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Chap-04
Mathematic of finance

Udhar dene ya lene pe kuch extra lena dena pdega bhi which is Intrest.

Why to take/Give Intrest?
- Time value of money
- Opportunity Cost
- Inflation
- Liquidity prefrence
- Risk factor

dene bala → Lender
lene bala → Borrower

Principal → first amount in transaction
Accumulated amount → the amount which lender get back → A = P+I
Rate of Intrest → I/P x100 it will depend on time period

Type of Intrest :

1) Simple Interest : (SI)
→ $\frac{P \times R \times T}{100}$ .or P x i x t $[i = r/100]$
→ A = P+SI
→ SI = A - P

* SI is always same for same tym intrvl for given principal & ROI

2) Compound Intrest:

Accumulated price jo nikle ayega bali next ka principle bnjaega.

Conversion period → the time period according to which it is going to compounded

If conversion of acc amount to principal in 1yr

$$A = P\left(1+\frac{r}{100}\right)^t \quad | \quad A = P+CI \text{ so } CI = A-P$$

$$CI = \left(P\left(1+\frac{r}{100}\right)^t - P\right)$$

Or

$$CI = \left(P\left(\frac{1+r}{100}\right)^t - 1\right)$$

Conversion period:

period	description	no. of C. period
1 day	compounded daily	365
1 month	" monthly	12
3 month	" Quarterly	4
6 month	" semi anually	2
12 month	" anually	1

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CI formula acc/dng to cnvrsn prd:

$$A = P\left(1 + \frac{r}{100 \times c}\right)^{t \times c}$$

↓

it will become

$A = P(1+i)^n$

[where $i = r/100 \times c$ & $n = t \times c$]

$n = t \times c$ (n = no. of cnvrsn prd in t time prd)

$i = r/100 \times c$

↳ i = rate of int in decimal for one cnvrsn prd.

$CI = P((1+i)^n - 1)$

$A = P + i\%_1 + i\%_2 + i\%_3$ (upto t)

$CI - SI \Rightarrow P\left(\left(\left(1 + \frac{r}{100}\right)^t - 1\right) - \frac{Prt}{100}\right)$

if we take P common: $P\left(\left(1 + \frac{r}{100}\right)^t - 1 - \frac{rt}{100}\right)$

- Effective rate of interest:

if interest is compounded more than once a year, the effective interest rate for a year exceeds the per annum interest rate

$$ERI \rightarrow \left(\left(1 + \frac{r}{100 \times c}\right)^c - 1\right) \times 100$$

- if Q is P ⟶ SIP in how many year?

do check the power of SIP which is 3 (P @0)

P $\xrightarrow{t \to 4 \times 10 \Rightarrow 40yr}$ SIP

In case of depreciation if written

reducing bal
or
Starting bal after every yr } CI

Initial Bal
or
Starting Bal } SI

Population wale Q m CI k formula apply h

$\frac{\text{Intrest}}{\text{Principal}} \times 100 \rightarrow r$

future Value:

future value is cash value of an investm at some time in the future.

$F = CF(1+i)^n \rightarrow$ FV of Single cash flow

Annuity:

Same amount same interval m jayga y ayega. (EMI)

Annuity

Annuity regular/certain
first instalment that will be paid at end of 1st prd

Annuity due / Immediat
first instalmnt is paid immediately of start of period

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future value of annuity regular:

$$A(n,i) = \frac{A((1+i)^n - 1)}{i}$$

FV in annuity is calculated at the end of last period or period after last payment

future value of annuity due:

$$A(n,i) \rightarrow \frac{A((1+i)^n - 1)}{i} \times (1+i)$$

Present Value:

$$P = \frac{F}{(1+i)^n} \text{ or } \frac{An}{1+i}$$

PV of Annuity regular:

$$V = \frac{A((1+i)^n - 1)}{i(1+i)^n}$$

PV of Annuity Immediate:

$$V = \frac{A((1+i)^{n-1} - 1)}{i(1+i)^{n-1}} + A$$

Applications of TVM:

1) Sinking fund: A amount which a person, organization put aside for some specific purpose, like debenture, renew, etc.

2) Leasing: It is an financial arrangement under which owner of asset (lessor) allow user of asset (lessee)

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to use the asset for a defined period of time (lease period) for a consideration (lease rental) payable over a given period of time.

3) Capital Expenditure → Capital expenditure means purchasing an asset today in result of benefit of tomorrow which would flow across life of the investment.

4) Perpetuity: when you get an annuity for unlimited time it becomes perpetuity.

Then $PVA_{\infty} = A/i$

- Calculating growing perpetuity:
means periodic installment is increasing with fixed int. rate.

$$\left[\frac{A}{i-g}\right] \rightarrow \left[g = \frac{G_r}{100 \times C}\right]$$

Some defenations:

- Nominal rate of return:
Offered rate (simple Interest)

Real rate of return:
Inflation adjusted

Effective rate of Interest:

Effectiveness because of compounding

Discounted rate of return:
Used for calculating present value of future cashflow.

Net Present Value:

NPV technique:
NPV = PV of cash inflow - PV of cash outflow
decision rule:
If NPV > 0 Accept the proposal
If NPV < 0 Reject the proposal

Valuation of Bond: ☆

A bond is a debt security in which the issuer owes the holder a debt and is obliged to repay the principal and interest bond are generally issue.

- Compound annual growth rate (CAGR) to find smoothed annualized gain of an investment over a given time period.

$$\left(\left(\frac{V_n}{V_0}\right)^{\frac{1}{t_n - t_0}} - 1\right) \times 100$$