



INDUSTRIAL ECONOMICS & FOREIGN TRADE

Module 2 | **Part 1**

HUT 300

SYLLABUS



Production function - law of variable proportion - economies of scale - internal and external economies - Isoquants, isocost line and producer's equilibrium - Expansion path - Technical progress and its implications - Cobb-Douglas production function - Cost concepts - Social cost: private cost and external cost - Explicit and implicit cost - sunk cost - Short run cost curves long run cost curves - Revenue (concepts) - Shutdown point - Break-even point.

MEANING OF PRODUCTION



Production is the process of converting inputs (like land, labour, capital, and entrepreneurship) into useful goods or services that satisfy human wants.



PRODUCTION FUNCTION



Production Function is the relationship between physical inputs (land, labour, capital, etc.) and physical outputs (quantity produced). It is a technical relationship (not an economic relationship) that studies material inputs on one hand and material outputs on the other hand.

General Form:

$$Q = f(L, K)$$

Where:

Q = Quantity of output

L = Labour

K = Capital

f = Function showing how inputs are turned into output

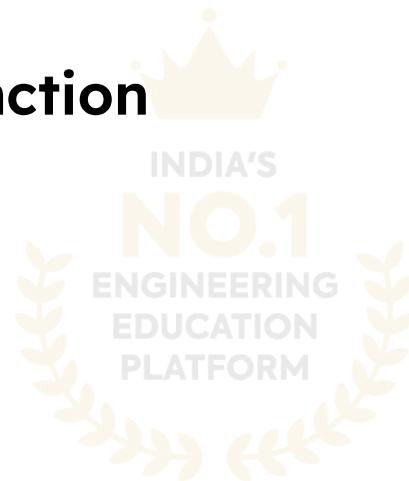


$$Q = f(L, K)$$

TYPES OF PRODUCTION FUNCTION



- Short Run Production Function
- Long Run Production Function



Short Run Production Function

Short Run is a period of time where output can only be changed by changing the level of variable inputs. In the short run, some factors are variable and some are fixed. Fixed factors remain constant in the short run like land, capital, plant, machinery, etc. Production can be raised by only increasing the level of variable inputs like labour. Therefore, the situation where the output is increased by only increasing the variable factors of input and keeping the fixed factors constant is termed as Short Run Production Function. This relationship is explained by the 'Law of Variable Proportions.'

Long Run Production Function

Long Run is a span of time where the output can be increased by increasing all the factors of production whether it is fixed (land, capital, plant, machinery, etc.) or variable (labour). Long run is enough time to alter all the factors of production. All factors are said to be variable in the long run. Therefore, the situation where the output is increased by increasing all the inputs simultaneously and in the same proportion is termed Long Run Production Function. This relationship is explained by the 'Law of Returns to Scale.'

CONCEPT OF PRODUCT



Product or output refers to the volume of the goods that the company produces using inputs during a specified period of time. The concept of product can be looked at from three different angles: Total Product, Marginal Product, and Average Product



Total Product

Total Product (TP) refers to the total quantity of goods that the firm produced during a given course of time with the given number of inputs. Total Product is also known as Total Physical Product (TPP) or Total Output or Total Return.

For example, if 6 labours produce 10 kg of wheat, then the total product is 60 kg

Average Product

Average Product refers to output per unit of a variable input. AP is calculated by dividing TP by units of the variable factor.

For example, if the total product is 60 kg of wheat produced by 6 labours (variable inputs), then the average product will be $60/6$, i.e., 10 kg.

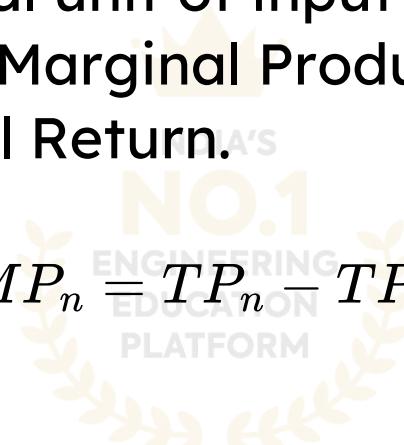
$$\text{Average Product} = \frac{\text{Total Product}}{\text{Units of Variable Factor}}$$

Marginal Product

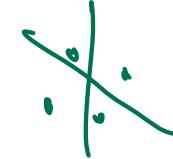


Marginal Product refers to the addition to the total product when one more unit of a variable factor is employed. It calculates the extra output per additional unit of input while keeping all other inputs constant. Other names of Marginal Product are Marginal Physical Product (MPP) or Marginal Return.

$$MP_n = TP_n - TP_{n-1}$$



LAW OF VARIABLE PROPORTION



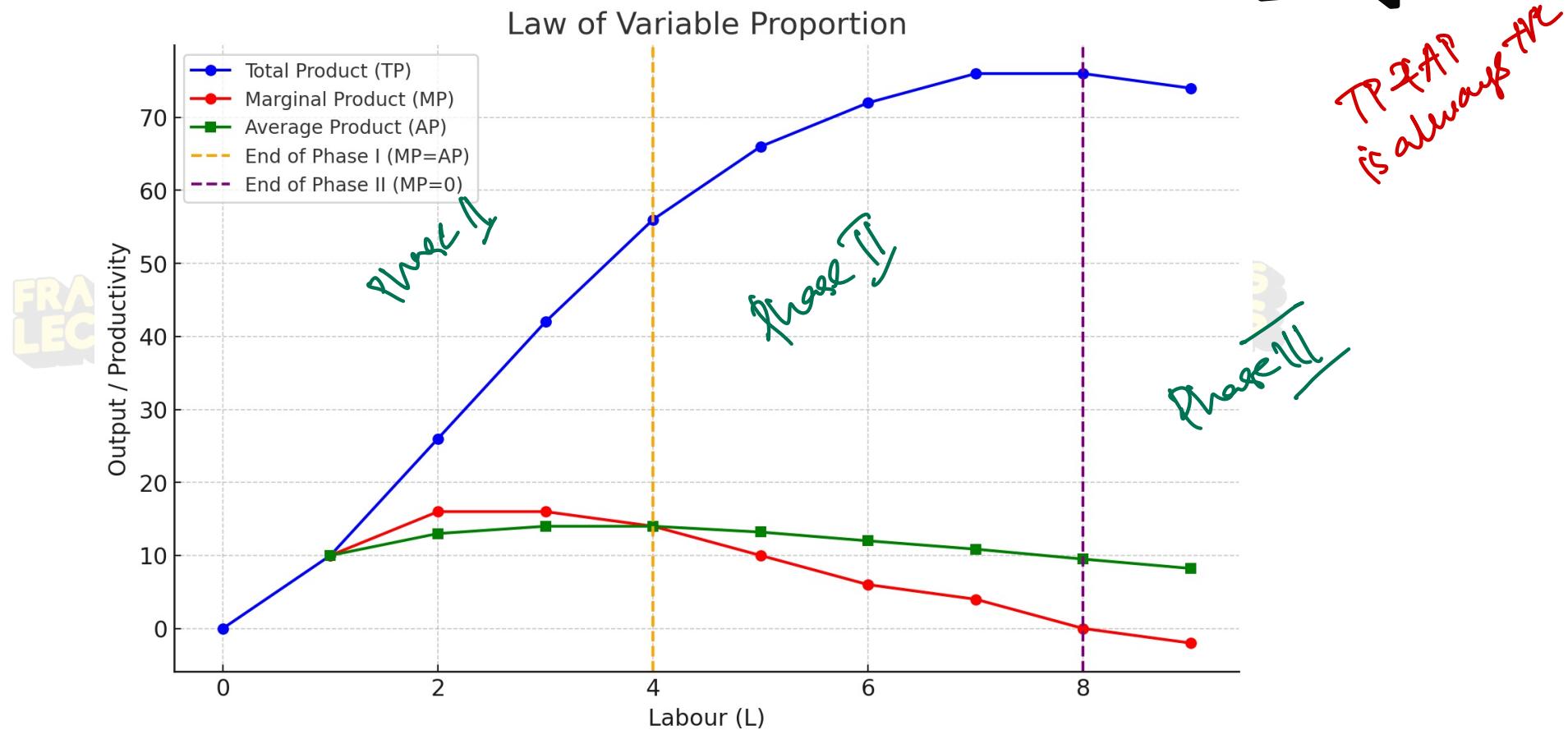
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The Law of Variable Proportions states that as we increase the quantity of only one input while keeping other inputs fixed, the total product increases initially at an increasing rate, then at a decreasing rate, and finally at a negative rate.

The Law of Variable Proportions, also known as the Law of Diminishing Returns / Returns to factor is a fundamental principle in economics that describes how the output of a production process changes as the quantity of one input varies while other inputs are kept constant. This law is applicable in the short run, where at least one factor of production (such as capital) is fixed.

Fixed Factor (Land)	Variable Factor (Labour)	TP (units)	MP (units)	Phase
1	1	5	5	Phase I: Increasing Returns to a Factor
1	2	20	15	
1	3	32	12	
1	4	40	8	Phase II: Decreasing Returns to a Factor
1	5	40	0	
1	6	35	-5	Phase III: Negative Returns to a Factor

TP > AP
is always true



PHASES OF LAW OF VARIABLE PROPORTION



Phase 1: Increasing Returns to the Variable Factor

- Explanation: As more units of the variable factor (usually labour) are added to the fixed factor (like land or capital), total product (TP) increases at an increasing rate, and marginal product (MP) rises.
- Why it happens:
 - Better utilization of fixed factors
 - Increased specialization and division of labor
- Graphically:
 - TP curve: Convex (steep upward)
 - MP curve: Rising
 - AP curve: Rising

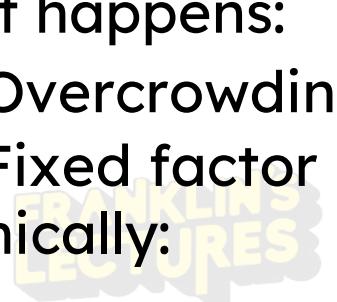
Rational producers want to enter production during or before this phase ends.



Phase 2: Diminishing Returns to the Variable Factor

- Explanation: TP continues to increase but at a decreasing rate. MP starts to decline but remains positive.
- Why it happens:
 - Overcrowding of variable factor
 - Fixed factor becomes a limiting constraint
- Graphically:
 - TP curve: Concave (increasing at decreasing rate)
 - MP curve: Falling
 - AP curve: Starts falling after reaching its peak

This is the most efficient and economically viable phase for production



Phase 3: Negative Returns to the Variable Factor

- Explanation: TP declines, MP becomes negative.
- Why it happens:
 - Severe overcrowding and overuse of fixed factor
 - Disruption and inefficiency
- Graphically:
 - TP curve: Starts to fall
 - MP curve: Falls below zero
 - AP curve: Continues to fall

This phase is irrational for producers – adding more units decreases total output.

Q. Explain Law of Variable Proportion with a diagram.

(10) (Dec 2021,2023)



LAW OF RETURNS TO SCALE



Returns to scale refer to the change in output that results from a change in the factor inputs simultaneously in the same proportion in the long run. Simply put, when a firm changes the quantity of all inputs in the long run, it changes the scale of production for the goods.

Three Stages of Returns to Scale

Increasing Returns to Scale:

Constant Return to Scale

Diminishing Returns to Scale:

ECONOMIES OF SCALE



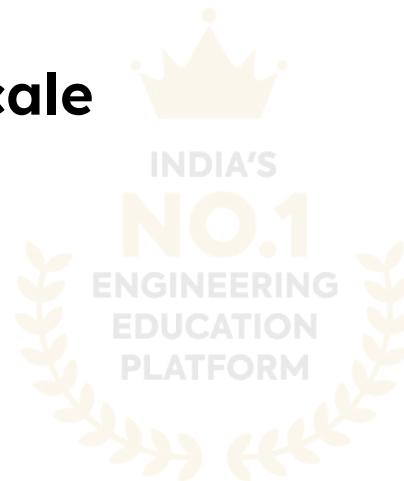
Economies of scale are the cost savings that arise as a business grows in its production or operations. As the output or activity increases, the average price per unit falls. This phenomenon is attributable to a number of factors that increase efficiency, offset fixed costs, and contribute towards total cost savings.

economies of scale is an underlying concept that states how a firm benefits from increasing its level of production or operations. This principle is derived from the fact that, as an aggregate output or activity increases, its average cost diminishes. That is, economies of scale enable an organization to produce goods or services in a more efficient manner and at a lower average unit cost.

TWO MAIN TYPES OF ECONOMIES OF SCALE



- Internal Economies of Scale
- External Economies of Scale



1. Internal Economies of Scale

(Happens within the firm)



Type	Meaning
Technical	Use of advanced machines and automation
Managerial	Hiring specialized managers for different tasks
Financial	Big firms get loans at lower interest rates
Marketing	Spread advertising costs over more output
Purchasing	Bulk buying of raw materials at discount
Risk-bearing	Diversifying products/markets reduces business risk

2. External Economies of Scale

(Happens due to industry growth, not just one firm)



Type	Meaning
Infrastructure	Better roads, ports, and communication for all firms
Skilled Labour	Industry hubs attract skilled workers
Support Services	Availability of suppliers, maintenance services, etc.
Knowledge Spillover	Firms learn from each other's innovations

ISOQUANT



An isoquant is a curve that shows all combinations of two inputs (like labour and capital) that produce the same level of output.

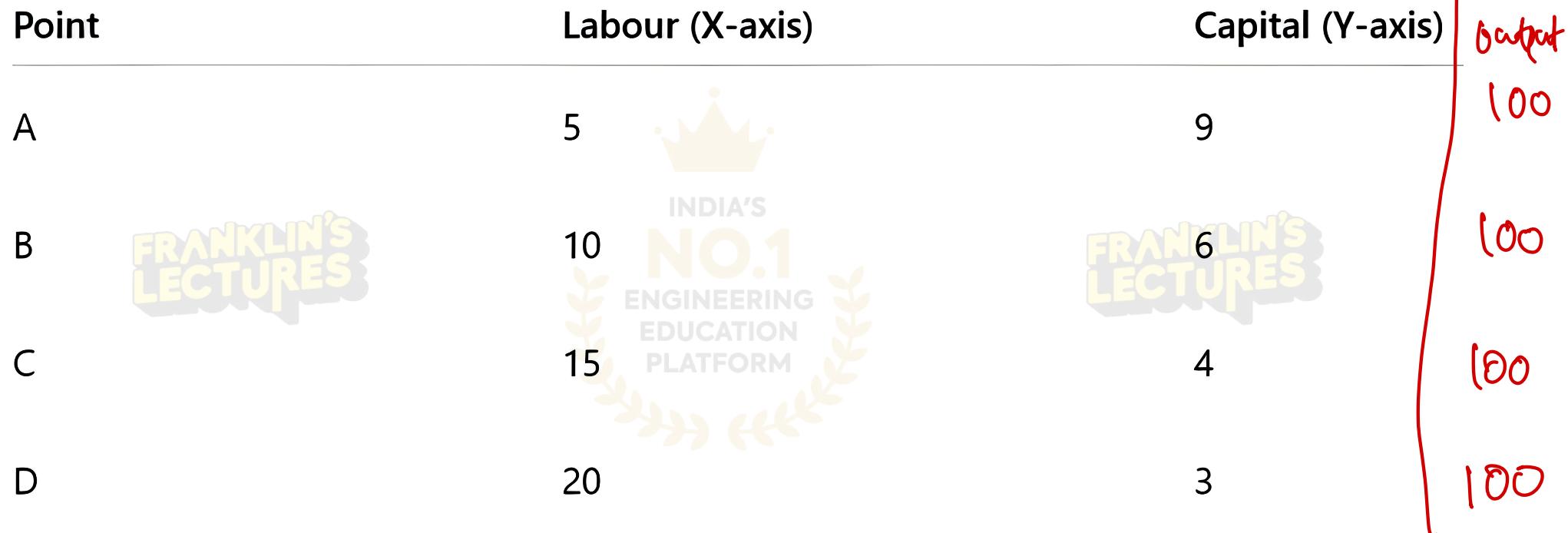
Meaning:

"Iso" = same "Quant" = quantity (of output)
So, Isoquant = "same quantity"

It shows different input combinations that result in the **same output**.

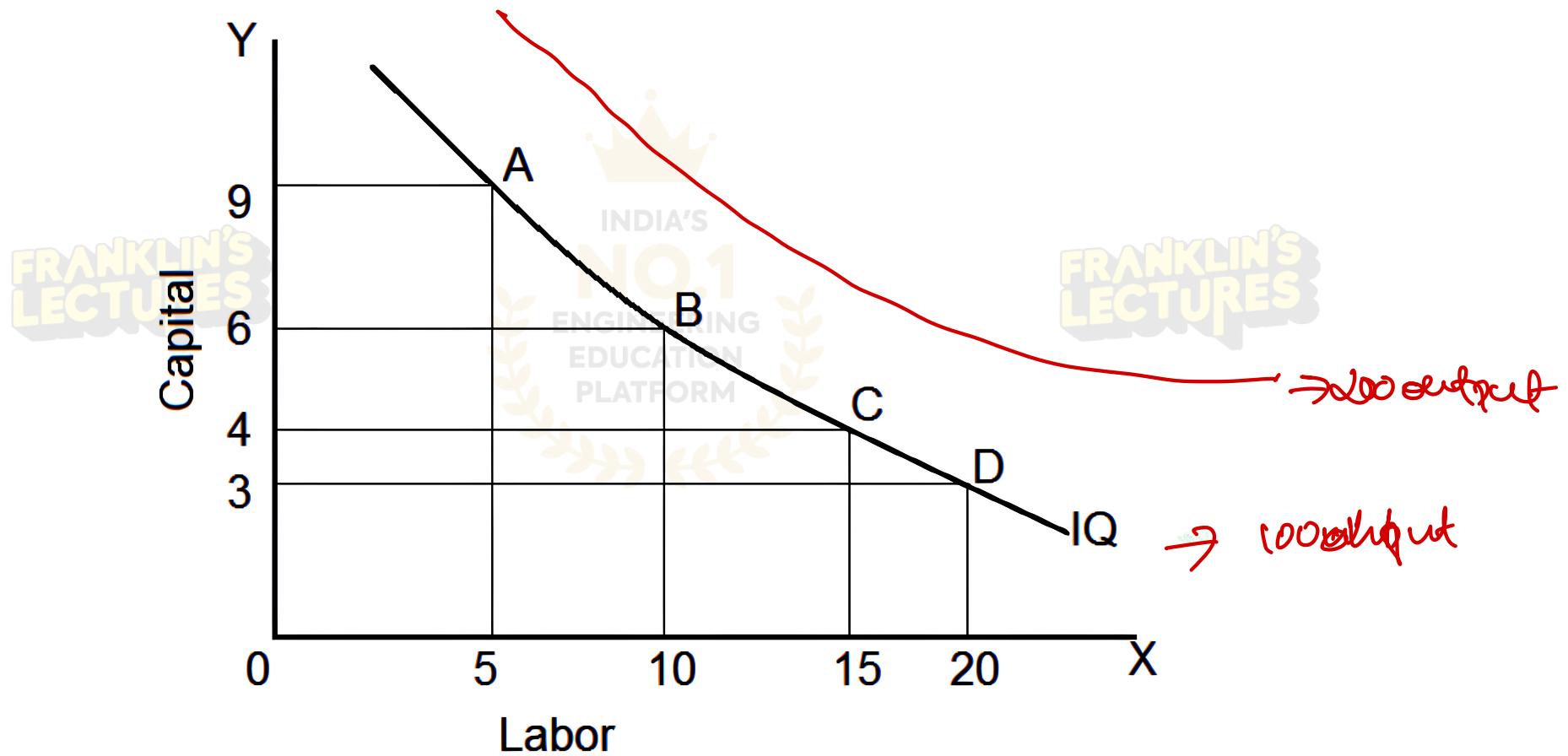
Isoquants are also called isoproduct curves or equal product curves

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Each row shows a different combination of labour and capital that can produce the same 100 units → all lie on **one isoquant**.

Figure 1



PROPERTIES OF ISOQUANTS

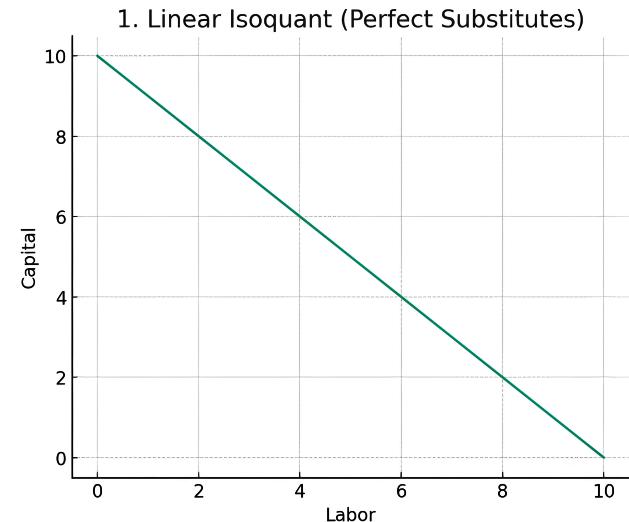


Property	Explanation
1. Downward Sloping	To maintain the same output, if one input increases , the other must decrease .
2. Convex to the Origin	Due to diminishing Marginal Rate of Technical Substitution (MRTS) .
3. Higher Isoquant = Higher Output	Isoquants further from the origin represent greater levels of output .
4. Two Isoquants Never Intersect	Each isoquant represents a unique output level – they cannot overlap .
5. Isoquants Cannot be Thick	A thick isoquant would mean different outputs from the same input combo – not possible .
6. Do Not Touch Axes	Zero use of any input gives zero output – isoquants cannot touch axes.
7. Infinite Number of Isoquants	There are countless isoquants for different levels of output.
8. MRTS is Diminishing	As we move along the curve, the rate at which one input substitutes another keeps decreasing .
9. Isoquants are Smooth	No sharp corners – because substitution of inputs is usually continuous .
10. Isoquants can be Parallel (Theoretical)	If production technology remains constant, isoquants may appear evenly spaced .

TYPES OF ISOQUANTS:

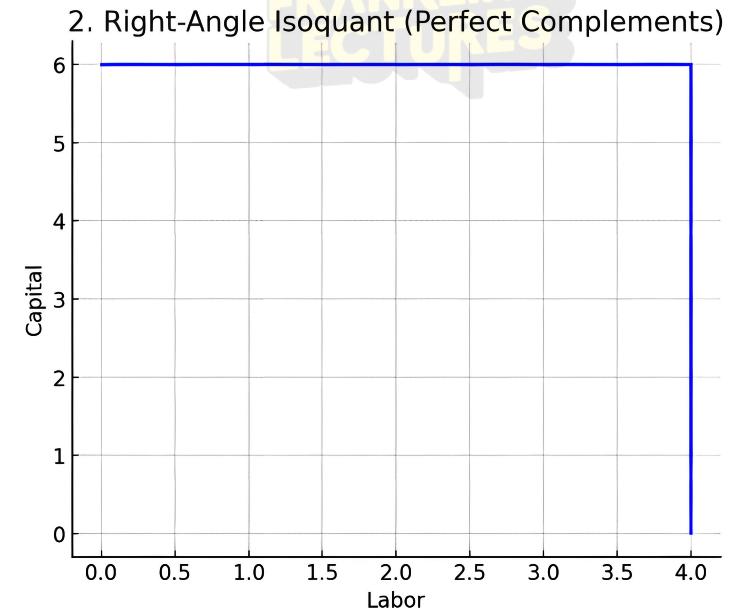
Linear Isoquant

- Shape: Straight line
- Explanation: Perfect substitutes — one input can be completely replaced by another at a constant rate.
- Example: 1 unit of labor can be replaced by 1 unit of capital without affecting output.



Right-Angle Isoquant (L-shaped)

- Shape: 90-degree angle (L-shape)
- Explanation: Perfect complements — inputs are used in fixed proportions; no substitution possible.
- Example: One machine and one operator are always used together; more of one without the other doesn't increase output.



**Q. Define Isoquant curve. Explain the properties of isoquant curve.
(7) (Dec 2021)**



Isocost Line

- An isocost line shows all the possible combinations of two inputs (typically labor and capital) that a firm can purchase for a given total cost, assuming input prices are fixed.

Formula of Isocost Line:

$$\text{Total Cost (TC)} = wL + rK$$

Where,

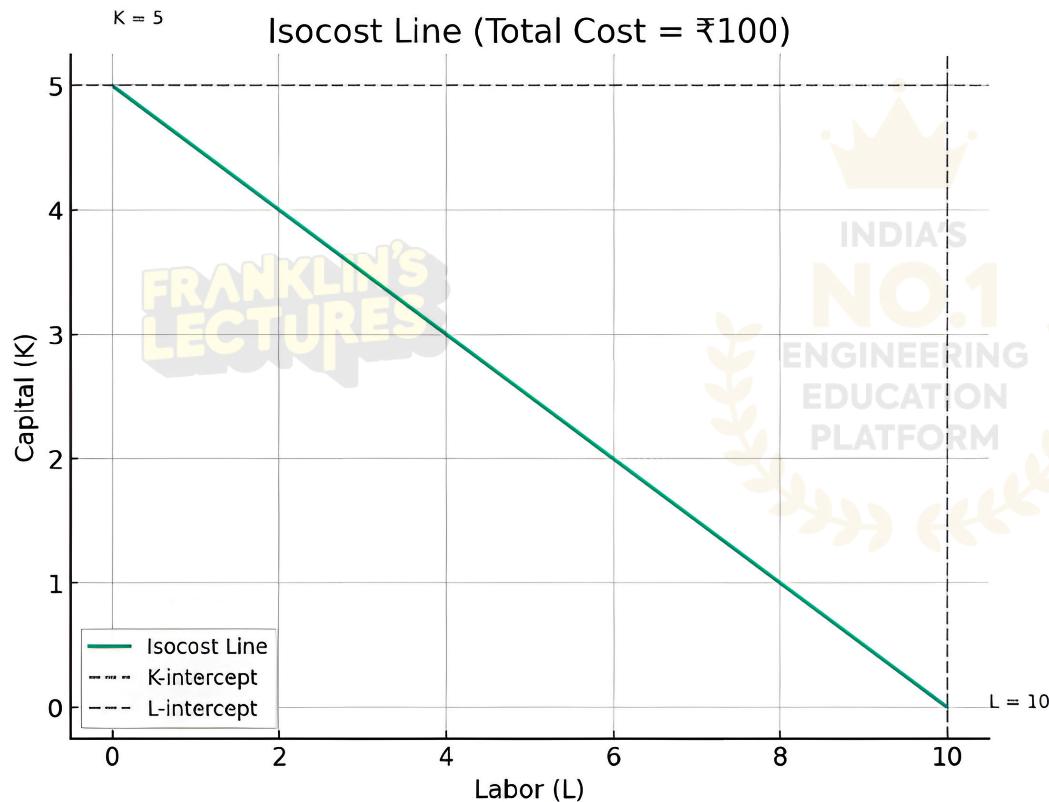
w → wage of labour

L → Labour

r → rent / cost of capital

K → Capital

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Slope of Isocost Line $= -\frac{w}{r}$

SHIFT IN THE ISOCOST LINE



A shift in the isocost line means the entire line moves parallelly outward or inward, showing that the firm's budget or input prices have changed, altering its capacity to buy inputs.

Types of Shifts in the Isocost Line:

1. Due to Change in Total Outlay (Budget)
2. Due to Change in Price of a Factor Input

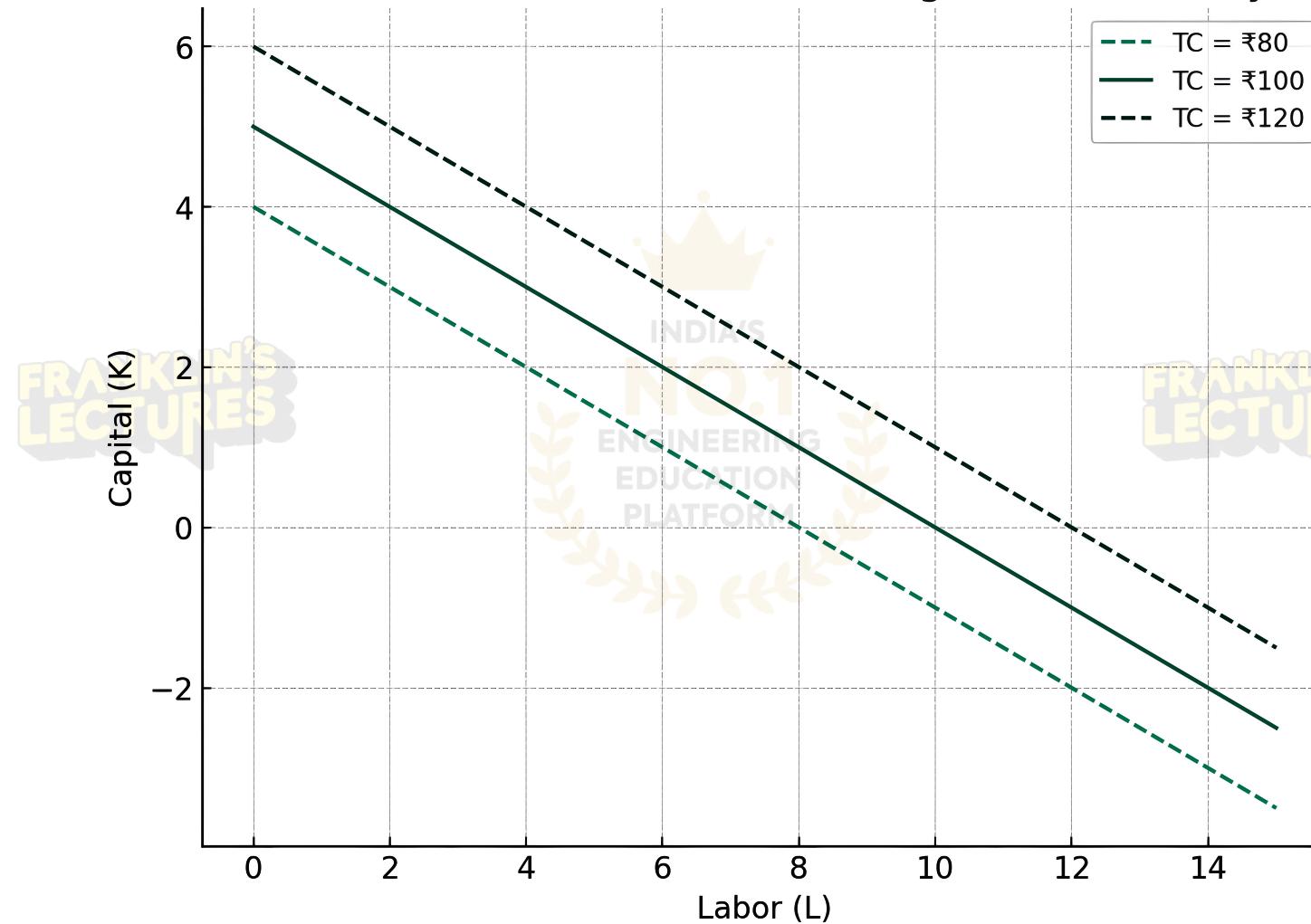
Shift Due to Change in Total Outlay

When input prices w and r remain constant, but the firm's total cost (TC) changes, the isocost line shifts parallel to the original one.

Effects:

- Increase in Total Outlay
 - Line shifts outward (away from origin)
 - Firm can afford more labor and capital
 - Slope remains unchanged
- Decrease in Total Outlay
 - Line shifts inward (toward origin)
 - Firm can afford less labor and capital
 - Slope remains unchanged

Shift of Isocost Line Due to Change in Total Outlay



Shift Due to Change in Price of a Factor-Input

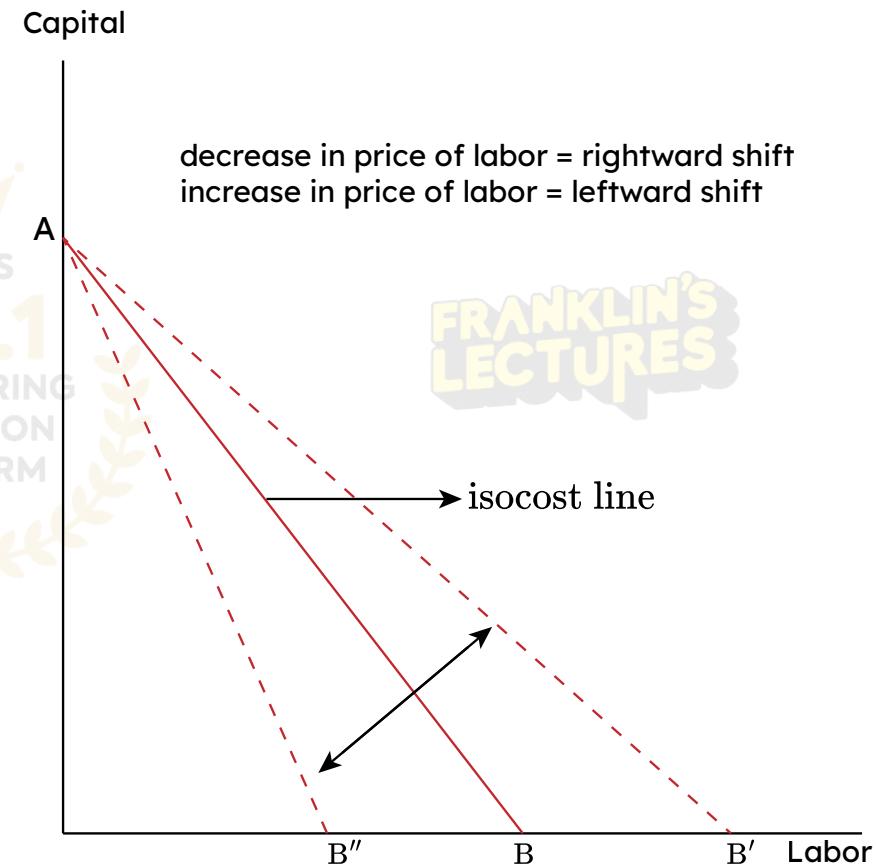
When the price of one input (either labor or capital) changes, and total cost (TC) remains the same, the slope of the isocost line changes — this is called a rotation of the isocost line.

A. Change in Wage Rate (Labor Cost)

- Wage Rate Increases ($w \uparrow w \uparrow w$)
 - Labor becomes costlier
 - Firm can afford less labor
 - X-intercept (L) shifts inward
 - Line becomes steeper

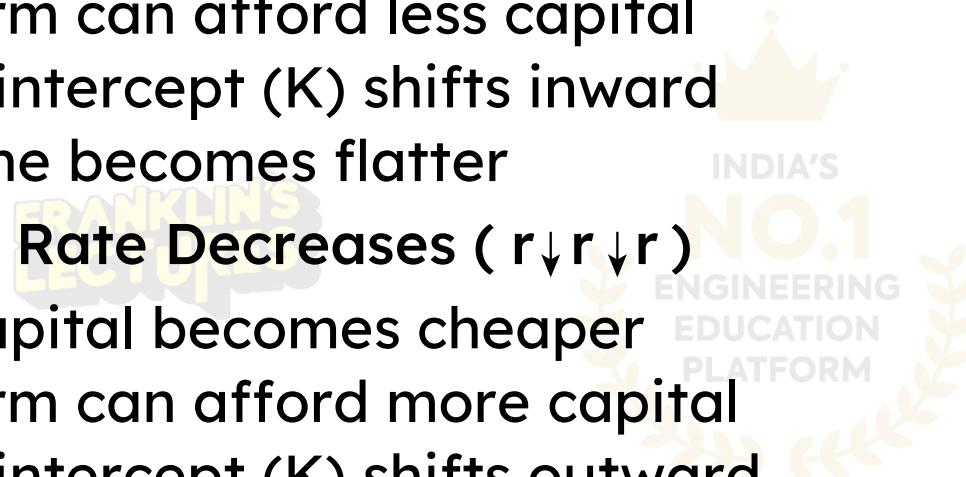
- Wage Rate Decreases ($w \downarrow w \downarrow w$)
 - Labor becomes cheaper
 - Firm can afford more labor
 - X-intercept (L) shifts outward
 - Line becomes flatter

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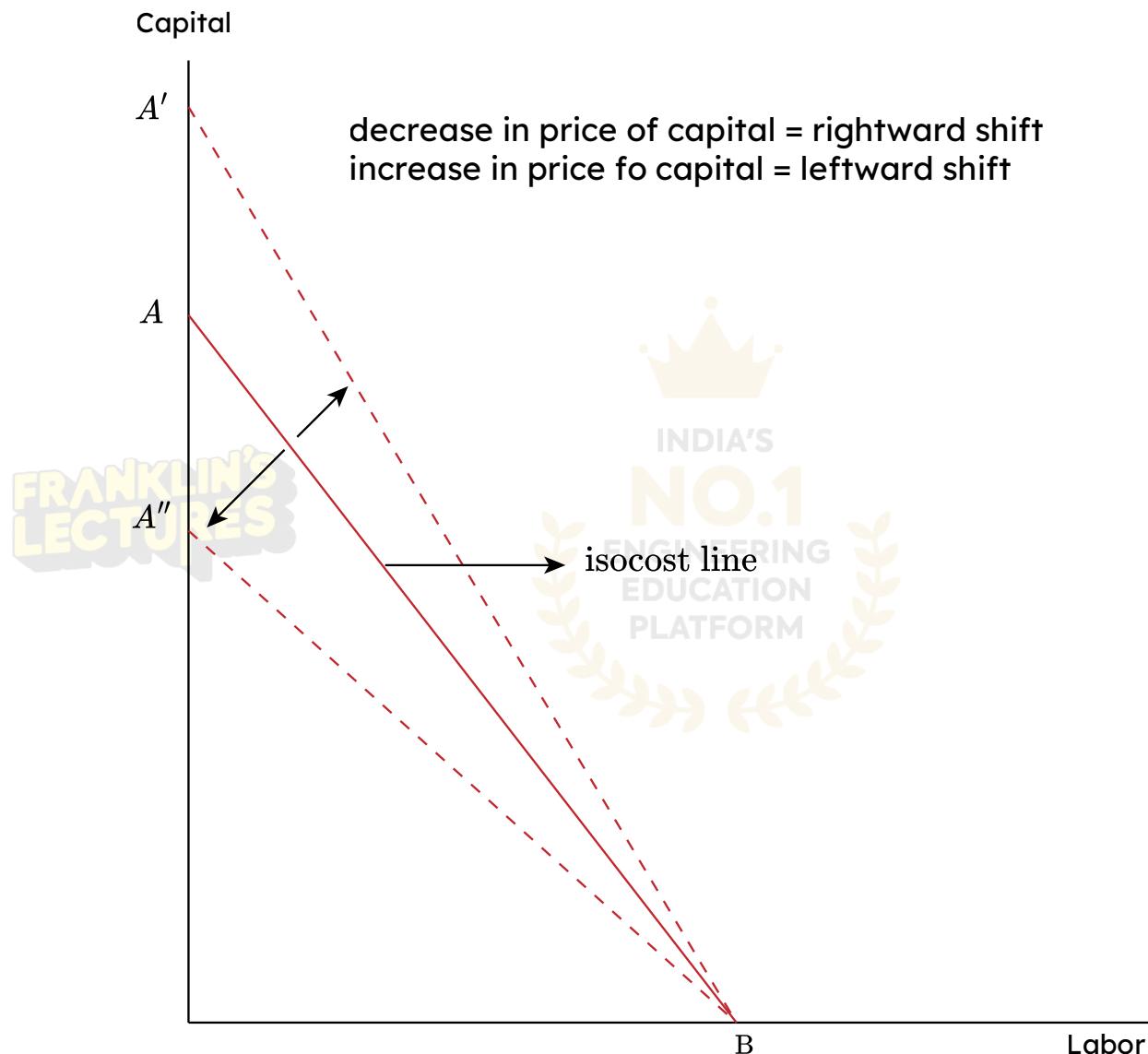
B. Change in Rent Rate (Capital Cost)

- Rent Rate Increases ($r \uparrow r \uparrow r$)
 - Capital becomes costlier
 - Firm can afford less capital
 - Y-intercept (K) shifts inward
 - Line becomes flatter
- Rent Rate Decreases ($r \downarrow r \downarrow r$)
 - Capital becomes cheaper
 - Firm can afford more capital
 - Y-intercept (K) shifts outward
 - Line becomes steeper





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THANK YOU