STUDY MATERIAL

SUBJECT: ENGG. ECONOMICS & COSTING (EEC)

(MODULE–I & II)

SEMESTER : 3RD /4TH

BRANCH : ME/CIVIL/EE/EEE/ETC/CSE

CONTENTS :

- ➤ SHORT TYPE QUESTIONS AND ANSWERS
- ➤ LONG TYPE QUESTIONS AND ANSWERS

DEPARTMENT OF SCIENCE AND HUMANITY

SRINIX COLLEGE OF ENGINEERING, BALASORE

(a)What do you m ean by engineering economics ?

Ans. Engineering economics is a part of micro economics which studies about evaluation of project selection, decision making & cost minimization process of production etc. to solve basic problem of the economy. It also includes replacement, break even analysis in production.

(b)Who defined economics as a science of wealth?

Ans:- Adam Smith

(c)Who is regarde d as the father of economics?

Ans. Adam Smith

(d)Define Micro economics.

Ans. **Microeconomics** (from Greek prefix *mikro*- meaning "small" and economics) is a branch of economics that studies the behavior of individuals and small impacting players in making decisions on the allocation of limited resources. Typically, it applies to markets where goods or services are bought and sold. Microeconomics examines how these decisions and behaviors affect the supply and demand for goods and services, which determines prices, and how prices, in turn, determine the quantity supplied and quantity demanded of goods and services.[2

(e)Define Macro Economics?

Ans. **Macroeconomics** (from the Greek prefix *makro*- meaning "large" and economics) is a branch of economics dealing with the performance, structure, behavior, and decision-making of an economy as a whole, rather than individual markets. This includes national, regional, and global economies. Macroeconomists study aggregated indicators such as GDP, unemployment rates, and price indices to understand how the whole economy functions. Macroeconomists develop models that explain the relationship between such factors as national income, output, consumption, unemployment, inflation, savings, investment, international trade and international finance

(f)Distinguish between micro economics & macro economics.

Ans.

1. Micro Economics studies the problems of individual economic units such as a firm, an industry, a consumer etc.

    Macro Economics studies economic problems relating to an economy viz., National Income, Total Savings etc.

2. Micro Economic studies the problems of price determination, resource allocation etc.

    Macro Economics studies the problems of economic growth, employment and income determination etc.

3. While formulating economic theories, Micro Economics assumes that other things .In Micro Economics economic variables are mutually inter-related independently remain constant.

4. The main determinant of Micro Economics is price.

    In Micro Economics economic variables are mutually inter-related independently.

(g)State the scope of engineering economics.

Ans. It deals with various subject matters like demand & supply analysis, productions, market ,distribution ,time value of money ,project evaluation, decision making, depreciation, break-even analysis etc.

(h)What do you mean by demand?

. Ans .it means the desire of a thing backed by willing & ability to0 purchase it. In other words, demand may defined as the quantity of a commodity purchased by a consumer at a certain price.

(i)What is derived demand?

Ans. **Derived demand** is a term in economics, where demand for a factor of production or intermediate good occurs as a result of the demand for another intermediate or final good. In other words, if the demand for a good such as wheat increases, then the productivity increases, which leads to an increase in labor. This may occur as the former is a part of production of the second. For example, demand for coal leads to derived demand for mining, as coal must be mined for coal to be consumed. As the demand for coal increases, so does its price. The increase in price leads to a higher demand for the resources involved in mining coal.

(j)What is Joint demand ?

Ans. In economics , **joint demand** is a kind of demand that occurs when the demand for two or more products or services are interdependent, normally because they are used together. The demand for razor blades may depend upon the number of razors in use; this is why razors have sometimes been sold as loss leaders, to increase demand for the associated blades.

(k)What is composite demand ?

Ans The demand for a commodity or good that provides multiple uses. For example, crude oil is demanded as a fuel,
tire component and detergent ingredient.

(l)What is demand functions ?

Ans The functional relationship between demand for a commodity $ all factors of demand is known as demand function.

(m)What is cross demand?

Ans *A claim made against someone who has already made a demand of the person asserting that claim.*These mutual claims are called cross-demands. A counterclaim is a kind of cross-demand.

(n)State the law of demand?

Ans the law of demand states that the quantity demanded and the price of a commodity are inversely related, other things remaining constant. If the income of the consumer, prices of the related goods, and preferences of the consumer remain unchanged, then the change in quantity of good demanded by the consumer will be negatively correlated to the change in the price of the good.

(o)What is Giffens paradox.?

Ans. According to the Law of Demand, when the price of a commodity falls the demand for it rises. Giffen's Paradox is an exception to this law. It is named after the 19th century British economist, Sir Robert Giffen, who found that when the price of bread fell, the'demand for it also fell. This was because when the price fell, the real income of the consumer rose and she was in a position to buy better quality/more bread.

(p)What is Veblen effect ?

Ans. The definition does not require that any Veblen goods actually exist. However, it is claimed that some types of high-status goods, such as expensive wines or perfumes are Veblen goods, in that decreasing their prices decreases people's preference for buying them because they are no longer perceived as exclusive or high status products. Similarly, a price increase may increase that high status, exclusive perception, actually increasing preference. The Veblen effect is named after the economist Thorstein Veblen, who invented the concepts of conspicuous consumption and status-seeking.

(q)What is demand schedule ?

Ans. In economics, the demand schedule is a table of the quantity demanded of a good at different price levels. Thus, given the price level, it is easy to determine the expected quantity demanded. This demand schedule can be graphed as a continuous demand curve on a chart having the Y-axis representing price and the X-axis representing quantity.

(r)Distinguish between joint demand & composite demand.

Ans.

(s)Why demand curve slopes down ward ?   (2010)

Ans Demand curve is slope downward because of inverse relationship between price and quantity.

(t)What is income effect ?

Ans. The income effect is a term used in economics to describe how consumer spending changes, typically based on price of consumer goods. Given the same income, consumer habits and quantity of items desired tends to be affected by price of those items. A person making a given salary tends to have lower purchasing power and may purchase a smaller quantity when prices are high. When they are lower, purchasing power goes up and a person may feel correspondingly "wealthier" since the same amount of money will buy more in quantity.

(u)Define substitutions effect.

Ans. An effect caused by a rise in price that induces a consumer whose income has remained the same) to buy more of a relatively lower-priced good and less of a higher-priced one.
Substitution effect is always negative for the seller: consumers always switch from spending on higher-

priced goods to lower-priced ones as they attempt to maintain their living standard in face of rising prices. Substitution effect is not confined only to consumer goods, but manifests in other areas as well such as demand for labor and capital . See also income effect.

(v)What is income elasticity of demand ?

Ans. A measure of the relationship between a change in the quantity demanded for a particular good and a change in real income. Income elasticity of demand is an economics term that refers to the sensitivity of the quantity demanded for a certain product in response to a change in consumer incomes. The formula for calculating income elasticity of demand is:

Income Elasticity of Demand = % change in quantity demanded / % change in income

For example, if the quantity demanded for a good increases for 15% in response to a 10% increase in income, the income elasticity of demand would be **15% / 10% = 1.5.** The degree to which the quantity demanded for a good changes in response to a change in income depends on whether the good is a necessity or a luxury.

(w)What is cross elasticity of demand ?

Ans. An economic concept that measures the responsiveness in the quantity demand of one good when a change in price takes place in another good. The measure is calculated by taking the percentage change in the quantity demanded of one good, divided by the percentage change in price of the substitute good:

$$E_c = \frac{P_1^A + P_2^A}{Q_1^B + Q_2^B} \times \frac{\Delta Q^B}{\Delta P^A}$$

Where:

P_1^A = The price of good A at time period 1

P_2^A = The price of good A at time period 2

Q_1^B = The quantity demanded of good B at time period 1

Q_2^B = The quantity demanded of good B at time period 2

ΔQ^B = The change in the quantity demanded of good B

ΔP^A = The change in price of good A

Cross elasticity of demand is synonomous to "cross price elasticity of demand".

(x)What is Giffen goods ?

Ans In economics and consumer theory, a **Giffen good** is a product that people consume more of as the price rises—violating the law of demand. Normally, as the price of goodsrises, the substitution effect makes consumers purchase less of it, and more of substitute goods. In the Giffen goods situation, the income effect dominates, leading people to buy more of the goods, even as its price rises..

(y)What is price elasticity of demand ?   (2011)

Ans. A measure of the relationship between a change in the quantity demanded of a particular good and a change in its price. Price elasticity of demand is a term in economics often used when discussing price sensitivity. The formula for calculating price elasticity of demand is:

Price Elasticity of Demand = % Change in Quantity Demanded / % Change in Price

If a small change in price is accompanied by a large change in quantity demanded, the product is said to be elastic. Conversely, a product is inelastic if a large change in price is accompanied by a small amount of change in quantity demanded.

(z)If demand equation is given by D=500-p & the supply equation is given by S=50+4p. What would be the price ?   (2012)

Ans. Equlibrium price means, D=S

Long Questions:-

1.(a)Explain the concept of elasticity of demand.   (2011)

Ans. The concept of elasticity of demand is very important in economic theory and policy. It is used to measure the effect of changes in price on quantity demanded. It is known that according to the law of demand, if price decreases

the demand increases and if price increases the demand falls. The quality of demand to change with changes in price is called the elasticity of demand.

By definition, then, the elasticity of demand is the rate at which the quantity demanded changes in response to a change in price.
Its formula is:
Ed = percentage change in quantity demanded/percentage change in price.

This rate of change in demand varies according to commodities, market and consumers. At times a small change in prices has a big effect of demand. This phenomenon is called elastic demand. This effect is usually seen when consumers have more buying options. There are also situations when a large change in price has a small effect of demand. This is called inelastic demand. Commodities like basic food items like salt tend to show inelastic demand.

A perfect elastic demand exists when demand increase with no change in price. This is called infinite elasticity. A situation of zero elasticity result when lowering the price does not increase the demand.

(b)What are the factors governing price elasticity of demand ?   (2011-12-13)

1. Price level:

Generally, the demand for very costly and very cheap goods is elastic. Very costly goods are demanded by the rich people and hence their demand is not affected much by changes in prices. For example, increase in the price of Maruti Car from Rs. 3, 00,000 to Rs. 3, 20,000 will not make any noticeable difference in its demand. Similarly, the changes in the price of very cheap goods (such as salt) will not have any effect on their demand, for a very small part of income is spent on suchcommodities .

2. Availability of Substitutes:

The demand for a commodity will be very elastic if some other commodities can be used for it. A small rise in the price of such a commodity will induce consumers to use its substitutes. For example gas, kerosene oil, coal etc. will be used more as fuel if the price of wood increases. On the other hand, the demand of such commodities is inelastic which have no substitutes such as salt.

3. Time period:

Longer is the time period more elastic is the demand. In the short period if price of a commodity like petrol is increased, its demand will not fall immediately and hence it would be inelastic or less elastic. But if period is longer alternative sources of energy can be developed and hence demand would be elastic.

4. Proportion of total expenditure spent on the product:

If a small proportion of total expenditure is spent on a commodity, its demand will be inelastic such as demand for salt. On the other hand, if a major portion of total expenditure is spent on a commodity, its demand will be more or highly elastic such as demand for luxuries.

5. Habits:

Some products which are not essential for some individuals are essential for others. If individuals are habituated of some commodities the demand for such commodities will be usually inelastic, because they will use them even when their prices go up. A smoker generally does not smoke less when the price of cigarette goes up.

6. Nature of the commodities:

Generally, the demand for necessaries is inelastic and that for comforts and luxuries of life elastic. This is so because certain goods which are essential to life will be demanded at any price, whereas goods meant for luxuries and comforts can be dispensed with easily if they appear to be costly.

7. Various uses:

Generally, a commodity which has several uses will have an elastic demand such as milk, wood etc. On the other hand, a commodity having only one use will have inelastic demand.

8. Postponement:

Usually the demand for such commodities whose use can be postponed for some time is elastic. For example, the demand for V.C.R. is elastic because its use can be postponed for some time if its price goes up, but the demand for rice and wheat is inelastic because their use cannot be postponed when their prices increase.

2. How equilibrium price is determined under perfect competition ?

Ans. Price determination is the main problem and a must in economic theory. It is because every activity measured in terms of money (price) is called economic activity. Similarly, a commodity the value of which can be measured in terms of money (value in exchange) is called economic good.

Thus, determination of price of a commodity or service is an essential part of the study of economics. All the branches of economics like consumption, production, exchange and distribution are affected by the theory of price.

We know that a commodity can command value only when it has utility and scarcity. The utility aspect represents demand and the scarcity aspect represents supply.

In any transaction, there are two parties, the buyers and sellers. The price of a commodity is determined by mutual agreement between the buyers and sellers. Under perfect competition price of a commodity is determined by the interaction of demand (buyers) and supply (sellers).

Pricing of commodities has been the most controversial issue in Economics. There are two approaches in this regard.

The first approach is propounded by the classical economists like Adam smith, Ricardo, J.S. Mill and some socialist thinkers like Robert Owen, Marx and Sismondi. According to these economists, the cost of production is the determinant of price. This view is one side and subject to criticisms.

The second approach is the Austrian approach, which is advocated by the Austrian economists like Manger, Wiser, Jevons and Bohme Bawerk. This approach is also known as the psychological or subjective approach. According to this approach, utility is the sole determinant of price. But this approach is also one-sided and subject to criticisms.

Prof Marshall synthesized the two approaches. He pronounced that price is determined by the interaction of the demand and supply forces. He compared price determination with the act of cutting with two blades of a pair of scissors. The cutting is done neither by the upper blade nor by the lower blade alone. Prof. Marshall remarks, "The price rests like the key stone of an arch, balanced in equilibrium between the contending pressures of its two opposing sides, demand on the one side and supply on the other."

The consumers will continue the consumption of the commodity until its price equals the marginal utility from the demand side. Similarly, sellers will continue with their sale until the price equals the marginal cost of production.

Equilibrium Price:

The Equilibrium price under perfect competition refers to that price at which the demand for and supply of the commodity are in equilibrium with each other.

In the words of Prof. J.L. Hansen, "The equilibrium price is one where quantity demanded of a commodity is exactly equal to the quantity supplied." Prof. D.W. Pearce says, "Equilibrium price is the price at which market is equilibrium."

The wishes of both buyers and sellers are satisfied only at the equilibrium price. Dr. Marshall says, "When the demand price is equal to the supply price the amount produced has no tendency either to be increased or decreased, it is equilibrium". If prices were greater than the equilibrium price quantity supplied would exceed quantity demanded. As a result, the price will go on declining till the quantity demanded equals quantity supplied. On the other hand, if prices were lower than the equilibrium price quantity demanded would exceed quantity supplied. Consequently, the price will go on rising till the quantity demanded and the quantity supplied are again equal. We thus see that the price, which will settle down, can be either greater or less than the equilibrium price.

$$= \frac{\text{Change in one factor}}{\text{Original of factor value}}$$

$$e_d = \frac{\frac{\Delta q}{q}}{\frac{\Delta F}{F}} \quad \text{or} \quad \frac{\Delta q}{\Delta F} \cdot \frac{F}{q}$$

If that factor is price only, it is called price elasticity. It means

$$e_p = \frac{\Delta q}{\Delta p} \cdot \frac{p}{q}$$

If that factor of demand is the income of the consumer. Then it is called income elasticity of demand

$$e_y = \frac{\Delta q}{\Delta y} \cdot \frac{p}{q}$$

If that factor is price of related goods, it means q_n & p_y cases cross elasticity comes to an exist

a) i.e $e_c = \frac{\Delta q_x}{\Delta p_y} \cdot \frac{p_y}{q_x}$

Ex. - If

Price	Quantity
P 10	50 q
P_1 15	30 q_1

$\Delta q = q_1 - q$
$\quad = -50 + 30 = -20$

$\Delta p = p_1 - p$
$\quad = 15 - 10 = 5$

$$e_p = \frac{\Delta q}{\Delta p} \cdot \frac{p}{q}$$
$$= \frac{20}{5} \cdot \frac{10}{50} = \frac{4}{5} < 1$$

(b) What are the factors governing price-elasticity of demand ?

Ans.: Factors Affecting Price Elasticity of Demand : Price elasticity of demand depends upon a number of factors. Some of them are discussed below.

Nature of the commodity : The elasticity of demand for any commodity depends upon the category to which it belongs, *i.e.*, whether it is a necessity, comfort, or luxury. The demand for necessaries of life or conventional necessaries is generally less elastic. For example, the demand for necessaries like food, salt, matches, etc. does not change much with rise or fall in their prices. Similar is the case with commodities which are required at the time of marriage, death ceremonies, etc.

The demand for necessaries of efficiency (such as milk, eggs, butter, etc.) and for comforts is moderately elastic because with the rise or fall in their prices, the demand for them decreases or increases moderately. On the other hand, the demand for luxuries is more elastic because with a small change in their prices there is a large change in their demand.

But the demand for prestige goods, like jewels, rare coins, rare stamps, paintings by Tagore or Picaso etc. is inelastic because they possess unique utility for the buyers who are prepared to buy them at all costs.

Substitutes : Commodities having substitutes have more elastic demand because with the change in the price of one commodity, the demand for its substitute is immediately affected. For example, if the price of coffee rises, the demand for coffee will decrease and that for tea will increase, and vice versa. But the demand for commodities having no good substitutes is inelastic.

Variety of uses : The demand for a commodity having composite demand or variety of uses is more elastic. Such commodities are coal, milk, steel, electricity, etc. For example, coal is used for cooking and heating, for power generation, in factories, in locomotive, etc. If there is a slight fall in the price of

coal, its demand will increase from al quarters. On the other hand, a rise in its price will bring a considerable decrease in demand in less important uses (domestic) and in more important uses efforts will also be made to economise its use, as in railways and factories, thus the over all effect will be reduction in demand. A commodity which cannot be put to more than one use, has less elastic demand.

Joint demand : There are certain commodities which are jointly demanded, such as car and petrol, pen and ink, bread and jam et. The elasticity of demand of the second commodity depends upon the elasticity of demand of the major commodity. If the demand for cars is less elastic the demand for petrol will also be less elastic. On the other hand, if the demand for say, bread is elastic, the demand for jam will also be elastic.

Deferred consumption : Commodities whose consumption can be deferred have an elastic demand. This is the case with durable consumer goods, like cloth, bicycle, fan, etc. If the price of any of these articles rise, people will postpone their consumption. As a result, their demand will decrease and vice versa.

Habits : People who are habituated to the consumption of a particular commodity, like coffee, tea or cigarette of a particular brand, the demand for it will be inelastic. We find that the prices of coffee, tea and cigarettes increase almost every year but there has been little effect on their demand because people are in the habit of consuming them.

Income groups : The elasticity of demand also depends on the income group to which a person belongs. Persons who belong to the higher income group, their demand for commodities is less elastic. It is immaterial to a rich man whether the price of a commodity has fallen or risen, and hence his demand for the commodity will be unaffected. On the other hand, the demand of persons in lower income groups is generally elastic. A rise or fall in the prices of commodities will reduce or increase the demand on their part. But this does not apply in the case of necessities, the demand for which on the part of the poor is less elastic.

Proportion of income spent : consumer spends a small proportion of his in on a commodity at a time, the demand for commodity is less elastic because he does not bot much about small expenditure. Such commodities shoe polish, pen, pencil, thread, needle etc. B commodities which entail a large proportion of t income of the consumer, the demand of them elastic, such as bicycle, watch etc.

Level of prices : The level of prices al influence the elasticity of demand for commoditi when the price level is high, the demand fo commodities is elastic, and when the price level low, the demand is less elastic.

Time factor : Time factor plays an importa role in influencing the elasticity of demand fo commodities. The shorter the time in which th consumer buys a commodity, the lesser will be th elasticity of demand for that product. On th otherhand, the longer the time which the consume takes in buying a commodity, the higher will be th elasticity of demand for that product.

Brand : The price or demand for a given bran of product may be elastic. If its price increases people turn towards the other brands easily. This i substitution effect. For example, if the price of th Hero bicycle increases, the consumer will buy th Atlas bicycle.

Recurring demand : Goods which hav recurring demand, their prices are more elastic tha the goods which are not demanded time and again

Distribution of income : If a country ha equal distribution of income and wealth, the deman for majority of goods is elastic because there ar more middle class people whose purchasing powe is almost equal.

Q. 8. Explain the concept of production and th law of variable proportions.

Ans. For Ans. Refer Probable Sectio Module–I, Q. no.-9.

1. What is depreciation ? Why is study of depreciation significant? Distinguish between decline balance method and straight-line method of depreciation.

Ans. In ordinary sense, depreciation means a decrease in worth. It refers to the loss of value of the physical assets used in production. In Economic sense, the consumption of fixed capital is called as depreciation. It is annually charged on the value of fixed assets which are used in production. In accounting sense, depreciation is the estimated value of fall in the worth of an asset. The wear and tear of fixed assets in the normal production process is regarded as depreciation. Accidental loss of value of fixed asset is capital loss not the depreciation.

According to J.N. Carter, "Depreciation is the gradual and permanent decrease in the value of an asset from any cause" There are several factors responsible for depreciation such as use of assets, physical depreciation, functional, technological problem, sudden failure, depletion etc.

Depreciation is needed to know the free value of profit and loss. To identify financial position and to provide funds for replacement of asset.

Needs for depreciation :
(i) It is necessary to ascertain true profit or net profit of a business.
(ii) It represents true and fair view of financial position.
(iii) It assures the exact cost of production.
(iv) It is necessary to comply legal requirements.
(v) It is needed to accumulate funds for replacement of assets.

Methods : There are several methods for computing depreciation as given.

(i) Straight-line method : Straight line depreciation is the simplest method to apply and the most widely used. The annual depreciation is constant. The book value (BV) is the difference between the purchase price and the scrape value of the asset at the end and annual depreciation charge.

$$DC(n) = \frac{P-S}{N}$$

P – Purchase price
or, initial investment
S – Salvage value

$$BV(n) = P - \frac{n}{N}(P-S)$$ N – No. of life years

n – depreciation calculating year.

Example : Small computers purchased by Rs. 7000/- each and their life period have 5 years. They have no salvage value, The company has a cost of capital (rate of return) 7%. Determine
(i) Depreciation charge
(ii) Depreciation reserves at the end of 3 years
(iii) Book value of the computers at the end of 3 years
(iv) Find the rate of depreciation.

Solution :
(i) Since the annual depreciation charge is constant.

$$DC(n) = \frac{P-S}{N} = \frac{Rs. 7000-0}{5} = Rs. 1400/- \text{ per year.}$$

(ii) The depreciation reserve at the end of 3 years is $3 \times Rs. 1400/- = Rs. 4200/-$

(iii) $BV(3) = P - \frac{n}{N}(P-S)$

$$= Rs. 7000 - \frac{3}{5}(Rs. 7000-0)$$

$$= Rs. 7000 - Rs. 4,200 = Rs. 2800/-$$

(iv) Rate of depreciation

$$= \frac{D}{P} \times 100 = \frac{Rs. 1400}{Rs. 7000} \times 100 = 20\%$$

(ii) Declining balance method : The declining balance method is a means of amortizing an asset at an accelerated rate early in its life, with corresponding lower annual charges near the end of service.

$$DC(n) = \frac{R}{N} BV(n-1)$$

R – Rate of depreciation may be determined by the tax payer. If R>1, the 1st year's depreciation charge will be greater than the corresponding charge.

$$R = 1 - \left(\frac{S}{P}\right)^{1/N}$$

S = Salvage value.
$BV(n) = P(1-R)^n$

$$= P\left\{1 - \left[1 - \left(\frac{S}{P}\right)^{\frac{1}{N}}\right]\right\}^n$$

Or, $D_t = K(1-K)^{t-1} P$
$B_t = (1-K)^t P$
K is rate of depreciation.

$$B.V = P\left\{\frac{S}{P}\right\}^{\frac{n}{N}}$$

By income tax code 1954
In double declining balanced method.

$$\text{Depreciation rate} = \frac{200\%}{N}$$

Example : If P = Rs. 1,00,000, S = 20,000, N = 5
Find out (i) DC (i) & (ii)
(ii) Book value at the end of 3 years
(iii) Depreciation Reserve for 3 years.

(ii) **Diminishing Balance Method :**
Under this method, depreciation is calculated at a certain percentage each year on the balance of the asset which is brought forward from the previous year.

(a) There is much uncertainty or revenue in later years and

(b) There is also increase in repairs and maintenance costs consequently decreasing efficiency and revenues in every succeeding period. It is usually adopted for plant and machinery.

Merits :
(i) It tends to give a fairly even charge of depreciation against revenue each year. Depreciation is generally heavy during the first few years and is counter-balanced by the repairs being light and in the later years when repairs are heavy this is counter - balanced by the decreasing charge for depreciation.

(ii) Fresh calculations of depreciation are not necessary as and when additions are made.

(iii) This method is recognised by the income tax authorities in India.

Demerits :
(i) The original cost of the asset is altogether lost sight in subsequent years and the asset can never be reduced to zero.

(ii) This method does not take into consideration the asset as an investment and interest is not taken into consideration.

(iii) As compared to the straight line method, it is difficult to determine the suitable rate of depreciation.

Q.5. The Central Government is planning to construct dam with an initial investment of Rs. 50,00,000. The Estimated life of the dam is 15 years. The annual operation and maintenance cost is Rs. 3,00,000. The annual savings in irrigation cost due to construction of dam is Rs. 8,00,000 every year. Check whether the project is justified on

benefit/Cost ratio by taking a discount rate of 10% compounded annually.

Ans. : Initial cost of project = Rs. 50,00,000
Annual cost = Rs. 3,00,000
Anual Savings :
through irrigation = Rs. 800,000
Life period = 15 years.
rate of interest = 10% (C.A.)

$$\text{By EAW B/C ratio} = \frac{B_A}{I_A + C_A}$$

$$\text{B/C ratio} = \frac{800000}{951500}$$

B/C < 1
Hence It is not justified to implement the project.

$$= \frac{800000}{5000000(A/P10\%15) + 300000}$$

$$= \frac{800000}{5000000(0.1315) + 300000}$$

$$= \frac{800000}{657500 + 300000}$$

Q.6. Explain the law of variable proportions in the study of production analysis with appropriate example. Narrate the relevance of such an analysis in the study of Engineering economics and costing.

Ans. Production refers to a technical relationship between input and output. The law of variable proportion occupies an important place in the theory of production. This law examines the production function with one factor variable, keeping other factors fixed.

$$Q = f(L, \overline{K}) \quad ...(1)$$

It is a short run production fⁿ where

Q – Output
L – Labour
K – Capital

Short run production is a technical relationship between input and output where capital is fixed. Hence it is expressed as

$$Q = f(L) \quad ....(2)$$

It indicates that output is changed by varying the quantity of one factor (labour) only, keeping other factors constant. The proportion between variable factor and fixed factor is changed by employment more and

...ore variable factors. With change in proportion of factors output also changes. It is known as law of variable proportion. It is also referred to returns to a factor or law of diminishing returns.

According to F. Benham "As the proportion of one factor in a combination of factors is increased, after a point, 1st the marginal and then the average product of that factor will diminish". As equal increments of one input are added, the input of other productive services being held constant, beyond a certain point the resulting increments of product will decrease i.e. marginal product will diminish. (G.J. Stigler)

Concepts of laws of prodⁿ :

There are 3 concepts of production are related such as total product, average product and marginal product.

Total product is the total physical output corresponding to each set of inputs.

Average product is the ratio of total product and total no. of variable factors employed.

Marginal product is the addition to the total product by the employment of an additional factor input.

$$MP = TP_n - TP_{n-1}$$

The law of variable proportion is based on following :

Assumptions :

(i) The state of technology in production should remain same or constant.

(ii) There must be some inputs kept constant.

(iii) It operates specially in short run production.

(iv) Labour or variable factors should be homogeneous.

The laws of production in terms of law of variable proportion is passed through 3 stages of production. It is explained by following table.

Production table

Labour employed	Capital (k)	L/K	TP	AP_L	MP_L
1	50	1:50	10	10	10
2	50	2:50	22 IR	11	12
3	50	3:50	42	14	20
4	50	4:50	52	13	10
5	50	5:50	60 DR	12	8
6	50	6:50	60	10	0
7	50	7:50	56 NR	8	-4

Above table indicates that law of variable proportion has 3 returns. i.e.

1st Stage – Increasing returns :

In this stage TP rises at an increasing rate. Both AP & MP rise also jointly but MP is greater than AP. Corresponding to the point of inflexion MP falls first then they meet each other at end of 1st stage. In the table up to 3rd units of labour employed we get increasing returns.

2nd stage – Diminishing returns :

The total product may continue to rise at a diminishing rate where AP & MP both are declining but AP>MP. When MP reaches at zero, total product becomes maximum and second stage comes to an end. From 3rd to 6th unit of labour employment period of production is known as diminishing returns.

3rd Stage – Negative returns :

Under this stage TP declines, AP falls continuously but never be zero. MP will be –ve. The units of labour employed indicates –ve returns in production.

The law of variable proportion is explained by the following diagramme.

In the diagram, up to 0L amount of labour employed. It is called as increasing returns. Here total product rises at an increasing rate till the point of inflexion T and MP becomes maximum first then falls. At the end of 1st stage they intersect each other.

LL₁ period of employment in production is known as second stage where TP rises at a diminishing rate till point H. Here it becomes maximum and 2nd stage ends. In this stage both AP & MP are decreasing.

After 0L₁ units of labour employment, the production is called as –ve returns because total product declines due to –ve marginal product.

It may be noted that Diminishing returns is the rational stage of prodⁿ for the producer.

Importance of law :

It is not only applied to land only but also any factors of production whose supply is fixed. It is applicable in agricultures, industry and manufacturing.

Limitations :

(i) Law of variable proportion can not be applied if the state of technology will vary during the production process.

(ii) The assumptions which are taken in law of variable proportion are unrealistic such as labours are homogeneous, perfect competition and capital is fixed etc.

Q.7. Explain the term "Break-Even Analysis" and discuss its usefulness. Calculate the break-even point from the following data:

Sales : 550 units
Sales Receipts : Rs. 28,875
Total Fixed Costs : Rs. 16,000
Total Variable costs : Rs. 11,000

Solution : Sales = 550 units.

Sales Revenue = Rs. 28875
Total fixed cost = Rs. 16000
Total variable Cost = Rs. 11000

$$\text{Selling price per unit} = \frac{\text{Sales revenue}}{\text{Sales units}}$$

$$= \frac{28875}{550} = \text{Rs. 52.50}$$

Variable Cost Per Unit

$$= \frac{\text{TVC}}{\text{Sales units}} = \frac{11000}{550} = \text{Rs. 20.00}$$

Break even Point (Units) =

$$\frac{\text{Fixed cost}}{\text{selling price per unit} - \text{V.C. Per Unit}}$$

$$= \frac{16000}{52.50 - 20.00} = 492.31$$

Break even point (Sales) = BEP × price

$$\Rightarrow 492.31 \times 52.50 = 25846.15$$

Q.8. Prepare the statement of cost and profit per unit of 100 units of product of Avilash Textiles Ltd for the month of January 2012.

	01.01.2012	31.01.2012
Raw materials	Rs. 15,000	Rs. 20,000
Work in progress	Rs. 20,000	Rs. 18,000
Finished goods	Rs. 16,000	Rs. 20,000
Raw material purchase		Rs.2,00,000
Labour charges		Rs. 1,20,000
Factory overhead		Rs.60,000
Office overhead		Rs. 36,000
Selling & Distribution overhead		Rs.24,000
Total Sales		Rs. 5,00,000

Solution :

Particulars	Amount	
Opening Stock of raw material	15000	
(+) Raw Material Purchase	20000	
(−) Closing stock of Raw materials	20,000	
Material consumed		195000
(+) Labour charges		120000
Prime cost		315000
(+) Factory overheads	60,000	
(+) Opening work in Progress	20,000	
(−) Closing work in Progress	18,000	
		62,000
Work Cost		377000
(+) Office Overhead	36000	
		36000
Cost of Product		413000
(+) Opening stock of finished goods		16000
(−) Closing stock of finished goods		20000
Cost of goods sold		409000
(+) Selling & Distribution overheads		24000
Total cost		433000
Total sales		500000
Total Profit		67000

$$\text{Profit per unit} = \frac{67000}{100} = \text{Rs.6700.00}$$

$$\text{Cost per unit} = \frac{433000}{100} = \text{Rs. 4330.}$$

Sodre – II (Short Questions)

1. What is time value of Money? (2010, 2009)

Ans: – The value or purchasing power of money at a particular time is called time value of money.

') What is Continous Compounding?

Ans:- It refers to a mathematical Procedure for evaluating compounding amount factor based on continous interest system.

') What is effective rate of interest?

Ans:– The effective annual interest rate is the ratio of the interest charge in a year to the principal amount.

$$i_{eff} = \frac{f - p}{p} \quad \text{or} \quad I_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

(d) What is Annuity due? (2007)

Ans:- A Series of equal payments which paid at the begining of the period is called as Annuity due. It has two parts of payment i.e. initial payment & general annuity.

(e) What is pay-back period? (2009)

Ans: – The time period over which a machine facility or other investment has produced sufficient net revenue over cost

$$\text{Pay back Period} = \frac{\text{Required invest}}{\text{Annual Receipts} - \text{Annual payments}}$$

$$\text{or} \quad \frac{\text{Initial cost}}{\text{Annual Saving}}$$

(f) Define IRR.

Ans: – The rate of interest at which the NPV of an asset is zero.

(g) Define Depletion (2008)

Ans:– Where the assets is of wasting character due to the extraction of some materials such as oil, coal etc. is called as depletion.

(h) why should there be public projects when private projects are performing exceeding well in modern days (2012)

Ans: – Public projects are essential because they provide

Social welfare & more benefits to the public. It is more treated on Profit. +ve externalities we get more from public Sectors. To control over monopoly practice of busin public Sectors are necessary.

(j) what do you mean by discounted pay-back period?
Ans: — In this method cash flows are 1st converted into the present values by applying suitable discounting factors, & added to ascertain the period of time required to re-cov the initial outlay on the project

) what is benefit cost ratio)(2008)
Ans: The quantitative measurement of benefit to co value of a project is called as cost benefit ratio.

$$B/C = \frac{Bp}{I+Cp}$$

k) why does Straight line method so called?
Ans: — A method of depreciation where by the amount to be rea iced is spread uniformity over the estimated life of th assets, in terms of time periods or units of output.

') What is meant by opportunity cost ? Give two examples (2013
Ans: The next best alternative cost is known as opportun ty cost.
Ex: — Production TV than Radio by an electronic Compa

Q. 8. Distinguish between NPV and IRR. Give the situation where present worth method is preferable to the IRR method.

Ans.: NPV is an important criterion used for project evaluation. Net present value is equal to the pw of Revenues or benefits minus the present value of operating cost and initial cost.

$$NPV = PV(B) - PV(C)$$

$$NPV = \left[\frac{R_1}{(1+i)} + \frac{R_2}{(1+i)^2} + ... + \frac{R_n}{(1+i)^n} \right]$$
$$- \left[\frac{C_1}{(1+i)} + \frac{C_2}{(1+i)^2} + ... + \frac{C_n}{(1+i)^n} \right]$$

$R_i \rightarrow$ The series of gross present receipts or benefits for ith periods.

$C_i \rightarrow$ Cost series

Or, $NPV = -C + \frac{R_1 - C_1}{(1+i)} + \frac{R_2 - C_2}{(1+i)^2} + ... + \frac{R_n - C_n}{(1+i)^n}$

Where C is the initial cost or 1st cost at zero period.

If NPV > 0 $\Rightarrow$ A project will be socially profitable & selected.

NPV < 0 $\Rightarrow$ Undesirable & project

NPV = 0 $\Rightarrow$ IRR (Indifferent decision)

IRR refers to the percentage rate of return at which present value of benefits and present value of cost of a project is equal. It means NPV = 0.

Similarities :

The NPV and IRR method are similar to each other by following arguments.

(i). Both methods are modern technique of capital budgeting.

(ii). Both take account the time value of money into consideration.

(iii) Both are also discounted cash flow techniques.

(iv) Both the techniques assume independence among the cash flow generated by cash project under consideration.

Differences :

(i) In NPV method, present value is determined by discounting the future cash flow of a project at a pre-determined or specified rate called cut off rate. But under the IRR method cash flows are discounted at a suitable rate by hit and trial method. Here discount rate is not pre determined.

(ii) The NPV method gives importance of market rate of interestary cost of capital. On the other hand IRR method does not consider the market rate of interstand seeks to determine the maximum rate of interest at which funds invested in any project could be repaid with the earnings generated by the project.

(iii) The basic assumption of NPV method is that intermediate cash flows are reinvested where as in case of IRR intermediate cash flow is reinvested at the IRR.

(iv) In case of independent projects both methods take identical decisions but when size of cash flow, timing of projects, & pattern of cash flow differ each other, they become contradictors that given below.

The NPV & IRR method both provides consistence result of Acceptance and rejections.

In the diagram there are NPV curves for project A & B. Hence NPV curve of A lies below B.

So project B is selected by NPV method, similarly $i_A < i_B$ hence project B also selected by IRR method.
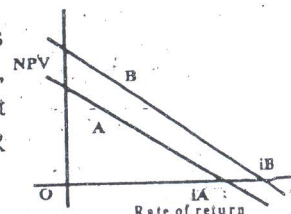
But in practice, sometime some consistency results may not available due to change in time, outlay, receipter. The ranking of projects may be quite opposite with the use of NPV & IRR method.
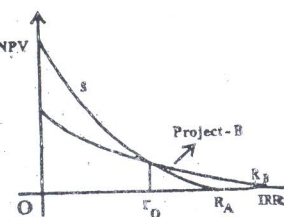
Here project B shows higher IRR than A ($R_B > R_A$) but NPV of project B is less than A for lower rate of interest when ($r < r_o$)

If $r > o$, then two methods would consistent in ranking the projects.

The NPV method is preferable for project evaluation in the following situations.

(i) If investors have storage of fund for investment.

(ii) If projects are mutually exclusive.

(iii) If projects differ in capital expenditure.

(iv) If there are −ve cash flow in the middle of life span of a project.

IRR method is preferable when

(i) the cost of capital is uncertain.

(ii) Evaluating risky projects.

(iii) It is most comparable.

(iii) It helps customers in transferring funds, from one place to another through cheques, bills of exchange etc.

(iv) It collects & pays various credit instruments like cheques, bills of exchange etc.

(v) The bank may employ income tax experts to prepare income tax returns for the customers.

(vi) Some bank may also provide passports etc. to their customers.

(vii) Customers may pay insurance, rents through bank

(ix) General utility function :

(i) The bank issues traveller cheques to customers to prevent loss of money during travel.

(ii) Banks provide locker facilities to its customers.

(iii) Banks issues letters of credit to their customers certifying their credit worthiness.

(iv) Banks provide inputs on important information relating to industry, trade etc.

(v) Deals with foreign currencies.

(vi) Some banks issue gift cheques of various denominations for auspicious occasions.

The Commercial bank plays an important role in the economy of a developing country. Commercial bank contribute to a country's economy in the following ways.

(i) It helps in capital formation by accepting deposits for economic development

(ii) It encourages entrepreneurial innovations by advancing loans to entrepreheurs.

(iii) It promotes trade and industry in developing economy.

(iv) It implements monetary policy for maintaining economic stability.

(v) It influences place of economic activities through rate of interest and availability of credit.

Role of Commercial bank in developing economy

In a modern economy banks are to be considered not only merely as dealers in money but also the leaders of the development. Commercial bank can also influence the direction in which resources to be utilised. Commercial banks can contribute to a country's economic development in following grounds.

(i) Commercial banks promote capital formation by generating and mobilising Saving for economic development.

(ii) It encourages entrepreneure invariance by providing loans to the entrepreneure.

(iii) It influences the pace of economic activities through rate of interest and availability of Credit.

(iv) It implements monetary policy for maintaining economic stability.

(v) It promotes trade and industry in developing economy.

Q.7. Discuss the present worth method of evaluating engineering alternatives. Give the situations where present worth method is preferred to IRR method.

Ans. In all engineering problems engineers encounter one i,e slection of projects. To select the best alternatives various methods have been evolved. Present worth comparision method is one of important method of comparision. In this method of comparision the present worth of all cash inflow (revenue) is compared against the present worth of all cash out flows associated with an investment project. Under this method all cash flows are discounted to time zero by assuming a specific rate of interest.

The present worth method is based on following assumptions

(1) The cash flow should be known

(2) Purchasing power of money is assumed to be constant.

(3) The interest rate should be known.

(4) Comparision should be made before tax.

(5) Comparision should not include intangible consideration.

If there is a single project, then decision whether a project will be selected or rejected can be made accordingly.

If NPW>0 the proposal will be selected. It means the present value of receipts is greater than present value of disbursement. So the difference between PW of revenue & PW of cost is called as net present worth.

If NPW > 0 $\Rightarrow$ Project will be selected

NPW = 0 $\Rightarrow$ Project will be indifferent in dicision

NPW < 0 $\Rightarrow$ Project will be rejected.

In case there are mutual exclusive alternatives, then the present worth cash flow can be calculated by two prominent methods.

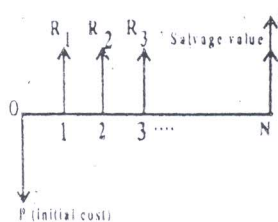(1) Revenue dominated cash flow

(2) Cost dominated cash flow.

... revenue dominated cash flow the profit, revenue, salvage value, will be assigned as +ve sign and initial cost, operating and maintenance charge are −ve in nature.

On the other hand cost dominated cash flow indicates costs or outflows are +ve & profit, revenue and salvage value are −ve sign.

In revenue dominated, the decision is to select the alternative with the maximum profit. It means if $PW_A > PW_B \Rightarrow$ A will be selected. For cost dominated cash flow if PW(A) < PW(B) $\Rightarrow$ A will be selected

Revenue dominated	Cost dominated
Cash flow	Cash flow
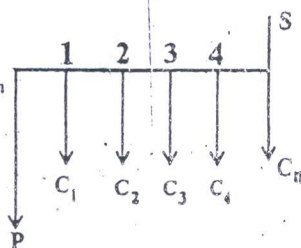
(Revenue dominated)

To find present worth of the cash flow we can flow the formula given below.
PW(i)

$$= -P + \frac{R_1}{(1+i)} + \frac{R_2}{(1+i)^2} + \dots + \frac{R_n}{(1+i)^n} + \frac{S}{(1+i)^n}$$

Or, PW(i) = −P + R_1(P/F, i, 1) + R_2(P/F, i, 2) + ...
+ R_n(P/F i,N) + S(P/F, i, N)

If it is an equal payment series
PW (i) = −P + R(P/A i, N) + S(P/F, i, N)

For cost dominated cash flow P is the initial cost, S is salvage value, R_i - Revenue, C_i is cost series. So the formula is PW(i)

$$= P + \frac{C_1}{(1+i)} + \frac{C_2}{(1+i)^2} + \dots + \frac{C_n}{(1+i)^n} - \frac{S}{(1+i)^n}$$

Or, PW(i) = P + C_1(P/F i,1) + C_2(P/F i,2)+....+C_n
(P/F i,N) − S(P/F i,N)

In case of uniform series
PW(i) = P+C(P/A i,N) − S(P/F i,N)

Example : The Bajaj co. ltd. is planning to expand its production operation by using two technologies given:

Technology	Initial Cost	Annual returns	Life Period
A	12,00,000	4,00,000	10
B	18,00,000	5,00,000	10

which should be adopted at 20% rate of interest.

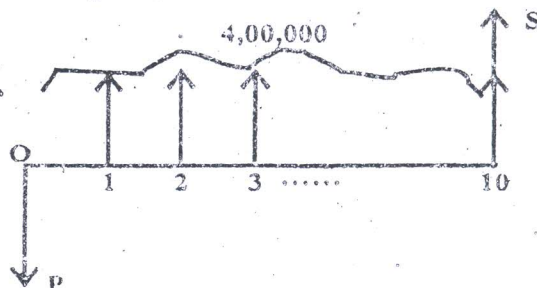**Solution :**

Technology A provides following data.
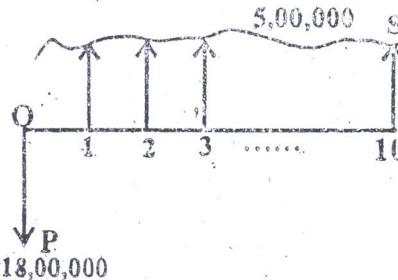P = Rs. 12,00,000
A = Rs. 4,00,000
i = 20
N = 10

The cash flow diagram is given below without salvage value.

$PW_A(20\%) = -P + A(P/A\ i,N)$
$= -12,00,000 + 4,00,000\ (P/A\ 20\%\ 10)$
$= -12,00,000 + 4,00,000\ (4.1925)$
$= -12,00,000 + 16,77,000$
$= 4,77,000$

In technology-B the cash flow diagram is

$PW_B(20\%) = -18,00,000 + 5,00,000\ (P/A\ 20\%\ 10)$
$= -18,00,000 + 5,00,000\ (4.1925)$
$= -18,00,000 + 20,9,6250$
$= Rs.\ 2,96,250$

(4) It studies about margin of safty of production.

Calculations : It is usually expressed in terms of percentages by

$$P/V \text{ ratio} = \frac{Contribution}{Sales} \times 100$$

$$= \frac{P - V}{P} \times 100$$

$$= \frac{Change\ in\ contribution}{Change\ in\ sales}$$

For multiple project or firms and

$$P/V \text{ ratio} = \frac{Change\ in\ Profit}{Change\ in\ sales}$$

or $$P/V \text{ ratio} = \frac{Profit}{Margin\ of\ Safety}$$

(c) Marginal cost.

It is an important derived element of the total cost. It may be defined as the extra cost or expenditure incured by a firm in producing an additional unit of outpit. It shows the movement of total cost curve. It is estimated by

$$MC = TC_n - TC_{n-1}$$

In short run production function we can get MC from total variable cost. $MC = TVC_n - TVC_n$

In other words marginal cost the ratio of change in total cost to change in output produced.

$$MC = \frac{\Delta C}{\Delta q} \quad Or \quad MC = \frac{dC}{dq}$$

It is also known as slope of the total cost function. The shape of the marginal cost curve is 'U' shaped due to the operation of increasing return and diminishing return in production process.
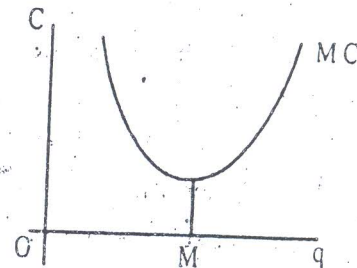
Importance :

1. It helps to find supply function of the industry in perfect competition.

2. It helps in firms equilibrium identification, i.e. MR = MC.

3. It calculates Total Cost of the firm.

4. It determines stages of production.

5. It helps to locate the Break-even point also.

Here $PW_{(A)} > PW_{(B)}$ though it is revenue dominated project A is selected

(i) Present worth gives the value maximising decision, when projects are used to choice of capital rationing system.

(ii) It can be used in which the sign of the cash flows are changed more then once in the project period.

(iii) It is useful in mutual exclusive project.

(iv) It helps to compute IRR.

Q.8. (a) Principle of Economic Equivalence

Ans.: Economic equivalence means the cash flows have same value in different time periods. It produces same effect in present and future situations. There are four principles of equivalence.

(1) Equivalence between cash flows

Now Rs. 1000/- will become Rs. 1100/- at the end of one year at 10% rate of interest. It means P = Rs 1000/- i = 10% N = 1
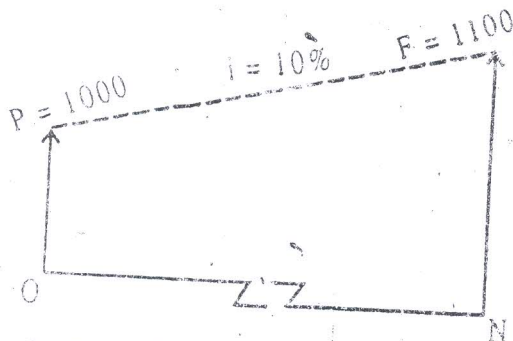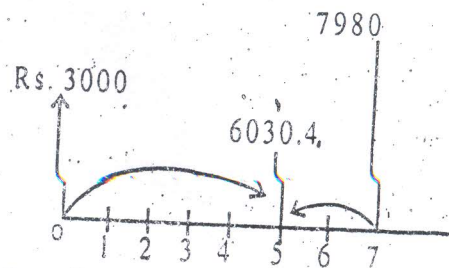

$$F = P(1+i)^N$$
$$\Rightarrow 1100 = 1000(1+0.01)$$

Similarly $P = F(1+i)^{-N}$
$$\Rightarrow 1000 = 1100(1+0.01)^{-1}$$

It means Rs. 1000/- now equivalent with Rs. 1100 after one year.

(2) Equivalance at any common point

Some times a certain equivalance in cash flows we get at a common point at a specific rate of interest but in different time period by compounding or discounting the cash flows.

Ex. P = Rs. 3000
N = 7 Years
i = 15%
$F = P(1+i)^N$
$F = 3000 (1+0.15)^7$
= 7980

In 5 years the future value will be F = 6030.4. If we estimate present worth from Rs. 7980 for 2 year it will be P = Rs. 6030.40

It means $3000(1+0.15)^5 = 7980(1+0.15)^{-2}$

(3) Equivalence by rate of interest

This principle states that any change in rate of interest will destroy the equivalence between two cash flows in different periods.

(4) Equivalence between Receipts and payments.

In equivalence principle It is required to calculate unknown time period and interest rate to maintain equivalence between Receipts and payments.

(b) P/V Ratio

Ans.: The P/V ratio shows the relationship between the contribution and value of sales. It is also known as contribution sales ratio. It gives the impact of change in output level as operating income or profit. It studies about the profit position of firm. It shows the financial position or strength of the company. High P/V ratio indicates high degree of profitability of the firm and opposite.

Importance : (1) It helps to determine Break-even point, sales.

(2) It calculates volume of profit from sales.

(3) It helps to estimate desired level of profit from sales.