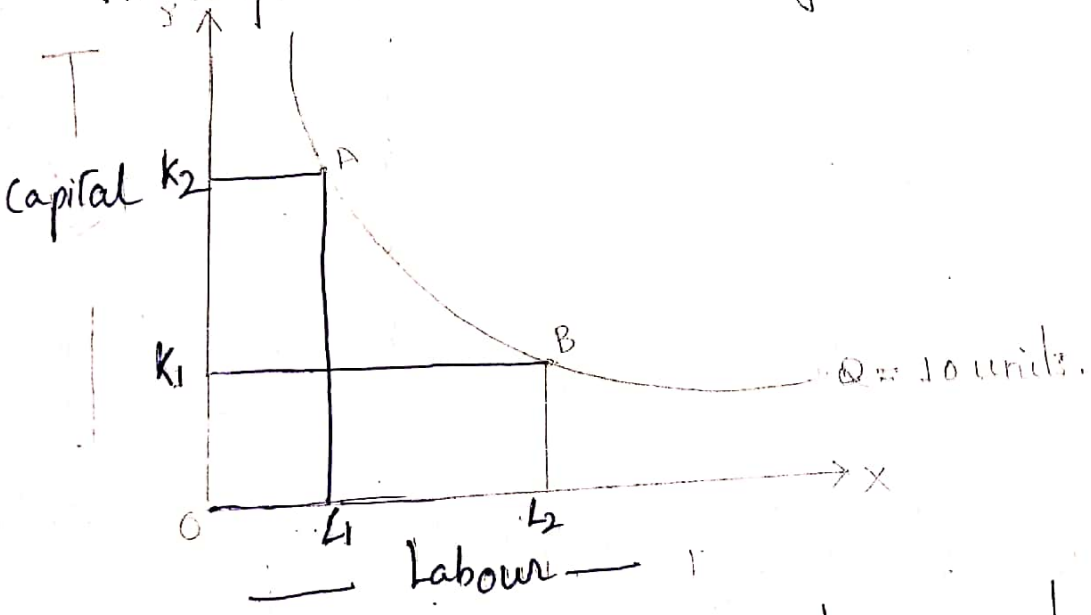
Ch-2-

2. What is Isoquant ?

Ans. An Isoquant is a locus of point showing combination of 2 inputs which ~~air~~ yelled the same level of output to the producer so that he is indifferent between them. The Isoquant therefore is also known as Producer's Indi-ference curve. The word "Isoquant", is derived from 2 different terms i.e., "Iso" which implies ~~complies~~ constant and "quant" which implies quantitiesy. An Isoquant is shown in the given following diagram :-



In the above diagram, the convex downward sloping curve is the Isoquant depicting an output level of 10 units. A/C to the diagram, combination A and B consisting of different amt. of capital and labour helps us to attain the same level of output. i.e., 10 units. Lastly, the slope of the isoquant is given by MRTS (Marginal Rate of Technical Substitution i.e., MRTS which can be expressed as follows :-

Marginal MP$_L$

* Properties of Isoquant :-

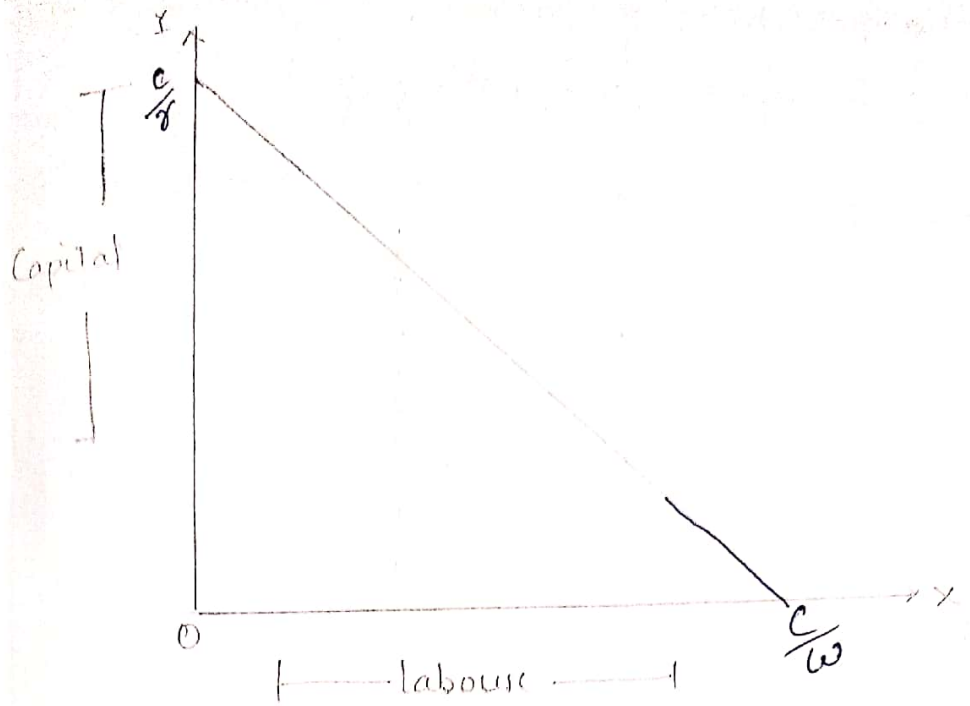
(1) Isoquant slopes downward from left to right :- This is so because if the quantity of a factor, say labour is increased, the quantity of other factor i.e, capital must be reduce. so as to keep output constant. on an given Isoquant.

(2) Isoquant are convex to the origin :- The convexity of Isoquant means that as we move downward along the curve, successively smaller unit of capital are required to be substituted by a given level increment of labour. Thus, the convexity of Isoquant is due to diminishing MRTS of one factor for another.

(3) No 2 Isoquant can't intersect :- 2 Isoquant can never intersect each other. If they did then the point of their intersection would give two diffn levels of output which impossible.

(4) A highest Isoquant will to the right of another represent higher level of output &.

* Iso-cost line :- The Iso-cost line is the locus of points showing combinations of 2 factors that the firm can pur with his monetary cost outlay. In other words, Iso-cost li donates combination of 2 inputs that the firm may pur with his budget fund. An Iso-cost line can be drawn in the following way :-



In the above diagram the linear downward sloping line is the Isoquant – cost line of the firm, which depicts the maximum input purchase capability of a firm. (Any point on the Iso-cost line shows combination of 2 ~~outputs~~ inputs for the purchase of which the firm has to spend his entire cost outlay. Any point within the Isoquant-cost implies combination of 2 inputs for the purchase of which the firm does not have to spend his entire income. Lastly, a point above the Iso-cost is unattainable by the firm with the given cost outlay).

* Slope of Iso-cost and the equation of Iso-cost :-

The equation for Iso-cost is given as :-

$wL + rK = C.$

where w and r are price of ~~cost~~ labour & capital resp. -ectively.

L and K are the quantities of labour and capital respectively, and C refers to cost outlay of the firm.

* Deriving the Intercept of Iso-cost :-

(i) Intercept of Y-axis :-

If $L = 0$,

$rK = C$

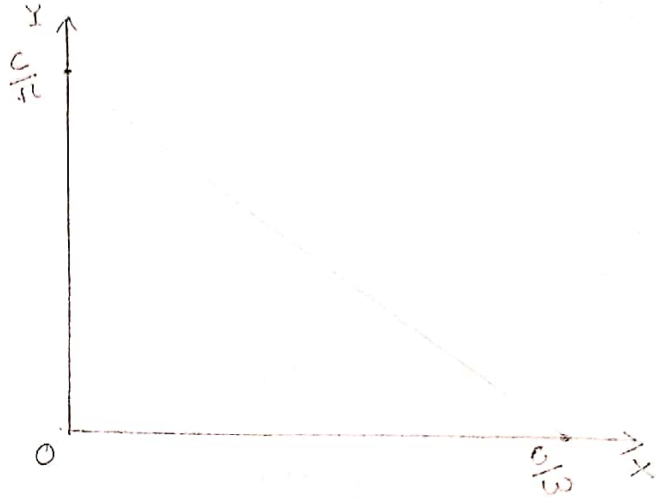
$\Rightarrow K = \frac{C}{r}$.

(ii) Intercept of X-axis :-

If $K = 0$,

$wL = C$.

$\Rightarrow L = \frac{C}{w}$.



* Deriving the slope of Iso-cost :-

$$\text{Slope of Iso-cost} = \frac{\text{Perpendicular}}{\text{Base}}$$

$$= \frac{-\frac{C}{r}}{\frac{C}{w}}$$

$$= \frac{1}{r} \Big/ \frac{1}{w}$$

$$= \frac{1}{r} \times \frac{w}{1}$$

$$= \frac{w}{r}.$$

Date : 19/7/19

* Producer's equilibrium or least cost combination of factors :-

or choice of optimal factor combination :-

The least cost combination of factors refers to a firm producing the largest volumn of output from a given cost. It may also imply producing a given level of output

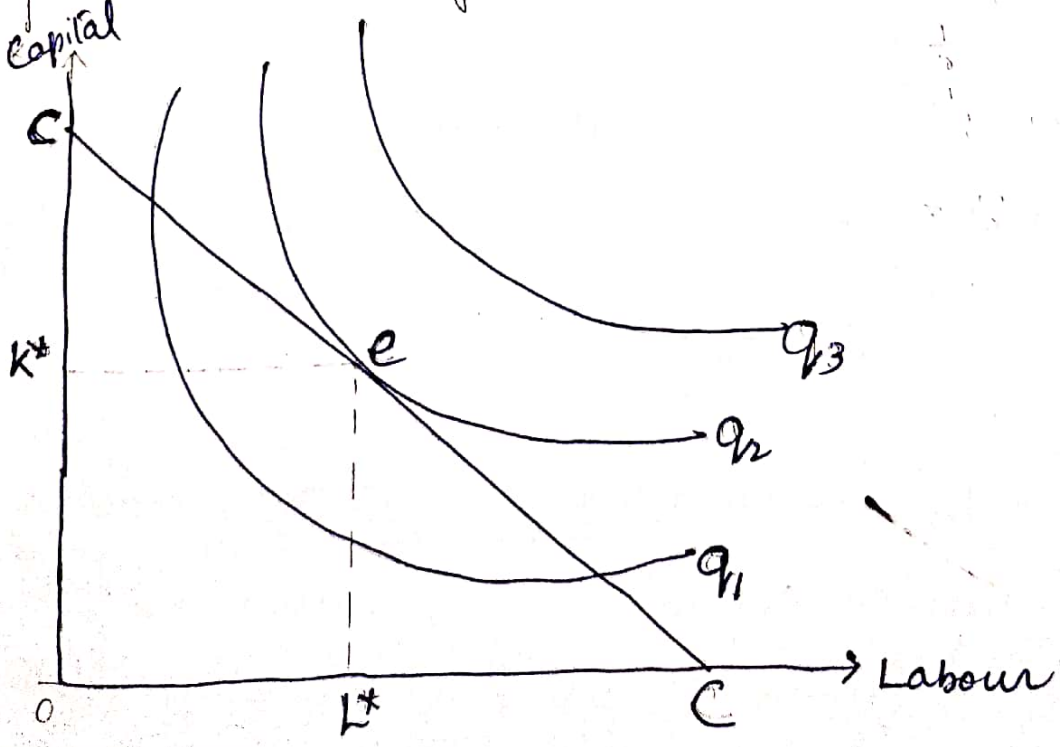
with the minimum cost. When the factors are combined optimum in an optimal manner.

There are 2 essentials for producer's equilibrium. They are :-

(i) The slope of isocost line must be equal to the slope of Isoquant curve., i.e., $\frac{w}{r} = MRTS_{LK}$.

(ii) The Isoquant must be convex to the point of origin. In other words, the marginal rate of technical substitution of labour and for capital must be diminishing at the level of equilibrium point.

Given, the production function (depicted by Isoquant's) and Isocost line, the firm is in equilibrium at the point of tangency betn the Iso-cost line and Isoquant curve. Diagramatically,

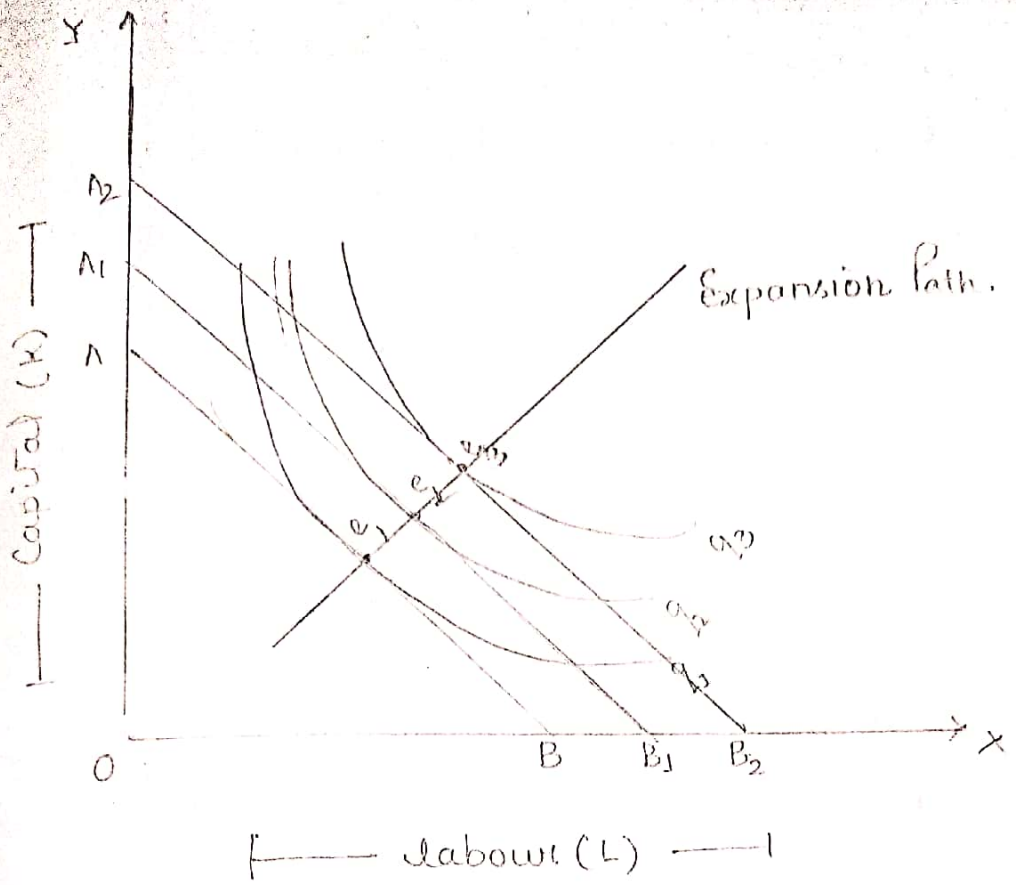


In the figure, the producer is in equilibrium at the pt. (E) where the Iso-cost line (CC) is tangent to Iso-quant curve (@ q_2). Thus, at pt. E, the first and the necessary condition of producer equilibrium is satisfied as pt. E $\frac{w}{r} = MP_L / MP_K = MRTS_{LK}$. Therefore, we can say that q_2 is the maximum level of output which can be produce by the given cost outlay. The second and the sufficient condition regarding diminishing $MRTS_{LK}$ is also satisfied at the pt. of equilibrium and it is guaranteed by the convex shape of Isoquant.

* The Expansion Path :- An expansion path shows the locus of point depicting least cost input combination for producing various levels of output. Assuming that the input price remains constant.

With largest budget, the firm will be in a position to hire largest factors input. And attain higher level of Isoquant. The concept of expansion path can be explained as follows :-

In the figure, as the budget of firm or the producer increases, the Iso-cost line shifts rightward from AB to A_1B_1 and further to A_2B_2. With the shifts in the Iso-cost line the equilibrium point also shifts from e_1 to



e_2 and further to e_3. Joining these equilibrium points with a straight line gives us the ~~Exception~~ Expansion Path. The Equilibrium Path along which production expands as the production budget increases is called the Expansion Path.

All the points on the expansion path represent tangency between isocost and Isoquant. And therefore, at all the points of Expansion Path, the condition of producers equilibrium (i.e., $\frac{w}{r} = \frac{MP_L}{MP_K}$) is satisfied.

* The equation of Expansion Path = $\frac{w}{r} = \frac{MP_L}{MP_K}$.

~~Ridge~~ ~~RIDGE~~

$\Rightarrow MRTS_{LK} = \frac{w}{r}$

$\Rightarrow \frac{MP_L}{MP_K} = \frac{w}{r}$

$\Rightarrow MP_L \cdot r = MP_K \cdot w$

$\Rightarrow MP_L \cdot r - MP_K \cdot w = 0$. //

* Marginal Rate of Technical Substitution ($MRTS_{LK}$) :-

$MRTS_{LK}$ can be defined as the no. of unit of capital which can be replaced by labour, the level of output remaining same. It is equal to the slope of Isoquant. Thus, $MRTS_{LK}$ is -

$= \frac{\Delta K}{\Delta L}$ or $MRTS_{LK} = \frac{MP_L}{MP_K}$. (in case $MRTS_{KL} = \frac{MP_K}{MP_L}$ or $\frac{\Delta L}{\Delta K}$)

In case of Isoquant, the law of diminishing $MRTS_{LK}$ guarantees the convexity of the Isoquants. It means that as we move along the Isoquant the willingness to substitute capital by labour decreases.

Date :- 23/07/19.

Q:- What is a production function ?

Ans:- * A production function shows relationship between input and output produced for a given technology and for a point of time. They may be classified as :-

(a) Short run production function → It is a production function in which, atleast one factor input remains constant and the output can be increased by increasing the variable inputs and vice-versa.

Ex:- $Q = f(L, \bar{K})$.

here, Q = output, L is the variable input,
$\bar{K}$ = constant input.

here, the time frame/period is so short that all the input can't be changed and atleast one input needs to remain constant

(b) Long run production function :— In the long run production function the time frame is so large that all the inputs can be change. Thus, there are no constant inputs in case of long run. production function.

Ex :- $Q = f(L, K)$.

here L and K are both variable input.

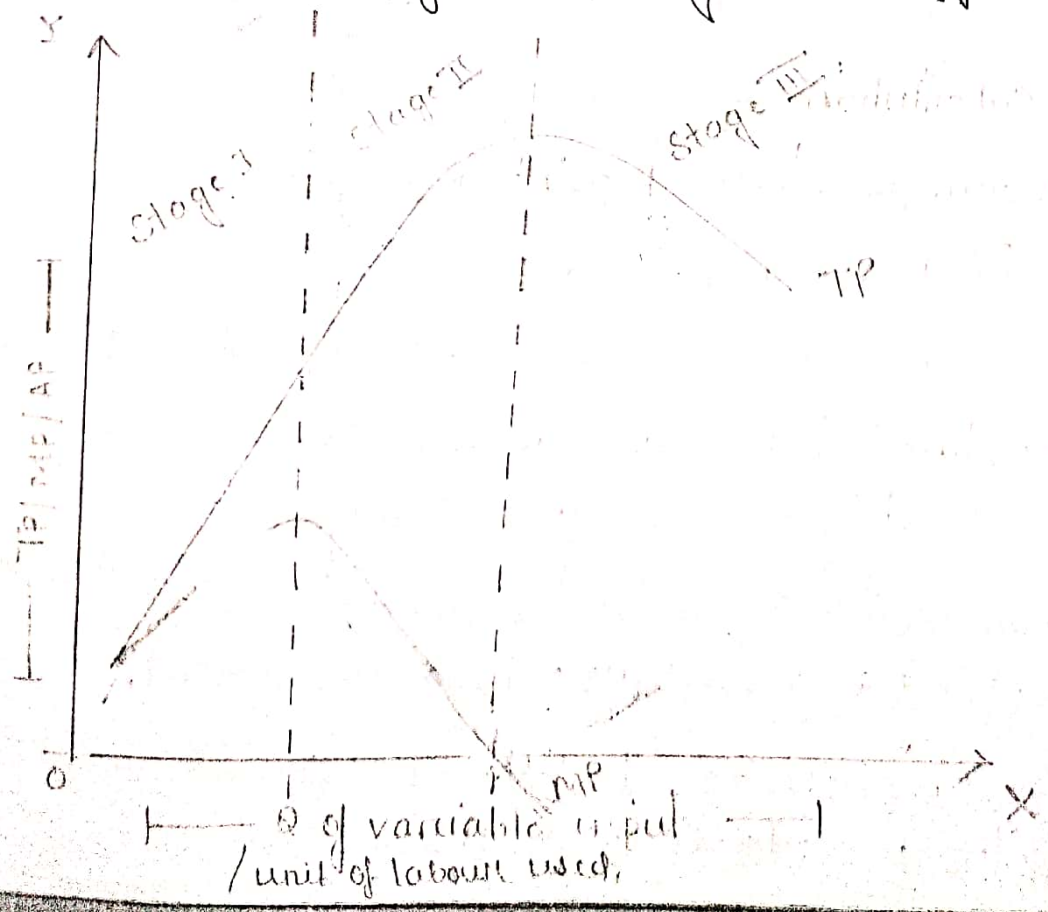
* A production function is depicted by Isoquant. It is also to be noted that production function relation does not depend only on input and output it also depend upon the production technology. If there is an advance production technology, then by using less inputs he may be able to get high level of

output and vice-versa.

Return to factor.

* Law of variable proportion :- The law of variable proportion explains the behaviour of production as the proportion between fixed & variable inputs are changed, by increasing the quantities of variable input. The law states that " The marginal product of a variable input eventually declines as ~~the~~ more and more of the input is being used". Some of the important feature of the law are :-

1) The law requires that there will be atleast one fixed input so that the ratio at which inputs are combined varies as the variable input is change. In other words, (the law operates in the short run.)
2) The law refers to marginal product only, and not to total and average product.
3) The law assumes a given level of technology.



The above figure depicts the 3 stages of production. as stated by the law of variable proportion.

Stage I :- The stage extends from zero (0) inputs of the variable factors to the level of input at which MP is maximum. At this stage the output produced is greatest than the rate of increase in the variable input. and thus it is said that at this stage the firm experiences increasing return.

Stage II :- This stage extend from the end of Stage I to the point where MP is zero or TP is maximum. Total output here increases at a diminishing rate. It will increases until it reaches the maximum point where MP = 0.

Stage III :- This stage extends beyond the end point of stage II. This stage experiences negative marginal product.

The law of return to Scale :-

The study of (change in output due to ≠ change in the scale of production) refers to law of return to scale. In other words, the behaviour of output following a change in quantities i.e., of input in the same proportion is known as return to scale. It may be of 3 types :-

(1) Increasing return to scale. (IRS) :- When with a proportional increase in input, output increases more than the proportion then it is known as Increasing return to scale. It occurs due to the working of economics of scale. When a firm expands its production, it enjoys certain advantages which are known as economies of scale. It may be in the form of better division of ~~level~~ labour, technical and managerial economies etc. These positive forces helps the firm to produce extra output with smaller input than before.

(2) Constant return to Scale (CRS) :- It is a situation when input and output are increased at the same rate or proportion. In other words, it is a situation when with a proportionate increase in input the output also increases in the same proportion. Gradually, as the production continuous, the firm reaches a ~~state~~ stage when all economies have been fully exploited. Under these circumstances an increases in input leads to a proportionate increase in output.

(3) Decreasing return to Scale (DRS) :- Finally, with further expansion of the firm ~~the~~ DRS economies may arise

cost in form of higher input cost, difficulties of management, lack of coordination, etc. These negative forces causes the firm to experience DRS. In other words, under such negative circumstances, a proportionate increase in input leads to increase in output but less than the proportion.