CHAPTER → 3   Theory of Production and Cost

Unit -I   Theory of Production

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Production is any economic activity which converts inputs into outputs which are capable of satisfying human wants, whether it is goods or services.

→ creating of utility either by transforming i.e. form utility transportation i.e. place utility and storage i.e. time utility.

→ It also include professional work of lawyers, doctors etc.

→ It should not meant for creation of matter, it is just the creation or addition of utility to the things that already exist in nature.

James Bates and J.R. Parkinson → organized activity of transform aiming to satisfy the demand of such transformed resources.

* Production consists of various process of utility addition :-

(i) Changing the form of natural resources → manufacturing processes . also called as conferring utility of form.

(ii) Changing the place of the resources → place utility.
(a) extraction from Earth eg. coal, minerals, gold etc. and supply them to markets.
(b) Transferring goods from where they give little or no satisfaction to the places where there utility is more. Through transportation.

(iii) Making available the materials at time when they are not normally available → utility of time → through storage & warehousing
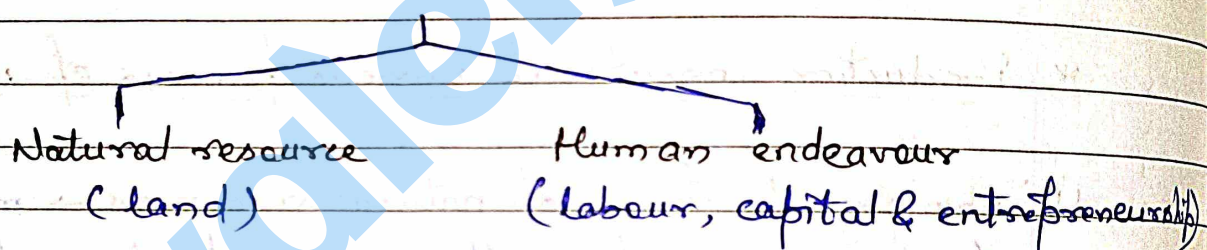
(iv) Making use of personal skills in the form of services.
→ merchants, organizers, transport workers, doctors, teachers, accountants, lawyers, actors etc.

⇒ Production does not include work done within a household by anyone out of love and affection, voluntary services and goods produced for self consumption

⇒ The money expenses incurred in the process of production constitute the cost of production.

☆ <u>Factors of Production</u>
~~Factors of inputs refers to~~
Factors of production refers to inputs which a firm buys for use in its production process.

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                    |
          _____|_____
         |                     |
  Natural resource       Human endeavour
     (land)          (labour, capital & entrepreneurship)
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☆ <u>Land</u>
It refers to all free gifts of nature which would include besides land in common parlance, natural resources, fertility of soil, water, air, light, heat, natural vegetation etc.

<u>Characteristics of land</u> :-

1 <u>Land is a free gift of nature</u> → It has no supply price i.e no payment is made to mother Earth for obtaining land

2. <u>Supply of land is fixed</u> → Supply of land is perfectly inelastic from the point of view of economy. But relatively elastic from the point of view of firm.

3. Land is permanent and has <mark>indestructible powers</mark>. (can not be destroyed).

4. Land is a passive factor, not an active factor

5. Land is immobile and cannot be shifted physically.

6. Land has multiple uses. → agriculture, industrial etc.

7. <mark>Land is heterogeneous</mark> → not alike → <mark>differ in fertility & situation</mark>

★ <u>Labour</u>
→ It means any <mark>mental or physical exertion</mark> directed to produce goods and services.
→ It refers to various types of human efforts which require the use of physical exertion, skill and intellect to secure an income apart from the pleasure. It must be done for the motive of some economic award.

<u>Characteristics of labour</u>

1. Human Effort.
2. labour is <mark>perishable</mark> → a labourer can't store his labour.
3. An <mark>active factor</mark> → Without labour, land and capital may not produce anything.
4. labour is inseparable from the labourer.
5. labour power differs from labourer to labourer. (heterogeneous)
6. All labour may not be productive → all labour efforts are not sure to produce resources.
7. labour has poor bargaining power → because it has no reserve

price, it can't be stored and it has more supply, that's why, the labourer is compelled to work at the wages offered by the employers.

8. Labour is mobile factor.
9. There is no rapid adjustment of supply of labour to the demand of it.

★ 10. A labourer can make choice b/w hours of labour and hours of leisure. → The supply and wage rate are directly related. However, beyond a desired level of income, the labour reduces the supply hours of labour and increases the hours of leisure in response to further rise in wage rate. This gives rise to a peculiar backward bending shape to the supply curve of labour after a certain point.

★ CAPITAL
It is that part of wealth of an individual or community which is used for further production of wealth. It is stock concept which yields a periodical income which is a flow concept.
Capital is defined as 'produced means of production' or 'man-made instruments of production'.
→ It refers to all man made goods that are used for further production.
→ Therefore capital is different from land and labour bcoz, land and labour are primary and original factors of production but capital is not a primary factor and it is a man made factor.
→ example - machines, tools, instruments, factories, dams, canals, transport equipment etc.

→ Wealth is the abundance of valuable financial assets or physical possessions which can be converted into a form that can be used for transactions. But capital is that part of wealth that is invested in the hope of a higher profit.

✱ TYPES OF CAPITAL

1. Fixed Capital → exists in durable shape and renders a series of services over a period of time. eg. tools, machines etc.

2. Circulating Capital → non-durable capital form eg. seeds, fuel, raw materials etc.

3. Real Capital → physical goods such as building, plant, machines etc.

4. Human Capital → refers to human skill and ability. A large investment is made to create these abilities in human, such investment is human capital.

5. Tangible capital → which can be perceived by senses

6. Intangible capital → which can not be perceived by senses eg. patents, goodwill, copyrights, trademark etc.

7. Individual Capital → personal property owned by an individual or a group of individuals.

8. Social Capital → what belongs to society as a whole in the form of roads, bridges etc.

✱ Capital Formation → (also known as Investment)

→ It means a sustained increase in the stock of real capital in a country. It involves production of more capital goods which are used for further production of goods.

The need of capital formation is to create additional

productive capacity. For accumulation of capital goods some current consumption has to be sacrificed and saving of current income are to be made. Savings are also to be channelised into productive investment. Higher rate rate of capital formation accelerate economic growth and add to employment oppurtunities.

Three Stages of Capital formation

1. **Savings** → Higher incomes are generally followed by high savings, because higher income falls the propensity to consume and propensity to ~~consume~~ ^{save} increases. A rich country has greater ability to save and thereby accelerating their national income quickly. Willingness to save it is also required which depends on individual's concern. Govt. can enforce compulsory savings on employed. Govt. also encourage saving by allowing tax deduction on income saved in insurance, provident fund etc.

2. **Mobilisation of Saving** → Saved money should enter into circulation. wide spread network of banking is required. Govt. plays an important role in channelising the savings through fiscal and monetary incentives.

3. **Investment** → The process of capital formation gets complete only when real savings get converted into real capital assets.

☆ **Entrepreneur**
Entrepreneur is a factor which mobilizes land, labour and capital, combines them in the right proportion, initiates the production process and bears the risk involved in it.

He has also been called the organiser, the manager or the risk taker. But in these days of specialisation, Manager or organizer and entrepreneur is different. While management involve decision-making of routine and non-routine types, the task of entrepreneur is to initiate production work and to bear the risk involved in it.

* Functions of an Entrepreneur

1. Initiating business enterprise and resource co-ordination

→ An entrepreneur senses business opportunities, conceives project ideas, decides on scale of operation, products and processes and builds up, owns and manages his own enterprise. The first function of an entrepreneur is to initiate a business enterprise. Then he undertakes obtaining of factors of production, bringing co-ordination among them using them to secure higher productivity. The surplus, if any, after paying fixed rent to land, wages to labour and fixed interest on capital, accrues to the entrepreneur. He may earn profits or losses. Other factors get the payments agreed upon, but entrepreneur can make either profit or loss.

2. Risk bearing or uncertainity bearing → The demand for a commodity, the cost structure, fashions and tastes of the people, government's policies regarding taxation, credit etc., change in production techniques changes which creates various financial and technological risk to the entrepreneur. There is diff. b/w risks and uncertainities. Risks can be

★ insured against such as loss by theft, fire etc. But uncertainities can not be insured against eg. changes in tastes, competition etc.

★ Frank knight → Profit is the reward for bearing uncertainities.

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3. <u>Innovations</u> → Innovation refers to commercial application of a new idea or invention to better fulfillment of business requirements. It includes the introduction of new or improved products, devices and production processes, utilization of new or improved source of raw materials, adoption of new or improved technology, novel business models, extending sales to unexplored markets etc. It yields more profits upto when it is widely accepted.

☆ <u>Schumpeter</u> → The true function of an entrepreneur is to introduce new innovations.

※ Enterprise's Objectives

1. <u>Organic objectives</u> → Survival which is possible only when enterprise is producing and distributing goods and services at a price which enables it to recover its costs.
Growth → The managers do not aim at optimising profits, rather they aim at optimisation of balanced growth.

2. Economic Objective → Profit maximization behaviour of firm.
⇒ There is diff. b/w accounting profit and Economic profit.
⇒ Accounting profit = Total revenue - Total costs (explicit cost only)
⇒ Economic profit = Total revenue - Total costs (explicit + implicit)
⇒ Since economic profit also includes implicit costs (opportunity cost associated with self-owned factors), it is generally lower than the accounting profits.
⇒ In economic sense profit is that after taking into account the capital and labour provided by the owners.
⇒ In economic sense, emphasis must be on normal profit (also including implicit cost) rather than super abnormal profit.

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★ H.A. Simon → firms have satisficing behavior and strive to profits that are satisfactory.

★ Baumol's theory of sales maximization → sales revenue maximization rather than profit maximization is the ultimate goal of business firms.

A.A. Berle
G.C Means
Williamson
Cyert & March

profit maximization ← firms owned and by entrepreneur himself considers not only money profits but also the sacrifice of leisure to produce outputs.

Utility maximization

own utility function max ← large Joint stock companies – utility functions by managers by attaining a best combination of profits, market, sales & production goals.

3. **Social objectives** :- (i) continuous & sufficient supply of unaltered goods and articles of standard quality (ii) To avoid profiteering and anti-social practices (iii) gainful employment (iv) prevent pollution (v) providing quality of life.

4. **Human Objectives** –: (i) providing fair deal to employees (ii) developing new skills and abilities and good work climate (iii) participate in decision – making (iv) make job contents interesting and challenging.

5. **National Objective** :- (i) remove inequality of opportunities. (ii) produce according to national policies. (iii) help country to become self reliant and avoid dependence on other nations. (iv) contribute in skill formation and economic growth & development.

* **Constraints of Enterprise**
1. Lack of knowledge and information.
2. Restrictions imposed in public interest by the state on the production, price and mobility of factors.
3. infrastructural adequacies and consequent supply chain bottlenecks resulting in shortages and various limitations.
4. changes in business & economic conditions and also change in external factors such as govt. policies and natural calimities
5. Events such as inflation, rising interest rates, unfavorable exchange rate fluctuations.

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* Enterprise's Problems

1. **Problems relating to objectives** → Enterprises face the problem of choosing objectives and strike a balance between them due to working in different environments – social, political, economic, cultural etc.

2. **Problems relating to location and size of plant** → Considering costs such as cost of labour, facilities, transportation, an enterprise faces problem regarding location of plant and size of the firm.

3. **Problems relating to selecting & organizing physical facilities** → A firm has to make decision on the nature of production process and type of equipments to be installed which depends on the required volume of production and their relative costs & efficiency.

4. **Problems relating to finance** → financial planning involves :-
   (i) determination of the amount of funds required for enterprise with reference to physical plans already made.
   (ii) assessment of demand and costs of its products.
   (iii) estimation of profits on investment and comparing them with others relatively
   (iv) determining capital structure and time for appropriate financing.

5. **Organization structure related problems** → division of work, specialisation, authority, responsibility, inter-relationship etc.

6. **Problems relating to Marketing** → The enterprise has to make decisions regarding 4 P's namely –!
   (i) **Product** → variety, quality, design, features, brand name, packaging, associated services, utility etc

(ii) <u>Promotion</u> → Method of communication with consumers, personal selling, social contacts, advertisement, publicity.

(iii) <u>Price</u> → pricing, discounts, allowance, credit terms etc.

(iv) <u>Place</u> → coverage, outlet for sales, distribution channels, location and layout of stores, inventory, logistics etc. (transport)

7. <u>Problems relating to legal formalities</u> → paying different taxes, maintenance of records, submission of informations to authorities adhering to various govt. rules and laws etc.

8. <u>Problems relating to industrial relations</u> → problems of winning worker's cooperation, enforcing proper discipline among workers, dealing with organized labour etc

☆ PRODUCTION FUNCTION

It states technological relationship between inputs and outputs

→ output is dependant variable and various inputs are independant variables in the production function.

$$Q = f(a, b, c, d, ---- n)$$ → a, b, c, d --- n are various factor inputs

$$Q = f(Ld, L, K, T, E)$$

Land | Capital | Entrepreneurship.
Labour | Technology

Mostly it is defined as function of labour and Capital $Q = f(L, K)$

<u>Samuelson</u> → for given state of technology, maximum output that can be produced with given quantities of inputs under a given state of technical knowledge; or minimum quantities of inputs that are required to yield a given quantity of output.

* Assumptions of Production function
1 relationship between inputs and outputs exist for a specific period of time. → i.e. Q is not a measure of accumulated output over time.
2. given certain 'state of art' - production technology. Any innovation would cause change in production function
3. The output resulting from whatever amt. of inputs utilization is at maximum level. i.e. inputs are fully utilized.

* Short run Vs long Run Production function
         ↓   ↓
   Short period   long period (planning horizon)
         ↓   ↓
at least one factor input   all factor inputs are variable
is kept constant   law of returns to scale
a firm can not install new equipments
capital is kept always a fixed factor → law of variable proportion

☆ Cobb-Douglas Production function
Paul H. Doughas and C.W. Cobb of U.S.A. studied production
of American Manufacturing industries,
→ does not apply to an individual firm but to the whole of manufacturing in USA → inputs are only labour and capital

$$Q = KL^a C^{(1-a)}$$ → k and a are +ve constants
                        → C = capital, L = labour
→ conclusion → labour + capital
                  3/4th   1/4th contribution in production
→ It is used as an approximation in Economics.

eventually → finally → अन्ततः

Law of proportionality, Law of Diminishing
Marginal Physical returns
↓ (Marginal Returns)

☆ **Law of Variable Proportion or Law of Diminishing Returns**
In short run → with one factor variable → labour
→ all other inputs held contant.
→ law of variable proportions (as the behaviour of output
is studied by changing the proportion in which inputs are combined)
→ law of returns to a variable input (as any change in output
is taken as resulting from additional variable input)
→ law of diminishing returns (as returns eventually diminishes)
→ an increase in some output input relative to other fixed
inputs will cause output to increase, but after a point, the
extra output resulting from same addition of extra input
will become less and less.

• **Total Product (TP)** → Total output resulting from the efforts
of all the factors of production combined together at any time.
TP varies with the quantity used of the variable factor.

• **Average Product (AP)** → Total product per unit of variable factor

$$AP = \frac{Total\ product}{No.\ of\ units\ of\ variable\ factor.}$$

• **Marginal Product (MP)** → Change in total factor per unit change
in the variable factor. i.e. an addition made to the total product
by an additional unit of variable input.

$$M.P_n = T.P_n - TP_{n-1} \quad or \quad \frac{\Delta TP}{\Delta V} \rightarrow \text{change in variable input}$$

* **Relationship between Average Product (AP) and Marginal Product (MP)**

1. When AP rises, MP > AP
2. when AP is maximum, then MP = AP. MP curve cuts the
   Average product curve at its maximum
3. when AP falls, MP < AP

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* **Assumptions of law of Variable Proportion**
1. State of technology is assumed to be given and unchanged.
2. There must be some inputs whose quantity is kept fixed.
3. Consider only physical inputs and outputs and not economic profitability.
4. Applicable in short run only.
5. Does not apply where the factors must be used in fixed proportion

→

Product Schedule

	Quantity of Labour (L)	Total Product (TP)	Average Product (AP)	Marginal Product (MP)
first Stage	1	100	100	100
	2	210	105	110
	3	(Point F) 330 (Point of Inflexion)	110	120
	4 (Point N)	440 (Point G)	110 (Point S)	110 (Point 8)
Second Stage	5	520	104	80
	6	600	100	80
	7	670	95.7	70
	8	720	90	50
	9	750	83.33	30
	(Point M) 10	(Point H) 750 (Point of Equilibrium)	75	0
Third stage	11	740	67.27	-10

★ Production function is a relationship between a given combination of inputs and the highest resulting output.

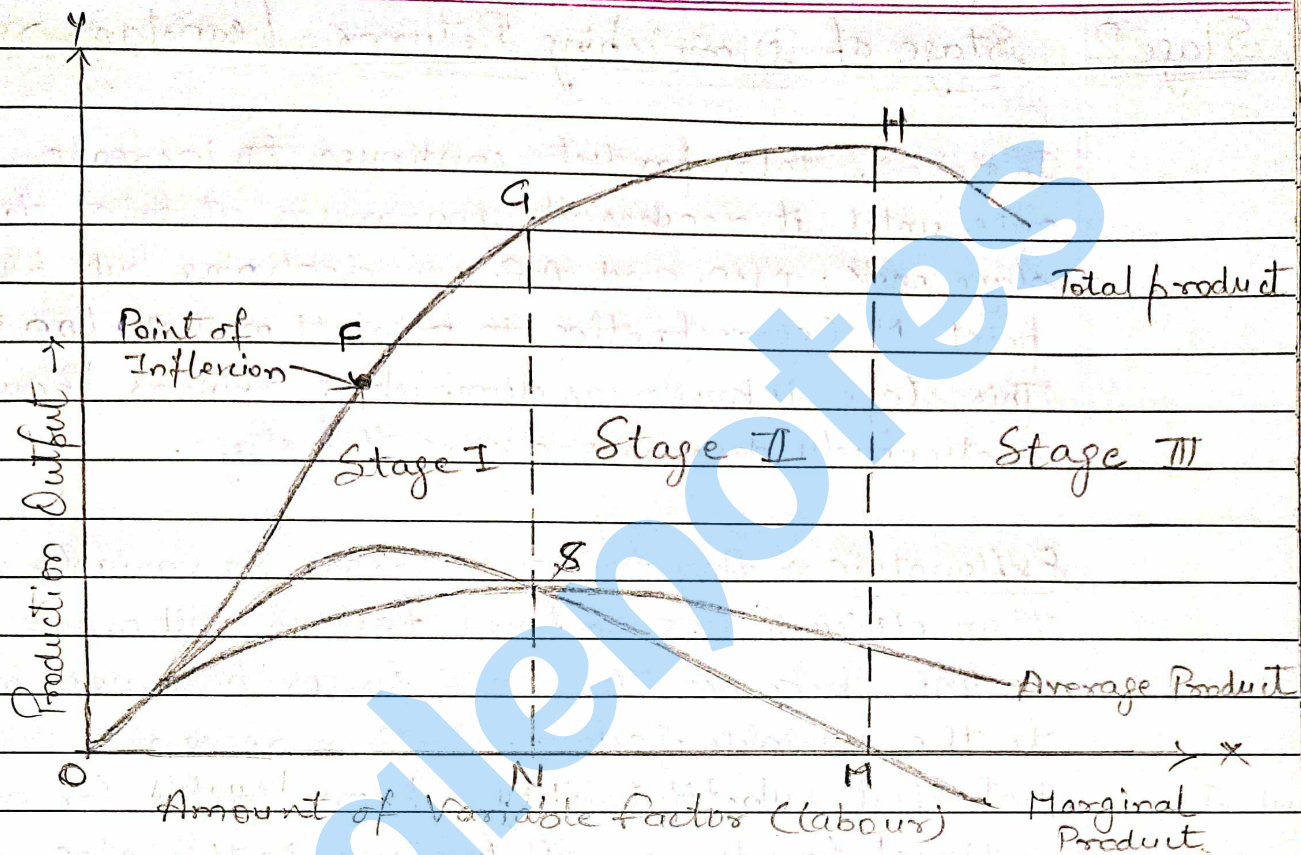indivisibility of a factor means that due to technological requirements, a minimum amount of factor must be employed whatever be the level of output.

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Stage I : Stage of Increasing Returns → T.P. increases upto a certain point F (inflexion point) and then increases at a diminishing rate, M.P. also increases and then after falls but positive. A.P. increases throughout this stage. In this stage MP > AP. At the end of this stage AP is maximum and equal to MP.

Explanation → The returns increases, because in beginning quantity of fixed factor is abundant relative to quantity of variable factor because the efficiency of fixed factors increases (as generally these are indivisible), as additional units of variable factors are added to them. Second reason is that as more units of variable factors are employed, the efficiency of variable factor increases due to division of labour and specialisation.

Stage 2 **Stage of Diminishing Returns** (constant returns stage)

In stage 2, total product continues to increase at a diminishing rate until it reaches its maximum at point H, where the second stage ends. M.P. and A.P. are declining but positive. At point M (corresponding to point H on T.P.) the M.P. is zero. This stage is known as diminishing returns because AP and MP continuously decreases during this stage.

Explanation → Any further increase in variable factors more than efficient use of fixed factors will cause MP and AP to decline because the fixed factor becomes inadequate relative to the variable factors. Another reason is that there is imperfect substitutability of one factor for another. A rational producer will produce in this stage to maximize his production.

Stage III **Stage of Negative Returns** → T.P. declines, M.P. is negative and A.P. is diminishing. This due to the excessive quantity of variable factor upon constant quantity of fixed factor so that they get in each other's ways with the result that the total output falls instead of rising. In this situation, a reduction in variable factor units will increase T.P.

* **Stage of Operation** → A rational producer will always produce in stage 2 where both MP and AP are diminishing. At what particular point in this stage, the producer will decide to produce depends upon prices of factors. The optimum level of employment of variable factor (labour) will be determined by applying the principle of marginalism in such a way that Marginal revenue product of labour is equal to Marginal wages.

★ **Law of Returns to Scale** (In Long Run)

Changes in output when all factors of production in a particular production-function are increased together i.e. all factors are variable. A change in scale means that all the factors of production are altered in the same proportion. Changes in scale is different from changes in factor proportion.

Returns to scale may be constant, increasing or decreasing.

1. **Constant Returns to Scale** → With the increase in the scale (inputs) in some proportion, output increases in the same proportion. ⇒ Linear Homogeneous Production function.

$$K \cdot Q_x = f(kK, kL)$$
$$K \cdot Q_x = f\{k(K,L)\}$$

$\begin{cases} K = Capital \\ L = Labour \end{cases}$

Where k is a amount of proportional increase

2. **Increasing Returns to Scale** → Output increases in greater proportion than the increase in inputs. When a firm expands, increasing returns to scale are obtained in beginning. Reason is that with increasing in initial quantity of inputs, their capacity increases manifolds. Another reason is the indivisibility of factors and greater possibilities of specialisation of land and Machinery.

3. **Decreasing Returns to Scale** → When output increase in a smaller proportion with an increase in all inputs.
→ Due to problems faced by management as regard to control and co-ordination when firm has expanded to a very large size

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* Cobb-Douglas production function is used to explain "returns to scale". → assumed that returns to scale are constant. At the first, function was constructed in a way that the exponents summed to $a + 1 - a = 1$. They rewrote the equation as → $Q = k \cdot L^a \cdot C^b$

where Q = Quantity of output, L = labour, K = Capital, k, a and b are positive constants.

- → If $a + b > 1$ → Increasing Returns to Scale
- → If $a + b = 1$ → Constant Returns to Scale
- → If $a + b < 1$ → Decreasing returns to scale
       → due to change in Labour and Capital.

☆ Production Optimisation
→ This can be done by combining the firm's production and cost functions, namely isoquants and isocost lines respectively.

* Isoquants → similar to indifference curve in the theory of consumer behaviour. Isoquant represents all those combinations of inputs which are capable of producing the same level of output. Product Curve, Production Indifference Curve, Isoproduct Curve.

Isoquants are negatively sloped, convex to the origin due to diminishing MRTS (Marginal Rate of Technical Substitution) and are non-intersecting.

There is one important difference b/w indifference curve and isoquant → In an indifference curve, it is not possible to quantify the level of consumer satisfaction, where as in an
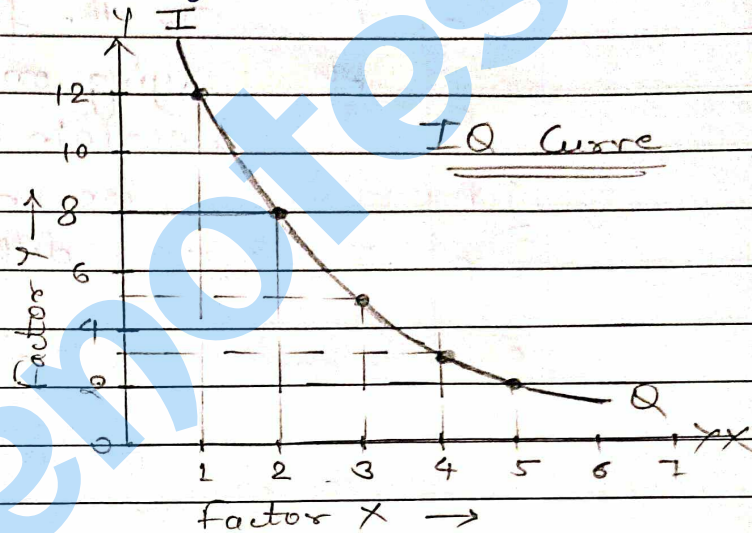
In Indifference curve, we get the satisfaction through a fixed money income.

Here, we study the best combination of factors by minimum cost to get a fixed certain output.

isoquant, the level of production is easily quantified.

Higher isoquant represents the higher level of output.

Factor combination	Factor X	Factor Y	MRTS
A	1	12	-
B	2	8	4
C	3	5	3
D	4	3	2
E	5	2	1

IQ Curve

factor X →

* **IsoCost or Equal Cost Lines → Budget line → Budget Constraints** → shows the various alternative combinations of two factors which the firm can buy with given outlay. All points on isocost line would cost the same amount for firm.
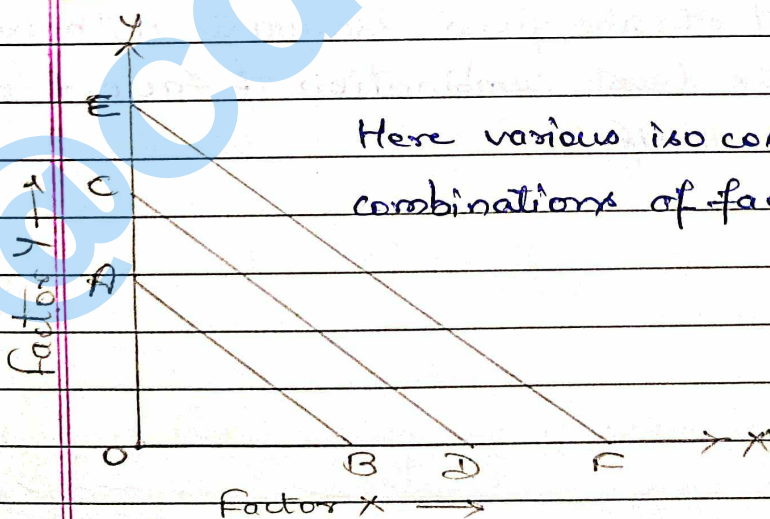

Here various iso cost lines representing different combinations of factors with different outlays.

⇒ Isoquants represent the technical conditions of production for a product.

⇒ Isocost lines represent various levels of cost or outlay.

Tangency points of Isoquants and Isocosts is
Called as **Expansion Path**.

⇒ The quantity decided by firm to be produced is represent
by Isoquant curve.
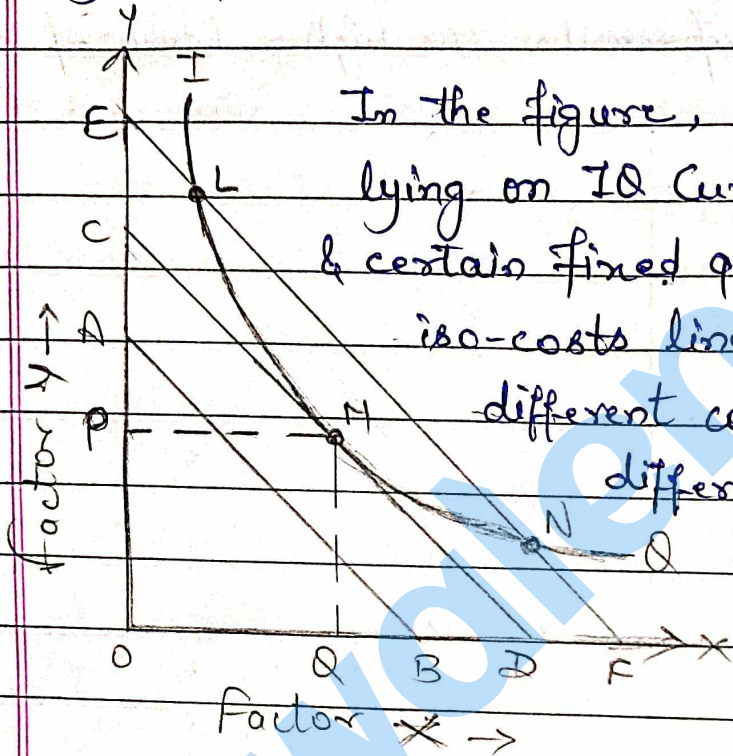
In the figure, L,M and N combinations
lying on IQ Curve can produce the sam
& certain fixed quantity of output. The
iso-costs lines AB, CD and EF are showing
different combinations of factors with
different outlays.

Isocost line CD is tangent
to the isoquant curve IQ
at point M.

This shows that the factor combination at point M ~~shows~~
is the best combination of factors to produce fixed
quantity of output at minimum cost. This is known as
production optimisation.

⇒ The tangency point of the given isoquant with an isocost
line represents the least combination of factors for
producing a given output.

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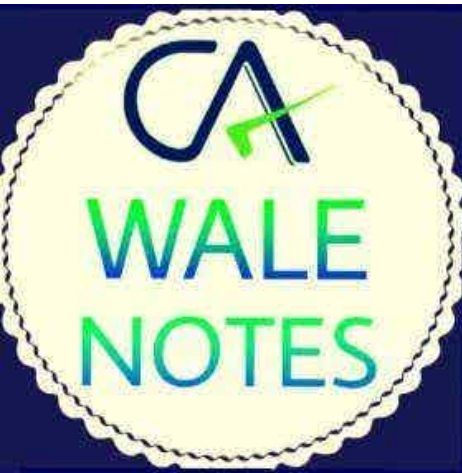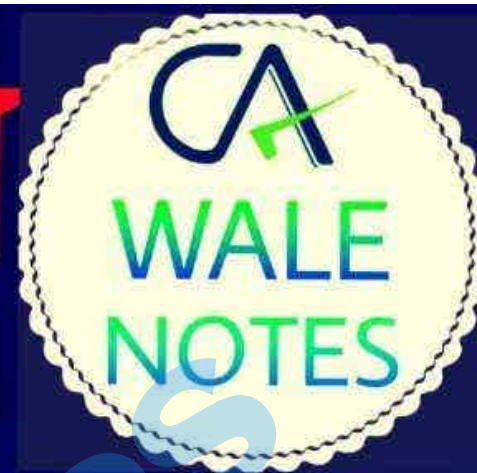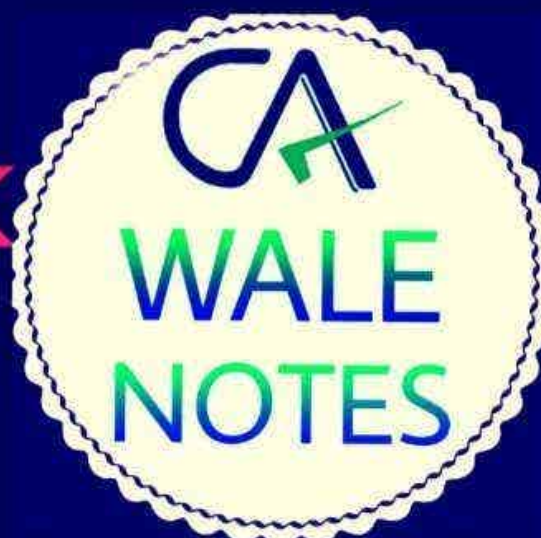
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