Production and Cost

I. Answer the following in a sentence each.

Question 1. What do you mean by production?
Answer: Production is the process in which transformation of inputs into output takes place. Here inputs are converted into output. For example, raw cotton is made into cloth.

Question 2. Define Production function.
Answer: According to Watson, Production function is "the relationship between physical inputs and physical output of a firm".

Question 3. What is Total Product?
Answer: Total product refers to total volume of goods and services produced by a firm during a specified period of time.

Question 4: What is Average Product?
Answer: The Average product refers to per unit of output produced with the help of variable factor.

Question 5: Define Marginal Product.
Answer: The Marginal Product refers to additional unit of output produced with help of additional factor input.

Question 6. Define Iso-quant.
Answer: An Iso-quant is a curve on which the various combinations of labour and capital show the same level of output. It also refers to the locus of all possible combinations of two inputs (Labour and Capital) which result in the same output level.

Question 7. What do you mean by cost?
Answer: Cost of production refers to the expenses incurred by the producer to produce various goods and services. It includes all those expenditures incurred by a firm or industry to manufacture their products.

Question 8: What is Fixed cost?
Ans. These are the costs which are incurred on fixed factors of production. The amount of expenditure.spent on fixed factors is unaltered in the short run.

Question 9. What is Variable cost?
Answer: Variable costs are the expenses incurred on the variable inputs like raw materials, ordinary labourers, electricity etc.

Question 10. Define Total cost.
Answer: It is the aggregate money expenditure incurred by the firm on all the factors to produce a given quantity of output.

Question 11. What is Average variable cost?
Answer: It is a variable cost for per unit of output. It can be calculated by dividing total variable cost by the total units of output.

**Question** 12: What is average cost?
Answer: It is the cost per unit of output produced. It is obtained by dividing total cost by the total output produced, i.e. AC = TC/output.

Question 13: Define Marginal cost.
Ans. It is an additional cost incurred to produce an additional output. In other words it is the net additions to the total cost when one more unit of output is produced. MC = $TC_n - TC_{n-1}$,

Question 14. What is the shape of MC and AC curves?
Answer: The shape of AC and MC is 'U' shaped and can be represented as follows:
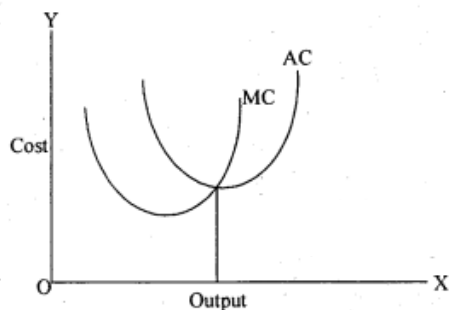
Question 15. Who introduced the concept of Real cost?
Answer: Prof. Alfred Marshall introduced the concept of Real cost.

Two Marks Questions

Question 1. Write the production function in the form of an equation.
Answer: The production function can be written as follows:
Q = f(R, L, K, O…..) where Q is quantity produced, f is function, R refers to Land, L to labour K to capital, O to organization.

Question 2: If 4 units of labour produce 70 units of'x'and 5 units of labour produce 75 units of 'x', calculate Marginal product and Average product.

Answer: Calculation of Marginal product:

4 Labour – 70 Units of 'x'

5 Labour- 75 Units of 'x'

$MP = TP_n - TP_{n-1}$, where $TP_n = 75$, $TP_{n-1} = 70$

= 75 – 70

= 5 units of product.

So, MP = 5

Calculation of Average Product (AP):

AP = TP/Input(Labour)

4 Labour – 70 Units of 'x'

AP = 70/4 = 17.5 with 4 labourers and capital

5 Labour- 75 Units of 'x'

AP = 75/5 = 15 with 5 labourers and capital

Question 3. Why are Average and Marginal Cost curves 'U' shaped.

Answer: For an increase in the output, AC and MC fall initially then reach a minimum value and later rise with the rise in output. The change in MC is greater than that in AC.

In the beginning, AC falls due to the more influence of of AFC and later rises under the influence of AVC with an increase in output. This makes AC to become U shaped.

MC falls as output increases in the beginning. It starts rising after a certain level of output. This happens because of the influence of the law of variable proportions. The fact that Marginal Product rises first, reaches maximum and then declines ensures that the Marginal Cost curve of a firm declines first, reaches minimum and then rises and becomes U shaped.

Question 4. Mention the three laws of variable proportions. .

Answer: The three laws of Variable Proportions are as follows:

The law of Increasing Returns.

The law of Diminishing Returns.

The Law of Negative Returns.

Question 5. Write the meaning of increasing returns.

Answer: When the output increases in a greater proportion than the increase in inputs it is called as Increasing Returns. When a firm expands, increasing returns to

scale are obtained in the beginning. Here the Total Product increases at increasing rate, For example, if there is 20% increase in inputs, the output increases by 30%.

Question 6. Give the meaning of diminishing returns.
Answer: Also known as decreasing returns to scale, operates when output increases in a smaller proportion for an increase in all inputs. Here, the Total Product increases in a decreasing rate. For example, if a producer increases all inputs by 20%, the total product may increase by 15% only.

Question 7. Mention any four short run costs:
Answer: The four major short run costs are as follows:

Fixed Cost

Variable Cost

Total Cost

Average Cost.

Question 8. Mention the costs involved in the long run.
Answer: In the long run, we have three types of costs viz.., Total cost, Long run average cost, and Long run marginal cost.

Question 9. Why does the SMC cut SAVC at its minimum point? .
Answer: When the Short run Average Variable Cost (SAVC) is decreasing, the Short run Marginal Cost (SMC) also should decrease and when SAVC increases, the SMC should also increase but more than SAVC. Hence, the SMC curve has to cut SAVC from below at the minimum point.

Question 10. What is Opportunity cost?
Answer: It is the cost of the next best alternative product which is measured in terms of revenue earned by the factor when it is employed in other alternative jobs.

In other words it is the cost of displaced alternative. While calculating opportunity cost the profit earned from the best alternative employment sacrificed is taken into consideration.
The concept of opportunity cost was popularized by an American writer - Prof.Heberlour.

Five Marks Questions

Question 1. Explain the concepts of Total Product, Average Product and Marginal Product with the help of a diagram:
Answer: (i) Total Product (TP): It refers to the aggregate output produced with the

help of factor inputs during a particular period of time. It is obtained by adding the Marginal product contributed by each input.

(ii) Average Product(AP): Average product is an unit of output which is produced per unit input. It is calculated by dividing the Total Product by the variable inputs.

$$AP = \frac{TP}{L}$$

where TP is Total product and L variable factor input (e.g. Labour)

(iii) Marginal Product (MP): Marginal product refers to additional unit of output produced with the help of additional unit of input of labour or Capital. We can calculate MP with the help of the following formula:
MP = TP_n – TP_{n-1}

Where, MP is marginal product, TP_n is Total product of 'n' units, and TP_{n-1} is Total product of the previous unit of output.
Diagrammatic representation of TP, AP and MP.
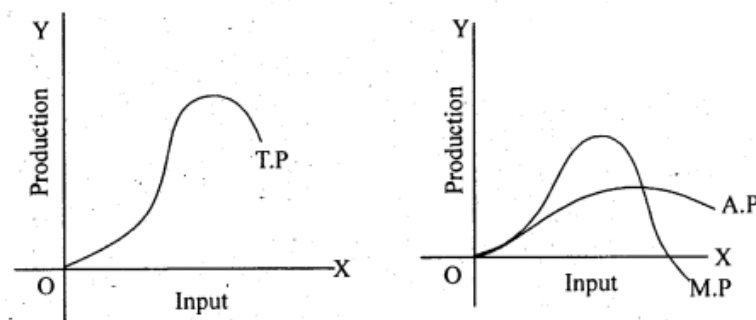
The total product (TP) curve, in the beginning increases at increasing rate later at decreasing rate, reaches maximum and starts falling.

The average product (AP) curve rises in the beginning, reaches maximum with the increase in inputs and output. The marginal product (MP) rises, reaches maximum level before AP and falls. It becomes zero when TP is maximum. When TP starts falling the MP curve crosses 'x' axis to become negative.

Question 2. Explain the law of variable proportions. (LVP)
Answer: The LVP refers to input-output relationship, when the output is increased by varying the quantity of one input. This law operates in short period when all the factors of production cannot be increased or decreased simultaneously. The producer can enhance the output by increasing only one variable input by keeping other factors fixed. So, there will be change in proportion between Variable and Fixed Inputs. This is called as the Law of Variable proportions.

Assumptions of LVP:

The LVP operates under certain assumptions: They are:

The technique of production remains same.

There will be existence of Fixed inputs.

The efficiency of variable inputs will be equal.

There is possibility to change the proportion of inputs.

The factor inputs are not close or perfect substitutes.

The law states that, an increase in variable inputs, in a given state of technology, cause output to increase, but after a point the extra output resulting from the same addition of extra inputs will become less and less.

The LVP can be illustrated with the help of a table:

(Product in tons)

Land (Hectares)	Capital (Rs - Lakhs)	Labour	Total Product	Average Product	Marginal Product
5	25,000	1	10	10	10
5	25,000	2	30	15	20
5.	25,000	3	60	20	30
5	25,000	4	80	20	20
5	25,000	5	90	18	10
5	25,000	6	95	15.8	5
5	25,000	7	95	13.5	0
5.	25,000	8	90	11.2	-5

In the above table, the producer (farmer) has 5 hectares of land in which he has spent Rs.25,000 for Agricultural machineries. When he increases labour input the TP, AP and MP increase in the beginning and later diminish. When the producer applies 3 units of labour the MP is highest at 30. Till here, the TP is in increasing returns. From 4th unit of labour, the MP and AP start decreasing. At 7th unit of labour the MP becomes zero indicating that the TP has reached optimum. When the producer uses 8th labour the MP becomes negative and TP starts falling.

Stages of LVP:
There are three stages of production as per LVP (i) Increasing Returns (2) Diminishing Returns and (3) Negative Returns.

I Stage-Increasing Returns:
In this stage, TP increases at an increasing rate i.e., up to 3rd unit of labour, MP also rises and reaches maximum at this point and AP also goes on increasing.

Causes for Increasing Returns: The law of increasing returns operates because, in the beginning the quantity of fixed factors is abundant relative to the quantity of the variable factor. When the producer adds more units of variable input to the fixed factor of inputs, then the fixed factors are more intensively and effectively used. That means the efficiency of the fixed factors increase as additional units of the variable factors are added to it.

Another reason for increasing returns during first stage is that as more units of variable factors are employed, the efficiency of the variable factors itself increases. This is because with sufficient quantity of variable factor, introduction of division of labour and specialization becomes possible which leads to increase in output.

II Stage – Diminishing Returns: .
In this stage, the TP continues to increase at a diminishing rate till it reaches 95 tons. Here, both AP and MP fall but they are positive. At the end of this stage, the MP becomes zero. This stage is called diminishing returns as both AP and MP start decreasing with the increase in inputs.

Causes for diminishing returns: When the producer increases the variable inputs even after the point where the variable input is sufficient to ensure efficient utilisation of the fixed factor, then further increase in the Variable factor will cause MP and AP to decline. This is because the fixed factor becomes inadequate relative to the quantity of variable factor.

Another reason for diminishing returns is the imperfect substitutability of one factor for another. If there is perfect substitute of the scarce fixed factor is available, the second stage would have been made up by increasing the supply of its perfect substitute with the result that output could be expanded.

III Stage – Negative Returns:
During the 3rd stage, the TP and AP will be falling and MP is negative. It is called negative returns as MP is negative.

Causes for negative returns: When the producer increases labour input beyond 6 units, the TP declines and MP becomes negative. This is due to the fact that'the quantity of variable factor becomes too excessive in relation to the fixed factor so that they get in each other's ways which result in decline in TP. In such situation, the producer has to reduce variable inputs to reduce the pressure on fixed factor.

Stage of operation-Production: Now the major _____ is which stage a rational producer , will seek to produce? A rational producer will never produce in 3rd stage where MP is negative. The producer will also do not produce in first stage where the MP is increasing which is beneficial. If the producer selects to produce at first stage, he will not be making best use of the fixed factor and he will not be utilizing fully the opportunities of increasing production by increasing quantity of the variable factor whose AP continues to rise throughout the first stage.

Thus, a rational producer will never produce in stages I and III. These stages are economic nonsense. Hence he selects the II stage to produce.

The LVP can be represented in the following diagram:
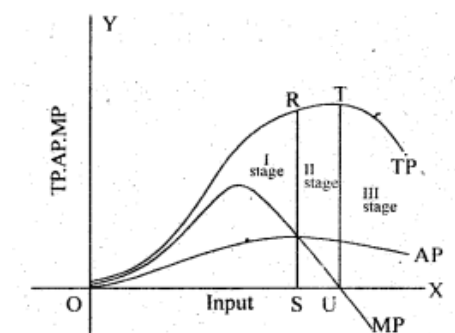
In the above diagram, factor input labour is measured in OX axis and TP, AP and MP are measured on OY axis. In the first stage, the producer is producing RS of output with OS level of variable input. During this stage, TP, AP and MP are increasing,

When the producer increases input labour from OS to OU, the TP reaches maximum at TU in the second stage. Here TP curve is increasing but MP and AP curves are decreasing and MP reaches zero at point U. In the third stage, the TP, AP and MP are falling and MP becomes negative. Here, the TP falls from T and AP remains positive though it is falling.

Question 3. Explain the laws of returns to scale with the help of a diagram. .
Answer: We know that, in the long run all factor inputs are variable. The returns to scale explain the relationship between input and output in the long period. They study about the changes in output as a consequence of changes in all the inputs. This can be represented as follows:
Q = f (X1,X2,........)

Stages of Returns to Scale: Returns to scale may be (1) Increasing Returns to Scale, (2) Constant Returns to Scale (3) Diminishing Returns to Scale.
These returns to scale can be seen in Total Product which is the result of changes in all inputs.

1. Increasing Returns to Scale: Here, the output increases in a greater proportion than the increase in inputs. When a firm expands, increasing returns to scale are obtained in the beginning. For example, if there is 20% increase in inputs, the output increases by 30%. The increasing returns to scale also is a result of indivisibility of factors. Some factors are available in large and can be utilized with utmost efficiency at a large output.

2. Constant Returns to Scale: The constant returns to scale exists when the output increases in same proportion with the increase in inputs. For example, if a producer increase inputs by 25%, the Total product increases by 25%. Here the Total Product increases at constant rate. It has been found that an individual firm passes through a long phase of constant returns to scale in its lifetime.

3. Diminishing Returns to Scale: Also known as decreasing returns to scale operate when output increase in a smaller proportion with an increase in all inputs. For example, if a producer increases all inputs by 20%, the Total product increase in 15%. Diminishing returns to scale eventually occur because of increasing difficulties of management, coordination and control. When the firm has expanded to a very large size it is difficult to manage it with same efficiency as earlier. So, the dimininishing returns to scale exist.

The returns to scale can be illustrated with the help of the table given below:

Factor inputs (L+C)	Total Product	Marginal Product	Returns to Scale
1+2 2+4 3+6	10 30 60	10 20 30	Increasing Returns to Scale
4+8 5+2 6+12	100 140 180	40 40 40	Constant Returns to Scale
7+14 8+16 9+18	210 230 240	30 20 10	Decreasing Returns to Scale

In the above table, we can notice that the Total product is increasing at increasing rate (MP is increasing by 10, 20, 30, 40) with the increase in both the inputs Labour and Capital (L+C). If the producer increases the inputs any further, TP increases at

constant rate (MP is constant at 40). Later, the TP increases at diminishing rate causing decreasing returns to scale (MP starts falling from 40, 30, 20, 10).

The laws of returns to scale can be graphically explained with the help of the following diagram:
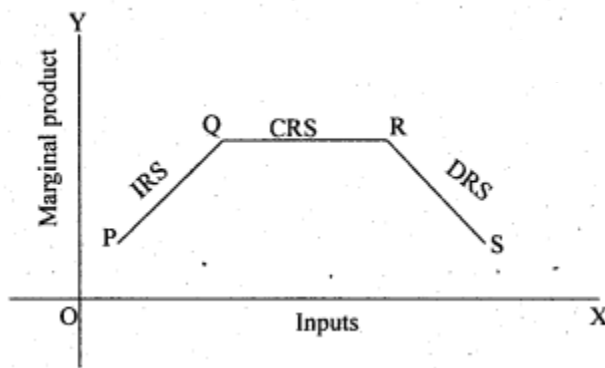
In the above diagram, inputs are measured along 'OX' axis, Marginal product is measured along 'OY' axis. From point P to Q, it is increasing returns, from Q to R it is constant returns and from R to S it is decreasing returns to scale.

Question 4. Discuss the various types of short run costs.
Answer: 1. Total Fixed Cost (TFC): It refers to the total money expenses incurred on all the fixed factors in the short run. TFC remains constant at all levels of output. There fore the total fixed cost curve is a horizontal straight line parallel to 'X' axis above the origin which indicates that it is never zero. This can be represented as follows:
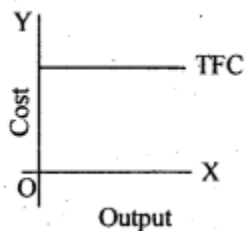

TFC = TC-TVC

2. Total Variable Cost (TVC): It refers to the total money expenses incurred on the variable factor inputs in the short-run. Total variable cost is the direct cost of the output because it increases along with the output and remains zero when the output is zero. So, the TVC curves starts from the origin and rises sharply in the beginning, gradually in the middle and stretch again sharply in the end. The nature of this slope is in accordance with the law of variable proportion. This can be represented as follows: –
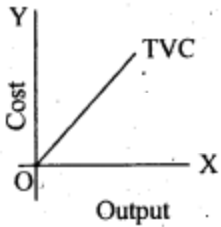
The Total Variable Cost is obtained as follows:
TVC = TC – TFC

3. Total Cost (TC): It is the aggregate money expenditure incurred by the firm on all the factors to produce a given quantity of output. TC varies in the same proportion as total variable cost because the total fixed cost is constant. The TC curve slope upwards from left to right, above the origin, indicating that, it includes total fixed cost and total, variable cost. This can be represented as follows:
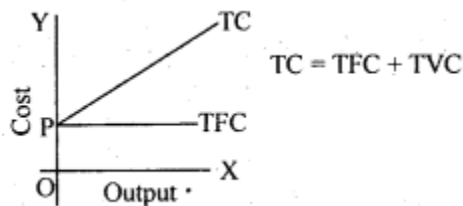

4. Average Fixed Cost (AFC): It is the fixed cost per unit of output. In other words, it is average expenses incurred on a single unit of output produced. AFC and output are in inverse relation i.e., AFC will be higher when the output level is less and as the output goes on increasing AFC starts reducing. When represented in a diagram, AFC curve will have a negative slope which falls very stiffly in the beginning and later on becomes parallel to the X axis. This shows that it is never zero as TFC is never zero. This can be represented as follows:
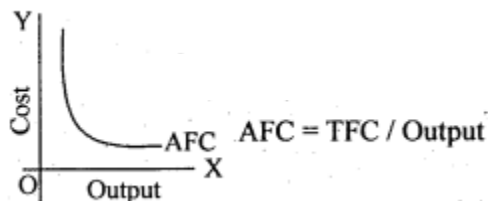

5. Average Variable Cost (AVC): It is a variable cost per unit of output. It can be calculated by dividing total variable cost by the total units of output. When this cost is graphically represented, we get a 'U' shaped AVC, which shows that the cost will be less as the number of units produced increases. This is because as the number of

variable inputs are added in a fixed plant the efficiency will increase and vice versa. This can be represented as follows: .
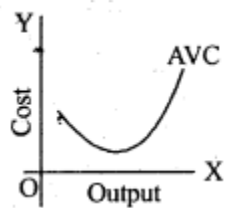

AVC = TVC/output or AVC = AC – AFC

6. Average Cost (AC): It is the cost per unit of output produced. It is obtained by dividing total cost by the total output produced i.e. AC = TC/Q or it is also obtained by adding AFC and AVC. If the AC is graphical represented we get U shaped curve because of the operation of law of variable proportions. The short run AC curve is also called as 'Plant Curves' because it indicates the optimum utilization of a given plant (Industry) capacity.
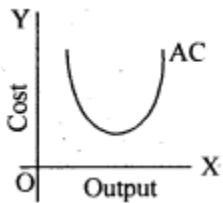
7. Marginal Cost (MC): It is an additional cost incurred to produce an additional output. In other words it is the net additions to the total cost when one more unit of output is produced. MC = TCn – TCn-1

Where TCn = Total cost of 'n' selected units of output and TCn-1 is total cost of the previous output
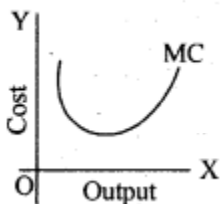

Question 5. Explain long run costs with the help of a diagram
Answer: Long run is defined as a period of time where adjustment to changed conditions is possible. During this period, the size of the plant can be changed at both fixed and variable factors. As all the factors are variable, the total cost constituents completely become total variable cost.

Long Run Average Cost:
It is per unit cost of production of different levels of output. It Is derived by dividing long run total cost from the total level of output.

The long run cost mid output relation is explained by drawing the long run cost curve through short run cost curve. This is because the long period is made up of many short periods which are shown as follows:
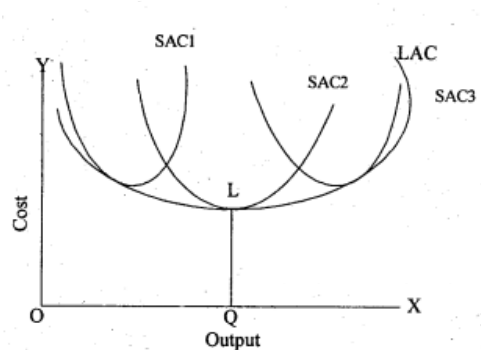
In the above diagram LAC curve is a drawn on the basis of 3 possible plant sizes and there are short run average cost curve such as SAC1, SAC2, and SAC3. They represent 3 different sales of output. For the output OQ the average cost will be LQ in the short run as well as long run.

Thus the diagram above shows that the cost incurred in the long run will be lesser than that of the short run. Therefore LAC curve is described as the planning curve which helps in producing optimum level of output at the minimum average cost. LAC is also called as Envelope curve because it includes a group of SAC curves which indicate different levels of output.

Long Run Marginal Cost: The concept of Marginal Cost in the long run is as that of LAC. The LMC curve is also derived from short run Marginal cost curves. The LAC and LMC are U shaped and more flatter than short run AC and MC. The LMC cuts LAC from below where LAC is at minimum. Both LAC and LMC are U shaped because of operation of law of returns to scale.
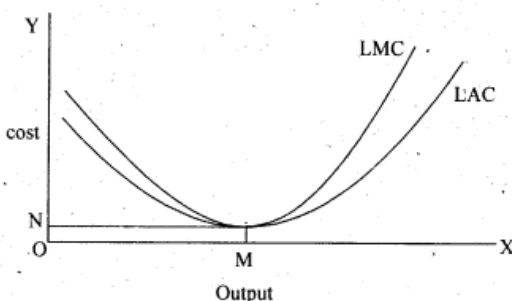
Question 6. Explain the various economies and dis economies of scale.
Answer: (i) Internal Economies: The internal economies (advantages of large scale production) arise within the firm when it increases its scale production by increasing all inputs. The major internal economies are as follows:

Technical economies – benefits from capital equipment i.e., machines

Managerial economies – reduction in managerial expenses

Marketing economies – can manage bulk orders of supply

Financial economies – can easily raise finance/loan.

Risk bearing economies – can face ups and downs in business.

Transport and storage economies – development of transport and warehouse of its own.

(ii) External Economies: These are the benefits which a firm gets when the entire industry is expanded. They accrue to all the firms as a result of expansion in the output of whole industry and they are not dependent on the output level of individual firms. The firms get these economies from outside because of expansion of the industry. The major external economies are as follows:

Low cost of raw materials and capital equipments.

Technological economies-use of latest techniques of production.

Development of skilled labour – trained labour for higher productivity. .

Growth of ancillary industry – small scale industries to supply spare parts and use of by-products.

Development of Transportation, communication and marketing facilities.

(iii) Diseconomies and Decreasing Returns to scale:
The decreasing returns in the production process operate mainly because of diseconomies of large scale production. The firm faces lots of difficulties in managing these roadblocks. When the size of the firm is expanded, its management and supervision becomes, complicated. There are many disadvantages of large scale production which area also known as dis-economies of scale.

There are two types of diseconomies viz., Internal Diseconomies and External Diseconomies of scale.

(a) Internal Diseconomies: These are the disadvantages.which a firm faces due to expansion of its scale of production. They are:

Lack of proper coordination among different departments of production process.

Lack of control on inputs.

Deterioration in communication between various departments.

Lack of identification of errors committed.

(b) External Diseconomies: These are the disadvantages which the firms have to face due to expansion in the industry as whole. They are:

Increased pressure on transportation – increase in cost of transport.

Increase in pollution – rise in social cost.

Shortage of capital-banks hesitate to finance.

The factors of production becoming costly.

Increase in business risk and marketing problems.

Ten Marks Questions

Question 1. Explain the meaning of various short-run costs with the help of a table and diagram.
Answer: The various short run costs are Total Cost, Total Fixed Cost, Total Variable Cost, Avenge Cost, Average Fixed Cost, Average Variable Cost, and Marginal Cost. The following table shows the various types of short run-costs:

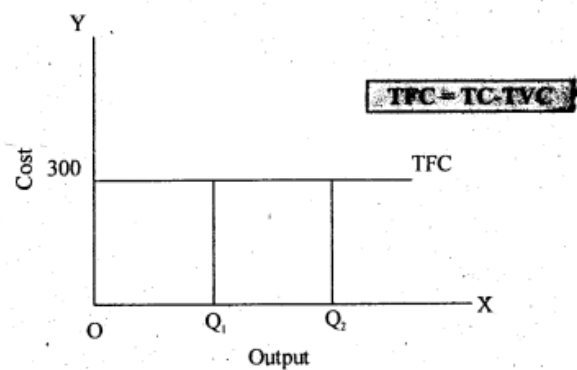Calcualtion of TFC, TVC, TC, AFC, AVC, AC and MC.

Calcualtion of TFC, TVC, TC, AFC, AVC, AC and MC.

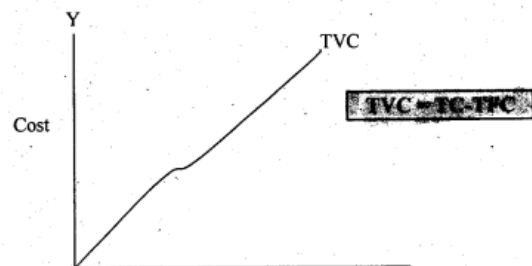| Output	TFC	TVC	TC	AFC	AVC	AC	MC
0	100	0	100	100	0	0	-
1	100	150	250	100	150	250	150
2	100	200	300	50	100	150	50
3	100	250	350	33.33	83.3	116.6	50
4	100	300	400	25	75	100	50
5	100	420	520	20	84	104	120
6	100	530	630	16.66	88.3	105	110

1. Total Fixed Cost (TFC):
It refers to the total money expenses incurred on alt the fixed factors in the short fun. TFC remains constant at all levels of output. Therefore the total fixed cost curve

is a horizontal straight line parallel to 'X' axis above the origin which indicates that it is never zero.

2. Total Variable Cost (TVC):
It refers to the total money expenses incurred on the variable factor inputs in the short-run. Total variable cost is the direct cost of the output because it increases along with the output and remains zero when the output is zero. So, the TVC curves starts from the origin and rises sharply in the beginning, gradually in the middle and stretch again sharply in the end. The nature of this slope is in accordance with the law of variable proportion.
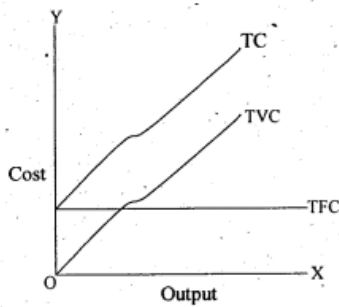

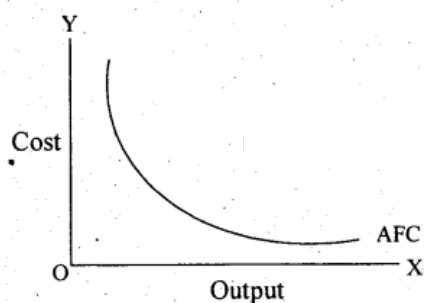The Total Variable Cost is obtained as follows: TVC = TC – TFC

3. Total Cost (TC):
It is the aggregate money expenditure incurred by the firm on all the factors to produce a given quantity of output. TC varies in the same proportion as total variable cost because the total fixed cost is constant. The TC curve slope upwards from left to right, above the origin, indicating that, it includes total fixed cost and total variable cost.

4. Average Fixed Cost (AFC): '

It is the fixed cost per unit of output. In other words, it is average expenses incurred on a single unit of output produced. AFC and output are in inverse relation i.e., AFC will be higher when the output level is less and as the output goes on increasing, AFC starts reducing. When represented in the diagram, AFC curve will have a negative slope which falls very stiffly in the beginning and later on becomes parallel to the X axis. This shows that it is never zero as TFC is never zero.
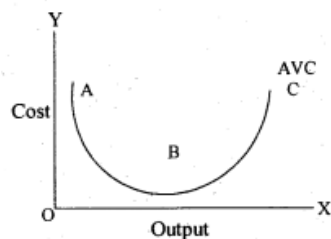

The Average Fixed Cost is obtained by dividing Total Fixed Cost by output.
AFC = TFC/output. .

5. Average Variable Cost (AVC):

It is a variable cost per unit of output. It can be calculated by dividing total variable cost by the total unite of output. When this cost is graphically represented, we get a 'U' shaped AVC, which shows that the cost will be less as the number of units produced increase, this is because as the number of variable inputs are added in a fixed plant the efficiency will increase and vice versa.
AVC = TVC/output or AVC = AC – AFC

6. Average Cost (AC):
It is the cost per unit of output produced. It is obtained by dividing total cost by the total output produced i.e, AC = TC/Q or it is also obtained by adding AFC and AVC. If the AC is graphical represented, we get a U shaped curve because of the operation of law of variable proportions. The short run AC curve is also called as 'Plant Curves' because it indicates the optimum utilization of a given plant (Industry) capacity.
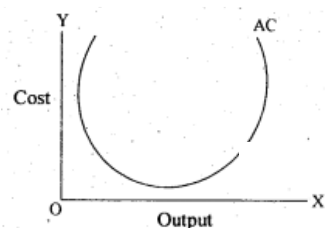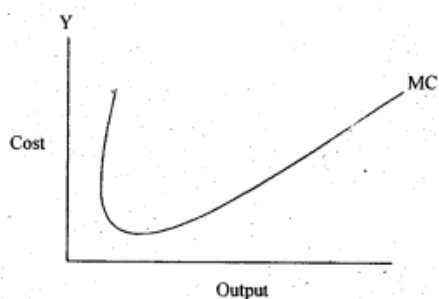

7. Marginal Cost (MC):
It is an additional cost incurred to produce an additional output. In other words it is the net additions to the total cost when one more unit of output is produced.
MC=TCn – TCn-1
(Where TCn = Total cost of 'n' selected units of output and TCn-1 is total cost of the previous output)

Question 2. Explain the law of variable proportions with the help of a table and diagram.
Answer: The Law of Variable Proportions (LVP) refers to input-output relationship, when the output is increased by varying the quantity of one input. This law operates in short period when all the factors of production cannot be increased or decreased simultaneously. The producer can enhance the output by increasing only one

variable input by keeping other factors fixed. So, there will be change in proportion between Variable and Fixed Inputs. This is called as the Law of Variable proportions.

Assumptions of LVP:
The LVP operates under certain assumptions: They are:

The technique of production remains same.

There will be existence of Fixed inputs.

The efficiency of variable inputs will be equal.

There is possibility to change the proportion of inputs.

The factor inputs are not close or perfect substitutes.

The law states that, an increase in variable inputs, in a given state of technology, cause output to increase, but after a point the extra output resulting from the same addition of extra inputs will become less and less.
The LVP can be illustrated with the help of a table:

(Product in tons)

Land (Hectares)	Capital (Rs - Lakhs)	Labour	Total Product	Average Product	Marginal Product
5	25,000	1	10	10	10
5	25,000	2	30	15	20
5	25,000	3	60	20	30
5	25,000	4	80	20	20
5	25,000	5	90	18	10
5	25,000	6	95	15.8	5
5	25,000	7	95	13.5	0
5	25,000	8	90	11.2	-5

In the above table, the producer (farmer) has 5 hectares of land in which he has spent Rs.25.000 for Agricultural machineries. When he increases labour input the TP, AP and MP increase in the beginning and later diminish. When the producer applies 3 units of labour the MP is highest at 30. Till here, the TP is in increasing returns. From 4th unit of labour, the MP and AP start decreasing. At 7th unit of labour the MP becomes zero indicating that the TP has reached optimum. When the producer uses 8th labour the MP becomes negative and TP starts falling.

Stages of LVP:
There are three stages of production as per LVP. (i) Increasing Returns (2) Diminishing Returns and (3) Negative Returns.

I Stage- Increasing Returns:
In this stage, TP increases at an increasing rate i.e., up to 3rd unit of labour, MP also rises and reaches maximum at this point and AP also goes on increasing.

Causes for Increasing Returns: The law of increasing returns operates because, in the beginning the quantity of fixed factors is abundant relative to the quantity of the variable factor. When the producer adds more units of variable input to the fixed factor of inputs, then the fixed factors are more intensively and effectively used. That means the efficiency of the fixed factors increase as additional units of the variable factors are added to it.

Another reason for increasing returns during first stage is that as more units of variable factors are employed, the efficiency of the variable factors itself increases. This is because with sufficient quantity of variabie factor, introduction of division of labour and specialization becomes possible which leads to increase in output.

II Stage – Diminishing Returns: .
In this stage, the TP continues to increase at a diminishing rate till it reaches 95 tons. Here, both AP and MP fall but they are positive. At the end of this stage, the MP becomes zero. This stage is called diminishing returns as both AP and MP start decreasing with the increase in inputs.

Causes for diminishing returns: When the producer increases the variable inputs even after the point where the variable input is sufficient to ensure efficient utilisation of the fixed factor, then further increase in the Variable factor will cause MP and AP to decline. This is because the fixed factor becomes inadequate relative to the quantity of variable factor.

Another reason for diminishing returns is the imperfect substitutability of one factor for another. If there is perfect substitute of the scarce fixed factor is available, the second stage would have been made up by increasing the supply of its perfect substitute with the result that output could be expanded.

III Stage-Negative Returns:
During the 3rd stage, the TP and AP will be falling and MP is negative. It is called negative returns as MP is negative.

Causes for negative returns: When the producer increases labour input beyond 6 units, the TP declines and MP becomes negative. This is due to the fact that the quantity of variable factor becomes too excessive in relation to the fixed factor so that they get in each other's ways which result in decline in TP. In such situation, the producer has to reduce variable inputs to reduce the pressure on fixed factor.

Stage of operation-Production: Now the major is which stage a rational producer will seek to produce? A rational producer will never produce in 3rd stage where MP is negative. The producer will also do not produce in first stage where the MP is increasing which is beneficial. If the producer selects to produce at first'stage, he will not be making best use of the fixed factor and he will not be utilizing fully the opportunities of increasing production by increasing quantity of the variable factor whose AP continues to rise throughout the first stage.

Thus, a rational producer will never produce in stage I and III. These stages are economic , non-sense. Hence it selects the II stage to produce.

The LVP can be represented in the following diagram:
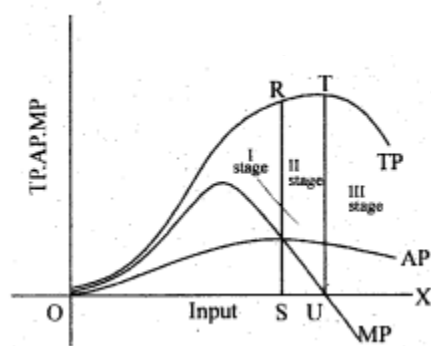
In the above diagram, factor input labour is measures in OX axis and TP, AP and MP are measures on OY axis. In the first stage, the producer is producing RS of output with OS level of variable input. During this stage, TP, AP and MP are increasing.

When the producer increases input labour from OS to OU, the TP reaches maximum at TU in the second stage. Here TP curve is increasing but MP and AP curves are decreasing and MP reaches zero at point U. In the third stage, the TP, AP and MP are filling and MP becomes negative. Here, the TP falls from T and AP remains positive though it is falling.

Question 3. Explain the meaning of laws of returns to scale with the help of arable and diagram.
Answer: We know that, in the long run all factor inputs are variable. The returns to scale explain the relationship between input and output in the long period. They study about the changes in output as a consequence of changes in all the inputs. This can be represented as follows:
Q = f(X1, X2,……..)

Stages of Returns to Scale: Returns to scale may be (1) Increasing Returns to Scale, (2) Constant Returns to Scale (3) Diminishing Returns to Scale.

These returns to scale can be seen in Total Product which, is the result of changes in all inputs.

1. Increasing Returns to Scale: Here, the output increases in a greater proportion than the increase in inputs. When a firm expands, increasing returns to scale are obtained in the beginning. For example, if there is 20% increase in inputs, the output increases by 30%. The increasing returns to scale also is a result of indivisibility of factors. Some factors are available in large and can be utilized with utmost efficiency at a large output.

2. Constant Returns to Scale: The constant returns to scale exists when the output increases in same proportion with the increase in inputs. For example, if a producer increase inputs by 25%, the Total product increases by 25%. Here the Total Product increases at constant rate. It has been found that an individual firm passes through a long phase of constant returns to scale in its lifetime.

3. Diminishing Returns to Scale: Also known as decreasing returns to scale operate when output increase in a smaller proportion with an increase in all inputs. For example, if a producer increases all inputs by 20%, the Total product increase in 15%. Diminishing returns to scale eventually occur because of increasing difficulties of management, coordination and control. When the firm has expanded to a very large size it is difficult to manage it with same efficiency as earlier. So, the diminishing returns to scale exist.

The returns to scale can be illustrated with the help of the table given below:

Factor inputs (L+C)	Total Product	Marginal Product	Returns to Scale
1+2 2+4 3+6	10 30 60	10 20 30	Increasing Returns to Scale
4+8 5+10 6+12	100 140 180	40 40 40	Constant Returns to Scale
7+4 8+16 9+8	210 230 240	30 20 10	Decreasing Returns to Scale

In the above table, we can-notice that the Total product is increasing at increasing rate (MP is increasing by 10, 20, 30, 40) with the increase in both the inputs Labour and Capital (L+C). If the producer increases the inputs any further, TP increases at

constant rate (MP is constant at 40). Later, the TP increases at diminishing rate causing decreasing returns to scale (MP starts falling from 40, 30, 20, 10).

The laws of returns to scale can be graphically explained with the help of the following diagram:
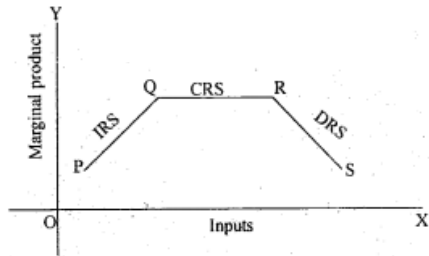
In the above diagram, inputs are measured along the 'X' axis, Marginal Product is measured along ' Y' axis. From point P to Q, it is increasing returns, from Q to R, it is constant returns and from R to S it is decreasing returns to scale.