# MUZAFFARPUR INSTITUTE OF TECHNOLOGY, MUZAFFARPUR, BIHAR – 842003

# Industrial Economics and Accounting

# Branch : IT (3rd Semester)

**Max Marks:20** **Time : 2hrs**

**NOTE: Attempt any four questions.**

**Each question carries equal marks.**

1. **Define production function. Explain law of variable proportion**.

production function relates physical output of a production process to physical inputs or factors of production. It is a mathematical function that relates the maximum amount of output that can be obtained from a given number of inputs – generally capital and labor

The law of variable proportions states that as the quantity of one factor is increased, keeping the other factors fixed, the marginal product of that factor will eventually decline. This means that upto the use of a certain amount of variable factor, marginal product of the factor may increase and after a certain stage it starts diminishing. When the variable factor becomes relatively abundant, the marginal product may become negative.

Assumptions: The law of variable proportions holds good under the following conditions:

Constant State of Technology: First, the state of technology is assumed to be given and unchanged. If there is improvement in the technology, then the marginal product may rise instead of diminishing.

Fixed Amount of Other Factors: Secondly, there must be some inputs whose quantity is kept fixed. It is only in this way that we can alter the factor proportions and know its effects on output. The law does not apply if all factors are proportionately varied.

Possibility of Varying the Factor proportions: Thirdly, the law is based upon the possibility of varying the proportions in which the various factors can be combined to produce a product. The law does not apply if the factors must be used in fixed proportions to yield a product.

The law of variable proportion is illustrated in the following table and figure. Suppose there is a given amount of land in which more and more labour (variable factor) is used to produce wheat.

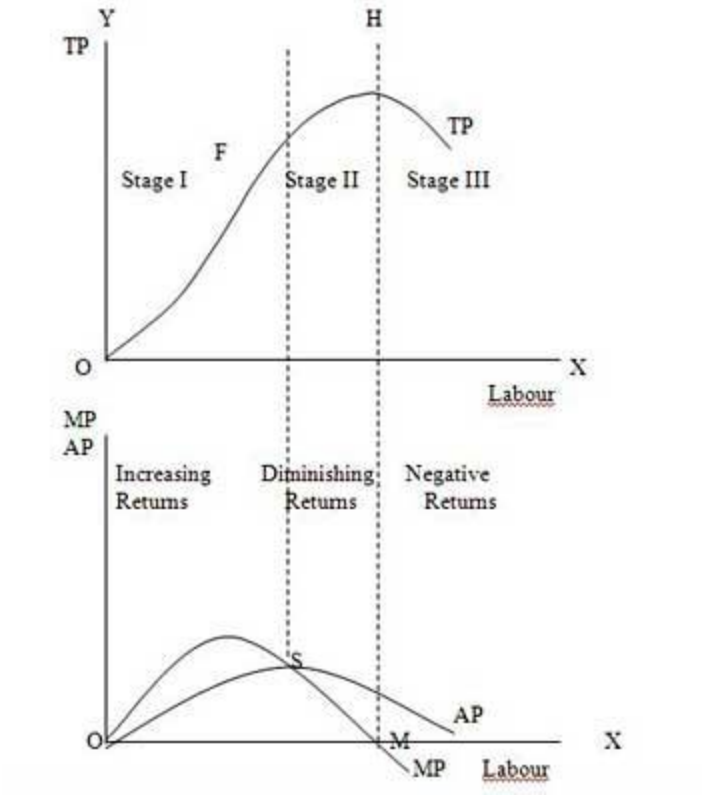
| Units of Labour | Total Product | Marginal Product | Average Product |
|---|---|---|---|
| 1 | 2 | 2 | 2 |
| 2 | 6 | 4 | 3 |
| 3 | 12 | 6 | 4 |
| 4 | 16 | 4 | 4 |
| 5 | 18 | 2 | 3.6 |
| 6 | 18 | 0 | 3 |
| 7 | 14 | -4 | 2 |
| 8 | 8 | -6 | 1 |

It can be seen from the table that upto the use of 3 units of labour, total product increases at an increasing rate and beyond the third unit total product increases at a diminishing rate. This fact is shown by the marginal product which is the addition made to Total Product as a result of increasing the variable factor i.e. labour.

It can be seen from the table that the marginal product of labour initially rises and beyond the use of three units of labour, it starts diminishing. The use of six units of labour does not add anything to the total production of wheat. Hence, the marginal product of labour has fallen to zero. Beyond the use of six units of labour, total product diminishes and therefore marginal product of labour becomes negative. Regarding the average product of labour, it rises up to the use of third unit of labour and beyond that it is falling throughout.

Three Stages of the Law of Variable Proportions: These stages are illustrated in the following figure where labour is measured on the X-axis and output on the Y-axis.

Stage 1. Stage of Increasing Returns: In this stage, total product increases at an increasing rate up to a point. This is because the efficiency of the fixed factors increases as additional units of the variable factors are added to it. In the figure, from the origin to the point F, slope of the total product curve TP is increasing i.e. the curve TP is concave upwards upto the point F, which means that the marginal product MP of labour rises. The point F where the total product stops increasing at an increasing rate and starts increasing at a diminishing rate is called the point of inflection. Corresponding vertically to this point of inflection marginal product of labour is maximum, after which it diminishes. This stage is called the stage of increasing returns because the average product of the variable factor increases throughout this stage. This stage ends at the point where the average product curve reaches its highest point.




Stage 2. Stage of Diminishing Returns: In this stage, total product continues to increase but at a diminishing rate until it reaches its maximum point H where the second stage ends. In this stage both the marginal product and average product of labour are diminishing but are positive. This is because the fixed factor becomes inadequate relative to the quantity of the variable factor. At the end of the second stage, i.e., at point M marginal product of labour is zero which corresponds to the maximum point H of the total product curve TP. This stage is important because the firm will seek to produce in this range.

Stage 3. Stage of Negative Returns: In stage 3, total product declines and therefore the TP curve slopes downward. As a result, marginal product of labour is negative and the MP curve falls below the X-axis. In this stage the variable factor (labour) is too much relative to the fixed factor.

2. **Define law of demand. What are the exceptions to this law? Explain with appropriate example**.

The law of demand expresses a relationship between the quantity demanded and its price. It may be defined in Marshall's words as "the amount demanded increases with a fall in price, and diminishes with a rise in price". Thus it expresses an inverse relation between price and demand. The law refers to the direction in which quantity demanded changes with a change in price.

**Assumptions *of the Law of Demand:***

(i) There is no change in the tastes and preferences of the consumer;

(ii) The income of the consumer remains constant;

(iii) There is no change in customs;

(iv) The commodity to be used should not confer distinction on the consumer;

(v) There should not be any substitutes of the commodity;

(vi) There should not be any change in the prices of other products;

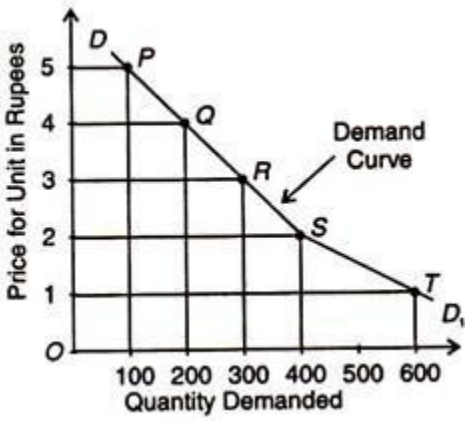
(vii) There should not be any possibility of change in the price of the product being used;

(viii) There should not be any change in the quality of the product; and

(ix) The habits of the consumers should remain unchanged. Given these conditions, the law of demand operates. If there is change even in one of these conditions, it will stop operating.

**Demand Schedule**

| Price (Rs) | Quantity Demanded |
|---|---|
| 5 | 100 Units |
| 4 | 200 Units |
| 3 | 300 Units |
| 2 | 400 Units |
| 1 | 600 Units |




The above table shows that when the price of say, orange, is Rs. 5 per unit, 100 units are demanded. If the price falls to Rs.4, the demand increases to 200 units. Similarly, when the price declines to Re.1, the demand increases to 600 units. On the contrary, as the price increases from Re. 1, the demand continues to decline from 600 units.

In the figure, point P of the demand curve DD1 shows demand for 100 units at the Rs. 5. As the price falls to Rs. 4, Rs. 3, Rs. 2 and Re. 1, the demand rises to 200, 300, 400 and 600 units respectively. This is clear from points Q, R, S, and T. Thus, the demand curve DD1 shows increase in demand of orange when its price falls. This indicates the inverse relation between price and demand.

**Exceptions to law of demand**

**Inferior goods/ Giffen goods**

Some special varieties of inferior goods are termed as giffen goods. Cheaper varieties of goods like low priced rice, low priced bread, etc. are some examples of Giffen goods.

This exception was pointed out by Robert Giffen who observed that when the price of bread increased, the low paid British workers purchased lesser quantity of bread, which is against the law of demand. Thus, in case of Giffen goods, there is indirect relationship between price and quantity demanded.

**Goods having prestige value**

This exception is associated with the name of the economist, T.Velben and his doctrine of conspicuous conception. Few goods like diamond can be purchased only by rich people. The prices of these goods are so high that they are beyond the capacity of common people. The higher the price of the diamond the higher the prestige value of it.

In this case, a consumer will buy less of the diamonds at a low price .

**3. What is market? Discuss various type of market structures in detail.**

A market is defined as the sum total of all the buyers and sellers in the area or region under consideration. The area may be the earth, or countries, regions, states, or cities.

**The Four Types of Market Structures**

**Perfect Competition**

Perfect competition describes a market structure, where a large number of small firms compete against each other. In this scenario, a single firm does not have any significant market power. As a result, the industry as a whole produces the socially optimal level of output, because none of the firms have the ability to influence market prices.

The idea of perfect competition builds on a number of assumptions: (1) all firms maximize profits (2) there is free entry and exit to the market, (3) all firms sell completely identical (i.e. homogenous) goods, (4) there are no consumer preferences. By looking at those assumptions it becomes quite obvious, that we will hardly ever find perfect competition in reality. This is an important aspect, because it is the only market structure that can (theoretically) result in a socially optimal level of output.

Probably the best example of a market with almost perfect competition we can find in reality is the stock market.

## Monopolistic Competition

Monopolistic competition also refers to a market structure, where a large number of small firms compete against each other. However, unlike in perfect competition, the firms in monopolistic competition sell similar, but slightly differentiated products. This gives them a certain degree of market power which allows them to charge higher prices within a certain range.

Monopolistic competition builds on the following assumptions: (1) all firms maximize profits (2) there is free entry and exit to the market, (3) firms sell differentiated products (4) consumers may prefer one product over the other. Now, those assumptions are a bit closer to reality than the ones we looked at in perfect competition. However, this market structure will no longer result in a socially optimal level of output, because the firms have more power and can influence market prices to a certain degree.

An example of monopolistic competition is the market for cereals. There is a huge number of different brands  Most of them probably taste slightly different, but at the end of the day, they are all breakfast cereals.

### Oligopoly

An oligopoly describes a market structure which is dominated by only a small number firms. This results in a state of limited competition. The firms can either compete against each other or collaborate. By doing so they can use their collective market power to drive up prices and earn more profit.

The oligopolistic market structure builds on the following assumptions: (1) all firms maximize profits, (2) oligopolies can set prices, (3) there are barriers to entry and exit in the market, (4) products may be homogenous or differentiated, and (5) there is only a few firms that dominate the market. Unfortunately, it is not clearly defined what a «few» firms means exactly. As a rule of thumb, we say that an oligopoly typically consists of about 3-5 dominant firms.

To give an example of an oligopoly, let's look at the market for gaming consoles. This market is dominated by three powerful companies: Microsoft, Sony, and Nintendo. This leaves all of them with a significant amount of market power.

### Monopoly

A monopoly refers to a market structure where a single firm controls the entire market. In this scenario, the firm has the highest level of market power, as consumers do not have any alternatives. As a result, monopilists often reduce output to increase prices and earn more profit.

The following assumptions are made when we talk about monopolies: (1) the monopolist maximizes profit, (2) it can set the price, (3) there are high barriers to entry and exit, (4) there is only one firm that dominates the entire market.

From the perspective of society, most monopolies are usually not desirable, because they result in lower outputs and higher prices compared to competitive markets. Therefore, they are often regulated by the government.

**4. What do you mean elasticity of demand? Discuss cross elasticity and income elasticity of demand in detail.**

The **Elasticity of Demand** measures the percentage change in quantity demanded for a percentage change in the price. Simply, the relative change in demand for a commodity as a result of a relative change in its price is called as the elasticity of demand

income elasticity of demand is the degree of responsiveness of quantity demanded of a commodity due to change in consumer's income, other things remaining constant. In other words, it measures by how much the quantity demanded changes with respect to the change in income.

## Expression of Income Elasticity of Demand

Mathematically, it is expressed as:

$$\text{Income elasticity of demand} = \frac{\%change\ in\ quantity\ demanded}{\%change\ in\ income}$$

Symbolically, it is expressed as:

$$E_Y = \frac{\Delta q}{\Delta y} \times \frac{y}{q}$$

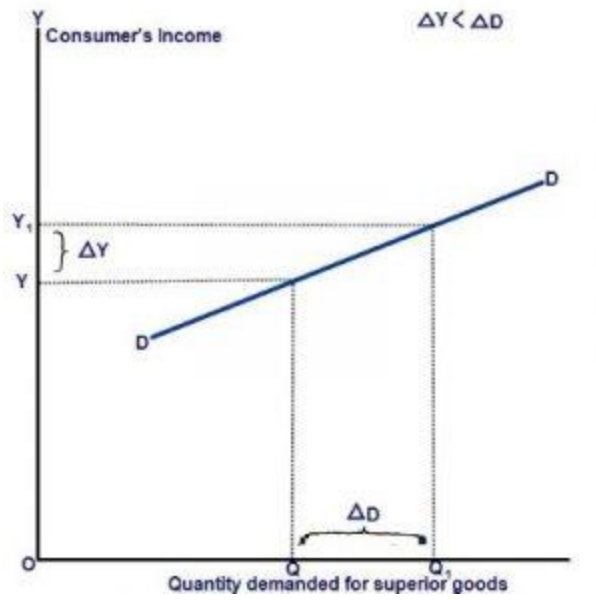
***1. Positive income elasticity of demand ($E_Y$>0)***

If there is direct relationship between income of the consumer and demand for the commodity, then income elasticity will be positive. That is, if the quantity demanded for a commodity increases with the rise in income of the consumer and vice versa, it is said to be positive income elasticity of demand. For example: as the income of consumer increases, they consume more of superior (luxurious) goods. On the contrary, as the income of consumer decreases, they consume less of luxurious goods.

Positive income elasticity can be further classified into three types:

- **Income elasticity greater than unity ($E_Y$ > 1)**

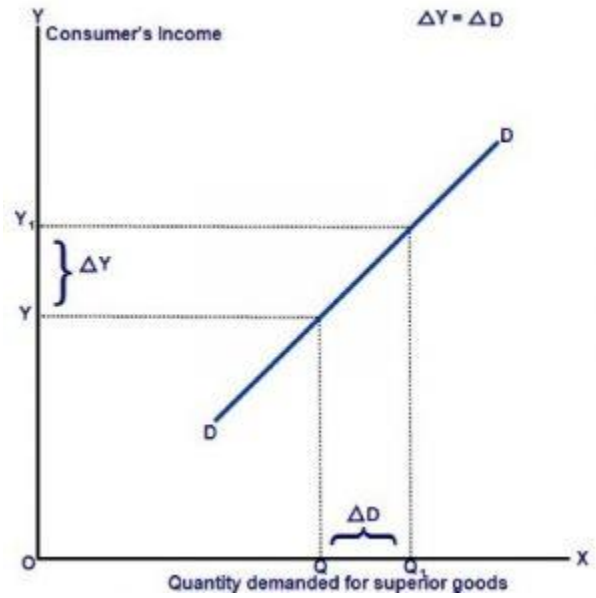
If the percentage change in quantity demanded for a commodity is greater than percentage change in income of the consumer, it is said to be income greater than unity. For example: When the consumer's income rises by 3% and the demand rises by 7%, it is the case of income elasticity greater than unity.




In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The small rise in income from **OY** to **$OY_1$** has caused greater rise in the quantity demanded from **OQ** to **$OQ_1$** and vice versa. Thus, the demand curve **DD** shows income elasticity greater than unity.

- **Income elasticity equal to unity ($E_Y = 1$)**

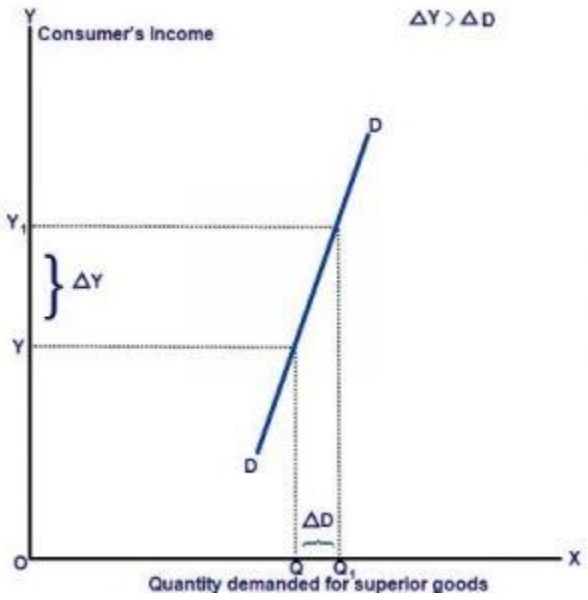
If the percentage change in quantity demanded for a commodity is equal to percentage change in income of the consumer, it is said to be income elasticity equal to unity. For example: When the consumer's income rises by 5% and the demand rises by 5%, it is the case of income elasticity equal to unity.



In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The small rise in income from **OY** to **$OY_1$** has caused equal rise in the quantity demanded from **OQ** to **$OQ_1$** and vice versa. Thus, the demand curve **DD** shows income elasticity equal to unity.

- **Income elasticity less than unity ($E_Y < 1$)**

If the percentage change in quantity demanded for a commodity is less than percentage change in income of the consumer, it is said to be income greater than unity. For example: When the consumer's income rises by 5% and the demand rises by 3%, it is the case of income elasticity less than unity.




In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The greater rise in income from **OY** to **$OY_1$** has caused small rise in the quantity demanded from **OQ** to **$OQ_1$** and vice versa. Thus, the demand curve **DD** shows income elasticity less than unity.

**Cross Elasticity of Demand:**

It is the ratio of proportionate change in the quantity demanded of Y to a given proportionate change in the price of the related commodity X.

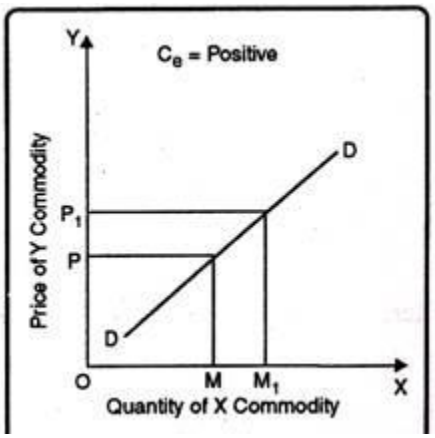
Cross elasticity may be infinite or zero if the slightest change in the price of X causes a substantial change in the quantity demanded of Y. It is always the case with goods which have perfect substitutes for one another. Cross elasticity is zero, if a change in the price of one commodity will not affect the quantity demanded of the other. In the case of goods which are not related to each other, cross elasticity of demand is zero.

**Types of Cross Elasticity of Demand:**

***1. Positive:***

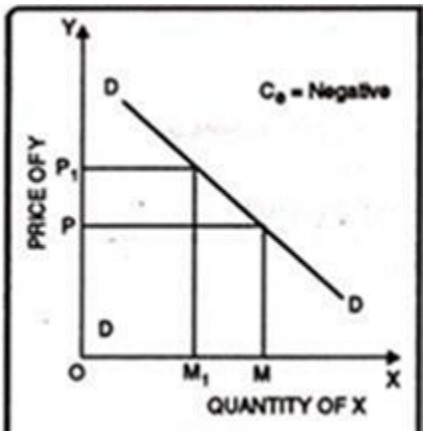
When goods are substitute of each other then cross elasticity of demand is positive. In other words, when an increase in the price of Y leads to an increase in the demand of X. For instance, with the increase in price of tea, demand of coffee will increase.

In fig quantity has been measured on OX-axis and price on OY-axis. At price OP of Y-commodity, demand of X-commodity is OM. Now as price of Y commodity increases to OP1 demand of X-commodity increases to OM1 Thus, cross elasticity of demand is positive.



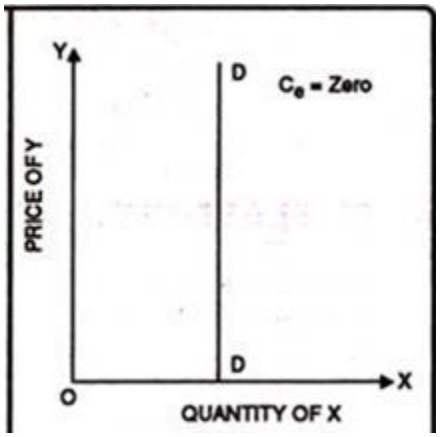

***2.* Negative*:***

In case of complementary goods, cross elasticity of demand is negative. A proportionate increase in price of one commodity leads to a proportionate fall in the demand of another commodity because both are demanded jointly. In fig. 22 quantity has been measured on OX-axis while price has been measured on OY-axis. When the price of commodity increases from OP to OP1 quantity demanded falls from OM to OM1. Thus, cross elasticity of demand is negative.



***3.* Zero*:***

Cross elasticity of demand is zero when two goods are not related to each other. For instance, increase in price of car does not effect the demand of cloth. Thus, cross elasticity of demand is zero. It has been shown in fig.




Therefore, it depends upon substitutability of goods. If substitutability is perfect, cross elasticity is infinite; if on the other hand, substitutability does not exist, cross elasticity is zero. In the case of complementary goods like jointly demanded goods cross elasticity is negative. A rise in the price of one commodity X will mean not only decrease in the quantity of X but also decrease in the quantity demanded of Y because both are demanded together.

5.**Define returns to scale. What conditions constitutes (a) Increasing returns to scale and (b) Decreasing returns to scale?**

Law of Returns to Scale : Definition, Explanation and Its Types

In the long run all factors of production are variable. No factor is fixed. Accordingly, the scale of production can be changed by changing the quantity of all factors of production.

Returns to scale are of the following three types:

1. Increasing Returns to scale.

2. Constant Returns to Scale

3. Diminishing Returns to Scale

Explanation:

In the long run, output can be increased by increasing all factors in the same proportion. Generally, laws of returns to scale refer to an increase in output due to increase in all factors in the same proportion. Such an increase is called returns to scale.

Suppose, initially production function is as follows:

P = f (L, K)

Now, if both the factors of production i.e., labour and capital are increased in same proportion i.e., x, product function will be rewritten as.

$$P_1 = f(xL, xK)$$

1. If $P_1$ increases in the same proportion as the increase in factors of production i.e., $\frac{P_1}{P} = x$, it will be constant returns to scale.

2. If $P_1$ increases less than proportionate increase in the factors of production *i.e.*, $\frac{P_1}{P} < x$, it will be diminishing returns to scale.

3. If $P_1$ increases more than proportionate increase in the factors of production, *i.e.*, $\frac{P_1}{P} > x$, it will be increasing returns to scale. Returns to scale can be shown with the help of table 8.

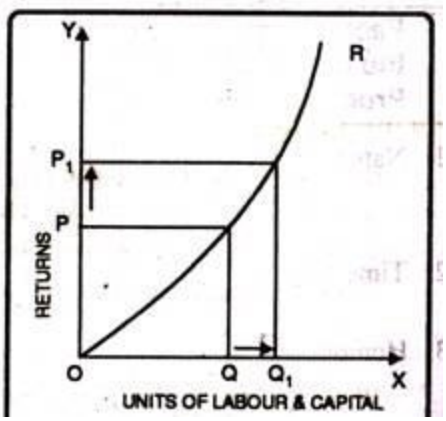
**Table 8. Showing different stages of return to scale**

| Units of Labour | Units of capital | %age increase in Labour & Capital | Total Product | %age increase in TP | Returns to scale |
|---|---|---|---|---|---|
| 1 | 3 | – | 10 | – | |
| 2 | 9 | 100% | 30 | 200% | Increasing |
| 3 | 9 | 50% | 60 | 100% | |
| 4 | 12 | 33% | 80 | 33% | Constant |
| 5 | 15 | 25% | 100 | 25% | |
| 6 | 18 | 20% | 120 | 10% | Decreasing |
| 7 | 21 | 16.6% | 130 | 8.3% | |

The above stated table explains the following three stages of returns to scale:

1. Increasing Returns to Scale:

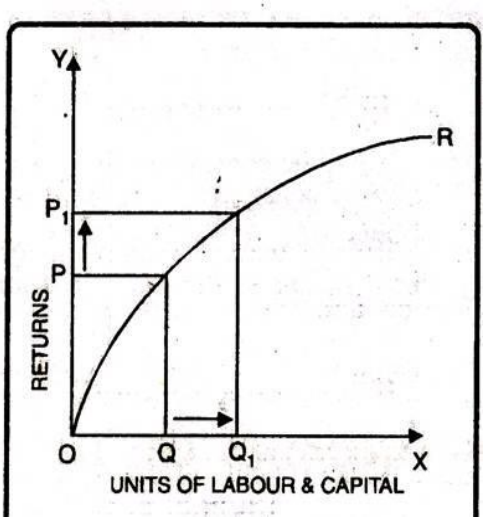
Increasing returns to scale or diminishing cost refers to a situation when all factors of production are increased, output increases at a higher rate. It means if all inputs are doubled, output will also increase at the faster rate than double. Hence, it is said to be increasing returns to scale. This increase is due to many reasons like division external economies of scale. Increasing returns to scale can be illustrated with the help of a diagram .




In figure 8, OX axis represents increase in labour and capital while OY axis shows increase in output. When labour and capital increases from Q to Q1, output also increases from P to P1 which is higher than the factors of production i.e. labour and capital.

2. Diminishing Returns to Scale

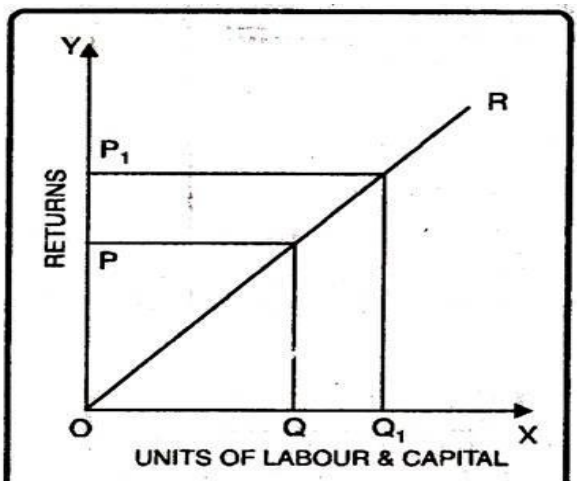
Diminishing returns or increasing costs refer to that production situation, where if all the factors of production are increased in a given proportion, output increases in a smaller proportion. It means, if inputs are doubled, output will be less than doubled. If 20 percent increase in labour and capital is followed by 10 percent increase in output, then it is an instance of diminishing returns to scale.




In this diagram, diminishing returns to scale has been shown. On OX axis, labour and capital are given while on OY axis, output. When factors of production increase from Q to Q1 (more quantity) but as a result increase in output, i.e. P to P1 is less. We see that increase in factors of production is more and increase in production is comparatively less, thus diminishing returns to scale apply.

3. Constant Returns to Scale:

Constant returns to scale or constant cost refers to the production situation in which output increases exactly in the same proportion in which factors of production are increased. In simple terms, if factors of production are doubled output will also be doubled.




**6. What are explicit and implicit costs? How do they differ? Give example of each.**

Explicit Costs are the costs which involve an immediate outlay of cash from the business. The cost is incurred when any production process is going on, or activity is conducted in the normal course of business. The cost is a charge for the use of factors of production like land, labour, capital and so on. They are in the form of rent, salary, material, wages, and other expenses like electricity, stationery, postage, etc. Explicit Costs show that payment has been made to outsiders, while business is carried on. The recognition and reporting of the explicit cost are very easy because they are recorded when they arise. They show that an amount has been spent over a business transaction. They can be calculated in terms of money. Recording of the explicit cost is very important because it helps in the calculation of profit as well as it fulfils purposes like decision-making, cost control, reporting, etc.

Definition of Implicit Cost

Implicit Cost, also known as the economic cost, is the cost which the company had foregone while employing the alternative course of action. They do not involve any outflow of cash from the business. It is the value of sacrifice made by the entity at the time of exercising some other action. The cost occurs when an asset is used as a factor of production by the entity instead of renting it out. As they are not actually incurred they cannot be easily measured, but they can be estimated. They are not recorded in the books of accounts as well as these are not reported. The purpose of ascertaining the implicit cost is that it helps in decision making regarding the replacement of any asset and much more. Implicit costs have a direct impact on the profitability

and performance of the company. Some common examples of implicit costs are Interest on owner's capital, salary to the proprietor, etc. which are not actually incurred but they exist.

Key Differences Between Explicit Cost and Implicit Cost

The following are the major differences between explicit cost and implicit cost

Explicit Cost is incurred when the entity has to pay for the utilisation of factors of production. Implicit Cost is the opportunity cost, which is incurred when the entity uses the owner's resources like capital inventory etc.

Explicit Cost is also known as out-of-pocket cost while Implicit costs are known as imputed cost.

Explicit Cost can be easily ascertained, but it is just opposite in the case of Implicit Cost as it does not have any paper trail.

The measurement of Explicit Cost is objective in nature because it is actually incurred whereas Implicit Cost occurs indirectly and that is why its measurement is subjective.

Explicit Cost helps in the calculation of both accounting profit and economic profit. Conversely, Implicit Cost helps in the calculation of only economic profit.

Explicit Cost is recorded and reported to the management. On the other hand, the implicit cost is neither recorded nor reported to the management of the company.