Date 14th Nov 2023

Time Value of Money

Formula Revision

(+) **SI - Simple Interest**

$$A = P + I$$

$$A = P(1 + it) = P + Pit$$

$$SI = P \cdot i \cdot t$$

$$i = \frac{A - P}{P \times t}$$

$$t = \frac{A - P}{P \times i}$$

$$P = A - I$$

(*) **Compound Interest with NOCCPY**

$$A = P\left(1 + \frac{i}{N}\right)^{t \times N}$$

$$CI = P\left[\left(1 + \frac{i}{N}\right)^{t \times N} - 1\right]$$

$$P = \frac{A}{\left(1 + \frac{i}{N}\right)^{t \times N}}$$

** **Effective Rate of Interest (ERI)**

$$ERI = \left(1 + \frac{i}{N}\right)^{t \times N} - 1 \quad \times 100 \text{ for } \%$$

Spiral

Date. 14/11/22

Annuity

* Future Value

Annuity Regular ⇒ $A\left[\frac{\left(1+\frac{i}{N}\right)^{t \times N}-1}{\frac{i}{N}}\right] = A[i, n]$

Annuity Due = $A[i, n] \times \left(1+\frac{i}{N}\right)$

$$A\left[\frac{\left(1+\frac{i}{N}\right)^{t \times N}-1}{\frac{i}{N}}\right] \times \left(1+\frac{i}{N}\right)$$

* Future Value for Single Cash Flow

$FV = CF\left(1+\frac{i}{N}\right)^{(t \times N) \text{ or } n}$ = no. of periods

* Present Value for Single Cash Flow

$PV = \frac{CF}{\left(1+\frac{i}{N}\right)^{(t \times N) \text{ or } n}}$ = no. of periods.

* Compounding & Discounting factors

Compounding	Discounting
$\times \left(1+\frac{i}{N}\right)^{t \times N}$	$\times \frac{1}{\left(1+\frac{i}{N}\right)^{t \times N}}$

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Date: 24/11/2023

* Present Value of Annuity Regular

$$PVAR = A\left(\frac{\left(1+\frac{i}{N}\right)^{t\times N}-1}{\frac{i}{N}\times\left(1+\frac{i}{N}\right)^{t\times N}}\right)$$

Calculator trick of PVAR

[(1 + i) ÷ , =, =, ... n - times] [GT]

* Present Value of Annuity Due

$$PVAD = A\left(\frac{\left(1+\frac{i}{N}\right)^{(t\times N-1)}-1}{\frac{i}{N}\times\left(1+\frac{i}{N}\right)^{t\times N-1}}\right)+A$$

* Perpetuity $= \left\{\frac{A}{i}\right\}$

* Growing Perpetuity $= \left\{\frac{A}{i-g}\right\}$

* Net Present Value = (PV of Inflows - PV of Outflows)

NPV ≥ 0 ⇒ Accept the Proposal

NPV < 0 ⇒ Reject the Proposal

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Date. 11/11/2025

* Real Rate of Return

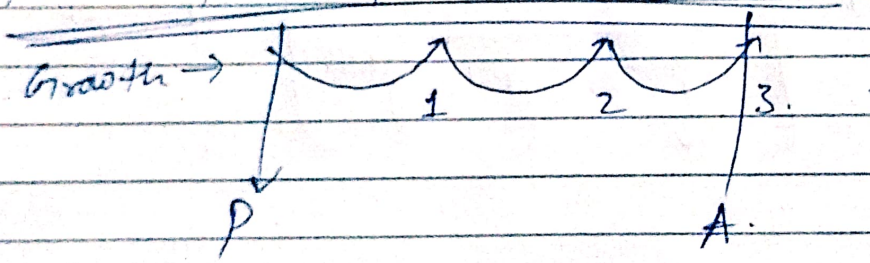
$$\text{RRR} \therefore \text{Nominal Rate} - \text{Rate of Inflation}$$

* CAGR
Compound Annual Growth Rate

using compound interest formula of Amount

$$A = P\left(1+\frac{i}{N}\right)^{t \times N}$$

Years	1	2	3	4
₹ Revenue	100	200	135	250



= time = 3 years.

* Applications of Annuity

- Sinking Fund = FV formula.
- Leasing = PV formulas (to find it is beneficial or not.)
- Capital Expenditure = PV formula (to buy or rent)
- Valuation of Bond $= \frac{100}{(1+0.14)^1} + \frac{100}{(1+0.14)^2} + \frac{100}{(1+0.14)^3} + \frac{1000}{(1+0.14)^3}$

$$\text{Annuity}\left[\begin{matrix}Y_0 - 5\\ Y_1 - 100\\ Y_2 - 100\\ Y_3 - 100\end{matrix}\right](100\times 10\%) \rightarrow = 100\left[\frac{(1+0.14)^5-1}{0.14\times(1+0.14)}\right] + \frac{1000}{(1+0.14)^3}$$

$$\text{Single}\left[Y_3 - 1000\right)\frac{1000}{(1+i)^n}$$