

DATE:

## 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 preference
- Risk factor

dene bala  $\rightarrow$  Lender

lene bala  $\rightarrow$  Borrower

Principal  $\rightarrow$  first amount in transaction

Accumulated amount  $\rightarrow$  the amount which

lender get back  $\rightarrow A = P + I$

Rate of Interest  $\rightarrow I/P \times 100$  it will depend on time period

Type of Intrest :

1) Simple Intrest : (SI)

$$\rightarrow \frac{P \times R \times T}{100} \text{ or } P \times i \times t \quad [i = r/100]$$

$$\rightarrow A = P + SI$$

$$\rightarrow SI = A - P$$

\* SI is always same for same tym intru for given principal & ROI

## 2) Compound Intrest:

Accumulated price jo niklke ayega balis 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 tyr

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

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

or

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

### Conversion period:

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

CI formula according to convrsn prd:

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

$n = t \times c$  ( $n = \text{no. of convrsn prd in } t \text{ time prd}$ )

$$i = r / 100 \times c$$

$\hookrightarrow i = \text{rate of int in decimal for one convrsn prd.}$

it will become

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

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

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

$$A = P + \underbrace{i + i + i + \dots}_{\text{upto } t}$$

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

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

• 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

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

\* if A is P  $\rightarrow$  SIP in how many year?  
do check the power of SIP which is  $3 \times 10^3$   
 $P \xrightarrow{t \rightarrow 4 \times 10} 40 \text{ yr} \rightarrow$  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

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

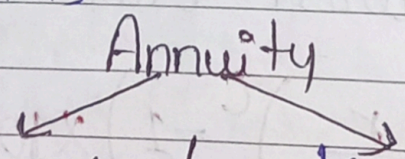
future value :

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 ayega. (EMI)



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

Annuity due / Immediate first instalment is paid immediately of start of period.

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)

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 benefits of tomorrow which would flow across life of the investment.

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

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

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

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

Some definitions:

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.

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