EE-287 Engineering Economics

Lecture Title:

Single Payment & Uniform Series Payment Formulas

Instructor:

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Single Payment Formulas (F/P & P/F)

Single payment formula is the **most fundamental** equation in EE

Used for: Determines the amount of money "F" accumulated after "n" years (or Periods) from a single present worth "P" with interest compounded one time per year (or Period)

Therefore, if **P** is invested at time **t = 0**, the amount F_1 accumulated in **1** year hence at an interest rate of **i** percent per year will be:

$$F_1 = P + Pi \qquad \text{So, } F_1 = P(1+i)$$

End of Year 2:

Now F_2 is the amount accumulated (and F_2 is the amount after **Year 1** plus the interest from the end of **Year 1** to the end of **Year 2** on the entire F_1)

$$F_2 = F_1 + F_1 i \qquad \text{As, } F_1 = P(1+i)$$

So, $F_2 = P(1+i) + P(1+i)i$ **(After simplifying)** $F_2 = P(1+i)^2$

Similarly, for **End of Year 3:** $\qquad F_3 = P(1+i)^3$

Thus, for **Any number of Years:** $\quad F_n = P(1+i)^n \qquad$ or $\qquad P = F_n/(1+i)^n$

Single Payment Formulas (Continued)

Remember: $(1 + i)^n$ is Single Payment Compound Amount Factor

While, $1/(1 + i)^n$ is known as Single Payment Present Worth Factor

Example: You have Rs.10,00,000/- to invest now at 9% per year for 30 years. Find the future value of your investment?

Solution: As we know, $F_n = P(1 + i)^n$ So, $F_{30} = P(1 + i)^{30}$

So, $$F_{30} = 10,00,000(1 + 0.09)^{30}$$
$$F_{30} = 13,267,678.4691 \qquad \text{(Answer – Compounded Interest)}$$

* Assignment for you regarding this is uploaded so check it out and submit.

Uniform Series Payment Formulas (P/A, A/P, A/F, F/A)

P ↔ A

$$P = A[(1 + i)^n - 1/i(1 + i)^n] \qquad (1)$$

$$A = P[i(1 + i)^n/(1 + i)^n - 1] \qquad (2)$$

F ↔ A

$$F = A[(1 + i)^n - 1/i] \qquad (3)$$

$$A = F[i/(1 + i)^n - 1] \qquad (4)$$

Example 1: **How much money YOU will have to invest to get Rs.400,000/- per year for 5 years starting next year at RoR of 15% per year?**

Solution: **Use Uniform Series Formula (1):** $P = A[(1 + i)^n - 1/i(1 + i)^n]$

$$P = 400,000[(1 + 0.15)^5 - 1/0.15(1 + 0.15)^5]$$
$$P = 1340862.03932 Rs \qquad \text{(Answer)}$$

Example 2: **YOUR company earns at a rate of 16% per year. YOU want to know the FUTURE worth of Rs.10,00,000/- per year investment for 5 years?**

Solution: **Use Uniform Series Formula (3):** $F = A[(1 + i)^n - 1/i]$

$$F = 10,00,000[(1 + 0.16)^5 - 1/0.16]$$
$$F = 6877135.36 Rs \qquad \text{(Answer)}$$

Thank You for listening