ENGINEERING ECONOMY

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(EX IES)

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ENGINEERING ECONOMY

Engineering economy is the science of applying economics criteria to select the most suitable from the group of alternative engineering design.

Significant terms used in engineering economics :

1. **Interest**
   It is the rental for the use of money to execute a particular Project.

2. **Interest rate**
   An interest rate is the ratio of gain recieved from an investment over a period of time.

- To compute it, usually one year is considered and investment is taken as 100 rupees.

3. Time value of money

It means two equal amount of money at different points of time possess different value due to the application of interest over it provided interest rate is positive, value of same amount of money decreases.

– Interest are of following types:

A. Simple Interest

When the total interest is charged directly proportional to the principal involved, interest rate and time period, it is termed as Simple Interest (SI)

$$SI = Pin$$

P = Principal amount
n = no. of years (Interest period)
i = rate of interest per year.

B. Compound Interest

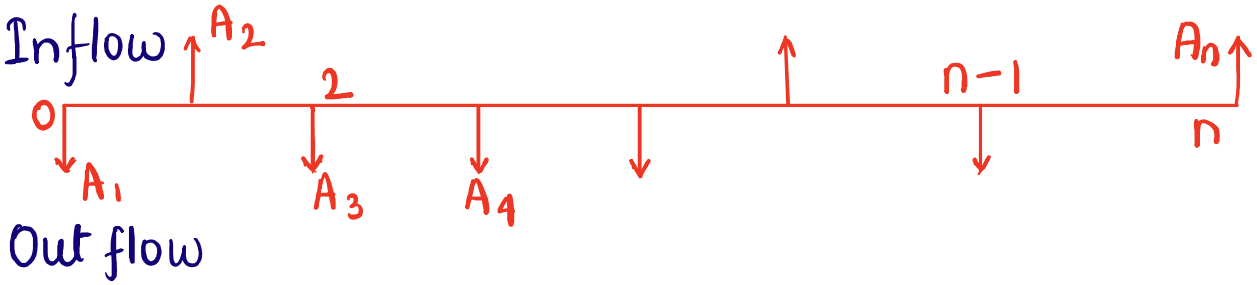
Whenever the interest is charged over the principal amount and the interest

accumulated over that period, it termed as Compound Interest.

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

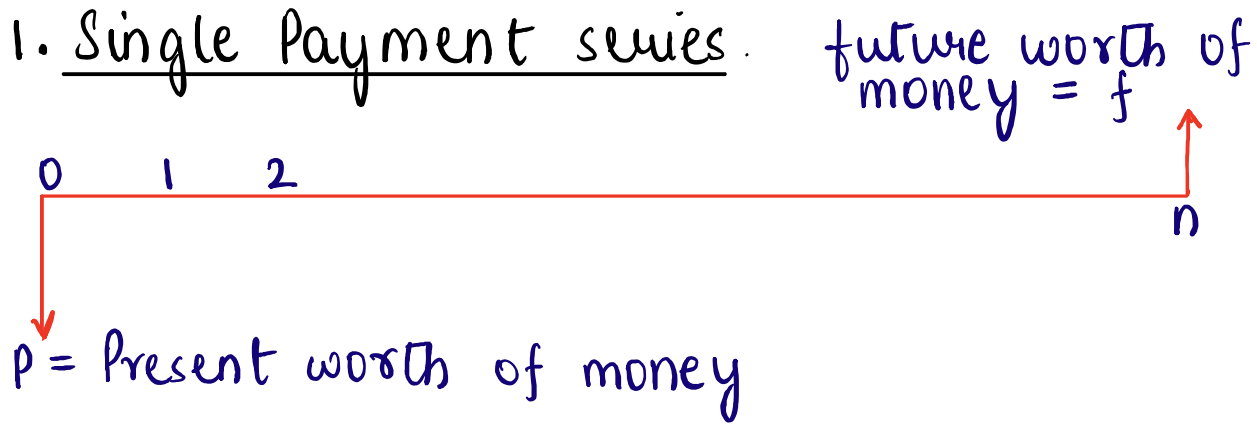
NOTE :

In order to indicate the inflow and outflow of cash from system, cash flow diagrams are used.



— Interest & Payment series

1. Single Payment series.



Case I : To find f

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

$$\frac{f}{P} = (1+i)^n$$

Here, $\left(\frac{f}{P}, i, n\right) = (1+i)^n$ = single payment compound amount factor (SPCAF).

Case II : To find P

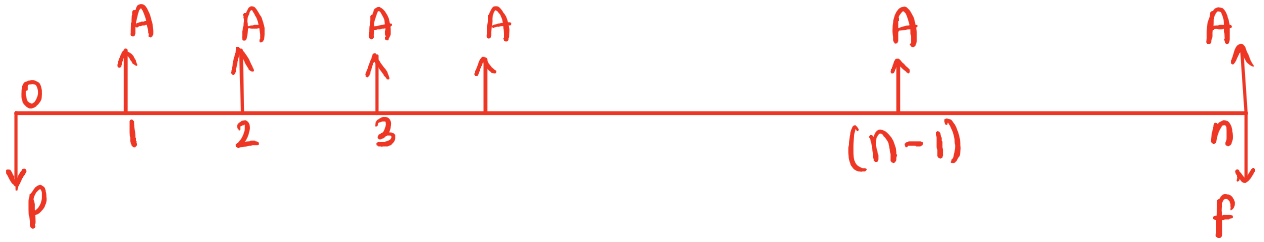
$$f = P(1+i)^n$$

$$P = \frac{f}{(1+i)^n}$$

$$\Rightarrow \frac{P}{f} = \frac{1}{(1+i)^n}$$

$\left(\frac{P}{f}, i, n\right) = \frac{1}{(1+i)^n}$ = Single payment present worth factor (SPPWF).

2. Equal or uniform payment series.



a) To find P

$$P = P_1 + P_2 + P_3 + \ldots\ldots P_n$$

$$P_1 = A\left(\frac{P_1}{f}, i, 1\right)$$

$$P_2 = A\left(\frac{P_2}{f}, i, 2\right)$$

$$P_3 = A\left(\frac{P_3}{f}, i, 3\right)$$

$$P_n = A\left(\frac{P_n}{f}, i, n\right)$$

$$P = \frac{A}{(1+i)^1} + \frac{A}{(1+i)^2} + \frac{A}{(1+i)^3} \cdots \frac{A}{(1+i)^n}$$

$$P = A\left[\frac{1}{(1+i)^1} + \frac{1}{(1+i)^2} + \frac{1}{(1+i)^3} + \ldots\ldots \frac{1}{(1+i)^n}\right]$$

NOTE :

$$\text{Sum of GP} = \frac{a(1-r)^n}{(1-r)}$$

Here, $a = \frac{1}{1+i}$, $r = \frac{1}{1+i}$

$$P = A\left\{\frac{1}{1+i}\left\{\frac{1-\left(\frac{1}{1+i}\right)^n}{1-\left(\frac{1}{1+i}\right)}\right\}\right]$$

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

Here, $\frac{(1+i)^n - 1}{i(1+i)^n} = \left[\frac{P}{A}, i, n\right]$ = Equal payment series present worth factor (EPSWF).

b) To find A

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

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

Here, $\frac{i(1+i)^n}{(1+i)^n - 1} = \left(\frac{A}{P}, i, n\right)$ = capital recovery factor (CRF).

c) To find f

$$P = \frac{f}{(1+i)^n} \quad \text{——— (I)}$$

$$P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] \quad \text{——— (II)}$$

from ① and ⑪

$$\frac{f}{(1+i)^n} = A\left[\frac{(1+i)^n-1}{i(1+i)^n}\right]$$

$$f = A\left[\frac{(1+i)^n-1}{i}\right]$$

Here,

$$\frac{(1+i)^n-1}{i} = \left(\frac{f}{A}, i, n\right) = \text{Equal payment series compound amount factor (EPSCAF).}$$

d) To find A

$$f = A\left[\frac{(1+i)^n-1}{i}\right]$$

$$A = f\left(\frac{i}{(1+i)^n-1}\right)$$

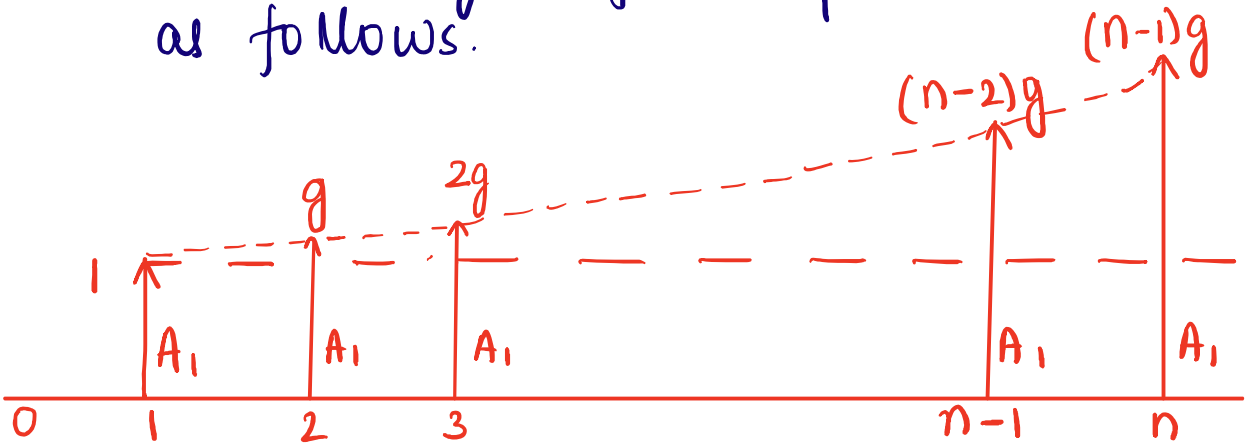
Here,

$$\frac{i}{(1+i)^n-1} = \left(\frac{A}{f}, i, n\right) = \text{Sinking fund factor. (SFF)}$$

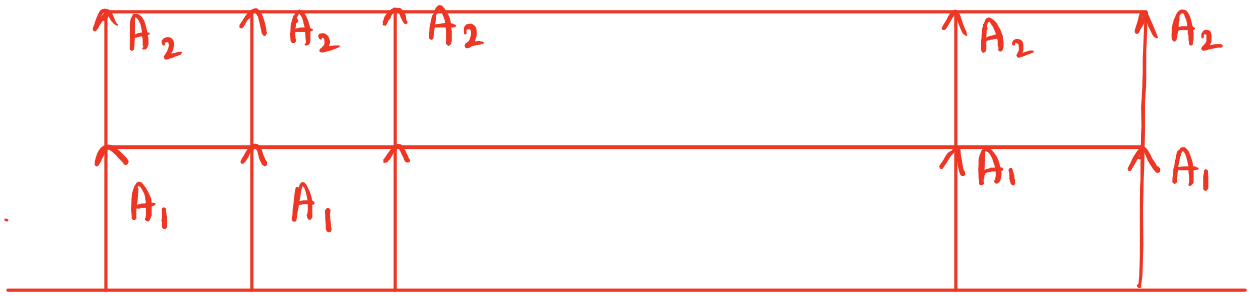
3. Uniform Gradient Series

In some economic analysis problem involves receipt or expenditure that are projected to increase by a uniform amount each year.

Eg: Maintenance of building, in such case analysis of this problem is done as follows.



· Uniform Gradient Series.



· Equivalent uniform series.

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