- Attendance will be done through the Top Hat app.
- Most classes are 1hr / 5 min. break / 1 hr.

Engineering Economics: The science that deals with techniques of quantitative analysis, used for selecting a preferred alternative from technically viable ones.

- Engineering economic analysis are decisions based upon established Facts.

Proprietorship: a business owned by 1 individual.

Partnership: a business with 1 or more owner.

Corporation: a legal entity created under provincial or federal law, entity separate from owners & managers

Equipment + process selection: Selecting best alternative

Equipment Replacement: Consider replacement expenditure

New Product + Product Expansion: Decisions for increasing revenue

Cost Reduction: lower Firms operating costs

Improvement of Quality Design: continuously improve quality of product

Engineers must estimate:

1. Required investment in a project
2. Product demand
3. Selling price
4. Manufacturing cost
5. Product life

Principles of Engineering Economics

Principle 1: nearby penny is worth a distant dollar

Principle 2: all that counts are the differences among alt's

Principle 3: marginal revenue must exceed marginal cost

Principle 4: additional risk is not taken without the expected additional return.

- in this course we're only considering compound interest

Market Interest Rate : interest rate quoted by financial institutions (the cost of money to the borrowers).

Earning power : money earns more over time.

Purchasing Power : loss of value due to inflation.

Time value : A dollar today is worth more than a dollar in the future.

Principal : Initial money.

Interest Rate : cost, expressed as percent per unit time.

Interest period : length of time, often a year (how frequently interest is calculated).

Number of Interest Periods : length of time of transaction.

Plan For Receipts (or payments) : particular cash flow over specified time.

Future amount of money : cumulative effects of the interest rate over a number of interest periods.

Jan. 9 / 20

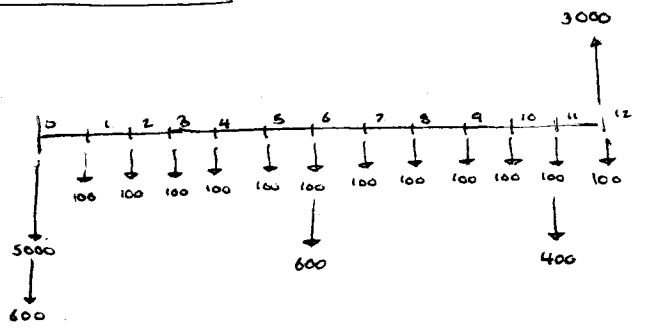
→ Exam on March 2nd (?)

Cash Flow diagram : graphical summary of the timing and magnitude of a set of cash flows.

↳ Upward arrows represent positive flow
Downward arrows represent negative flow

end of period convention : placing all cash-flow transactions at the end of an interest period.

Example 1



Simple interest : interest rate charged to initial sum

Compound interest : interest rate charged to initial sum + uncollected interest

(*) General compound interest equation →

$$F = P(1+i)^N$$

where N is number of periods
i is interest rate
P is principal amount

Economic equivalence : exists between individual cash flows and/or patterns of cash flows that have the same economic effect (in the end).

Principle 1 : Equivalence calculations made to compare alternatives need the same timescale

Principle 2 : Equivalence depends on interest rate

Principle 3 : Equivalence calculations ...

Principle 4 : ...

Five types of cash flows:
Single cash flow
Equal series
Linear gradient series
Geometric gradient series
Irregular series

Compound amount factor: $F = P(1+i)^N = P(F/P, i, N)$

Example

$P = 20000$
$i = 12\%$
$N = 15$ years
$F = ?$
$F = P(F/P, i, N)$
$F = P(F/P, 12\%, 15)$

By equation:

$F = 20000(1 + 0.12)^{15}$
$F = 109472$

By tables:

$F = P(F/P, 12\%, 15)$
$= 5.4736$ (compound amount factor)
$= 20000(5.4736)$
$= 109472$

Present worth factor: $P = F/(1+i)^N = F(P/F, i, N)$

Example 2

$F = 1000$
$i = 12\%$
$N = 5$
$P = ?$

$P = F(P/F, 12\%, 5)$
$= 0.5674$ (
$= 1000(0.5674)$
$= 567.40$

Example 3

$P = 10$

$F = 20$

$N = 5$

$i = ?$

$F = P(F/P, i, N)$

$20 = 10(1+i)^5$

$\hookrightarrow i = 14.87\%$

Example 4

$P = 6000$

$F = 12000$

$i = 20\%$

$N = ?$

$F = P(F/P, i, N)$

$12000 = 6000(1+0.2)^N$

$\hookrightarrow N = 3.8$ years

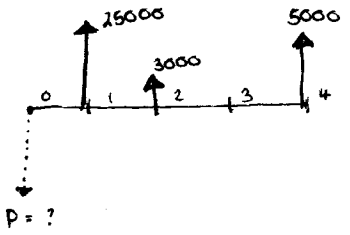
Example 5

$P = 25000(P/F, 10\%, 1) + 3000(P/F, 10\%, 2) + 5000(P/F, 10\%, 4)$

$P = 25000(0.9091) + 3000(0.8264) + 5000(0.6830)$

$P = 28622$

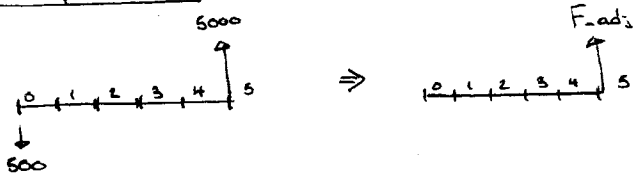
here's the question...



The sinking fund factor (A)

$$A = F\left[\frac{i}{(1+i)^N - 1}\right] = F(A/F, i, N)$$

Example 6



Step 1 : $F_{adj} = 5000 - 500(F/P, 7\%, 5)$

$\cong 4299$

Step 2 : $A = F_{adj}(A/F, 7\%, 5)$

$= 4299\left[\frac{0.07}{(1+0.07)^5 - 1}\right]$

$= 4299[0.1739]$

$= 747.55$

Example 7

$A = 3000$

$i = 7\%$

$N = 10$

$F = ?$

$F = A(F/A, 7\%, 10)$

$= 3000\left[\frac{(1+0.07)^{10} - 1}{0.07}\right]$

$\cong 41449$

Capital recovery factor $A = P\left[\frac{i(1+i)^N}{(1+i)^N - 1}\right] = P(A/P, i, N)$

{ P is always 1 period before First period.
F is always last period. }