Part 1: Theory of Production and Costs
Concept of Production – Production Function — short run versus long run production function- Law of Variable Proportions – TP, AP, MP and their interrelationships – Isoquants- Properties- MRTS - Isocost Curve –Producer Equilibrium- Law of Returns to Scale – Expansion Path – Internal and External Economies- Linearly Homogeneous Production Function - Cobb-Douglas production function

Part 2: Theory of Costs
Cost function – Cost concepts- Explicit and implicit costs, opportunity cost, private cost, social cost, economic cost, accounting cost, sunk cost, fixed and variable cost, marginal and average cost -Short run and Long run cost curves - Modern theory of costs.

THEORY OF PRODUCTION

Production

Production may be defined as a process by which inputs are transformed into an output

Production Function

The production function examines the technological relationship between inputs and output. It shows the maximum quantity of output, that can be produced as a function of inputs used in the production process In functional form we write

$Q = f(X_1, X_2, X_3 \ldots\ldots X_n)$ or $Q = f(X_i)$ Where Q = output; $X_1, X_2, X_3 \ldots\ldots X_n$ are inputs

If we consider Labour (L) and (K) are the two factors, then the production function takes the following form, Q = f (L,K)

Short run and Long run Production Function

The **short run** is a time frame in which the quantity of one or more resources used in production is fixed. For most firms, the capital, is fixed in the short run. Other resources used by the firm (such as labor, raw materials, and energy) can be changed in the short run. When one or more inputs are fixed in quantity we call it short run production function (Example is ***law of variable proportion***). A typical short run production function with one variable factor is given as

$Q_{max} = f(L, K_{const})$ $Q_{max} = f(K, L_{const})$

When all inputs are freely variable, we call it long run production function. A long run production function is given as $Q_{max} = f(K, L)$. Here both factors are variable. (Example for long run production function is ***Returns to Scale***)

Total Product or TP Curve

Total Product is defined as the sum total volume of Production or total number of Units produced with the given fixed and variable inputs. In functional form we have

PRODUCTION WITH TWO VARIABLE INPUT

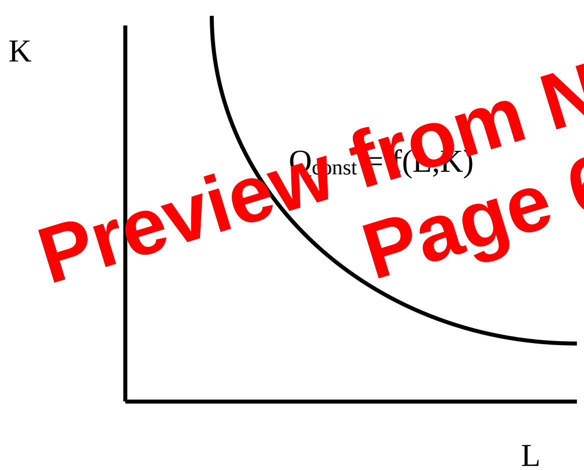
ISOQUANT (Equal Product Curve Or Iso Product Curve or production indifference curve)
An isoquant shows the different combinations of two factors (say Labour and Capital) which produce same level of output. Table given below examines different combinations of Labour and Capital which produce the same level of output. Combination A with one dose of labour and 20 doses of capital produces 100 units. Similarly, another combination 5 doses of labour and 6 doses of capital also produces same output.

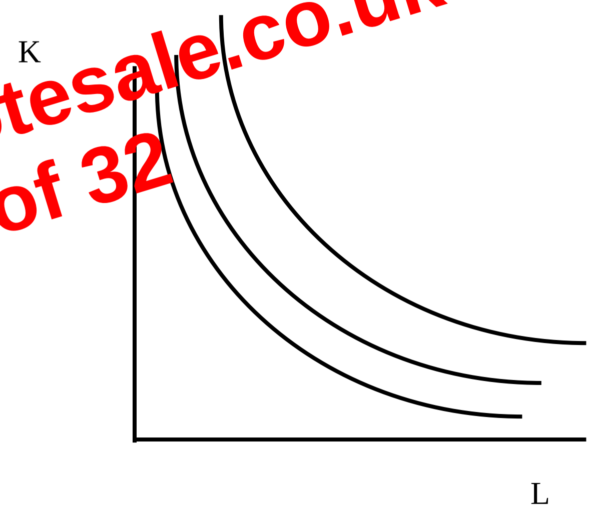
Isoquant schedule

combination	labaour	Capital	Output
A	1	20	100
B	2	15	100
C	3	11	100
D	4	8	100
E	5	6	100

Plot graph using the table to the right of this

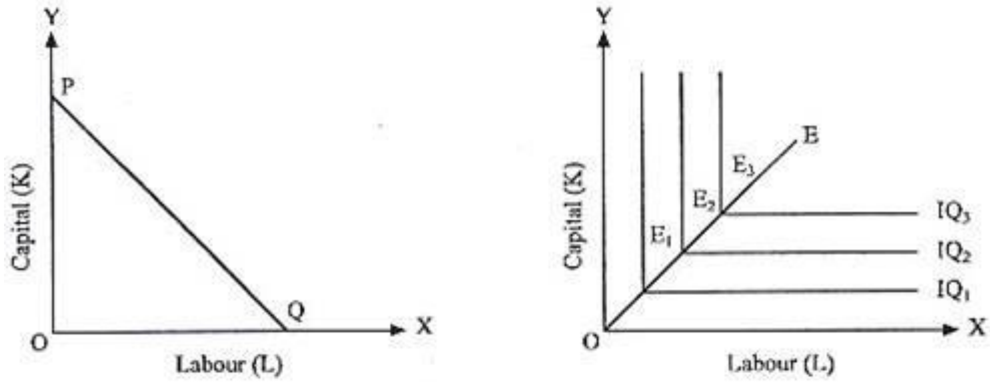
> **isoquant -** Curve showing all possible combinations of inputs that yield the same output.



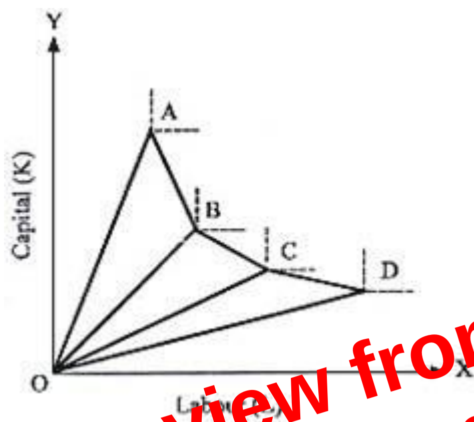


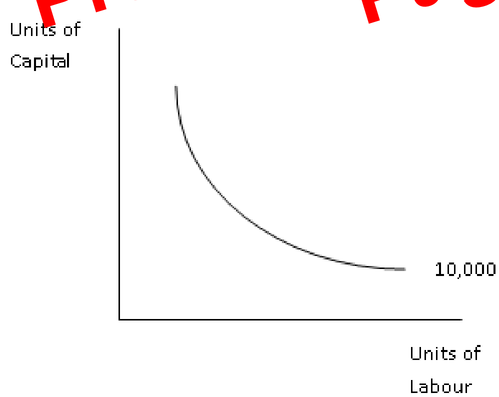
Plotting these combinations into a graph we obtain a convex downward slopping curve called isoquant. Along the isoquant the maximum possible output is constant. Symbolically it is represented as $Q_{const} = f(L,K)$

Isoquant Map: It is a graph combining a number of isoquants, used to describe a production function. In an isoquant map output increases as we move to higher from isoquants. For example isoquant q_1 produces 100 units. But higher q_2 produces 200 and q3 300 units. Total product curve can be derived from the isoquant map.



(a) **Perfect Subsitutes** (b) **Perfect Complement**





If the output OA is produced in the long run, then it must be produced on the LAC at point H which is a tangency point with the short-run average cost curve SAC_1. When output OA is produced the short-run marginal cost curve is SMC_1. Corresponding to the tangency point H there is a point N on the short run marginal cost curve SMC. This means that the production of output OA in the long run involves the marginal cost AN. Therefore point N must lie on the long-run marginal cost curve corresponding to output OA. If output OB is to be produced in the long run, it will be produced at point Q which is the tangency point between LAC and SAC_2.

Q is also the point on the short-run marginal cost curve SMC_2, corresponding to output OB. (Q is the common point between SAC_2 and SMC_2 because Q is the minimum point of SAC_2, at which the SMC_2, cuts it from below). Thus Q must also lie on the long-run marginal cost curve corresponding to output OB. Similarly, if output OC is to be produced in the long run, it will be produced at point M which is the tangency point between LAC and SAC_3Corresponding to point M, the relevant point on the SMC_3 is K which means that the long-run marginal cost of producing OC is CK.

By connecting points N, Q and K we obtain the long-run marginal cost curve LMC. It will be seen from the figure that long-run marginal cost curves is flatter than the short-run marginal cost curves.

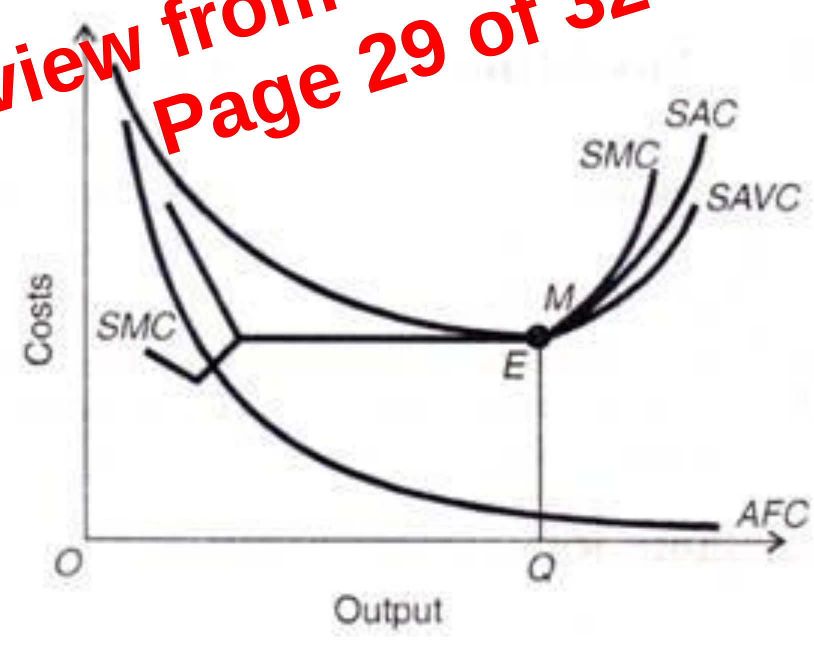
It should also be remembered that the relationship between the long-run marginal cost curve LMC and the long-run average cost curve LAC is the same as that between the short-run marginal cost curve and the short-run average cost curve. When the long-run marginal cost curve LMC lies below the long-run average cost curve, the latter will be falling, and when the long-run marginal cost curve lies above the long-run average cost, the latter will be rising. When the long- run marginal cost is equal to the long- run average cost, the latter will be neither rising nor falling. That is LMC passes through the minimum of LAC

The flat stretch corresponds to the built-in-the-plant reserve capacity. Over this stretch the SAVC is equal to the MC, both being constant per unit of output. To the left of the flat stretch, MC lies below SAVC, while to the right of the flat stretch the MC rises above the SAVC. The falling part of the SAVC shows the reduction in cost due to the better utilization of the fixed factor and the consequent increase in skills and productivity of the variable factor (labour). With better skills the wastes in raw materials are also being reduced and a better utilization of the whole plant is reached. The increasing part of the SAVC reflects reduction in labour productivity due to the longer hours of work, the increase in cost of labour due to overtime payments (which is higher than the current wage), the wastes in materials and the more frequent breakdown of machinery as the firm operates with overtime or with more shifts. The traditional theory assumes that each plant is designed (without any flexibility) to produce optimally only a single level of output. The innovation of modern microeconomics in this field is the theoretical establishment of a short-run SAVC curve with a flat stretch over a certain range of output. In figure 2, the range of output X1 X2 reflects the planned reserve capacity which does not lead to increases in costs and the entrepreneur expects to operate his plant within the X1 X2 range. Usually firms consider that the 'normal' level of utilization of their plant is somewhere between two-third and three-quarters of their capacity

The average total cost:

The average total cost is obtained by adding the average fixed and the average variable costs at each level of output. The ATC is shown in figure 3

Figure 3



The ATC curve falls continuously up to the level of output (X2) at which the reserve capacity is exhausted. Beyond that level ATC will start rising. The MC will intersect the average total-cost curve at its minimum point (which occurs to the right of the level of output X2, at which the flat stretch of the AVC ends).

LONG-RUN COSTS: