UNIT – II

THEORY OF PRODUCTION AND COST ANALYSIS

Introduction to Production Cost:-

Production cost refers to the expenses incurred in creating goods or services. It includes costs related to raw materials, labor, equipment, utilities, and overhead. Understanding production costs is essential for businesses to determine pricing, manage profitability, and make informed decisions about their operations. Different industries and businesses have varying production cost structures based on factors like economies of scale, technology, and market conditions.

Nature of production cost:-

The nature of production costs can be classified into several categories:

1. **Interdisciplinary Nature:**
   This analysis draws from various fields such as economics, accounting, finance, and operations management. It combines economic theories, financial principles, and operational concepts to provide a comprehensive understanding of production and cost dynamics.
2. **Short-term and Long-term Perspectives:**
   Production and cost analysis takes into account both short-term and long-term perspectives. Short-term analysis focuses on immediate decisions like pricing and output adjustments, while long-term analysis considers factors like capital investments, technology upgrades, and economies of scale.
3. **Cost Classification:**
   One of the foundational aspects of this analysis is the classification of costs. Costs are categorized into fixed costs (remain constant regardless of production levels), variable costs (change with production quantities), and semi-variable costs (partly fixed and partly variable).
4. **Comparative Analysis:**
   Businesses often compare different production methods, technologies, or input combinations to identify the most cost-efficient approach. Comparative analysis helps in making choices that optimize resources.
5. **Decision Support:**
   Production and cost analysis provides crucial information for managerial decision-making. It aids in choosing production levels, pricing strategies, cost reduction measures, and investment decisions.
6. **Cost-Volume-Profit Relationship:**
   The interaction between production volume, costs, and profit is at the heart of this analysis. Understanding how changes in these variables impact each other helps businesses determine their break-even points and profit potential.
7. **Profit Maximization:**
   Ultimately, the goal of production and cost analysis is to help businesses maximize profits. By finding the optimal production levels that balance revenue and costs, organizations can work toward achieving their financial objectives.

Significance of production cost:-

The significance of production costs is paramount for businesses and decision-makers due to several reasons:

1. **Pricing Strategy:** Production costs are a fundamental factor in setting prices for goods and services. Businesses need to ensure that the prices they charge cover their production expenses while remaining competitive in the market.
2. **Profitability Analysis:** By accurately calculating production costs, businesses can determine their profit margins on products or services. This information is crucial for evaluating the financial health of the company and making informed decisions.
3. **Cost Control and Efficiency:** Understanding production costs helps identify areas where cost-saving measures can be implemented. This might involve optimizing processes, reducing waste, or negotiating better deals with suppliers.
4. **Budgeting and Financial Planning:** Accurate knowledge of production costs enables effective budgeting and financial forecasting. Businesses can allocate resources more effectively and plan for future growth and investment.
5. **Resource Allocation:** With insights into production costs, businesses can allocate resources, such as labor and materials, more efficiently to maximize productivity and minimize waste.
6. **Investment Decisions:** When considering new equipment, technology, or expansion, understanding production costs helps assess the potential return on investment and the impact on overall operations.
7. **Competitive Strategy:** Businesses can gain a competitive advantage by strategically analyzing production costs. This might involve differentiating based on cost leadership or focusing on value-added services.
8. **Negotiation Power:** Knowledge of production costs empowers businesses when negotiating with suppliers, vendors, and contractors, leading to more favorable terms and agreements.
9. **Risk Management:** Accurate cost analysis allows businesses to assess the impact of external factors like fluctuations in raw material prices or changes in market demand, helping to mitigate risks.

Advantages of production cost:-

Production costs offer several advantages to businesses and decision-makers:

Pricing Accuracy: Production costs provide a solid foundation for setting accurate and competitive prices for products or services, ensuring that they cover expenses and contribute to profitability.

Profitability Assessment: By comparing production costs with revenues, businesses can gauge the profitability of individual products, services, or projects, aiding in effective resource allocation.

Cost Control: Understanding production costs helps identify areas where costs can be reduced or eliminated, leading to increased efficiency, lower expenses, and improved margins.

Budgeting and Planning: Accurate production cost data allows for better budgeting and financial planning, helping businesses allocate resources effectively and make informed investment decisions.

Resource Allocation: Knowledge of production costs assists in allocating labor, materials, and other resources more efficiently, leading to improved productivity and reduced waste.

Performance Evaluation: Monitoring actual production costs against projected costs enables businesses to evaluate the effectiveness of management decisions and operational strategies.

Risk Management: Understanding production costs helps assess the impact of external factors on operations, enabling better risk mitigation and contingency planning.

Strategic Decision-Making: Production cost data informs strategic choices such as expansion, market entry, and technology adoption, contributing to better-informed decisions.

Negotiation Power: Armed with accurate production cost information, businesses can negotiate better terms with suppliers, contractors, and vendors, leading to cost savings.

Competitive Advantage: Effective cost management based on production cost analysis can lead to a cost leadership advantage in the market, making a business more competitive.

Innovation and Efficiency: Knowledge of production costs can inspire innovation by encouraging the development of new products, processes, or technologies that reduce costs or improve quality.

Investment Evaluation: When considering investments, production costs provide insights into potential returns and risks, aiding in decision-making.

FACTORS OF PRODUCTION:-

Land

Land has a broad definition as a factor of production and can take on various forms, from agricultural land to commercial real estate to the resources available from a particular piece of land. Natural resources, such as oil and gold, can be extracted and refined for human consumption from the land.

Cultivation of crops on land by farmers increases its value and utility. While land is an essential component of most ventures, its importance can diminish or increase based on industry. For example, a technology company can easily begin operations with zero investment in land. On the other hand, land is the most significant investment for a real estate venture.

Labor

Labor refers to the effort expended by an individual to bring a product or service to the market. Again, it can take on various forms. For example, the construction worker at a hotel site is part of labor, as is the waiter who serves guests or the receptionist who enrolls them into the hotel. Skilled and trained workers are called “human capital” and are paid higher wages because they bring more than their physical capacity to the task.

For example, an accountant’s job requires the analysis of financial data for a company. Countries that are rich in human capital experience increased productivity and efficiency. The difference in skill levels and terminology also helps companies and entrepreneurs create corresponding disparities in pay scales. This can result in a transformation of factors of production for entire industries. An example of this is the change in production processes in the information technology (IT) industry after jobs were outsourced to countries with lower salaries.

Capital

In economics, capital typically refers to money. However, money is not a factor of production because it is not directly involved in producing a good or service. Instead, it facilitates the processes used in production by enabling entrepreneurs and company owners to purchase capital goods or land or to pay wages. For modern mainstream (neoclassical) economists, capital is the primary driver of value.

It is important to distinguish personal and private capital in factors of production. A personal vehicle used to transport family is not considered a capital good, but a commercial vehicle used expressly for official purposes is. During an economic contraction or when they suffer losses, companies cut back on capital expenditure to ensure profits. However, during periods of economic expansion, they invest in new machinery and equipment to bring new products to market.

As a factor of production, capital refers to the purchase of goods made with money in production. For example, a tractor purchased for farming is capital. Along the same lines, desks and chairs used in an office are also capital.

Entrepreneurship

Entrepreneurship is the secret sauce that combines all the other factors of production into a product or service for the consumer market. An example of entrepreneurship is the evolution of the social media behemoth Meta (META), formerly Facebook.

Mark Zuckerberg assumed the risk for the success or failure of his social media network when he began allocating time from his daily schedule toward that activity. When he coded the minimum viable product himself, Zuckerberg's labor was the only factor of production. After Facebook, the social media site, became popular and spread across campuses, it realized it needed to recruit additional employees. He hired two people, an engineer (Dustin Moskovitz) and a spokesperson (Chris Hughes), who both allocated hours to the project, meaning that their invested time became a factor of production.

Technology

Though technology isn't the fifth factor officially, many consider it to be one. In the current world, technology plays a very important role in coming up with a product or service.

Technology is a very broad term. It could include software, hardware, or a combination of two to make the production process more efficient. So, it won't be wrong to say that technology helps in the efficient utilization of all four factors of production. For instance, the use of robots in production can help a company to raise productivity, as well as reduce costs. Technology also helps an entrepreneur to make better decisions.

PRODUCTION FUNCTION:-

Samuelson define the production function as "the technical relationship which reveals the maximum amount of output capable of being produced by each and every set of inputs"

Michael define production function as "that function which defines the maximum amount of output that can be produced with a given set of inputs".

The production function expresses a functional relationship between physical inputs and physical outputs of a firm at any particular time period. The output is thus a function of inputs. Mathematically production function can be written as

$$Q = F(L1,L2,C,O,T)$$

Where Q is the quantity of production, F explains the functions, that is, the type of relation between inputs and outputs , L1,L2,C,.O,T refer to land, labout, capital, organization and technology respectively. These inputs have been taken in conventional terms. In reality, material also can be included in a set of inputs.

A manufacturer has to make a choice of the production function by considering his technical knowledge, the process of various factors of production and his efficiency level to manage. He should not only select the factors of production but also should work out the different permutations and combinations which will mean lower cost of inputs for a given level of production.

In case of an agricultural product, increasing the other factors of production can increase the production, but beyond a point, increase output can be had only with increased use of agricultural land, investment in land forms a significant portion of the total cost of production for output, whereas, in the case of the software industry, other factor such as technology , capital management and others become significant. With change in industry and the requirements the production function also needs to be modified to suit to the situation.

Production Function with One Variable Input :-

The laws of returns states that when at least one factor of production is fixed or factor input is fixed and when all other factors are varied, the total output in the initial stages will increase at an increasing rate, and after reaching certain level or output the total output will increase at declining rate. If variable factor inputs are added further to the fixed factor input, the total output may decline. This law is of universal nature and it proved to be true in agriculture and industry also. The law of returns is also called the **law of variable proportions** or the **law of diminishing returns**.

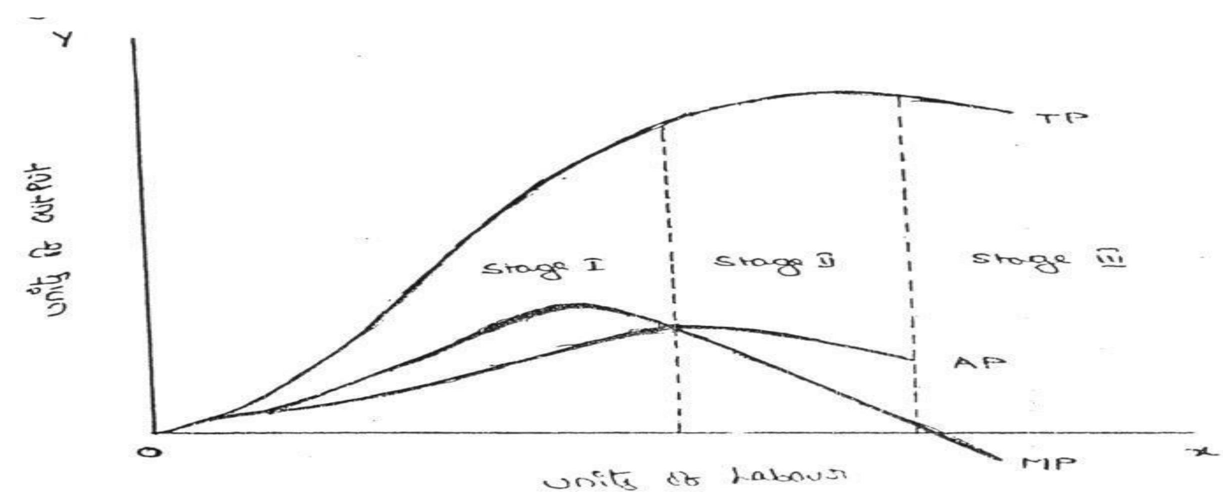
Definition According to **G. Stigler**

"If equal increments of one input are added, the inputs of other production services being held constant, beyond a certain point the resulting increments of product will decrease i.e. the marginal product will diminish".

According to **F. Benham**

"As the proportion of one factor in a combination of factors is increased, after a point, first the marginal and then the average product of that factor will diminish".

Units of labour	Total production(tp)	Marginal product (mp)	Average product(ap)	Stages
0	0	0	0	Stages 1
1	10	10	10	
2	22	12	11	
3	33	11	11	Stages 2
4	40	7	10	
5	45	5	9	
6	48	3	8	Stages 3
7	48	0	6.85	
8	45	-3	5.62	



From the above graph the law of variable proportions operates in three stages. In the first stage, total product increases at an increasing rate. The marginal product in this stage increases at an increasing rate resulting in a greater increase in total product. The average product also increases. This stage continues up to the point where average product is equal to marginal product. The law of increasing returns is in operation at this stage. The law of diminishing returns starts operating from the second stage awards. At the second stage total product increases only at a diminishing rate. The average product also declines. The second stage comes to an end where total product becomes maximum and marginal product becomes zero. The marginal product becomes negative in the third stage. So the total product also declines. The average product continues to decline.

Production Function With Two Variable Inputs And Laws Returns:-

Production process that requires two inputs, capital and labour (L) to produce a given output (Q). There could be more than two inputs in a real life situation, but for a simple analysis, we restrict the number of inputs to two only. In other words, the production function based on two inputs can be expressed as

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

Where C= capital , L = labour,

Normally, both capital and labour are required to produce a product. To some extent, these two inputs can be substituted for each other. Hence the producer may choose any combination of labour and capital that gives him the required number of units of output, for any one combination of labour and capital out of several such combinations. The alternative combinations of labour and capital yielding a given level of output are such that if the use of one factor input is increased , that of another will decrease and vice versa. However, the units of an input foregone to get one unit of the other input changes, depends upon the degree of substitutability between the two input factors, based on the techniques or technology used, the degree of substitutability may vary.

Functions of the Production Function:

1. Input-Output Relationship: It defines the relationship between inputs (like labor, capital, and raw materials) and the output produced. This relationship helps businesses understand how much output can be generated with varying levels of inputs.

2. Efficiency Measurement: The production function allows firms to assess how efficiently they are utilizing their resources. By analyzing this function, businesses can identify areas where they can improve efficiency.

3. Cost Analysis: It plays a crucial role in understanding production costs. Firms can evaluate how changes in output levels affect their costs, which is essential for pricing strategies and budgeting.

4. Optimal Resource Allocation: The production function helps firms determine the best combination of inputs to maximize output, guiding decisions on how to allocate resources effectively.

5. Forecasting Production: It can be used to predict future production levels based on anticipated changes in input usage, aiding businesses in planning for growth.

Advantages of the Production Function:

1. Decision-Making Tool: It serves as a framework for making informed production decisions. Firms can analyze various scenarios and choose the most efficient production methods.

2. Understanding Returns to Scale: The production function helps firms comprehend how output changes when all inputs are increased proportionally, which is vital for scaling operations.

3. Identifying Bottlenecks: By examining inputs and outputs, businesses can pinpoint bottlenecks in their production processes and make adjustments to enhance efficiency.

4. Profit Maximization: A clear understanding of the production function enables firms to optimize production processes, which helps in minimizing costs and maximizing profits.

5. Economic Analysis: It is a key element in economic theories, aiding economists in understanding and predicting market behaviors and economic dynamics.

ISO - QUANTS

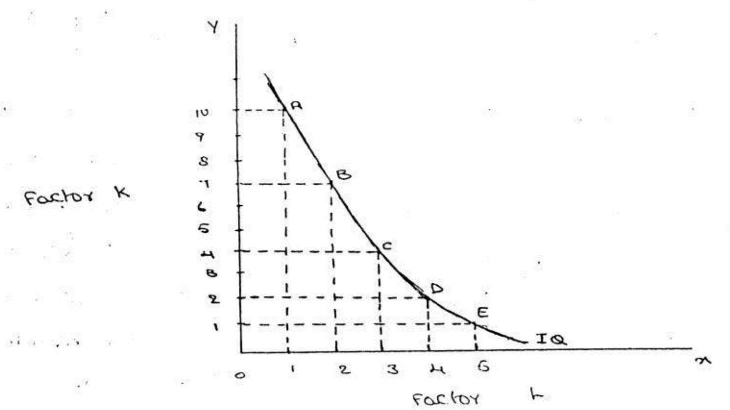
The term Isoquants is derived from the words iso and quant – Iso means equal and quent implies quantity. Isoquant therefore, means equal quantity. Isoquant are also called iso-product curves, an isoquant curve show various combinations of two input factors such as capital and labour, which yield the same level of output.

As an isoquant curve represents all such combinations which yield equal quantity of output, any or every combination is a good combination for the manufacturer. Since he prefers all these combinations equally an isoquant curve is also called product indifferent curve.

An isoquant may be explained with the help of an arithmetical example

Combinations	Labour (units)	Capital (Units)	Output (quintals)
A	1	10	50
B	2	7	50
C	3	4	50
D	4	2	50
E	5	1	50

Combination A represent 1 unit of labour and 10 units of capital and produces 50 quintals of a product all other combinations in the table are assumed to yield the same given output of a product say 50 quintals by employing any one of the alternative combinations ofthe two factors labour and capital. If we plot all these combinations on a paper and join them, we will get continues and smooth curve called Iso-product curve as shown below.



Labour is on the X-axis and capital is on the Y-axis. IQ is the ISO-Product curve, which shows all the alternative combinations A, B, C, D, E which can produce 50 quintals of a product.

Features of isoquant:-

1. **Downward sloping**: isoquant are downward sloping curves because , if one input increase, the other one reduces. There is no question of increase in both the inputs to yield a given output.A degree of substitution is assumed between the factors of production. In other words, an isoquant cannot be increasing, as increase in both the inputs does not yield same level of output.If it is constant, it means that the output remains constant through the use of one of the factor is increasing, which is not true, isoquant slope from left to right.

2. **Convex to origin**: isoquant are convex to the origin. It is because the input factors are not perfect substitutes. One input factor can be substituted by other input factor in a diminishing marginal rate. If the input factors were perfect substitutes, the isoquant would be a falling straight line. When the inputs are used in fixed proportion, and substitution of one input for the other cannot take place, the isoquant will be L shaped

3. **Do not intersect**: two isoquant do not intersect with each other. It is because, each of these denote a particular level of output. If the manufacturer wants to operate at a higher level of output, he has to switch over to another isoquant with a higher level of output and vice versa.

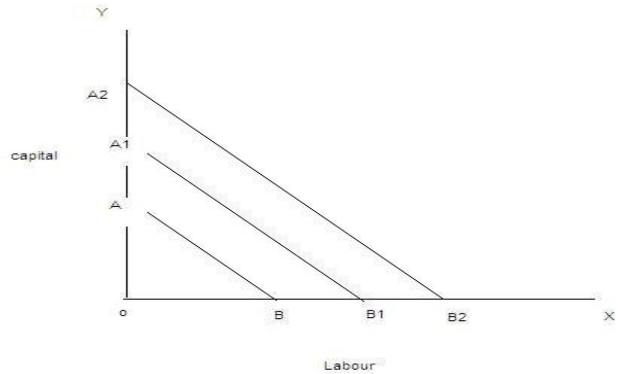
4. **Do not axes**: the isoquant touches neither X-axis nor Y- axis, as both inputs are required toproduce a given product.

ISO COST:-

Iso cost refers to that cost curve that represents the combination of inputs that will cost the producer the same amount of money. In other words, each isocost denotes a particular level of total cost for a given level of production. **If the level of production changes, the total cost changes and thus the isocost curve moves upwards, and vice verse.**

Isocost curve is the locus traced out by various combinations of L and K, each of which costs the producer the same amount of money (C) Differentiating equation with respect to L,we have $dK/dL = -w/r$ this gives the slope of the producer’s budget line (isocost curve). Iso cost line shows various combinations of labour and capital that the firm can buy for a given factor prices. **The slope of iso cost line = PL/Pk. In this equation, PL is the price of labour and Pk is the price of capital.** The slope of iso cost line indicates the ratio of the factor prices. A set of isocost lines can be drawn for different levels of factor prices, or different sums of money. The iso cost line will shift to the right when money spent on factors increases or firm could buy more as the factor prices are given.

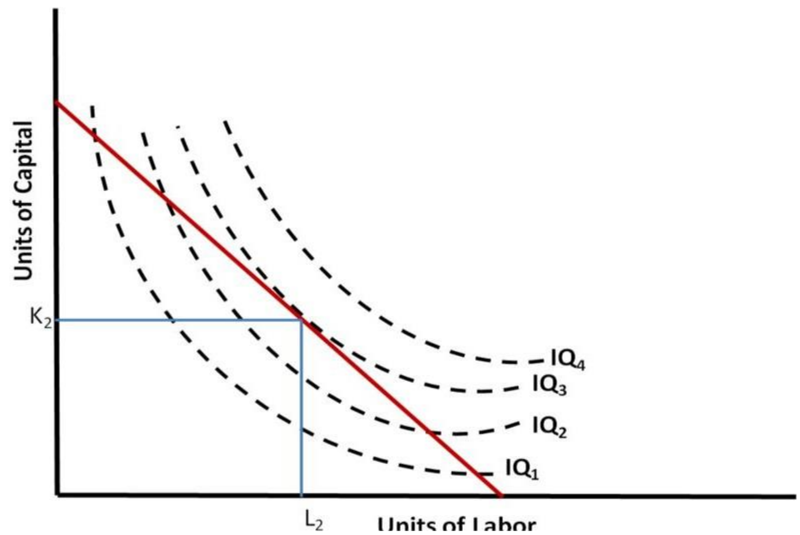
With the change in the factor prices the slope of iso cost lien will change. If the price of labour falls the firm could buy more of labour and the line will shift away from the origin. The slope depends on the prices of factors of production and the amount of money which the firm spends on the factors. When the amount of money spent by the firm changes, the isocost line may shift but its slope remains the same. A change in factor price makes changes in the slope ofisocost lines as shown in the figure.



Least Cost Combination of Inputs

The manufacturer has to produce at lower costs to attain higher profits. The isocost and isoquants can be used to determine the input usage that minimizes the cost of production. **Where the slope of isoquant is equal to that of isocost, there lies the lowest point of cost of production.** This can be observed by superimposing the isocosts on iso-product curves. It is evident that the producer can, with a total outlay.

The firm can achieve maximum profits by choosing that combination of factors whichwill cost it the least. The choice is based on the prices of factors of production at a particulartime. **The firm can maximize its profits either by maximizing the level of output for a given costor by minimizing the cost of producing a given output.** In both cases the factors will have to beemployed in optimal combination at which the cost of production will be minimum. The leastcost factor combination can be determined by imposing the isoquant map on isocost line. **Thepoint of tangency between the isocost and an isoquant is an important but not a necessary condition for producer's equilibrium.** The essential condition is that the slope of the isocost linemust equal the slope of the isoquant. Thus at a point of equilibrium marginal physicalproductivities of the two factors must be equal the ratio of their prices. The marginal physical product per rupee of one factor must be equal to that of the other factor. And isoquant must beconvex to the origin. The marginal rate of technical substitution of labour for capital must bediminishing at the point of equilibrium.



Cobb-Douglas production function

The Cobb-Douglas production function is based on the empirical study of the American manufacturing industry made by Paul H. Douglas and C.W. Cobb. It is a linear homogeneous production function of degree one which takes into account two inputs, labour and capital, for the entire output of the manufacturing industry.

The Cobb-Douglas production function is expressed as:

$$\mathbf{Q = A.L^{\alpha}K^{\beta}}$$

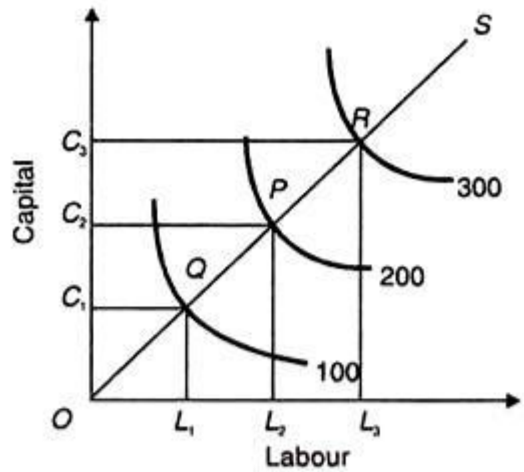
Where Q is output and L and K are inputs of labour and capital respectively. A, α and β are positive parameters where = $\alpha > 0$, $\beta > 0$.

The conclusion drawn from this famous statistical study is that labour contributed about 3/4th and capital about 1/4th of the increase in the manufacturing production.

$\alpha + \beta = 1$ (Constant Returns to scale)

$\alpha + \beta > 1$ (Increasing Returns to scale)

$\alpha + \beta < 1$ (Decreasing Returns to scale)



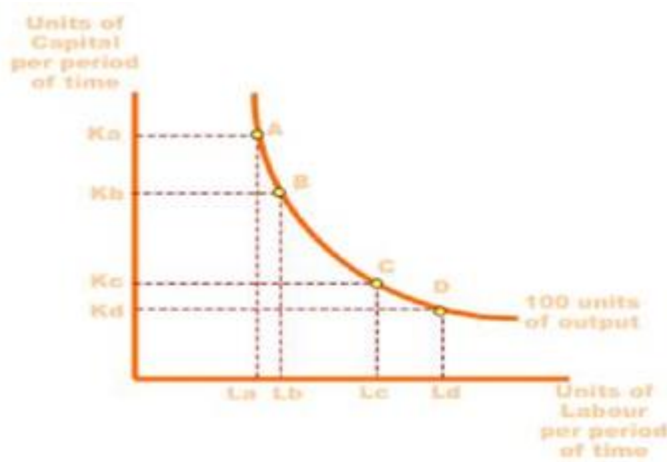
Assumptions:

It has the following assumptions
1. The function assumes that output is the function of two factors viz. capital and labour.
2. It is a linear homogenous production function
3. There are constant returns to scale
4. All inputs are homogenous
5. There is perfect competition
6. There is no change in technology

Marginal Rate of Technical Substitution

The marginal rate of technical substitution (MRTS) refers to the rate at which one input factor is substituted with the other to attain a given level of output. In other words, the lesser units of one input must be compensated by increasing amounts of another input to produce the same level of output.

Isoquants are typically convex to the origin reflecting the fact that the two factors are substitutable for each other at varying rates. This rate of substitutability is called the "marginal rate of technical substitution" (MRTS) or occasionally the "marginal rate of substitution in production". It measures the reduction in one input per unit increase in the other input that isjust sufficient to maintain a constant level of production. For example, the marginal rate of substitution of labour for capital gives the amount of capital that can be replaced by one unit of labour while keeping output unchanged.



To move from point A to point B in the diagram, the amount of capital is reduced from Ka to Kb while the amount of labour is increased only from La to Lb. To move from point C to point D, the amount of capital is reduced from Kc to Kd while the amount of labour is increased from Lc to Ld. The marginal rate of technical substitution of labour for capital is equivalent to the absolute slope of the isoquant at that point (change in capital divided by change in labour). It is equal to 0 where the isoquant becomes horizontal, and equal to infinity where it becomes vertical.

The opposite is true when going in the other direction (from D to C to B to A). In this case we are looking at the marginal rate of technical substitution capital for labour (which is the reciprocal of the marginal rate of technical substitution labour for capital).

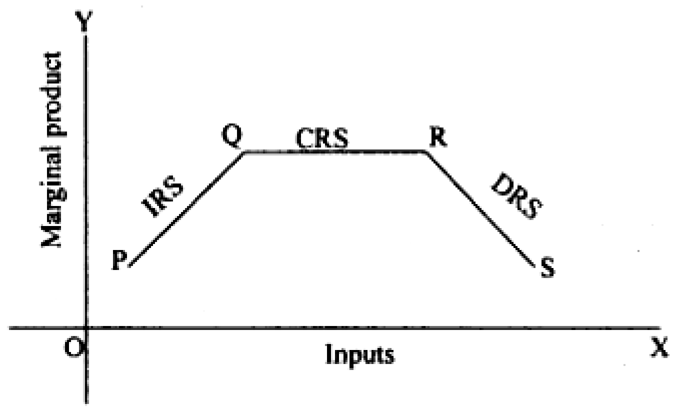
It can also be shown that the marginal rate of substitution labour for capital, is equal to the marginal physical product of labour divided by the marginal physical product of capital.

<u>LAW OF RETURNS TO SCALE</u>

There are three laws of returns governing production function. They are

1. **Law of increasing returns to scale**
   This law states that the volume of output keeps on increasing with every increase in the inputs,. Where a given increase in inputs leads to a more than proportionate increase in the output, the law of increasing returns to scale is said to operate. We can introduce division of labour and other technological means to increase production. Hence, the totalproduct increases at an increasing rate.
2. **Law of constant returns to scale**
   When the scope for division of labour gets restricted, the rate of increase in the total output remains constant, the law of constant returns to scale is said to operate, this law states that the rate of increase/decrease in volume of output is same to that of rate of increase/decrease in inputs.
3. **Law of decreasing returns to scale**
   Where the proportionate increase in the inputs does not lead to equivalent increase in output, the output increases at a decreasing rate, the law of decreasing returns to scale is said to operate. This results in higher average cost per unit.

INPUTS	TOTAL PRODUCT	MARGINAL PRODUCT
1	4	4
2	10	6
3	18	8
4	28	10
5	38	10
6	48	10
7	56	8
8	62	6
9	66	4



ECONOMIES OF SCALE:

Economies of scale are cost advantages reaped by companies when production becomes efficient. Companies can achieve economies of scale by increasing production and lowering costs. This happens because costs are spread over a larger number of goods. Costs can be both fixed and variable. Advantages or benefits that acquire to a firm as a result of increasing in the scale of production or maximization of profits.

Economies of Scale is of two types

1. Internal Economies of Scale

2. External Economies of Scale

INTERNAL ECONOMIES OF SCALE

INTERNAL ECONOMIES refer to the economies all the development which you do inside your company. The internal economies occur as a result of increase in the scale of production. Enjoy the benefits by the large firms.

1. **Managerial Economies**: as the firm expands, the firm needs qualified managerial personnel to handle each of its functions marketing, finance, production, human resources and others in a professional way. Functional specialization ensure minimum wastage and lowers the cost of production in the long –run.
2. **Commercial Economies**: the transaction of buying and selling raw material and other

operating supplies such as spares and so on will be rapid and the volume ofeach transaction also grows as the firm grows, there could be cheaper savings in the procurement, transportation and storage cost, this will lead to lower costs and increased profits.

3. **Financial Economies**: The large firm is able to secure the necessary finances either for block capital purposes or for working capital needs more easily and cheaply. It can barrow from the public, banks and other financial institutions at relatively cheaper rates. It is in this way that a large firm reaps financial economies.
4. **Technical Economies**: Technical economies arise to a firm from the use of bettermachines and superior techniques of production. As a result, production increases and per unit cost of production falls. A large firm, which employs costly and superior plant and equipment, enjoys a technical superiority over a small firm. Another technicaleconomy lies in the mechanical advantage of using large machines. The cost of operating large machines is less than that of operating mall machine. More over a larger firm is able to reduce it"s per unit cost of production by linking the various processes of production. Technical economies may also be associated when the large firm is able to utilize all its waste materials for the development of by-products industry. Scope for specialization is also available in a large firm. This increases the productive capacity of the firm and reduces the unit cost of production.
5. **Marketing Economies:** The large firm reaps marketing or commercial economies in buying its requirements and in selling its final products. The large firm generally has a separate marketing department. It can buy and sell on behalf of the firm, when the market trends are more favorable. In the matter of buying they could enjoy advantages like preferential treatment, transport concessions, cheap credit, prompt delivery and fine relation with dealers. Similarly it sells its products more effectively for a higher margin of profit.
6. **Risk Bearing Economies**: The large firm produces many commodities and serves widerareas. It is, therefore, able to absorb any shock for its existence. For example, during business depression, the prices fall for every firm. There is also a possibility for market fluctuations in a particular product of the firm. Under such circumstances the risk- bearing economies or survival economies help the bigger firm to survive business crisis.
7. **Economics of Research And Development**: large organizations such as Dr.Reddys labs, Hindustan Lever spend heavily on research and development and bring out several innovative products. Only such firms with a strong research and development base can cope with competition globally.

<u>EXTERNAL ECONOMIES OF SCALE:</u>

External economics refer to all the firms in the industry, because of growth of the industry as a whole or because of growth of ancillary industries, advantages or benefits obtained by our firm because of other firms of similar products. External economies benefit all the firms in the industry as the industry expands. This will lead to lowering the cost of production and thereby increasing the profitability.

1. Locational Economies: Firms often locate in areas where they can easily access the inputs they need for production. As mentioned earlier, external economies of scale can result from businesses clustering together in a certain location. This can lead to cost savings and increased efficiency for individual firms due to shared infrastructure, skilled labor.

2. Economies of Concentration: When an industry is concentrated in a particular area, all the member firms reap some common economies like skilled labour, improved means of transport and communications, banking and financial services, supply of power and benefits from subsidiaries. All these facilities tend to lower the unit cost of production of all the firms inthe industry.

3. Economies of Research And Development: all the firms can pool resources to finance research and development activities and thus share the benefits of research. There could be a common facility to shares journals, newspapers and other valuable reference material of common interest.

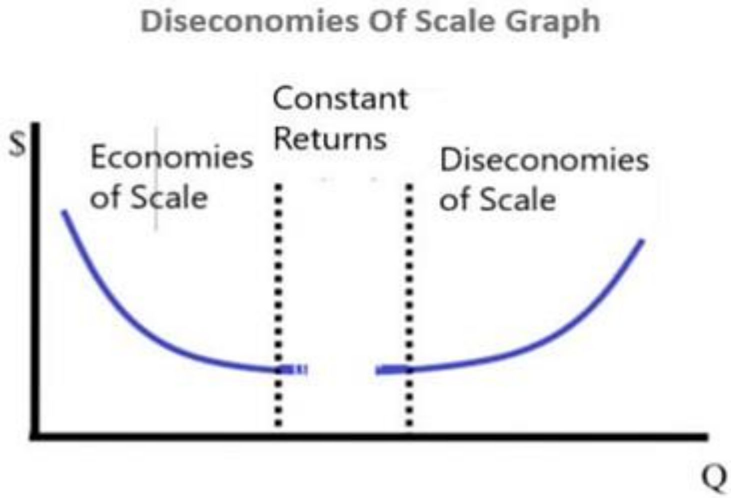
4. Economies of Welfare: there could be common facilities such as canteen, industrial housing, community halls, schools and colleges, employment burearu, hospitals and soon, which can be used in common by the employees in the whole industry.

5. Economies of Information: When several firms are located close to each other, they can access perfect information on the prices of inputs. Since all firms purchase inputs from the same suppliers, the latter cannot charge different prices from different firms. The elimination of discriminatory pricing ensures that no firm pays a higher amount for inputs, and it reduces the overall average cost.

6. Economies of Innovation: Many firms prefer to set up their premises close to centers engaged in research and development of efficient production methods. Firms can then quickly adapt to all innovations developed by these centers in order to achieve greater efficiency in production and, therefore, lower their costs.

Diseconomies of scale

Diseconomies of scale occur when an additional production unit of output increases marginal costs, which results in reduced profitability. Instead of production costs declining as more units are produced (which is the case with economies of scale), the opposite happens, and costs increase with the production of each additional unit.



Causes of Diseconomies of Scale

Diseconomies of scale may result from several factors, including communication breakdown, lack of motivation, lack of coordination, and loss of focus by the management and employees.

The cause of diseconomies of scale can rarely be attributed to one specific factor, but the following list outlines the most common catalysts that often initiate a “domino effect” that negatively affects the financial state of a company.

- Strategic Mistakes by Management Team
- Loss of Control in Organizational Structure

- Technical Difficulties
- Misalignment in Production Capacity and Market Demand (i.e. Capacity Constraint)
- Operational Disruption (“Bottlenecks”)
- Ineffective Communication Between Divisions
- Overlap in Business Functions (or Divisions)
- Loss of Employee Morale
- Reduction in Overall Workplace Productivity

While external factors, such as the prevailing economic conditions, can contribute to the occurrence of diseconomies of scale, internal factors are more frequently the source of the problem.

For example, suppose a company’s management team decides to prioritize growth and achieving scalability to reach new markets (and customers), without much consideration for the risks posed by such corporate actions.

Occasionally, adopting that sort of mindset can work, but only if the management team truly understands the risks beforehand and takes the precautionary measures to mitigate the risk.

Conclusion:

Economies of scale exist when long run average total cost decreases as output increases, Diseconomies of scale occur when long run average total cost increases as output increases, and Constant returns to scale occur when costs do not change as output increases.

COST:

Cost refers to the expenditure incurred to produce a particular product or services. All cost involves a sacrifice of some kind or other to acquire some benefit. For example , if I want to eat food, I should be prepared to sacrifice money.

Cost refers to the amount of expenditure incurred in acquiring something. In business firm, itrefers to the expenditure incurred to produce an output or provide service. Thus the cost incurred in connection with raw material , labour, other heads constitute the overall cost
of production.

COST CONCEPTS:

A managerial economist must have a clear understanding of the different cost concepts for clear business thinking and proper application. The several alternative bases of classifying cost and the relevance of each for different kinds of problems are to be studied. The various relevant concepts of cost are:

1. Opportunity costs and outlay costs:

Out lay cost also known as actual costs obsolete costs are those expends which are actually incurred by the firm these are the payments made for labour, material, plant, building, machinery traveling, transporting etc., These are all those expense item appearing in the books of account, hence based on accounting cost concept.

On the other hand opportunity cost implies the earnings foregone on the next best alternative, has the present option is undertaken. This cost is often measured by assessing the alternative, which has to be scarified if the particular line is followed. The opportunity cost concept is made use for long-run decisions. This concept is very important in capital expenditure budgeting. This concept is very important in capital expenditure budgeting.

2. Explicit and implicit costs:

Explicit costs are those expenses that involve cash payments. These are the actual or business costs that appear in the books of accounts. These costs include payment of wages and salaries, payment for raw materials, interest on borrowed capital funds, rent on hired land, Taxes paid etc.

Implicit costs are the costs of the factor units that are owned by the employer himself. These costs are not actually incurred but would have been incurred in the absence of employment of self – owned factors. The two normal implicit costs are depreciation, interest on capital etc. A decision maker must consider implicit costs too to find out appropriate profitability of alternatives.

3. Historical and Replacement costs:

Historical cost is the original cost of an asset. Historical cost valuation shows the cost of an asset as the original price paid for the asset acquired in the past. Historical valuation is the basis for financial accounts.

A replacement cost is the price that would have to be paid currently to replace the same asset. During periods of substantial change in the price level, historical valuation gives a poor projection of the future cost intended for managerial decision. A replacement cost is a relevant cost concept when financial statements have to be adjusted for inflation.

4. Short – run and long – run costs:

Short-run is a period during which the physical capacity of the firm remains fixed. Any increase in output during this period is possible only by using the existing physical capacity more extensively. So short run cost is that which varies with output when the plant and capital equipment in constant.

Long run costs are those, which vary with output when all inputs are variable including plant and capital equipment. Long-run cost analysis helps to take investment decisions.

5. Fixed and variable costs:

Fixed cost is that cost which remains constant for a certain level to output. It is not affected by the changes in the volume of production. But fixed cost per unit decrease, when the production is increased. Fixed cost includes salaries, Rent, Administrative expenses depreciations etc.

Variable is that which varies directly with the variation is output. An increase in total output results in an increase in total variable costs and decrease in total output results in a proportionate decline in the total variables costs. The variable cost per unit will be constant. Ex: Raw materials, labour, direct expenses, etc.

6. Past and Future costs:

Past costs also called historical costs are the actual cost incurred and recorded in the book of account these costs are useful only for valuation and not for decision making.

Future costs are costs that are expected to be incurred in the futures. They are not actual costs. They are the costs forecasted or estimated with rational methods. Future cost estimate is useful for decision making because decision are meant for future.

7. Traceable and common costs:

Traceable costs otherwise called direct cost, is one, which can be identified with a products process or product. Raw material, labour involved in production is examples of traceable cost.

Common costs are the ones that common are attributed to a particular process or product. They are incurred collectively for different processes or different types of products. It cannot be directly identified with any particular process or type of product.

8. Incremental and sunk costs:

Incremental cost also known as different cost is the additional cost due to a change in the level or nature of business activity. The change may be caused by adding a new product, adding new machinery, replacing a machine by a better one etc.

Sunk costs are those which are not altered by any change – They are the costs incurred in the past. This cost is the result of past decision, and cannot be changed by future decisions. Investments in fixed assets are examples of sunk costs.

9. Total, average and marginal costs:

Total cost is the total cash payment made for the input needed for production. It may be explicit or implicit. It is the sum total of the fixed and variable costs.

Average cost is the cost per unit of output. If is obtained by dividing the total cost (TC) by the total quantity produced (Q)

$$\text{Average cost} = \frac{TC}{Q}$$

Marginal cost is the additional cost incurred to produce and additional unit of output or it is the cost of the marginal unit produced.

DIFFERENCE BETWEEN FIXED COST AND VARIABLE COST

Fixed Cost	Variable Cost
Fixed costs are costs that do not change with the changing volume of production of a firm. The volume, when increases, show better productivity though.	Variable costs change with the change in the volume of production. There is a change in productivity with changing volume in the case of variable costs.
Fixed cost is based on time. It is time-dependent and changes after a certain period of time. These costs are therefore made daily, weekly, monthly, or on a yearly basis depending on the nature of the cost.	Variable costs are dependent on the volumes manufactured. The costs change depending on the production volume and there is nothing related to time in the case of variable costs.
Fixed costs are costs of total production. They don't have anything to do with the number of units produced. This means that the cost of production stays the same even when the number of units produced is increased.	Variable costs are costs per unit of production. It is the cost of each unit that is produced. That is why, when production goes up, the costs also go up.
Fixed costs usually go down with an increase in the number of production. As the production goes up, the per unit cost comes down which decreases the total cost of the process.	Variable costs do not change with an increase in volume. It will remain the same per unit even when the production goes up.
In the case of fixed costs, higher production leads to more profitability as the cost per unit comes down.	The profitability does not change in the case of variable costs even when production goes up. This happens because the per unit cost remains the same.
Some examples of fixed costs are salaries, rent, and property taxes.	Examples of variable costs include the cost of raw materials, labor costs, and sales commissions.

BREAK-EVEN ANALYSIS

A business is said to break even when its total sales are equal to its total costs. It is a point of **no profits no loss.** Break even analysis is defined as analysis of costs and their possible impact on revenues and volume of the firm. Hence, it is also called the cost – volume- profit analysis. A firm is said to attain the BEP when its total revenue is equal to total cost.

Determination of Break Even Point

1. Fixed cost
2. Variable cost
3. Contribution
4. Margin of safety
5. Angle of incidence
6. Profit volume ratio

Fixed cost*:* Expenses that do not vary with the volume of production are known as fixed expenses. Eg. Manager‟s salary, rent and taxes, insurance etc. It should be noted that fixed changes are fixed only within a certain range of plant capacity. The concept of fixed overhead is most useful in formulating a price fixing policy. Fixed cost per unit is not fixed

Variable Cost*:* Expenses that vary almost in direct proportion to the volume of production of sales are called variable expenses. Eg. Electric power and fuel, packing materials consumable stores. It should be noted that variable cost per unit is fixed.

Contribution*:* Contribution is the difference between sales and variable costs and it contributed towards fixed costs and profit. It helps in sales and pricing policies and measuring the profitability of different proposals. Contribution is a sure test to decide whether a product is worthwhile to be continued among different products.

Contribution = Sales – Variable cost

Contribution= Fixed Cost+ Profit.

Margin of safety*:* Margin of safety is the excess of sales over the break even sales. It can beexpressed in absolute sales amount or in percentage. It indicates the extent to which the salescan be reduced without resulting in loss. A large margin of safety indicates the soundness of the business.

The formula for the margin of safety is:

Present sales – Break even sales **or** $\frac{\text{Profit}}{\text{PV ratio}}$

Margin of safety can be improved by taking the following step

1. Increasing production
2. Increasing selling price
3. Reducing the fixed or the variable costs or both
4. Substituting unprofitable product with profitable one.

Angle of incidence: This is the angle between sales line and total cost line at the Break-even point. It indicates the profit earning capacity of the concern. Large angle of incidence indicates a high rate of profit; a small angle indicates a low rate of earnings. To improve this angle, contribution should be increased either by raising the selling price and/or by reducing variable cost. It also indicates as to what extent the output and sales price can be changed to attain a desired amount of profit.

Profit Volume Ratio: It is usually called P. V. ratio. It is one of the most useful ratios for studying the profitability of business. The ratio of contribution to sales is the P/V ratio. It may be expressed in percentage. Therefore, every organization tries to improve the P. V. ratio of each product by reducing the variable cost per unit or by increasing the selling price per unit. The concept of P. V. ratio helps in determining break even-point, a desired amount of profit etc.

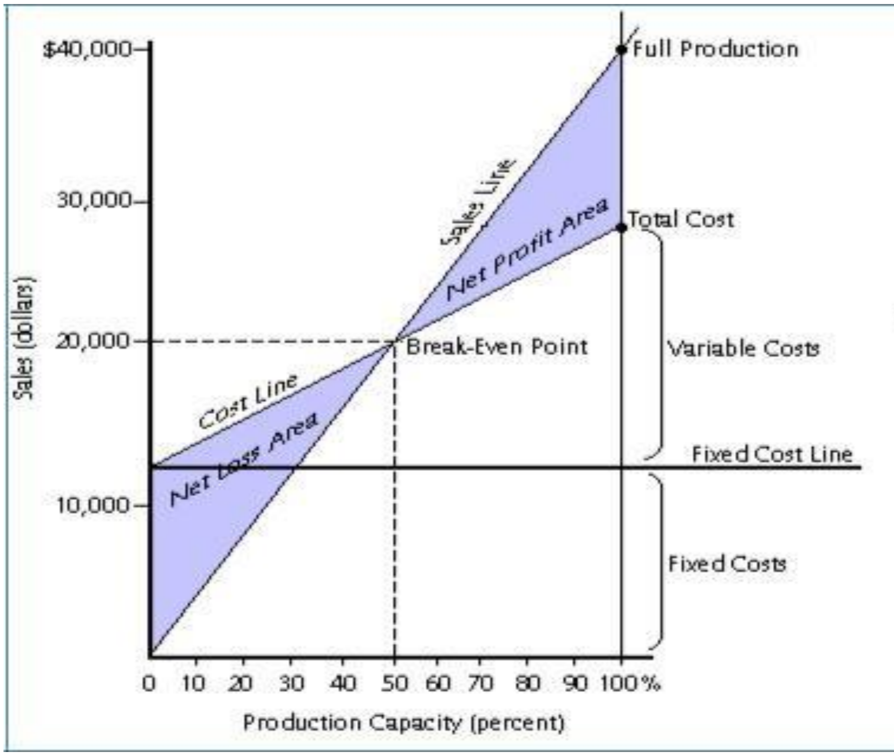


Figure 1
A Break-Even Graph

Assumptions:

Break-even analysis is based on three following assumptions:-

1. Total cost should be fixed.
2. All the elements of cost are divided into fixed or variable cost.
3. The stock valuation is restricted to a certain cost.
4. There is always coordination between production and sale.
5. Sales price per unit should be constant.
6. The cost is influenced by the volume of production.

Significance of BEA

Break-even Analysis is essential because of the following reasons:

1. Set the number of units to be sold: With the help of break-even analysis, a manager can set a target for the number of units to be sold in order to cover the costs. Variable costs, fixed costs, and the selling price are generally used in the calculation of the break-even point.

2. Pricing Strategy: Break-even Analysis tells the company about the selling price; i.e., What selling price can be charged per unit in order to cover the expenses. Also, if the selling price of a commodity is increased, then the number of units of that product to be sold to achieve the break-even point will be

reduced. Similarly, if the selling price of a commodity is reduced, then the company will have to sell extra to achieve the break-even point.
3. Setting Targets: The target being set under break-even analysis acts as the goal of the sales team so that they can plan on how and when to sell the units in order to reach the target.
4. Monitors and Controls Costs: Break-even Analysis helps in monitoring the costs occurring in the production process and then control them by cutting down the useless expenses.
5. Manages the Margin of Safety: During financial breakdown, a company's sales tend to fall. Under those circumstances, break-even analysis helps in deciding the least number of sales that the company needs to make profits. Besides, with the help of margin of safety reports, the management of a company can easily execute high business decisions.

Merits:

1. Information provided by the Break Even Chart can be understood more easily then those contained in the profit and Loss Account and the cost statement.
2. Break Even Chart discloses the relationship between cost, volume and profit. It reveals how changes in profit. So, it helps management in decision-making.
3. It is very useful for forecasting costs and profits long term planning and growth
   The chart discloses profits at various levels of production.
4. It serves as a useful tool for cost control.
5. Analytical Break-even chart present the different elements, in the costs – direct material, direct labour, fixed and variable overheads.

Limitations of BEA

- Break – even - point is based on fixed cost, variable cost and total revenue. A change in one variable is going to affect the BEP
- All cost cannot be classified into fixed and variable costs. We have semi-variable costs also.
- In case of multi-product firm, a single chart cannot be of any use. Series of charts have to be made use of.
- Total cost and total revenue lines are not always straight as shown in the figure. The quantity and price discounts are the usual phenomena affecting the total revenue line.
- Where the business conditions are volatile, BEP cannot give stable results

Marginal Costing Formulae:-

1. Contribution = Sales-Variable cost

$$= \text{Fixed Cost} + \text{Profit}$$

$$= \frac{\text{P/V Ratio}}{100} \times \text{Sales}$$

2. BEP (in units) = $\frac{\text{Total fixed cost}}{\text{Contribution}}$

3. BEP (in sales)= BEP(in units) ×Selling price per unit

$$= \frac{\text{Total fixed cost}}{\text{P/V Ratio}} \times 100$$

$$= \text{Sales} - \text{Margin of safety}$$

4. Margin of Safety = Sales – BEP Sales

$$= \underline{\quad\text{Profit}\quad} \times 100$$

$$\frac{}{\text{P/V Ratio}}$$

= Sales × Margin of safety ratio

5. Sales when desired profit given **=** $\dfrac{\text{Fixed cost + Desired Profit}}{\text{P/V Ratio}}$

6. Units when desired profit given **=** $\dfrac{\text{Fixed cost + Desired Profit}}{\text{Contribution}}$

7. Profit = (Contribution × Number of units sold) – Total Fixed Cost

8. P/V Ratio = $\dfrac{\text{Contribution}}{\text{Sales}} \times 100$

$= \dfrac{\text{Fixed cost}}{\text{BEP Sales}} \times 100$

$= \dfrac{\text{Profit}}{\text{Margin of Safety}} \times 100$

$= \dfrac{\text{Changes in Profit}}{\text{Changes in Sales}} \times 100$

PROBLEMS

1. **From the following information find out a)BEP in Units b)P/V Ratio c) BEP in value d)Number of units to be sold to achieve a target profit of Rs.1,20,000 e)Profit at sale of 8000 units.**
   Selling Price/Unit- Rs.50,
   Variable Cost/ Unit-Rs.30
   TFC- Rs.1, 00,000.

Given the information:

Selling Price/Unit: Rs. 50

Variable Cost/Unit: Rs. 30

Total Fixed Costs (TFC): Rs. 1,00,000

a) BEP in Units:

$$\text{BEP (in units)} = \frac{\text{Total fixed cost}}{\text{Contribution}}$$

Contribution = Selling Price per Unit - Variable Cost per Unit

Contribution = Rs. 50 - Rs. 30 = Rs. 20

BEP (in units) = Rs. 1,00,000 / Rs. 20 = 5000 units

b) P/V Ratio:

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

Contribution = Selling Price per Unit - Variable Cost per Unit = Rs. 20

Sales = Selling Price per Unit = Rs. 50

P/V Ratio = (20 / 50) × 100 = 40%

c) BEP in Value:

BEP (in value) = BEP (in units) × Selling Price per Unit

BEP (in value) = 5000 units × Rs. 50 = Rs. 2,50,000

d) Number of Units to Achieve Target Profit of Rs. 1,20,000:

$$\text{Units when desired profit given} = \frac{\text{Fixed cost + Desired Profit}}{\text{Contribution}}$$

$$= \frac{1{,}00{,}000 + 1{,}20{,}000}{20}$$

$$= \frac{2{,}20{,}000}{20}$$

$$= 11{,}000 \text{ units}$$

e) Profit at Sale of 8000 Units:

Profit = (Contribution Margin per Unit × Number of Units Sold) - Total Fixed Costs

Profit = (Rs. 20 × 8000) - Rs. 1,00,000

Profit = Rs. 1,60,000 - Rs. 1,00,000 = Rs. 60,000

2. **The information about Raj & Co. is given below.**

   P/V Ratio is 20%

   TFC is Rs.36,000

   Selling Price/ Unit is Rs.150

   Compute a) Contribution/Unit b) Variable Cost/Unit c) BEP in Units & Rupees.

Given the information:

P/V Ratio: 20%

Total Fixed Costs (TFC): Rs. 36,000

Selling Price/Unit: Rs. 150

a) Contribution per Unit:

$$\text{Contribution} = \frac{\text{P/V Ratio}}{100} \times \text{Sales}$$

$$= \frac{20\,\%}{100} \times 150$$

$$= \frac{20}{100} \times 150$$

$$= \text{Rs. } 30$$

b) Variable Cost per Unit:

Contribution per Unit = Selling Price per Unit - Variable Cost per Unit

Rs. 30 = Rs. 150 - Variable Cost per Unit

Solving for Variable Cost per Unit:

Variable Cost per Unit = Rs. 150 - Rs. 30 = Rs. 120

c) BEP in Units:

BEP (in units) = Total Fixed Costs / Contribution per Unit

BEP (in units) = Rs. 36,000 / Rs. 30 = 1200 units

BEP in Rupees:

BEP (in rupees) = BEP (in units) × Selling Price per Unit

BEP (in rupees) = 1200 units ×Rs. 150 = Rs. 1,80,000

3. **If actual sales are 10,000 units, Selling price is Rs. 20/Unit, Variable Cost is Rs. 10/Unit and Fixed Cost is Rs.80, 000, Find out a) BEP in units and value b) What should be the sales required for earning a profit of RS.60,000.**

Selling Price/Unit: Rs. 20

Variable Cost/Unit: Rs. 10

Fixed Costs (TFC): Rs. 80,000

Actual Sales: 10,000 units

a) BEP (Break-Even Point) in Units:

BEP (in units) = Total Fixed Costs / Contribution per Unit

Contribution per Unit = Selling Price per Unit - Variable Cost per Unit

Contribution per Unit = Rs. 20 - Rs. 10 = Rs. 10

BEP (in units) = Rs. 80,000 / Rs. 10 = 8000 units

BEP in Value:

BEP (in value) = BEP (in units) × Selling Price per Unit

BEP (in value) = 8000 units × Rs. 20 = Rs. 1,60,000

b) Sales Required for Earning a Profit of Rs. 60,000:

$$\text{Sales when desired profit given} = \frac{\text{Fixed cost + Desired Profit}}{\text{P/V Ratio}}$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

$$= \frac{10}{20} \times 100$$

$$= 50\ \%$$

$$\text{Sales when desired profit given} = \frac{80{,}000 + 60{,}000}{50\ \%}$$

$$= \frac{1{,}40{,}000}{0.5}$$

$$= \text{Rs. } 2{,}80{,}000$$

4. a) Break-even point in terms of sales value and in units.

b) Number of units that must be sold to earn a profit of Rs. 80,000.

Fixed Factory Overheads cost – 70,000

Fixed Selling Overheads cost – 15,000

Variable Manufacturing Cost per unit – 15

Variable Selling Cost per unit – 5

Selling Price per unit – 30

a) Breakeven point = Fixed cost/Selling price per unit-Variable cost per unit

Variable cost per unit = 15+5 = 20

Total Fixed Cost = 70,000+15000 = 85,000

= 85,000/30-20

Breakeven point(in units) = 8,500

Breakeven point(in sales value) = 8,500 ×30 = 2,55,000

b) Number of units that must be sold to earn a profit of Rs. 80,000.

$$\text{Units when desired profit given} = \frac{\text{Fixed cost + Desired Profit}}{\text{Contribution}}$$

$$= \frac{85,000 + 80,000}{20}$$

$$= \frac{1,65,000}{10}$$

$$= 16,500 \text{ units}$$

5. You are given the information about 2 companies in 2000

Particulars	**Company A**	**Company- B**
Sales	**50 00 000**	**50 00 000**
F.E	**12 00 000**	**17 00 000**
V.E	**35 00 000**	**30 00 000**

You are required to calculate, p/v ratio, BEP, margin of safety.

Sol:-

Company-A

Sales = 50, 00, 000

F.E = 12, 00, 000

V.E = 35, 00, 000

a) $\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$

$\text{P/V Ratio} = \frac{50,00,000 - 35,00,000}{50,00,000} \times 100$

$$= \frac{15,00,000}{50,00,000} \times 100$$

$$= 30\%$$

b) BEP(in units)= $\frac{\text{Total fixed cost}}{\text{Contribution}}$

$$= \frac{12,00,000}{15,00,000}$$

$$= 0.8 \text{ units}$$

BEP(in sales)= BEP(in units) × Sales

= 0.8 × 50,00,000

= Rs. 40,00,000

c) Margin of sales = Sales - BEP sales

= 50,00,000 - 40,00,000

= Rs. 10,00,000/-

<u>Company-B</u>

Sales = 50,00,000

F.E = 17,00,000

V.E = 30,00,000

a) P/V Ratio = $\frac{\text{Contribution}}{\text{Sales}} \times 100$

P/V Ratio = $\frac{50,00,000 - 30,00,000}{5000000} \times 100$

$$= \frac{20,00,000}{50,00,000} \times 100$$

$$= 40\%$$

b) BEP(in units)= $\frac{\text{Total fixed cost}}{\text{Contribution}}$

$$= \frac{17,00,000}{20,00,000}$$

$$= 0.85 \text{ units}$$

BEP(in sales)= BEP(in units) × Sales

= 0.85 × 50,00,000

= Rs. 42,50,000

c) Margin of sales = Sales - BEP sales

= 50,00,000 - 42,50,000

= Rs.7,50,000/-

2 MARKS QUESTIONS

1. **Define production function and write formula for production function?**

The production function expresses a functional relationship between physical inputs and physical outputs of a firm at any particular time period. The output is thus a function of inputs. Mathematically production function can be written as

$$Q = F(L1,L2,C,O,T)$$

Where Q is the quantity of production, F explains the functions, that is, the type of relation between inputs and outputs , L1,L2,C,.O,T refer to land, labout, capital, organization and technology respectively. These inputs have been taken in conventional terms. In reality, material also can be included in a set of inputs.

2. **What is the meaning of Iso-quant?**

The term Isoquants is derived from the words „iso" and „quant" – „Iso" means equal and „quent" implies quantity. Isoquant therefore, means equal quantity. Isoquant are also called iso-product curves, an isoquant curve show various combinations of two input factors such as capital and labour, which yield the same level of output.

As an isoquant curve represents all such combinations which yield equal quantity of output, any or every combination is a good combination for the manufacturer. Since he prefers all these combinations equally , an isoquant curve is also called product indifferent curve.

3. **What is the meaning of Iso-cost?**

Iso cost refers to that cost curve that represents the combination of inputs that will cost the producer the same amount of money. In other words, each isocost denotes a particular level of total cost for a given level of production. If the level of production changes, the total cost changes and thus the isocost curve moves upwards, and vice verse.

Isocost curve is the locus traced out by various combinations of L and K, each of which costs the producer the same amount of money (C) Differentiating equation with respect to L,we have $dK/dL = -w/r$ This gives the slope of the producer"s budget line (isocost curve). Isocost line shows various combinations of labour and capital that the firm can buy for a given factor prices. The slope of iso cost line = PL/Pk.

4. **Explain cobb –douglas production function?**

The Cobb-Douglas production function is based on the empirical study of the American manufacturing industry made by Paul H. Douglas and C.W. Cobb. It is a linear homogeneous production function of degree one which takes into account two inputs, labour and capital, for the entire output of the .manufacturing industry.

The Cobb-Douglas production function is expressed as:

$$Q = A.L^{\alpha}K^{\beta}$$

where Q is output and L and K are inputs of labour and capital respectively. A, α and β are positive parameters where = $\alpha > 0$, $\beta > 0$.

The conclusion drawn from this famous statistical study is that labour contributed about $3/4^{th}$ and capital about 1/4th of the increase in the manufacturing production.

$\alpha + \beta = 1$ (Constant Returns to scale)
$\alpha + \beta > 1$ (Increasing Returns to scale)
$\alpha + \beta < 1$ (Decreasing Returns to scale)

5. What is MRTS?

The marginal rate of technical substitution (MRTS) refers to the rate at which one input factor is substituted with the other to attain a given level of output. In other words, the lesser units of one input must be compensated by increasing amounts of another input to produce the same level of output.

Isoquants are typically convex to the origin reflecting the fact that the two factors are substitutable for each other at varying rates. This rate of substitutability is called the "marginal rate of technical substitution" (MRTS) or occasionally the "marginal rate of substitution in production".

It can also be shown that the marginal rate of substitution labour for capital, is equal to the marginal physical product of labour divided by the marginal physical product of capital.

6. Define cost?

Cost refers to the expenditure incurred to produce a particular product or services. All cost involves a sacrifice of some kind or other to acquire some benefit. For example , if I want to eat food, I should be prepared to sacrifice money.

Cost refers to the amount of expenditure incurred in acquiring something. In business firm, it refers to the expenditure incurred to produce an output or provide service. Thus the cost incurred in connection with raw material , labour, other heads constitute the overall cost of production.

7. Explain about BEA point?

A business is said to break even when its total sales are equal to its total costs. It is a point of **no profits no loss.** Break even analysis is defined as analysis of costs and their possible impact on revenues and volume of the firm. Hence, it is also called the cost – volume- profit analysis. A firm is said to attain the BEP when its total revenue is equal to total cost.

8. Explain Explicit cost and Implicit cost?

- Explicit costs are those expenses that involve cash payments. These are the actual or business costs that appear in the books of accounts. These costs include payment of wages and salaries, payment for rawmaterials, interest on borrowed capital funds, rent on hired land, Taxes paid etc.
- Implicit costs are the costs of the factor units that are owned by the employer himself. These costs are not actually incurred but would have been incurred in the absence of employment of self – owned factors. The two normal implicit costs are depreciation, interest on capital etc. A decision maker must consider implicit costs too to find out appropriate profitability of alternatives.

9. Explain Out of pocket cost and Book cost?

- Out-of pocket costs also known as explicit costs are those costs that involve current cash payment. Book costs also called implicit costs do not require current cash payments. Depreciation, unpaid interest, salary of the owner is examples of back costs.
- The book costs are taken into account in determining the level dividend payable during a period. Both book costs and out-of-pocket costs are considered for all decisions. Book cost

is the cost of self-owned factors of production.

10. Explain Fixed cost and Variable cost.

- Fixed cost is that cost which remains constant for a certain level to output. It is not affected by the changes in the volume of production. But fixed cost per unit decrease, when the production is increased. Fixed cost includes salaries, Rent, Administrative expenses depreciations etc.
- Variable is that which varies directly with the variation is output. An increase in total output results in an increase in total variable costs and decrease in total output results in a proportionate decline in the total variables costs. The variable cost per unit will be constant. Ex: Raw materials, labour, direct expenses, etc.

11. Write formulas of breakeven point?

$$\text{BEP (in units)} = \frac{\text{Total fixed cost}}{\text{Contribution}}$$

$$\text{BEP (in sales)} = \text{BEP(in units)} \times \text{Selling price per unit}$$

$$= \frac{\text{Total fixed cost}}{\text{P/V Ratio}} \times 100$$

$$= \text{Sales} - \text{Margin of safety}$$

12. What are the merits of BEA?

- Information provided by the Break Even Chart can be understood more easily then those contained in the profit and Loss Account and the cost statement.
- Break Even Chart discloses the relationship between cost, volume and profit. It reveals how changes in profit. So, it helps management in decision-making.
- It is very useful for forecasting costs and profits long term planning and growth
- The chart discloses profits at various levels of production.
- It serves as a useful tool for cost control.
- Analytical Break-even chart present the different elements, in the costs – direct material, direct labour, fixed and variable overheads.

13. What are the demerits of BEA?

- Break – even - point is based on fixed cost, variable cost and total revenue. A change in one variable is going to affect the BEP
- All cost cannot be classified into fixed and variable costs. We have semi-variable costs also.
- In case of multi-product firm, a single chart cannot be of any use. Series of charts have to be made use of.
- Total cost and total revenue lines are not always straight as shown in the figure. The quantity and price discounts are the usual phenomena affecting the total revenue line.
- Where the business conditions are volatile, BEP cannot give stable results

14. What is the meaning of contribution?

Contribution is the difference between sales and variable costs and it contributed towards fixed costs and profit. It helps in sales and pricing policies and measuring the profitability of different proposals. Contribution is a sure test to decide whether a product is worthwhile to be continued among different products.

- **Contribution = Sales – Variable cost**

- **Contribution= Fixed Cost+ Profit.**

15. What is margin of safety?

Margin of safety is the excess of sales over the break even sales. It can be expressed in absolute sales amount or in percentage. It indicates the extent to which the sales can be reduced without resulting in loss. A large margin of safety indicates the soundness of the business.

The formula for the margin of safety is:

- Present sales – Break even sales **or** $\frac{\text{Profit}}{\text{P. V. ratio}}$

16. What is angle of incidence?

This is the angle between sales line and total cost line at the Break-even point. It indicates the profit earning capacity of the concern. Large angle of incidence indicates a high rate of profit; a small angle indicates a low rate of earnings. To improve this angle, contribution should be increased either by raising the selling price and/or by reducing variable cost. It also indicates as to what extent the output and sales price can be changed to attain a desired amount of profit.