UNIT II

THEORY OF PRODUCTION

&

COST ANALYSIS

UNIT 2 - TOPICS

1. Production Function
2. Isoquants
3. Isocosts
4. Internal and External Economies of Scale
5. Law of Returns
6. Cost Analysis
7. Cost concepts
8. Types of costs
9. Break-even Analysis (BEA)- Determination of Break-Even Point
10. BEP problems

WHAT IS PRODUCTION???

Production is an activity that transforms inputs into output.

It can be defined as the process of creation of utility.

PRODUCTION FUNCTION

Production Function is purely a technological relationship which expresses the relation between output of a good and the different combinations of inputs used in its production.

It shows the maximum production obtained from a given set of inputs with a given state of technology.

MATHEMATICAL EXPRESSION

Production Function can be expresses mathematically in the form of an equation.

$$Q = f (L_1, L_2, C, O, T)$$

Where, Q= Quantity of production

f = function

L1= Land

L2= Labour

C = Capital

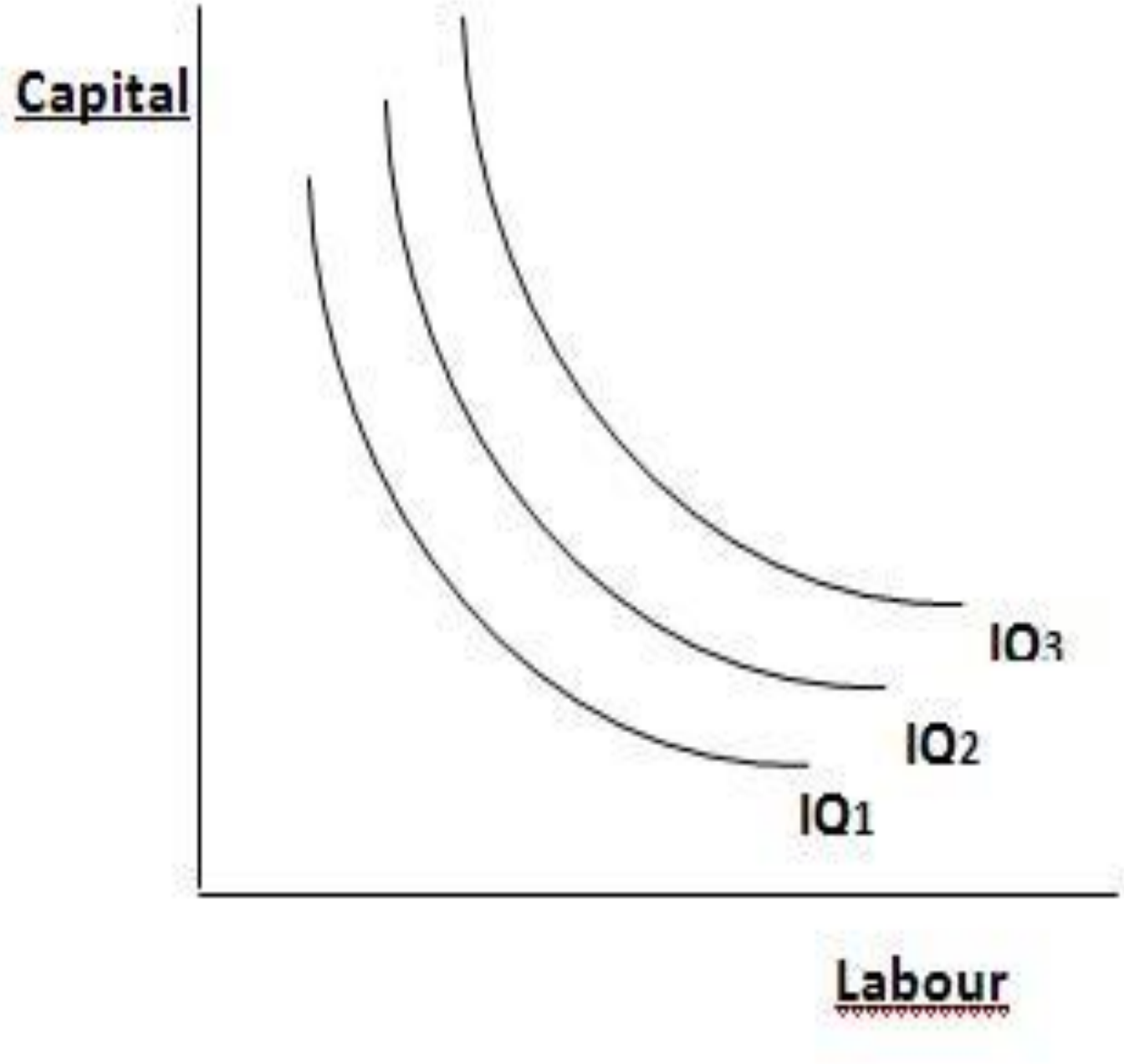
O = Organization

T = Technology

ISOQUANT

An Isoquant is a curve representing the various combinations of two inputs that produce the same amount of output.

An isoquant is also known as iso-product curve, equal – product curve or production indifference curve.


Capital
IQ3
IQ2
IQ1
Labour

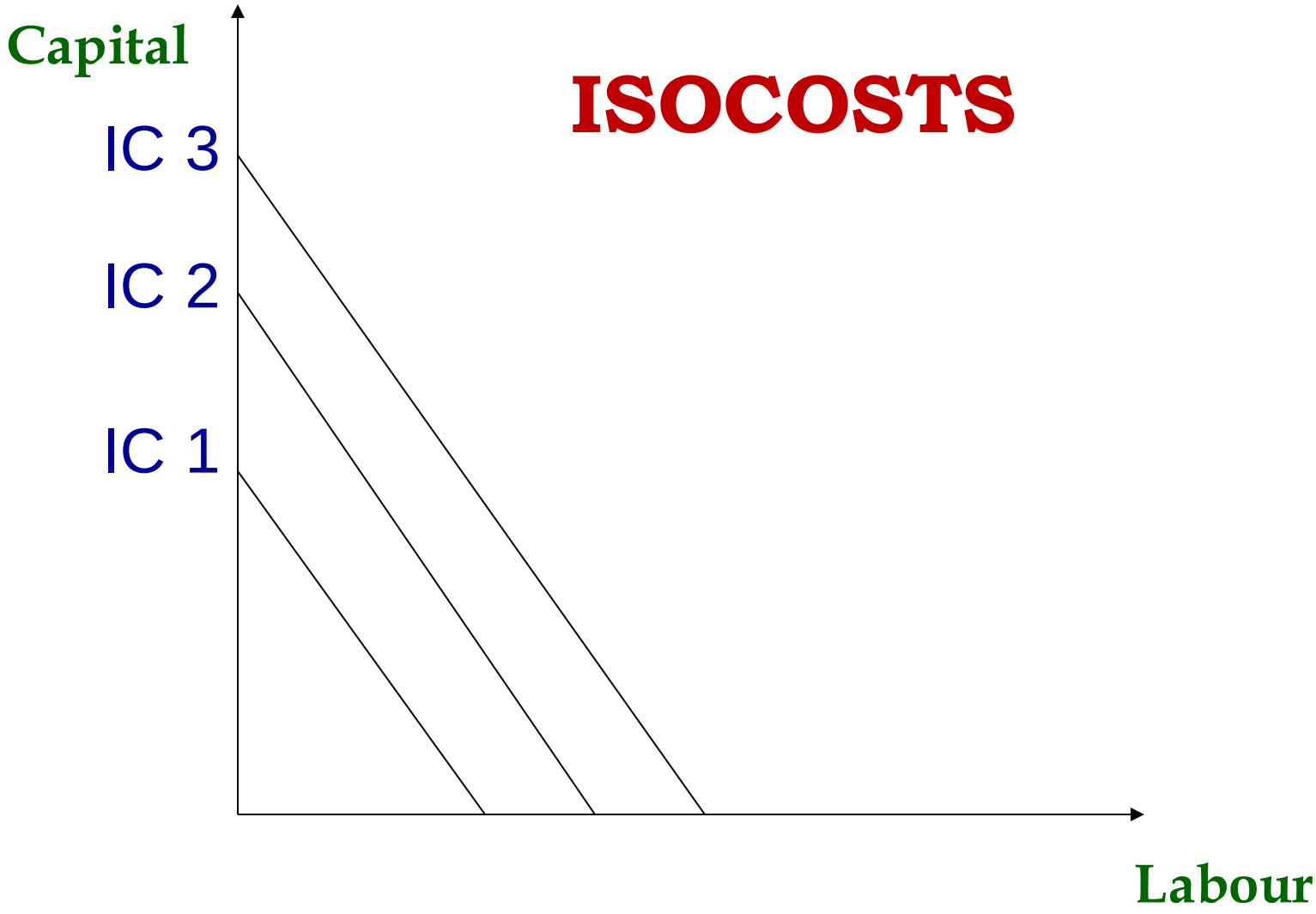
Properties of Isoquants

- ✓ An Isoquants is downward sloping to the right
- ✓ Higher Iso-quant represents larger output
- ✓ No two Isoquants intersect or touch each other
- ✓ Isoquants are convex to the origin.

ISOCOSTS

Isocosts refers to that cost curve that represents the combination of inputs that will cost the producer the same amount of money.

ISOCOSTS



There are two methods by which output can be raised:

1. Changing some inputs
2. Changing all inputs

Changing some inputs - Law of Variable proportions
(or) Law of Diminishing returns

Changing all inputs - Returns to Scale

LAW OF VARIABLE PROPORTIONS

Law of Variable proportions refers to the short run.

Law of Variable proportions explains the changes in output when a factor of production is varied while keeping other factors constant.

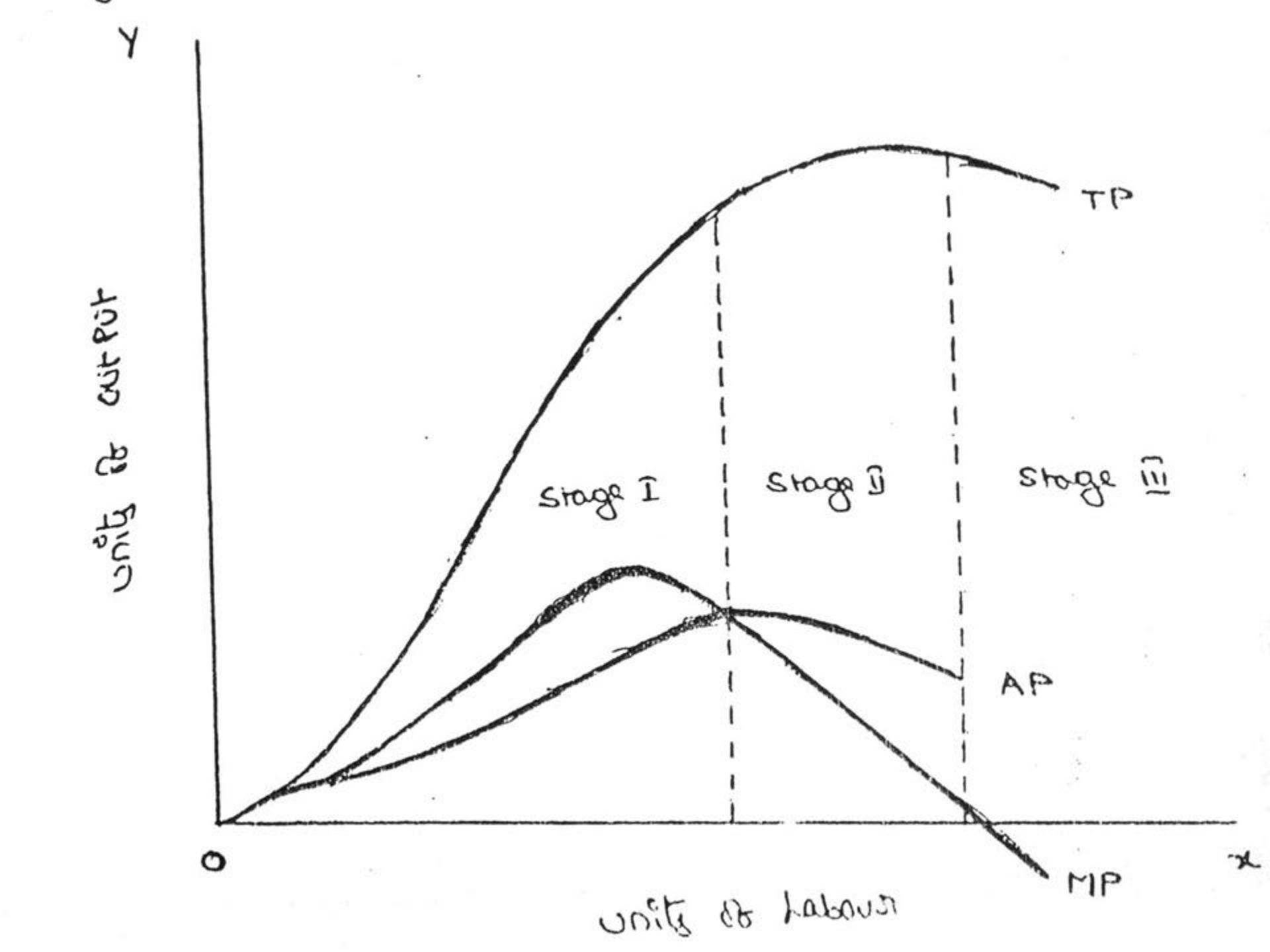
It is also called " Law of Diminishing returns"

ASSUMPTIONS OF THE LAW

- The state of technology or the methods of production remain constant..
- Only one factor of input is made variable and other factors are kept constant.
- The analysis relates to short period.
- The law assumes labour is homogeneous i.e. no difference in labour skills.

EXPLANATION OF LAW

Labour	TP	AP	MP	Stages
0	0	0	0	STAGE I
1	5	5	5	
2	12	6	7	
3	18	6	6	STAGE II
4	20	5	2	
5	20	4	0	
6	18	3	-2	STAGE III
7	14	2	-4	


Y
Units of output
TP
Stage I
Stage II
Stage III
AP
MP
O
X
Units of labour

RETURNS TO SCALE

Economists use the phrase, "Returns to Scale" to describe the relationship between output behavior in the long run in relation to the variations of factor inputs.

In the long run, adjustments can be made among the different factors and therefore, all factors become variable during this period.

Returns to scale are of three types:

- **Increasing Returns to Scale**
- **Constant Returns to Scale**
- **Decreasing Returns to Scale**

Increasing returns to scale

Increasing returns to scale arise when a given percentage increase in inputs leads to a greater percentage increase in the resultant output.

Hence, the total product increases at an increasing rate.

Constant Returns to Scale

Constant returns to scale is a stage where the given percentage increase in inputs will be equal to the percentage increase in the resultant output.

Decreasing Returns To Scale

Decreasing returns to scale will occur when a firm continues to expand its size beyond a particular point.

Decreasing returns to scale operate when the percentage increase in output is less than the percentage increase in input.

ECONOMIES OF SCALE

The advantages of large scale production are called Economies of Scale.

- **Internal Economies**
- **External Economies**

INTERNAL ECONOMIES

Internal Economies are those economies which are open to an individual firm when its size expands.

- **Technical Economies**
- **Marketing Economies**
- **Managerial Economies**
- **Financial Economies**
- **Risk Bearing Economies**

TECHNICAL ECONOMIES

Technical Economies arise when a firm uses better machines & techniques of production, as a result of these economies there will be increase in production and fall in the cost of production.

MARKETING ECONOMIES

- **A large firm purchases various inputs in bulk and therefore, it can secure them at cheaper rate when compared to small firms.**

- **It can also secure special transport concessions & better quality inputs etc.**

- **It can also sell its finished goods without any difficulty with the help of best marketing strategies.**

MANAGERIAL ECONOMIES

- **A large firm can appoint specially qualified and highly paid officials to look after the production, accounts, advertisements etc.**

- **Managerial Economies arise due to better and more elaborate management which only large size firm can afford.**

FINANCIAL ECONOMIES

- **A large firm can procure money in time at cheaper rates of interests because it possesses large assets and good reputation.**

- **It can also mobilize fresh capital by issue of shares and debentures in the capital market easily.**

RISK BEARING ECONOMIES

A large firm produces a variety of products and sells them in different areas. Therefore it is in a better position then a small firm in facing the risk. It can counter balance the loss in one product by gain in the other products

EXTERNAL ECONOMIES

When the number of firms producing the same commodity increase in a particular area, all the firms enjoy certain advantages which are called External Economies.

- **Economies of Concentration**
- **Economies of Information**
- **Economies of Specialization**
- **Economies of Welfare**

Both internal and external economies increase the output and reduce the cost of production.

But, these economies arise only up to a particular limit beyond which, diseconomies emerge.

COST ANALYSIS

- **Different business proposals are evaluated in terms of their costs and revenues.**

- **To know what costs are to be examined, it is necessary to understand what cost is and how to analyze the cost.**

- **Cost refers to expenditure incurred to produce a product or service.**

- **Cost of production normally includes cost of materials, labor, and other overheads this is known as the total cost.**

- **Total cost = fixed cost + variable cost + semi variable cost.**

- **Total cost is compared with total revenue. The difference between total cost & total revenue is termed as profit.**

(TR-TC=PROFIT)

- **Understanding the meaning of various cost concepts is essential for clear business thinking.**

- ***Fixed costs*** **are those costs that are fixed in the short run.**

- **Whether the production is taken up or not we have to incur certain expenses such as rent for factory & office buildings, insurance, telephone, electricity and so on.**

- **In other words total fixed costs remain constant in the short run.**

- ***Variable cost*** **are those costs that vary with the volume of production.**

- **Variable costs comprises cost of raw materials, wages and so on, these costs are incurred only when there is production.**

- **In other words the more the production the more will be the variable cost and vice versa.**

- ***Marginal cost*** **it refers to additional cost incurred for manufacturing an additional unit of product.**

- **Marginal cost in economic theory is useful in matters relating to allocation of resources, product pricing decisions, make or buy decisions and so on.**

- ***Opportunity cost*** it refers to cost of next best alternative foregone.

- Opportunity costs refers to earnings/profits that are foregone from alternative ventures by using given limited facilities for a particular purpose.

- If there are no alternatives there will be no opportunity cost.

- They record only the sacrificed alternative so they are not recorded in the books of accounts.

- **Opportunity cost is said to exist when the resources are scarce and there are alternative uses for the resources.**

- **Opportunity cost example:**

  The cost of getting college education is not merely you spend on college fee & books. It also includes the earnings you have foregone throughout the year by not taking up a full time job.

- ***Explicit costs*** **are also called as out of pocket costs.**
- **Explicit costs involves payment of cash.**
- **Rent for the landlord, wages for the labor, taxes & duties paid and so on are the explicit costs.**
- **Explicit costs are also called as out of pocket costs because they are incurred in reality.**

- ***Implicit costs*** **are also called as imputed costs or non cash costs or notional cost.**

- **Implicit costs don't involve payment of cash as they are not actually incurred.**

- **They would have been incurred had the owner not been in the possession of facilities.**

- **Interest on own capital, rent on own premises, savings in terms of salary due to own supervision are examples of implicit cost.**

BREAKEVEN ANALYSIS

INTRODUCTION

- Break even analysis refers to analysis (study) of ***Break Even Point*** **(BEP).**

- BEP is defined as **no profit or no loss point.** (BEP is the point at which total revenue is equal to total cost)

- The term BEA is interpreted in two senses, In its narrow sense, it is concerned with finding out BEP. In its broad sense determines the probable profit at any level of production.

- **BEP** denotes minimum volume of production to be undertaken to avoid losses.

- In other words BEP points out, how much minimum is to be produced to get the profit.

- BEP is a technique for **profit planning & control.**

- Break Even Analysis is defined as analysis of Costs & their possible impact on Profits & Volumes of the firm, hence it is also called as **CVP analysis.**

- A firm is said to attain the BEP when its **Total Revenue equals to Total Cost (TR =TC).**

Assumptions underlying Break Even Analysis

- All costs are classified into two – fixed and variable.
- Selling price per unit remains constant in spite of competition or change in the volume of production.
- There will be no change in operating efficiency.
- Volume of sales and volume of production are equal. Hence there is no unsold stock (closing stock).

DETERMINATION OF BREAK EVEN POINT

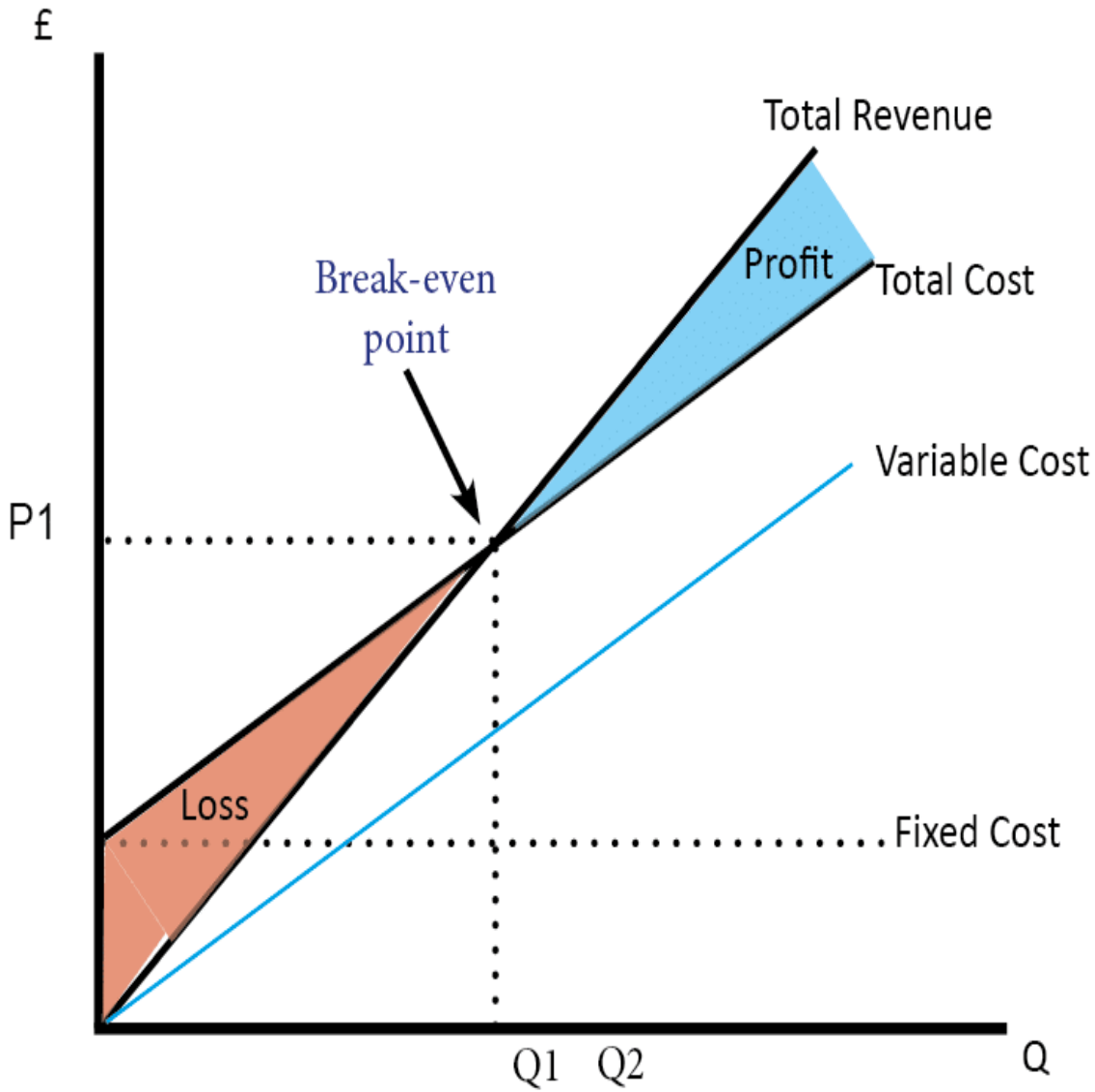
Break Even Point can be determined by two methods:

1. Graphical Representation Method &

2. Algebraic Method

Determination of Break even point with Graphical representation method

Graphical Representation Method



Example

No. of Units	FC	VC	TC	TR(SP = Rs. 50)	Profit / Loss
10	1000	100	1100	10 x 50 = 500	-600
20	1000	200	1200	20 x 50 = 1000	-200
22	1000	220	1220	22 x 50 = 1100	-120
24	1000	240	1240	24 x 50 = 1200	-40
25	1000	250	**1250**	25 x 50 = **1250**	**No Profit, No loss**
30	1000	300	1300	30 x 50 = 1500	200

Break Even Chart explanation:

- The total variable cost (**TVC**) line is drawn first, variable cost varies proportionately with the volume of production.

- Total Fixed cost(**TFC**) line is horizontal straight line, it is parallel to X axis since total fixed cost remains constant in the short run.

- The total cost (**TC**) line is derived by adding, the **TVC & TFC.** The total cost line is parallel to total variable cost line.

- The total revenue (**TR**) line starts from origin & increases along with the volume of sales.

- The total revenue line intersects total cost line at point **BEP. (BEP = TC = TR)**

- The zone below BEP point is loss zone & zone above BEP point is profit zone.

- The point at which total cost line & total revenue line intersects is called Break – Even Point (BEP), ***At this point there exists neither profit nor loss***

- The angle formed at BEP, i.e., the point of intersection of total cost & total revenue is called **ANGLE OF INCIDENCE** (AOI).

- The larger the angle of incidence , the higher is the quantum of profit.

- Sales over & above break even sales are termed **as MARGIN OF SAFETY** (MOS).

- In the above graph margin of safety is OQ – OP i.e.,

MOS = total sales – break even sales

Analysis of break even chart

A break even chart gives us clear picture about the following:

I. Break Even Point (**BEP**)
II. Angle Of Incidence (**AOI**)
III. Margin Of Safety (**MOS**)

- The lower the **BEP** the better it is, a firm can survive even if it is operating at a lower level of activity.

- The larger the **AOI** the greater is the benefit, angle of incidence represents the difference between total revenue & total cost.

- The larger the **MOS** the better it is for the firm, it has greater capacity to with stand Recessionary phases.

- **Conclusion** a high **MOS**, large **AOI** & low **BEP** denotes the most favorable position to the firm.

SIGNIFICANCE OF BEA

- BEP denotes **minimum volume** of production to be under taken to avoid losses, in other words it points out how much minimum is to be sold to get the profits.

- It helps in **ascertaining the profit** on a particular level of sales volume.

- It also helps in **estimating sales** required, to earn a particular desired level of profit.

- It is useful tool in **comparing the efficiency** of different firms.

- It helps in "**Make or Buy decisions**" for a given component or spare part.

- It helps in assessing the impact of changes in fixed cost, variable cost & selling price on profits during a period of time. (**CVP analysis**)

LIMITATIONS OF BEA

- BEA is based on **Fixed cost concept**, & hence holds good only in the short run.
- If business conditions are **Volatile,** BEP cannot give stable results.
- All costs cannot be **Classified** into Fixed & Variable costs, some times we may also have Semi variable costs.
- In case of **Multi Product Firm**, a single chart cannot be of any use, series of charts have to be made use of, which is a complex process.

- **The above limitations do not deter the utility of Break Even Analysis.**

- **Even today most of the business proposals are evaluated on the concept of BEP, the given project is chosen if its break even point is lower.**

APPLICATION OF BEA

The following are some of the areas of applications of Break Even Analysis

I. *Make or Buy decisions*
II. *Drop or Add decisions*
III. *Choosing a product mix when there is a limiting factor*

Determination of BEP - Algebraic Method

- The following formulae are used to determine Break Even Point.

SP = FC + VC + profit
SP – VC = FC + Profit
= Contribution

So, Contribution per Unit = SP p.u – VC p.u

$$\text{BREAK EVEN POINT} = \frac{\text{FC (in units)}}{\text{Contribution p.u}}$$

CONTRIBUTION MARGIN

Contribution Margin is the difference between receipts and variable expenses.

Ex: If a product is sold at Rs.10 per unit and its variable expenses are Rs.4.

This implies that each unit of the product recovers Rs.6 over and above its variable expenses of Rs.4.Thus, Rs.6 is contribution to the recovery of fixed expenses or profit.

DETERMINATION OF BREAK EVEN POINT

$$\text{BREAK EVEN POINT} = \frac{\text{FC (in value)}}{\text{Contribution margin ratio}}$$

$$\text{Where, CMR} = \frac{\text{CM p. u}}{\text{SP p. u}}$$

Determination of Break Even Point when per unit data is not available

$$\text{BREAK EVEN POINT (in value)} = \frac{\text{FC}}{\text{PV Ratio}}$$

Where, PV ratio = Profit Volume ratio

$$= \frac{\text{Contribution}}{\text{Sales}}$$

$$\textbf{MOS} = \frac{\textbf{Net profit}}{\textbf{P/V Ratio}}$$

PROBLEMS ON BEP

1. If sales are 10,000 units and selling price is Rs.20 per unit, variable cost Rs.10 per unit and fixed cost is Rs.80000, find out BEP in units and in sales revenue. What is profit earned? What should be the sales for earning a profit of Rs.60,000?

2. Determine MOS using above information.

2. The information about Raj & Co., are given below:

i) Profit-Volume Ratio 20%
ii) Fixed Cost Rs.36,000
iii) Selling price per unit Rs.150

Calculate:
a) BEP (in Rs.)
b) BEP (in units)

3. Analyze the following information:

- Sales are Rs. 90,000 producing a profit of Rs. 2900 in period-I

- Sales are Rs. 1, 10,000 producing a profit of Rs. 6000/- in period-II

Determine BEP and Fixed Expenses.

4 .Calculate the following parameters using given data.

i) p/v ratio

ii) Break even sales volume

iii) Margin of safety

iv) Profit

Given data: Sales Rs 4000, Cost Rs 2000,

Fixed Cost Rs 1600.

5. If Selling Price Per Unit Rs.12,
   Variable Cost Per Unit Rs.8,
   Fixed Cost Rs.40000

Find out
(a) Break Even sales units and value
(b) profit when sales are Rs.300000
(c) Margin of Safety when sales are Rs.350000.

6. A company prepares a budget to produce 3 lakh units, with fixed costs as Rs.15 lakhs and average variable cost of Rs.10 each . The selling price is to yield 20% profit on cost. you are required to calculate

(a) P/V ratio.

(b) Break even point.

END