

Year - 2015

Semester - spring

1.g) Define engineering economics. What are the basic principles of economics?

→ Engineering economics is the application of economic techniques to the evolution of design and engineering alternatives. The role of engineering economics is to access the appropriateness of a given project, estimate its value, and justify it from an engineering standpoint.

The basic principles of economics are:

- Rationality: Economics is the study of rational human being.
- Consistency and transitivity of choices if  $A > B > C$  then always  $A > B \& C$ .
- Takes the calculated risk.
- Consumer tries to buy more commodity at lower price and vice versa.
- Interest rate is directly proportional to saving and inversely proportional to investment.
- Economic growth is directly proportional to number of labour force existing in country.
- Fragmented market supports for price discrimination.
- Cost and price are different thing.
- Human resources and Technological development.
- Technology increases the production efficiency and decreases the unit cost.

b) Explain the different types of cost involved in manufacturing products with suitable example.

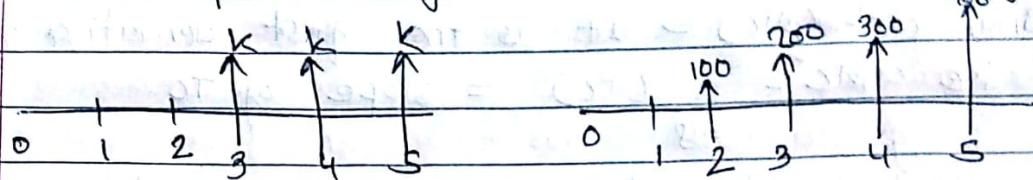
⇒ Anything that is incurred in production of goods and services is known as cost. It indicates the manufacturing efficiency of industry and utilization of plant, technology and manpower, lower the cost, higher will be the efficiency and better use of plant and technology and vice-versa.

Different types of cost involved in manufacturing products are described below:

- i) Total fixed cost → It does not depend upon the unit of production. so it is parallel to quantity axis.
- ii) Total variable cost → It is directly proportional to the output unit produced. It increases when the unit of production increases at first.
- iii) Total cost → It is obtained by adding TFC and TVC  
i.e.  $TC = TFC + TVC$
- iv) Average fixed cost → It is obtained by dividing total fixed cost by quantity output. It is rectangular hyperbola in shape because the numerator term remains fixed and the denominator term i.e. quantity output goes on increasing.

- v) Average variable cost  $\rightarrow$  It is obtained by dividing total variable cost by quantity output.
- vi) Marginal cost (MC)  $\rightarrow$  It is the first derivative of total cost i.e.  $MC = \frac{d(TC)}{dQ} = \text{slope of } TC$   
It can be defined as extra unit of cost that is required to increase output by one unit.
- vii) Sunk cost  $\rightarrow$  It is that cost which cannot be recovered when the firm leaves from industry. It has no relevancy in current decision making and future decision making.  
eg: Decoration cost, licensing cost
- viii) Opportunity cost  $\rightarrow$  The cost of best rejected opportunity to earn return is opportunity cost. It is hidden cost in nature.  
for eg: we are given two jobs (A and B). If we choose A, B is opportunity cost.
- ix) Marginal cost  $\rightarrow$  It is the incremental cost by employing extra unit of factor. If the amount of o/p should be increased by one unit then the amount of increase cost is the marginal cost.
- x) Direct cost  $\rightarrow$  cost related to production. Eg: raw material cost.
- xi) Indirect cost  $\rightarrow$  cost except the production.

2. a) For the cash flow diagrams given below what should be the value of  $k$  on left hand cash flow diagram to be equal to right hand cash flow diagram if  $i = 12\%$



Here,

$$k = ?$$

we know

$$A = F(A/F, 12\%, 3)$$

$$= 1127 \left[ \frac{i}{(1+i)^N - 1} \right]$$

$$= 1127 \left[ \frac{0.12}{(1+0.12)^5 - 1} \right]$$

$$= 1127 * 0.2963$$

$$= 334$$

$$(F/G, 12\%, 5) = G \left[ \frac{(1+i)^N - 1}{i} \right]$$

$$= NG$$

$$= \frac{100}{0.12} \left[ \frac{(1.12)^5 - 1}{0.12} \right] - \frac{5 * 100}{0.12}$$

$$= 833.3 * 6.353 - 4167$$

$$= 5294 - 4167$$

$$= 1127$$

$$\therefore F = 1127$$

- b) Which is supposed to improve the annual savings as shown in cash flow diagram below. Calculate simple and discounted payback period assuming MARR = 5%.

period

0

cash flow

-85000

1

15000

2

25000

3

35000

4	45000
5	45000
6	35000

Solution:

for simple payback period

Period	Net cash flow (Rs)	Cumulative cash flow (Rs)
0	-85000	-85000
1	15,000	-70000
2	25,000	-45,000
3	35,000	-10,000
4	45000	+35,000
5	45000	+80,000
6	35000	+115,000

Here, cumulative cash flow turns to positive in period 4. Therefore, payback period lies between period 3 and 4. By interpolating, we get payback period.

$$= 3 + \frac{10,000}{45,000} = 3 + 0.22$$

$$\theta = 3.22 \text{ periods}$$

- b) Following are the two independent projects, determine which project is worthwhile by using B/C ratio. Assume that MARR is 10%.

	Project A	Project B
Initial Investment (Rs.)	3,50,000	4,50,000
Annual Benefits (Rs.)	1,50,000	1,75,000
Annual O and M costs (Rs.)	30,000	40,000
Salvage value (Rs.)	50,000	75,000
Life in years	4	5

Solution:

using modified B/C ratio and AW formulation,

Project	Project A	Project B
$AW(B) - AW(O \text{ and } M)$		
$1,50,000 - 30,000$	120000	
$1,75,000 - 40,000$		135000

$\Rightarrow CR \text{ costs}^{\circ}$

$$3,50,000 (A/P, 10\%, 4)$$

$$= 3,50,000 \left[ \frac{0.1(1.1)^4}{1.1^4 - 1} \right] = 110250$$

A

B

$$4,50,000 \left( A/P, 10\%, 5 \right)$$

$$= 4,50,000 \left[ 0.1 (1.1)^5 \right]$$

$$\quad \quad \quad \frac{1.1^5 - 1}{1.1 - 1}$$

118708

→ Modified B/C ratio<sup>o</sup>

120000	1.08
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110250	
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1.85000	
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118708	1.137
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∴ Project B is the better of the two as B/C ratio of project B is greater than A.

4.b) Describe project risk. Explain the sensitivity analysis method of describing project risk.

→ Project risk is used to refer variability in a project's NPW. A greater project risk means a greater variability in a project's NPW i.e. risk is the potential for loss. Risk is the intermediate case b/w certainty and uncertainty in which we can assign the probability to the possible outcome. For e.g. The safest place for ship is harbor but that is not what ships are for. The main objective of ship is to carry goods from one harbor to another. So, the obstacles which occur in achieving these objectives are risk. The main sources of <sup>project</sup> risk are:

- Cash flow estimate
- Nature of business
- Rate of interest / rate of inflation
- Study period

There are three methods for describing project risk:  
They are i) Break even analysis  
ii) Sensitivity analysis  
iii) Scenario analysis

Sensitivity analysis reveals how much the NPW of a project will change in response to a given change in one input variable/parameter. In calculating cash flows, some items may have greater influence on the final result than others i.e. the most significant item may be easily influenced or identified. For eg: the estimate of annual revenue is often a major factor in a problem in which the annual revenue varies alternatively.

Sensitivity analysis begins with a base-case situation, which is developed by using the most likely values for each input. We then change the specific variable of interest by several specified percentage points above and below the most likely value while holding all other variables constant.

Next, we calculate a new NPW for each of the values we obtained. A convenient and useful way to present the results of a sensitivity analysis is to plot sensitivity graphs. The slopes of the lines show how sensitive the NPW is to changes in each of the inputs. The steeper the slope, the more sensitive the NPW is to a change in a particular variable/input. Hence, sensitivity graphs identify the crucial variables that affect the final economic outcome most.

5.1) Define ecological footprint. Explain the concept of sustainable development.

→ Ecological footprint refers the total direct and indirect requirement of land use for the given units of crop production with global average i.e. primary productivity for resource regeneration and waste absorption for the agricultural and industrial production and infrastructure development of an economy. It also describes how the trade flows of open economies would become adjustment by the land requirement for imports and exports.

Concept of sustainable development:

Deforestation, over fishing, toxic waste production, climate change, overgrazing, air and water pollution etc are the results given by economic decisions throughout the world. The economic measurement and understanding about these issues have become more serious among the economists. Since 1980s, the growing concern for environment has given birth to the concept of sustainable development.

Sustainable development is process of fulfilling the needs of present generation without compromising the needs of future generations. It focuses the principle of resource management and carrying capacity of eco-system. This principle is specially associated with the consumption pattern and recreation of renewable resources by human being according to natural life cycle. In another words, the resources should be utilized by keeping intact the natural life cycle so that the nature could create natural resources continuously.

Hence, sustainable development is an art of resource management that fulfills the need of present generation and also guarantees the fulfillment needs of the future generations.

- 5.b) Consider the following accounting information for a computer system:

cost basis of the asset,  $I = \text{Rs } 10,000$

useful life,  $N = 5$  years

Estimated salvage value,  $s = 0$ . use double declining balance depreciation method to compute annual depreciation allowances and resulting book values.

→ Here,

$$I = \text{Rs } 10,000$$

$$N = 5 \text{ years}$$

$$s = 0$$

Now,

$$\text{Depreciation Rate (R)} = \frac{1}{N} \times 100 \times 2$$

(Declining balance rate)

$$= \frac{1}{5} \times 100 \times 2$$

$$5$$

$$= 40\%$$

$$\therefore R = 40\%$$

We can compute required annual depreciation amount and resulting book values with the given information as follows:

Year (k)	Book Value	Annual depreciation at 40%
1	10,000	4,000
2	6,000	2,400
3	3,600	1,440
4	2,160	864
5	1,296	518.4
Total		9222.4

6(a) Explain cost of capital. Briefly explain the equity financing and debt financing.

→ Cost of capital refers to the opportunity cost of making a specific investment. It is the rate of return that could have been earned by putting the same money into a different investment with equal risk. Cost of capital is an important component of business valuation work. Because an investor expects his or her investment to grow by at least the cost of capital, cost of capital can be used as a discount rate to calculate the fair value of an investment's cash flows.

Cost of capital depends on the mode of financing used, it refers to the cost of equity if the business is financed, it refers to the cost of debt if it is financed solely through debt. Many companies use a combination of debt and equity to finance their businesses, and for such companies, their overall cost of capital is derived from a weighted average of all capital sources, widely known as the weighted average cost of capital (WACC).

**Equity financing:** It is a method of raising fresh capital by selling shares of the company to public, institutional investors, or financial institutions. It is a method of raising funds to meet liquidity needs of an organization by selling a company's stock in exchange for cash. It spans a wide range of activities in scale and scope, from a few thousand dollars raised by an entrepreneur from friends and family into the billions by household names such as Google and Facebook.

A startup that grows into a successful company will have several rounds of equity financing as it evolves, since a startup typically attracts different types of investors at various stages of its evolution, it may use different equity instruments for its financing needs.

- **Equity:** When a company goes for equity financing to meet its liquidity needs, for diversification or expansion purpose, it has to prepare a prospectus where financial details of the company are mentioned. The company has to also specify as to what it plans to do with the funds raised.

**Debt financing:** When a company borrows money to be paid back at a future date with interest it is known as debt financing. It could be in the form of a secured as well as an unsecured loan.

A firm takes up a loan to either finance a working capital or an acquisition.

Debt means the amount of money which needs

to be repaid back and financing means providing funds to be used in business activities. The payback period could be made monthly, half yearly, or towards the end of the loan tenure. If a company needs a big loan then debt financing is used, where the owner of the company attaches some of the firm's asset and based on the valuation of those assets, loan is given.

A company undergoes debt financing because they do not have to put their own capital. But too much debt is also risky and thus, companies have to decide a level which they are comfortable with.

b) what is income statement and balance sheet? How are they related to each other?

→ Income statement is the first part of financial statement. In case of trading business, it is prepared in two steps:

- i) Trading account
- ii) profit and loss account.

Balance sheet is the next important part of financial statement which is not an account but a statement of assets, liabilities and capital.

→ The relationship betn balance sheet and income statement is that the profit of the business shown in the income statement, belongs to the owners and this is shown by a movement in equity betn the opening

and closing balance sheets of the business. The financial statements are most valuable when presented together. The income statement reports a company's financial performance while the balance sheet reports its financial health. One proceeds from the other. A company's financial performance regulates its financial health. Performance and health are linked through the net income account on the income statement and the equity account on the balance sheet.

- The income statement and balance sheet report the summary of all accounts together. The statement of cash flows is prepared using the changes in balance sheet and income statement activity.

Hence, in this way income statement and balance sheet are interrelated.

7) Write short notes on:

a) Direct and Indirect tax

→ Tax is a compulsory contribution/payment to government by the people and institution without any expectation of direct benefit. On the basis of nature and impact, taxes are divided into two types: i) Direct tax  
ii) Indirect tax

i) Direct tax

→ The tax which cannot be shifted to other is called direct tax. If the tax is paid by the same person

to whom it is levied, then it is known as a direct tax. The incidence and impact of this tax fall on the same person. In Nepalese context, income tax, property tax, house rent tax, land tax, interest tax etc. are the example of direct tax.

The merits of direct tax are :-

- Equality

- Certainty

- Elastic

- Economy

- Progressive

The demerits of direct tax are:-

- Inconvenient

- Unpopular

- Possibility of evasion

- Arbitrary

- Limited scope

ii) Indirect tax : the tax is legally imposed on one person but is actually paid by another person is called indirect tax.

The burden of indirect tax fall to others. Hence, it is shiftable nature tax and generally levied on goods and services.

Merits:- Convenient

- Difficulty of evasion

- Wider scope

- Promotes social welfare

- Progressive

Demerits:-

- Inequality

- Uncertainty

- Uneducative

- Unproductive

- Inflation

## ii) fundamental equation of Accounting

→ Assets, Liabilities and capitals are the three basic elements of every business transaction. Here, assets denote resource and capital element and liabilities are sources of finance. The value of resource and sources must be equal. The relationship betn these three elements remains unaltered that can be expressed by using a mathematical form which is called accounting equation. The change in one element results in corresponding change in the same item or in other element. It can be expressed as,

$$\text{Assets} = \text{Capital} + \text{Liabilities}$$

$$\text{Capital} = \text{Assets} - \text{Liabilities}$$

$$\text{Liabilities} = \text{Assets} - \text{Capital}$$