140-JKSC. ICAI
84 C.W 55 H.W

Chapter-4 Time value of money

mathematics of finance

Simple Interest
Compound Interest
Annuity Interest

Simple interest

formula = $\frac{PRN}{100}$ where i = simple interest
P = principal sum Initial deposit
R = Rate percent p.a
N = Number of year

Amount = principal + Interest
↑ future value

$A = P + I$
$A = P + \frac{PRN}{100}$
$A = P * \left(1 + \frac{RN}{100}\right)$

Module
$I = Pit$
T = Time in Years
i = Rate of interest in decimal form $R/100$
$A = P(1+it)$

Note: If a sum invested in simple Interest become K Times.

$R = \frac{(K-1)}{N} \times 100$ $N = \frac{(K-1)}{R} \times 100$

IF S.I on P_1, P_2, P_3 . sum

$$P_1 : P_2 : P_3 = \frac{1}{R_1 N_1} : \frac{1}{R_2 N_2} : \frac{1}{R_3 N_3}$$

Note:- If SI on certain sum is K (time) The principal and rate percent and number of years are equal (R=N)

$$R = N = \sqrt{100K}$$

Compound interest

Nothing is given then Calculate yearly Interest.

Compound amount $= P(1+i)^n$ or $P\left(1+\frac{R}{100}\right)^n$

Compound Interest $= P[(1+i)^n - 1]$

$CI = A - P$

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

$= P[(1+i)^n - 1]$

half yearly → 2

Quaterly → 4

Monthly → 12

daily → 1/365

$$A = P\left(1 + \frac{i}{m}\right)^{mn}$$

A = compound amount

P = Principal

i = rate of interest p.a decimal

m = Number of conversion period in a year

N = Number of year

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

i = Rate interest per conversion period

n = total conversion period

Compound Interest $= P((1+i/m)^{mn} - 1)$

→ Value of machine after n year.

(1) Straight line method

→ $P_n = P_0(1 - in)$
→ $A = P(1 - it)$

Note:- When no method given in question calculate WDV method on sum.

(2) Written down value (WDV) method.

→ $A, P_n, P_0 = P(1-i)^n$ $(i = R/100)$

Note:- Difference between C.I & S.I

(A) For 2 Years $D = Pi^2$

(B) For 3 Years $D = Pi^2(i+3)$

→ If a sum Invested in C.I become a double

$N = \frac{72}{R}$ or $R = \frac{72}{N}$ (approximately)

→ Treble

$N = \frac{114}{R}$ or $R = \frac{114}{N}$ (approximately) effective Rate I = PEt

PAGE NO.:

- Effective rate on Interest

$$Re = \{[1 + i/m]^m - 1\} \times 100 \qquad e = (1 + i)^n - 1$$

- Annuity (Future value)

A series of payments of equal size made at equal interval of time is called annuity.

- Recurring
- Sinking fund.

} amount future value

- Types of annuity

1) annuity ordinary & annuity due.
(regular annuity) (annuity Immediate)

Ordinary annuity :-
payments are made at the beginning of each payment intervel.

2) annuity certain & perpetuity

annuity certain :-
number of payment are finite

perpetuity :-
number of payment are infinite payment are made for ever.

Ordinary annuity :-

Future value or amount of annuity

$$\dot{A} = a \cdot A(n, i)$$
$$= a\left[\frac{(1+i)^n - 1}{i}\right]$$
$$= \frac{a}{i}\left[(1+i)^n - 1\right]$$

a = size of each payment
i = Rate of interest per payment interval
v = present value
N = Number of payment
A = Amount of future value.

present value of annuity :-

$$v = \frac{a}{i}\left[1 - (1+i)^{-n}\right] = \frac{a}{i}\left[1 - \frac{1}{(1+i)^n}\right]$$
$$= a\, P(n, i)$$

present value :-

- → loan repayment
- → leasing
- → capital expenditure
- → Bond

Present value of perpetuity (v) $= \frac{a}{i}$

(c) Annuity due

$$\text{amount} = \frac{a}{i}\left[(1+i)^{n}-1\right](1+i)$$

$$\text{P.V} = \frac{a}{i}\left[1-\frac{1}{(1+i)^{n}}\right]+a.$$