit of combining assets in a portfolio.
- If assets return when perfectly negatively correlated, portfolio risk could be minimum.
- If assets return when perfectly positively correlated, portfolio risk could be maximum.

**Portfolio Diversification** refers to the strategy of reducing risk by combining many different types of assets into a portfolio. Portfolio risk falls as more assets are added to the portfolio because not all assets prices move in the same direction at the same time. Therefore, portfolio diversification is affected by the:

a) **Correlation between assets:** Lower correlation means greater diversification benefits.

b) **Number of assets included in the portfolio:** More assets means greater diversification benefits.

**LOS 9:** Standard-deviation of a 3-asset Portfolio

\[ \sigma_{1,2,3} = \sqrt{\alpha_1^2 w_1^2 + \alpha_2^2 w_2^2 + \alpha_3^2 w_3^2 + 2 \alpha_1 \alpha_2 w_1 w_2 r_{1,2} + 2 \alpha_1 \alpha_3 w_1 w_3 r_{1,3} + 2 \alpha_2 \alpha_3 w_2 w_3 r_{2,3}} \]

Or

\[ \sigma_{1,2,3} = \sqrt{\alpha_1^2 w_1^2 + \alpha_2^2 w_2^2 + \alpha_3^2 w_3^2 + 2 w_1 w_2 \text{Cov}_{1,2} + 2 w_1 w_3 \text{Cov}_{1,3} + 2 w_2 w_3 \text{Cov}_{2,3}} \]

**Portfolio consisting of 4 securities**

\[ \sigma_{1,2,3,4} = \sqrt{\alpha_1^2 w_1^2 + \alpha_2^2 w_2^2 + \alpha_3^2 w_3^2 + \alpha_4^2 w_4^2 + 2 \alpha_1 \alpha_2 w_1 w_2 r_{1,2} + 2 \alpha_1 \alpha_3 w_1 w_3 r_{1,3} + 2 \alpha_1 \alpha_4 w_1 w_4 r_{1,4} + 2 \alpha_2 \alpha_3 w_2 w_3 r_{2,3} + 2 \alpha_2 \alpha_4 w_2 w_4 r_{2,4} + 2 \alpha_3 \alpha_4 w_3 w_4 r_{3,4}} \]

**LOS 10:** Standard Deviation of Portfolio consisting of Risk-free security & Risky Security

\[ A = \text{Risky Security} \]
\[ B = \text{Risk-free Security} \]

We know that S.D of Risk-free security is ZERO.

\[ \sigma_{A,B} = \sqrt{\sigma_A^2 w_A^2 + \sigma_B^2 w_B^2 + 2\sigma_A w_A \sigma_B w_B r_{A,B}} = \sqrt{\sigma_A^2 w_A^2 + 0 + 0} \]

\[ \sigma_{A,B} = \sigma_A w_A \]
LOS 11: Calculation of Portfolio risk and return using Risk-free securities and Market Securities

- Under this we will construct a portfolio using risk-free securities and market securities.

**Case 1: Investment 100% in risk-free (RF) & 0% in Market**
[S.D of risk-free security is always 0(Zero).]

- **Risk = 0%**
- **Return = risk-free return**

**Case 2: Investment 0% in risk-free (RF) & 100% in Market**

- **Risk = \( \sigma_m \)**
- **Return = \( R_m \)**

**Case 3: Invest part of the money in Market & part of the money in Risk-free (\( \sigma \) of RF = 0)**

- **Return = \( R_m \ W_m + R_f \ W_{RF} \)**
- **Risk of the portfolio = \( \sigma_m \times W_m \)**

**Case 4: Invest more than 100% in market portfolio. Addition amount should be borrowed at risk-free rate.**

Let the additional amount borrowed weight = \( x \)

- **Return of Portfolio = \( R_m \times (1+ x) - R_f \times x \)**
- **Risk of Portfolio = \( \sigma_m \times (1+ x) \)**

**Example:**

Assume that the risk-free rate, \( R_f \) is 5%; the expected rate of return on the market, \( E(R_m) \), is 11%; and that the standard deviation of returns on the market portfolio, \( \sigma_m \), is 20%. Calculate the expected return and standard deviation of returns for portfolios that are 25%, 75% and 125% invested in the market portfolio. We will use \( R_M \) to represent these portfolio weights.

**Solution:**

Expected portfolio returns are calculated as \( E(R_p) = (1- W_m) \times R_f + W_m \times E(R_m) \), so we have following:

- \( E(R_f) = 0.75 \times 5\% + 0.25 \times 11\% = 6.5\% \)
- \( E(R_f) = 0.25 \times 5\% + 0.75 \times 11\% = 9.5\% \)
- \( E(R_f) = -0.25 \times 5\% + 1.25 \times 11\% = 12.5\% \)

Portfolio standard deviation is calculated as \( \sigma_p = W_m \times \sigma_m \) and \( \sigma \) of risk-free = 0, so we have the following:

- \( \sigma_p = 0.25 \times 20\% = 5\% \)
- \( \sigma_p = 0.75 \times 20\% = 15\% \)
- \( \sigma_p = 1.25 \times 20\% = 25\% \)

**Note:**

- With a weight of 125% in the market portfolio, the investor borrows an amount equal to 25% of his portfolio assets at 5%.
- An investor with \( \text{₹} \) 10,000 would then borrow \( \text{₹} \) 2,500 and invest a total of \( \text{₹} \) 12,500 in the market portfolio. This leveraged portfolio will have an expected return of 12.5% and standard deviation of 25%.
LOS 12 : Optimum Weights

For Risk minimization, we will calculate optimum weights.

\[ W_A = \frac{\sigma_B^2 - \text{Covariance (A,B)}}{\sigma_A^2 + \sigma_B^2 - 2 \times \text{Covariance (A,B)}} \]

\[ W_B = 1 - W_A \quad \text{(Since } W_A + W_B = 1) \]

We know that

\[ \text{Covariance (A,B)} = r_{A,B} \times \sigma_A \times \sigma_B \]

LOS 13 : CAPM (Capital Asset Pricing Model)

For Individual Security:

The relationship between Beta (Systematic Risk) and expected return is known as CAPM.

Required return/ Expected Return

\[ E(R) = R_f + \beta_s (R_m - R_f) \]

Note:

- Market Beta is always assumed to be 1.
- Market Beta is a benchmark against which we can compare beta for different securities and portfolio.
- Standard Deviation & Beta of risk free security is assumed to be Zero (0) unless otherwise stated.
- \( R_m - R_f \) = Market Risk Premium.
- If Return Market (\( R_m \)) is missing in equation, it can be calculated through HPR (Holding Period Return)
- \( R_m \) is always calculated on the total basis taking all the securities available in the market.
- Security Risk Premium = \( \beta (R_m - R_f) \)

For Portfolio of Securities:

\[ \text{Required return/ Expected Return} = R_f + \beta_{\text{Portfolio}} (R_m - R_f) \]

LOS 14 : Decision Based on CAPM

<table>
<thead>
<tr>
<th>Case</th>
<th>Decision</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPM Return &gt; Estimated Return/ HPR</td>
<td>Over-Valued</td>
<td>Sell</td>
</tr>
<tr>
<td>CAPM Return &lt; Estimated Return/ HPR</td>
<td>Under-Valued</td>
<td>Buy</td>
</tr>
<tr>
<td>CAPM Return = Estimated Return/ HPR</td>
<td>Correctly Valued</td>
<td>Buy, Sell or Ignore</td>
</tr>
</tbody>
</table>

- CAPM return need to be calculated by formula, \( R_f + \beta (R_m - R_f) \)
- Actual return / Estimated return can be calculated through HPR (Through data given)
LOS 15: Interpret Beta/ Beta co-efficient / Market sensitivity Index

The sensitivity of an asset’s return to the return on the market index in the context of market return is referred to as its Beta.

Note:

- Beta is a measure of Systematic Risk.
- However, Beta is not equal to Systematic Risk.

Example:

If Beta = 2, it means when market increases by 1%, security will increase by 2% and if market decrease by 1%, security will decrease by 2%.

### Calculation of Beta

1. **Beta Calculation with % change Formulae**

   \[
   \beta = \frac{\text{Change in Security Return}}{\text{Change in Market Return}}
   \]

   **Note:**
   - This equation is normally applicable when two return data is given.
   - In case more than two returns figure are given, we apply other formulas.

2. **Beta of a security with Co-variance Formulae**

   \[
   \beta = \frac{\text{Covariance of Asset i's return with the market return}}{\text{Variance of the Market Return}} = \frac{\text{COV}_{i,m}}{\sigma_m^2}
   \]

3. **Beta of a security with Correlation Formulae**

   We know that Correlation Co-efficient \(r_{im}\) = \(\frac{\text{COV}_{i,m}}{\sigma_i \sigma_m}\)

   to get \(\text{Cov}_{im} = r_{im} \sigma_i \sigma_m\)

   Substitute \(\text{Cov}_{im}\) in \(\beta\) equation, We get \(\beta_i = \frac{r_{im} \sigma_i \sigma_m}{\sigma_m^2}\)

   \[\beta = r_{im} \frac{\sigma_i}{\sigma_m}\]
4. Beta of a security with Regression Formulae

\[ \beta = \frac{\sum xy - n \bar{x} \bar{y}}{\sum y^2 - n \bar{y}^2} \]

\( x \) = Security Return  \\
\( y \) = Market Return  \\
**Note:** Advisable to use Co-Variance formula to calculate Beta.

**LOS 16: Beta of a portfolio**

It is the weighted average beta of individual security.

\[ \text{Beta of Portfolio} = \text{Beta}_{X\text{ Ltd.}} \times W_{X\text{ Ltd.}} + \text{Beta}_{Y\text{ Ltd.}} \times W_{Y\text{ Ltd.}} \]

Where, \( W_i = \frac{\text{Market Value of investments in asset}}{\text{Market Value of the Portfolio}} \)

**LOS 17: Evaluation of the performance of a portfolio (Also used in Mutual Fund)**

**Performance Evaluation**

- **Method 1: Sharpe Ratio**
  \[ \frac{R_P - R_F}{\sigma_P} \]
- **Method 2: Treynor Ratio**
  \[ \frac{R_P - R_F}{\beta_P} \]
- **Method 3: Jensen's Alpha**
  \[ \alpha_P = R_P - (R_F + \beta (R_m - R_F)) \]
  Or
  \[ \alpha_P = \text{Actual Return} - \text{CAPM Return} \]

1. **Sharpe’s Ratio (Reward to Variability Ratio):**
   - It is excess return over risk-free return per unit of total portfolio risk.
   - Higher Sharpe Ratio indicates better risk-adjusted portfolio performance.

   \[ \text{Sharpe’s Ratio} = \frac{R_P - R_F}{\sigma_P} \]

   Where \( R_F = \text{Return Portfolio} \)  \\
   \( \sigma_P = \text{S.D of Portfolio} \)

   **Note:**  
   - Sharpe Ratio is useful when Standard Deviation is an appropriate measure of Risk.
   - The value of the Sharpe Ratio is only useful for comparison with the Sharpe Ratio of another Portfolio.

2. **Treynor’s Ratio (Reward to Volatility Ratio):**
   Excess return over risk-free return per unit of Systematic Risk (\( \beta \) )
11.12

Treynor’s Ratio = \( \frac{R_P - R_F}{\beta_P} \)

**Decision:** Higher the ratio, Better the performance.

3. **Jenson’s Measure/Alpha:**
   This is the difference between a fund’s actual return & CAPM return

\[ \alpha_p = R_P - (R_F + \beta (R_m - R_F)) \]

Or

\[ \text{Alpha} = \text{Actual Return} - \text{CAPM Return} \]

It is excess return over CAPM return.
- If Alpha is +ve, performance is better.
- If Alpha is -ve, performance is not better.

4. **Market Risk - return trade – off:**
   Excess return of market over risk-free return per unit of total market risk.

\[ \frac{R_M - R_F}{\sigma_M} \]

**LOS 18 : Characteristic Line (CL)**

Characteristic Line represents the relationship between Asset excess return and Market Excess return.

**Equation of Characteristic Line:**

\[ Y = \alpha + \beta X \]

Where
- \( Y \) = Average return of Security
- \( X \) = Average Return of Market
- \( \alpha \) = Intercept i.e. expected return of an security when the return from the market portfolio is ZERO, which can be calculated as \( Y - \beta x X = \alpha \)
- \( \beta \) = Beta of Security

**Note:**

The slope of a Characteristic Line is \( \frac{COV_{LM}}{\sigma^2_M} \) i.e. Beta
LOS 19: New Formula for Co-Variance using Beta

\[
(Cov_{A,B}) = \beta_A \times \beta_B \times \sigma^2_m
\]

LOS 20: New Formula for Correlation between 2 stocks

Correlation between A & B

\[
r_{AB} = r_{A, Mkt.} \times r_{B, Mkt.}
\]

LOS 21: Co-variance of an Asset with itself is its Variance

\[
Cov_{(m,m)} = Variance_m
\]

Co-variance Matrix

<table>
<thead>
<tr>
<th>COV</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>(\sigma_A^2)</td>
<td>Cov_{AB}</td>
<td>Cov_{AC}</td>
</tr>
<tr>
<td>B</td>
<td>Cov_{BA}</td>
<td>(\sigma_B^2)</td>
<td>Cov_{BC}</td>
</tr>
<tr>
<td>C</td>
<td>Cov_{CA}</td>
<td>Cov_{CB}</td>
<td>(\sigma_C^2)</td>
</tr>
</tbody>
</table>

LOS 22: Correlation of an Asset with itself is = 1

\[
r_{(A,A)} = 1
\]

Correlation Matrix

<table>
<thead>
<tr>
<th>or</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>(r_{AB})</td>
<td>(r_{AC})</td>
</tr>
<tr>
<td>B</td>
<td>(r_{BA})</td>
<td>1</td>
<td>(r_{BC})</td>
</tr>
<tr>
<td>C</td>
<td>(r_{CA})</td>
<td>(r_{CB})</td>
<td>1</td>
</tr>
</tbody>
</table>
Unsystematic Risk (Controllable Risk):-
- The risk that is eliminated by diversification is called Unsystematic Risk (also called unique, firm-specific risk or diversified risk). They can be controlled by the management of entity. E.g. Strikes, Change in management, etc.

Systematic Risk (Uncontrollable Risk):-
- The risk that remains can’t be diversified away is called systematic risk (also called market risk or non-diversifiable risk). This risk affects all companies operating in the market.
- They are beyond the control of management. E.g. Interest rate, Inflation, Taxation, Credit Policy

LOS 23: Sharpe Index Model or Calculation of Systematic Risk (SR) & Unsystematic Risk (USR)

Risk is expressed in terms of variance.

Total Risk (TR) = Systematic Risk (SR) + Unsystematic Risk (USR)

For an Individual Security:

\[
\text{Total Risk} \ (\%) = \sigma_s^2
\]

\[
\text{Systematic Risk} \ (\%) = \beta_s^2 \times \sigma_m^2
\]

\[
\text{Unsystematic Risk} \ (\%) = \sigma_{el}^2 = \text{USR} \quad \text{(Standard Error/ Random Error/ Error Term/ Residual Variance)}
\]

\[
\text{SR} = \beta_s^2 \times \sigma_m^2
\]

\[
\text{USR} = \text{TR} - \text{SR} = \sigma_s^2 - \beta_s^2 \times \sigma_m^2
\]
For A Portfolio of Securities:

LOS 24: Co-efficient of Determination

- Co-efficient of Determination = \((\text{Co-efficient of co-relation})^2 = r^2\)
- Co-efficient of determination \((r^2)\) gives the percentage of variation in the security’s return i.e. explained by the variation of the market index return.

**Example:**

If \(r^2 = 18\%\), in the X Company’s stock return, 18\% of the variation is explained by the variation of the index and 82\% is not explained by the index.

- According to Sharpe, the variance explained by the index is the systematic risk. The unexplained variance or the residual variance is the Unsystematic Risk.

**Use of Co-efficient of Determination in Calculating Systematic Risk & Unsystematic Risk:**

- **Explained by Index [Systematic Risk]**
  
  \[
  \frac{SR}{TR} = r^2 \quad \text{or} \quad SR = TR \times r^2 \quad \text{i.e.} \quad \sigma_i^2 \times r^2
  \]

- **Not Explained by Index [Unsystematic Risk]**
  
  \[
  \frac{USR}{TR} = r^2 \quad \text{or} \quad USR = TR \times (1 - r^2) \quad \text{i.e.} \quad \sigma_i^2 \times (1 - r^2)
  \]

LOS 25: Portfolio Rebalancing

- Portfolio re-balancing means balancing the value of portfolio according to the market condition.
- **Three policy of portfolio rebalancing:**
  a) Buy & Hold Policy: [“Do Nothing” Policy]
  b) Constant Mix Policy: [“Do Something” Policy]
  c) Constant Proportion Portfolio Insurance Policy (CPPI): [“Do Something” Policy]

**Value of Equity (Stock)**

\[
\text{Value of Equity (Stock)} = m \times \left[\text{Portfolio Value} - \text{Floor Value}\right]
\]
Where \( m = \text{multiplier} \)

- The performance feature of the three policies may be summed up as follows:

**a) Buy and Hold Policy**

(i) Gives rise to a straight line pay off.
(ii) Provides a definite downside protection.
(iii) Performance between Constant mix policy and CPPI policy.

**b) Constant Mix Policy**

(i) Gives rise to concave pay off drive.
(ii) Doesn’t provide much downward protection and tends to do relatively poor in the up market.
(iii) Tends to do very well in flat but fluctuating market.

**c) CPPI Policy**

(i) Gives rise to a convex pay off drive.
(ii) Provides good downside protection and performance well in up market.
(iii) Tends to do very poorly in flat but in fluctuating market.

*Note:*

- If Stock market moves only in one direction, then the best policy is CPPI policy and worst policy is Constant Mix Policy and between lies buy & hold policy.
- If Stock market is fluctuating, constant mix policy sums to be superior to other policies.

**Example:**

Consider a payoff from initial investment of 100000 when the market moves from 100 to 80 and back to 100 under three policies:

a) Buy and hold policy under which the initial stock bond mix is 50:50.
b) Constant mix policy under which the stock bond mix is 50:50
c) A CPPI policy which takes to form investment in stock = 2 (Portfolio value – 75000 i.e. floor value)

Compute the value of equity and bond at each state

**Solution:**

1. **Buy and Hold Policy**

<table>
<thead>
<tr>
<th>(i) When Market is at 100</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>50,000</td>
</tr>
<tr>
<td>Bond</td>
<td>50,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,00,000</strong></td>
</tr>
</tbody>
</table>
(ii) **When Market Falls from 100 to 80 i.e. 20% decrease**

<table>
<thead>
<tr>
<th></th>
<th>Before Re-balancing</th>
<th>After Re-balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Bond</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>90,000</td>
<td>90,000</td>
</tr>
</tbody>
</table>

**Action:** No Action

(iii) **When Market Rises from 80 to 100 i.e. 25% increase**

<table>
<thead>
<tr>
<th></th>
<th>Before Re-balancing</th>
<th>After Re-balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Bond</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>1,00,000</td>
<td>1,00,000</td>
</tr>
</tbody>
</table>

**Action:** No Action

2. **Constant Mix Policy**

(i) **When Market is at 100**

<table>
<thead>
<tr>
<th></th>
<th>Stock</th>
<th>Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>1,00,000</td>
<td></td>
</tr>
</tbody>
</table>

(ii) **When Market Falls from 100 to 80 i.e. 20% decrease**

<table>
<thead>
<tr>
<th></th>
<th>Before Re-balancing</th>
<th>After Re-balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>40,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Bond</td>
<td>50,000</td>
<td>45,000</td>
</tr>
<tr>
<td></td>
<td>90,000</td>
<td>90,000</td>
</tr>
</tbody>
</table>

**Action:** Sell Bond & Buy Stock of ₹ 5000

(iii) **When Market Rises from 80 to 100 i.e. 25% increase**

<table>
<thead>
<tr>
<th></th>
<th>Before Re-balancing</th>
<th>After Re-balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>56,250</td>
<td>50,625</td>
</tr>
<tr>
<td>Bond</td>
<td>45,000</td>
<td>50,625</td>
</tr>
<tr>
<td></td>
<td>1,01,250</td>
<td>1,01,250</td>
</tr>
</tbody>
</table>

**Action:** Sell Stock & Buy Bond of ₹ 5625

3. **CPPI Policy**

(i) **When Market is at 100**

<table>
<thead>
<tr>
<th></th>
<th>Stock</th>
<th>Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>1,00,000</td>
<td></td>
</tr>
</tbody>
</table>

(ii) **When Market Falls from 100 to 80 i.e. 20% decrease**

<table>
<thead>
<tr>
<th></th>
<th>Before Re-balancing</th>
<th>After Re-balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>40,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Bond</td>
<td>50,000</td>
<td>60,000</td>
</tr>
<tr>
<td></td>
<td>90,000</td>
<td>90,000</td>
</tr>
</tbody>
</table>

**Action:** Sell Stock & Buy Bond of ₹ 10,000

(iii) **When Market Rises from 80 to 100 i.e. 25% increase**

<table>
<thead>
<tr>
<th></th>
<th>Before Re-balancing</th>
<th>After Re-balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>37,500</td>
<td>45,000</td>
</tr>
<tr>
<td>Bond</td>
<td>60,000</td>
<td>52,500</td>
</tr>
<tr>
<td></td>
<td>97,500</td>
<td>97,500</td>
</tr>
</tbody>
</table>
**LOS 26: Arbitrage Pricing Theory/ Stephen Ross’s Apt Model**

**Overall Return**

\[
\text{Overall Return} = \text{Risk free Return} + \{\text{Beta Inflation} \times \text{Inflation differential or factor risk Premium}\} + \{\text{Beta GNP} \times \text{GNP differential or Factor Risk Premium}\} + \ldots \ldots \text{& So on.}
\]

Where, Differential or Factor risk Premium = [Actual Values – Expected Values]

**LOS 27: Adjustment in CAPM**

When two or more Risk Free Rates are given, we are taking the Simple Average of given Rates.

**Effect of Increase & Decrease in Inflation Rates**

- **Increase in Inflation Rates:**
  
  Revised \( R_F = R_F + R_F \times \text{Inflation Rate} \)

- **Decrease in Inflation Rates:**
  
  Revised \( R_F = R_F - R_F \times \text{Deflation Rate} \)

**LOS 28: Modern Portfolio Theory/ Markowitz Portfolio Theory/ Rule of Dominance in case of selection of more than two securities**

Under this theory, we will select the best portfolio with the help of efficient frontier.

**Efficient Frontier:**

- Those portfolios that have the greatest expected return for each level of risk make up the efficient frontier.
- All portfolios which lie on efficient frontier are efficient portfolios.
Efficient Portfolios:

Rule 1: Those Portfolios having same risk but given higher return.
Rule 2: Those Portfolios having same return but having lower risk.
Rule 3: Those Portfolios having lower risk and also given higher returns.
Rule 4: Those Portfolios undertaking higher risk and also given higher return

In-efficient Portfolios:

Which don’t lie on efficient frontier.

Solution Criteria:

For selection of best portfolio out of the efficient portfolios, we must consider the risk-return preference of an individual investor.

✦ If investors want to take risk, invest in the Upper End of efficient frontier portfolios.
✦ If investors don’t want to take risk, invest in the Lower End of efficient frontier portfolios.

Note:
CV is not used in this case, CV is only used for selection of one security between many securities & major drawback is that it always select securities with lower risk.

LOS 29 : Capital Market Line (CML)

The line of possible portfolio risk and Return combinations given the risk-free rate and the risk and return of a portfolio of risky assets is referred to as the Capital Allocation Line.

✦ Under the assumption of homogenous expectations (Maximum Return & Minimum Risk), the optimal CAL for investors is termed the Capital Market Line (CML).
✦ CML reflect the relationship between the expected return & total risk ($\sigma$).

Equation of this line:

$$E(R_p) = R_f + \frac{\sigma_p}{\sigma_m} [E(R_m) - R_f]$$
**LOS 30: SML (Security Market Line)**

SML reflects the relationship between expected return and systematic risk ($\beta$).

**Equation:**

\[
E(R_i) = R_{FR} + \frac{\text{COV}_{i, \text{Market}}}{\sigma^2_{\text{Market}}} \left[ E(R_{\text{Market}}) - R_{FR} \right] \cdot \text{Beta}
\]

- If $\text{Beta} = 0$, $E(R) = R_f$
- If $\text{Beta} = 1$, $E(R) = R_m$

**Graphical representation of CAPM is SML.**

According to CAPM, all securities and portfolios, diversified or not, will plot on the SML in equilibrium.

**LOS 31: Cut-Off Point or Sharpe’s Optimal Portfolio**

Calculate Cut-Off point for determining the optimum portfolio.

**Steps Involved**

1. **Step 1:** Calculate Excess Return over Risk Free per unit of Beta i.e. $\frac{R_i - R_f}{\beta_i}$
2. **Step 2:** Rank them from highest to lowest.
3. **Step 3:** Calculate Optimal Cut-off Rate for each security.
**Cut-off Point of each Security**

\[
C_i = \frac{\sigma^2 \sum_{i=1}^{N} \left( R_i - R_f \times \beta \right)}{\sigma^2 \sum_{i=1}^{N} \beta_i} \frac{\sum_{i=1}^{N} \beta_i^2}{1 + \sigma^2 \sum_{i=1}^{N} \beta_i^2} \\
\]

**Step 4:** The Highest Cut-Off Rate is known as “Cut-off Point”. Select the securities which lies on or above cut-off point.

**Step 5:** Calculate weights of selected securities in optimum portfolio.

a) Calculate \( Z_i \) of Selected Security

\[
Z_i = \frac{\beta_i}{\sigma^2_{ei}} \left[ \frac{(R_i - R_f)}{\beta_i} - \text{Cut off Point} \right]
\]

b) Calculate weight percentage

\[
W_i = \frac{Z_i}{\sum Z}
\]
LOS 1: International Capital Budgeting

- Capital Budgeting is the process of Identifying & Evaluating capital projects i.e. projects where the cash flows to the firm will be received over a period longer than a year.
- Any corporate decisions with an IMPACT ON FUTURE EARNINGS can be examined using capital budgeting framework.
- Categories of Capital Budgeting Projects:
  a) Replacement projects to maintain the business
  b) Replacement projects for cost reduction
  c) Expansion projects
  d) New product or market development
  e) Mandatory projects

Types of Capital Budgeting Proposals:

a) Mutually Exclusive Proposals: when acceptance of one proposal implies the automatic rejection of the other proposal.
b) Complementary Proposals: when the acceptance of one proposal implies the acceptance of other proposal complementary to it, rejection of one implies rejection of all complementary proposals.
c) Independent Proposals: when the acceptance/rejection of one proposal doesn’t affect the acceptance/rejection of other proposal.

LOS 2: Net Present Value (NPV)

NPV = PV of Cash Inflows – PV of Cash Outflows

Decision: If NPV is
+ve Accept the project- increase shareholder’s wealth
-ve Reject the project- decrease shareholder’s wealth
Zero Indifferent-No effect on shareholder’s wealth

\[
\text{NPV} = -CF_0 + \frac{CF_1}{(1+k_0)^1} + \frac{CF_2}{(1+k_0)^2} + \cdots + \frac{CF_n}{(1+k_0)^n}
\]

Where,
- \(CF_0\) = the initial investment outlay.
- \(CF_t\) = after- tax cash flow at time \(t\)
- \(k_o\) = required rate of return for project.

LOS 3: Profitability Index (PI)/ Benefit cost Ratio/ Desirability Factor/Present Value Index

\[
\text{PI} = \frac{\text{PV of Cash InFlows}}{\text{CF}_0 \text{ or Present value of Outflows}}
\]

\(\text{CF}_0\) = Initial Cash Out Flows
Note:
- \( \text{NPV} = -C_{F0} + \text{PV of future Cash In Flows} \)
- \( C_{F0} + \text{NPV} = \text{PV of Future Cash In Flows} \)
- If NPV is given, then Add Initial outlay in NPV to get, PV of Cash inflows.

Decision:
- If NPV is Positive, the PI will be greater than one.
- If NPV is Negative, the PI will be Less than one.

Rule:
If \( \text{PI} > 1 \), Accept the project
If \( \text{PI} < 1 \), Reject the project
If \( \text{PI} = 1 \), Indifferent

LOS 4 : Pay-Back Period Method (PBP)
The pay-back period (PBP) is the number of years it takes to recover the initial cost of an investment.

Case I: When Cash inflows are Constant/ equal
Pay-back Period = \( \frac{\text{Initial Investment/outflow}}{\text{Annual Cash Inflow}} \)

Case II: When Cash inflows are unequal
Pay-back Period = Full years until recovery + \( \frac{\text{Unrecovered Cost}}{\text{Cash Flow during next Year}} \)

Decision:
- Shorter the PBP, better the project.

Drawback:
- PBP does not take into account the time value of money and cash flows beyond the payback period.

Benefit:
- The main benefit of the pay-back period is that it is a good measure of project liquidity.

LOS 5 : Discount pay-back period
- The discounted payback period uses the present value (PV) of project’s estimated Cash flows.
- It is the number of years it takes a project to recover its initial investment in present value terms.
- Discounted pay-back period must be greater than simple pay-back period.

LOS 6 : IRR Techniques (Internal Rate of Return)
- IRR is the discount rate that makes the PV of a project’s estimated cash inflows equal to the PV of the project’s estimated cash outflows.
- i.e. IRR is the discount rate that makes the following relationship:
  \[ \text{PV (Inflows)} = \text{PV (Outflows)} \]
- IRR is also the discount rate for which the NPV of a project is equal to ZERO.
IRR = \frac{\text{Lower Rate NPV}}{\text{Higher Rate NPV} - \text{Lower Rate NPV}} \times \text{Difference in Rate (HR-LR)}

How to find the starting rate for calculation of IRR:

**Step 1:** Calculate Fake Pay-back period:

\[
\text{Fake Pay-back Period} = \frac{\text{Initial Investment}}{\text{Average Annual Cash Flow}}
\]

**Step 2:** Locate the above figure in Present Value Annuity Factor Table and take this discount rate to start the calculation of IRR.

Accept/Reject Criteria:

- IRR > Cost of Capital: Accept the Proposal
- IRR = Cost of Capital: Indifferent
- IRR < Cost of Capital: Reject the Proposal

**LOS 7: Net Profitability Index or Net PI**

\[
\text{Net PI} = \frac{\text{NPV}}{\text{Initial Investment} / \text{Present Value of Outflows}}
\]

**Decision:** Higher the Better.

**LOS 8: Calculation of NPV**

<table>
<thead>
<tr>
<th>Total Fund Approach / Overall Project Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate</td>
</tr>
<tr>
<td>Initial Outflow</td>
</tr>
<tr>
<td>Equity – Share Capital (Fund) + Debenture + Long-term Loan + Preference Share Capital Or Total Cost of Project</td>
</tr>
<tr>
<td>Operating Cash Inflows</td>
</tr>
<tr>
<td>Cash Inflow available for overall project</td>
</tr>
<tr>
<td>Terminal Cash flows</td>
</tr>
<tr>
<td>SV adjusted for Tax Release of Working Capital</td>
</tr>
<tr>
<td>NPV</td>
</tr>
<tr>
<td>NPV that a project earns for the company as a whole.</td>
</tr>
</tbody>
</table>

**Calculation of Project Cash Flows**

<table>
<thead>
<tr>
<th></th>
<th>xxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale Price Per Unit</td>
<td></td>
</tr>
<tr>
<td>Less: Variable Cost Per Unit</td>
<td>xxx</td>
</tr>
<tr>
<td>Contribution Per Unit</td>
<td>xxx</td>
</tr>
<tr>
<td>× No. of Unit</td>
<td>xxx</td>
</tr>
<tr>
<td><strong>Total Contribution</strong></td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Fixed Cost</td>
<td>xxx</td>
</tr>
<tr>
<td><strong>EBDIT</strong></td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Depreciation</td>
<td>xxx</td>
</tr>
<tr>
<td><strong>EBIT</strong></td>
<td>xxx</td>
</tr>
<tr>
<td>Less: Tax</td>
<td>xxx</td>
</tr>
<tr>
<td><strong>NOPAT</strong></td>
<td>xxx</td>
</tr>
<tr>
<td>Add: Depreciation</td>
<td>xxx</td>
</tr>
<tr>
<td><strong>CFAT</strong></td>
<td>xxx</td>
</tr>
</tbody>
</table>
Note 1: Treatment of Depreciation

[EBDIT – Depreciation] [1 – Tax Rate] + Depreciation

Or

EBDIT (1 – Tax Rate) + Tax saving on Depreciation

Note 2: Treatment of Interest Cost / Finance Cost

- Finance Cost are already reflected in the Projects required rate of return / WACC / Ko
- This shows that Interest on Long Term Loans as well as its Tax Saving is already considered by K0

Note 3: Net Investment in Working Capital

NWC investment = Change in non-cash current assets

(-)

Change in non-cash current liabilities

(Other than cash and cash equivalents, notes payable, short-term liabilities and current portion of long-term loans.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Table</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of Working Capital</td>
<td>Outflow</td>
<td>Year 0</td>
</tr>
<tr>
<td>Release of Working Capital</td>
<td>Inflow</td>
<td>End of project Life</td>
</tr>
</tbody>
</table>

- Working Capital should never be adjusted for tax as it is a balance sheet item. Working capital is also not subject to depreciation.

Note 4: Treatment of Tax

If we have loss in a particular year, there are two adjustments:

- Set-off: assumed the firm as other profitable business, Loss in a year generate tax savings in that year.
- Carry Forward: The company has an individual business or a new business having no other operations, loss in a year will be carried forward to future years for the purpose of Set-off.

Note 5: Key Points to Remember

1. Decisions are based on cash flows, not accounting income:
2. Consider INCREMENTAL CASH FLOWS, the change in cash flows that will occur if the project is undertaken.
3. Sunk costs should not be included in the analysis: These costs are not effected by the accept/reject decisions. e.g. Consulting fees paid to a marketing research firm to estimate demand for a new product prior to a decision on the project.
4. Externities / Cannibalization: When considering the full implication of a new project, loss in sales of existing products should be taken into account & also consider positive effects on sale of a firm’s other product line.
5. Cash flows are based on Opportunity Costs: Opportunity costs should be included in projects costs.
6. The timing of cash flows is important: Cash flows received earlier are worth more than cash flows to be received later.
7. Cash flows are analyzed on an after-tax basis.

LOS 9: Modified NPV/ IRR

When Cost of Capital & Re-investment rate are separately given, then we calculate Modified NPV.

Modified IRR: It is the discount rate at which Modified NPV is Zero.
i.e. Modified NPV = \[ \frac{Terminal \ Value}{(1+K_0)^n} \] - PV of Cash Outflow

'or'

PV of cash outflow = \[ \frac{Terminal \ Value}{(1+K_0)^n} \]

**LOS 10: Inflation under Capital Budgeting**

**Inflation Rate Effect**

Cash Flow

Discount Rate

NPV

**Cash Flow:**

**CASH FLOWS**

Real Cash Flows

Money / Nominal Cash Flows

It excludes inflation

It includes inflation

**Conversion of Real Cash Flow into Money Cash Flow & Vice-versa**

Money Cash Flow = Real Cash Flow \( (1 + \text{Inflation \ Rate})^n \)

Or

Real Cash Flow = \[ \frac{\text{Money Cash Flow}}{(1+\text{Inflation \ Rate})^n} \]

**Discount Rate:**

**DISCOUNT RATE**

Real Discount Rate

Money / Nominal Discount Rate

It excludes inflation

It includes inflation

**Conversion of Real Discount Rate into Money Discount Rate & Vice-versa**

\( (1 + \text{Money Discount Rate}) = (1 + \text{Real Discount Rate}) (1 + \text{Inflation Rate}) \)
**NPV:**

- PV may either be calculated
  - By discounting real cash flow by real discount rate.
  - By discounting money cash flow by money discount rate.

**Note:**
- Answer in both the cases will be same.
- Depreciation is not affected by inflation rate as depreciation is changed on the book value of the asset & not market value.

**LOS 11: Overall Beta/ Asset Beta/ Project Beta/ Firm Beta**

**Situation 1:**
- 100% Equity Firm → Unlevered Firm
  - \( \beta_{Equity} = \beta_{Assets} = \beta_{Overall} \)

**Situation 2:**
- Debt + Equity Firm → Levered Firm
  - \( \beta_{Levered} = \beta_{Unlevered} = \beta_{Overall} = \beta_{Assets} \)

- Overall Beta of the companies belonging to the same industry/sector, always remain same.
- Equity Beta and debt Beta may change with the change in Capital structure.
- Overall Beta of a project can’t be changed with the change in capital structure of a particular company.
- According to MM, the change in capital structure doesn’t change the overall beta.
- Debt is always assume to be risk free, so Debt Beta = 0.

**Overall Beta = equity Beta \times \frac{Equity}{Equity+Debt (1-tax)} + Debt Beta \times \frac{Debt (1-tax)}{Equity+Debt (1-tax)}**

**Overall Cost of Capital/ Discount Rate**

<table>
<thead>
<tr>
<th>Cost of Capital ( (K_o) )</th>
<th>( K_e W_e + K_d W_d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( K_e )</td>
<td>( R_f + \beta_{equity} (R_m - R_f) )</td>
</tr>
<tr>
<td>( K_d )</td>
<td>Interest ( (1 - \text{tax rate}) )</td>
</tr>
<tr>
<td>OR</td>
<td>( K_o = R_f + \beta_{Overall} (R_m - R_f) ) (Only applicable when tax rate is missing)</td>
</tr>
</tbody>
</table>

**Note:**
- If interest rate is not given, it is assumed to be equal to risk-free rate.
- If Beta Debt is not given, it is assumed to be equal to Zero
- If \( debt = 0 \) overall beta = Equity Beta
  - i.e. for 100% equity firm overall beta & equity beta is same

**Estimating the project Discount Rate**
CAPM can be used to arrive at the project discount rate by taking the following steps:
1. Estimate the project beta.
2. Putting the value of Beta computed above into the Capital Asset Pricing Model (CAPM) to arrive at the cost of equity.
3. Estimate the cost of debt.
4. Calculate the WACC for the project.

**LOS 12 : Proxy Beta (If more than one comparable co. data is given)**

- Sometimes overall beta of similar companies belonging to same sector may be slightly different.
- In such case we use proxy beta concept by taking average of all the given companies.