firm uses straight line method for providing depreciation. The estimated cash flows before tax (CFBT) from the machine are as follows.

Year	CFBT (Rs.)
1	60,000
2	70,000
3	90,000
4	1,00,000
5	1,50,000

6.9 Suggested Readings:

1. I.M. Pandey, Financial Management, Vikas Publishing New Delhi.
2. James C. Van Horne Financial Management and Policy Prentice Hall, New Delhi.
3. M.Y. Khan and P.K. Jain, Financial Management, Tata McGraw Hill, New Delhi.
4. Prasanna Chandra, Financial Management, Tata McGrew Hill, New Delhi.

Lesson -7

MARGINAL COSTING

Structures

7.0 Learning Objectives

After studying the lesson, you should be able to understand:-

1. The concept of Marginal Cost and Marginal Costing
2. Ascertainment of P/V Ratio, margin of safety and breakeven point. Etc.
3. Application of Marginal Costing

7.1 Introduction

We have already learnt that total costs can be divided into fixed, semi variable according to the variable classification of costs. Semi variable costs again can be segregated into fixed and variable portions. Thus the two broad divisions of costs will be fixed and variable costs. Total costs of a product will decrease with the increase in units of production and will decrease with the decrease in the units of production. This is because of the fact that variable cost per unit remains the same whereas fixed cost per unit increases with the decreases in the units of production and decreases with the increase in the units of production. Thus when taken together total costs will increase with the increase in units of production and decrease with the increase in the units of production. The changes in total costs will not provide the management the comparable data on the basis of which the decisions may be taken by the management. Thus management thought of excluding the fixed cost from the total cost in order o have variable costs only which remains the same per unit of production. This provided the management comparable data which helps the management to take various type of decisions. This lead to the invention of a new technique known as marginal costing. In U.S.A variable costing is used for marginal costing (which is used in U.K)

7.2 MEANING OF MARGINAL COST AND MARGINAL COSTING

There are two terms which confuse the students generally. These are marginal cost and marginal costing. Marginal cost is the change in the aggregate costs with the increase or decrease one unit of production. If 1000 units are produced and the marginal cost is Rs. 3 per unit hen the total cost will be Rs. 3,000. If the production is increased to 1001 unit of production then the total cost will be Rs.3,003. The change in the aggregate cost is Rs.3 and is the marginal cost. In the context a unit may be single, a batch of articles, an order, a stage of production capacity or a department. It relates o he change in output in the particular circumstances under consideration.

Marginal costing is the ascertainment of marginal costs by differentiating between fixed costs and variable costs and to see the effects of profit of changes in volume or type of output. Thus marginal costing includes two things i.e. (i) the ascertainment marginal cost and (ii) The cost volume profit relationship.

7.3 ASCERTAINMENT OF MARINAL COST

We have already seen how cost is presented in the cost sheet with various divisions of costs. This presentation is made under the method of absorption or total cost method. Under this method the total cost is absorbed in the units of production. But presentation under marginal cost is different from the absorption costing. Under marginal costing the cost is ascertained as under :

Sales		**Rs.**
Less Marginal Cost		xxxxxx
Direct Material	xxxxx	
Direct Wages	xxxxxx	
Direct Expenses	xxxxxx	
Variable Overheads	xxxxxx	xxxxxx
Contribution		xxxxxx

Less fixed Costs	xxxxxx
Profit or oss)	xxxxxx

Thus, we find that out of sales, marinas cost is deducted in ode o calculate the gross margin or contribution. The contribution of a product will create a fund out of which fixed costs of the concern as whole is deducted to have profit or moss

It is only in presentation that total cost method is different from the marginal cost. The same transaction which are included in the cost sheet are taken for the purpose of marginal costing but with the difference that in case of marginal costing we take first of all the marginal cost and then fixed costs in order o calculate the profit or loss. Generally it is expected that the profits or loss as per total cost and marginal cost must be the same but it may be different because of the following reason:-

(i) Difference in stock Valuation

In total cost method he stock (opening and closing) is valued at total cost basis whereas in marginal costing such stock is valued at marginal cost basis. Thus the valuation under marginal costing will be less as compared to total cost method and hence there will be difference in profits calculated under two methods. If the closing stock is more than the opening stock or production exceeds sales there will be more profit in absorption costing. But if costing stock is less than the opening stock i.e. sales exceed production there will be higher profit in marginal costing.

(ii) Over or under absorption of overheads

In absorption costing there is every possibility of under o over absorption of overheads because of difficulty in forecasting cost and volume of output. Thus there wild not be hundred percent absorption of fixed costs. But in marina costing, fixed costs are not taken into consideration and directly charged to Costing Profit and Loss Account treating it as fixed costs. Thus due to under o over-absorption of overheads there will be difference in profits as calculated under absorption costing and marinas costing

After ascertain in the marginal cost it becomes necessary for us to see the other aspect of marginal costing i.e. cost volume profit relationship. It is a known fact that if volume of a product is increased, the cost will decrease and posit will increase and vice-versa will be true if volume is decreased.

In order o understand he relationship of cost volume profit relationship it becomes necessary to understand the following terms:

1. Contribution
2. P/V Ratio
3. Break Even Point
4. Margin of Safety

These will be discussed now one by one.

1. **Contribution**:- Contribution is the difference between the sales and variable cost of sales. It contributes to the 'fund' out of which fixed expenses are deducted to calculate profit or loss. Thus if the selling price is Rs. 10 and the variable costs is 6 per unit then contribution will be Rs. 4 per unit. Suppose the concern is producing 1000 units hen Rs. 4000 will be total contribution. If the total fixed expenses are Rs. 2000, then the profit will be Rs. 2,000. If the fixed expenses are Rs. 7000 then there will be loss of Rs.3, 000. It can be represented as:

Contribution=Selling-Marginal Cost

Or Contribution=Fixed+ Profit/Loss

Or Contribution-Fixed Expenses=Profit/loss

Contribution is very important in marginal costing as it helps to determine the profitability of various products, departments in profit planning, in selecting a better product mix and other decision making task of he management. Contribution per unit will also help to determine the breakeven point. In general we can say that product or department which gives maximum contribution is the best as compared to other product or departments.

Marginal Cost Equation

The above relationship can also be put in the form of marginal equation:

Saes=Variable Cost+ Fixed Expenses +Profit/Loss

Or Sales-Variable Cost=Fixed Cost= Fixed Expenses +Profit/Loss

Or S-V=F+P (where S stand for sales, V for variable costs, F for fixed expenses, +P for profit and _P for loss)

Or S-V=C (as F+P i.e. fixed expenses + Profit=Contribution)

From his equation we can calculate the value of four factors i.e. S, V, E, P, if any of these factors are known.

Illustration: Determine the amount of fixed expenses from the following particulars:

	Rs.
Sales	10, 00,000
Direct Materials	3, 00,000
Direct labour	2, 00,000
Variable overheads	1, 50,000
Profit	1, 0,000

Solution:

Sales –Variable Cost=Fixed Cost +1, 0,000 or Fixed Cost +Rs. 2, 00,000.

2. **P/V Ratio**. Profit Volume or Contribution Saes ratio is the ratio of contribution to sales and is calculated by the following formula:

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

$$\text{Or} = \frac{Fixed\ Expenses + Profit}{Sales}$$

$$\text{Or} = \frac{Sales - Variable\ Cost}{Sales}$$

$$\text{Or} = \frac{Changes\ in\ Profits\ or\ conribution}{Changes\ in\ sales}$$

The ratio is multiplied by 100 then P/V ratio can be expressed in the form of percentage.

Suppose the sale price of a unit is Rs. 10 and the variable cost per unit in Rs. 6 then the contribution will be Rs. 4 per unit P/V Ratio will be 4/10x100=40%.

The P/V ratio is very important ratio studying the profitability of operations of a business and established relationship between the contribution and sales. In order to find out which product is most profitable, we have to calculate the profit-volume ratio of the different products. The product which gives the maximum P/V ratio is the most profitable. Every concern tries o maximise P/V ratio, as higher P/V ratio gives an indication of more profit. It can be increased by:

Increasing the selling price of the product.

(i) Decreasing the variable cost of the product and

(ii) Shifting to the production of those products which are more profitable or having more P/V ratio

With the help of this ratio variable costs can also be calculated by the following:

Variable costs=Sales (1-P/V ratio)

Breakeven point (as will be discussed later on) can also be calculated with the help of this ratio by the following rule

$$\text{Break Even Point} = \frac{Fixed\ cost}{P/V\ Ratio}$$

Illustration

Assuming that the cost structure and selling price remain the same in Periods I and II find out P/V ratio and fixed expenses.

Period	Sales	Profit
I	Rs. 1,20,000	Rs. 9,000
II	Rs. 1,40,000	Rs.13,000

Solution

P/V ratio=

$$\frac{Change\ in\ Profits}{Change\ in\ sales} = \frac{4{,}000}{20{,}000} * 100 = 20\%$$

For calculating the fixed cost, contribution will be calculated by multiplying the P/V ratio with the sales of one period and then profit of the same period will be deducted to find out the fixed costs.

Fixed Costs= (P/V ratio*sales)-Profit

=(20*1,20,000)-9,000

=24,000-9,000=Rs.15,000

3. Break Even Point

Break Even Point is that where the total costs is equal to the total sales and there is no profit or loss. Contribution will be equal to the fixed costs at this point. Even Point can be calculated either in units or value. Breakeven Point can be calculated either units or value. Break Even Point in units can be calculated by the following formula

Break Even Point (in units)=

$$\frac{Total\ Fixed\ Expenses}{Selling\ price\ per\ unit - Marinal\ cost\ per\ unit}$$

Breakeven point in sales can be calculated by multiplying the units with the sales price.

Break Even Point can also be calculated with the help of the P/V ratio as already given previously.

Calculation of Profit when sales are given:

Sometimes it is required to calculate the amount of profit when sales are given. First of all sales are to be multiplied with the P/V ratio in order to calculate the contribution. Out of contribution fixed expenses are to be deduced in order to calculate the profit.

Calculation of sales when it is desired to earn a certain amount of profit

If it is desired o earn a certain amount of profit then the desired amount of profit should be added to the fixed expenses in order to calculate the desired contribution which should be divided by the P/V ratio in order to calculate the amount of sales.

Illustration. From the following data find out (i) PV Ratio (ii) Break Even Point (iii) Sales required to earn a profit of Rs. 1, 60,000 and (iv) Profit when sales are 2,00,000

Selling Price per unit	Rs40
Variable cost per unit:	
Direct Materials	Rs.10
Direct Labour	Rs.7
Variable Overheads-100 on direct labour cost	
Fixed Expenses	Rs.64, 000

Solution:

Selling Price		Rs.40
Less Marginal Cost:		
Direct Materials	Rs.10	
Direct Labour	Rs.7	
Variable overheads	Rs. 7	Rs.24

Contribution		Rs.16

(i) P/V Ratio= $\frac{Contribution}{Saes} * 100 = \frac{16}{40} * 100 = 40\%$

(ii) Break Even Point=

$$\frac{Fixed\ Costs}{\frac{P}{V} Ratio}$$

$$\frac{64,000}{40\%} = Rs.\ 1,60,000$$

(iii) Sales required to earn a profit of Rs. 1,60,000

$$\frac{Fixed\ expenses + Desied\ pofit}{\frac{P}{V} Raio}$$

$$\frac{64,000 + 1,60,000}{40\%}$$

=Rs.5, 60,000

(iv) Profit when sales are Rs.2,00,000

Profit =Contribution-fixed expenses

=(P/V Ratio x Sales)-Fixed Expenses

= 40% x 2,00,000)-Rs. 6400

= Rs.80,000-Rs. 64,000=Rs.16,000

4. Margin of Safety

Margin of safety is the difference between the actual sales and sales at break even point. At break even point we have seen there is no profit or loss. It is only after the break even point that the profit starts. The more the actual sales are from the break even point the more margin of safety will be. Thus margin of safety can be calculated by the following formula:

Margin of Safety =Present Sales-Break Even Sales

Margin of Safety can also be calculated with the following formula:

Marin of Safety=

$$\frac{Profit}{\frac{P}{V}Ratio}$$

Margin of safety indicates the strength of the business. If the production or sales are increased from the break even point the margin of safety will increase. More the margin of safety it will be more beneficial for the business. Every concern tries to increase the margin of safety in order to increase the strength of the business. Margin of safety can be increased by the following steps:

(a) Increase the level of production

(b) Increase the selling price

(c) Reduce the fixed costs or variable costs or both

(d) Substitute the existing product y more profitable products.

Illustration.

The sales turnover and profit during two years were as follow:-

Year	Sales	Profit
	Rs.	Rs.
I	3, 00,000	40,000
II	3, 40,000	50,000

You are required to calculate:

(i) P/V Ratio

(ii) Fixed Costs

(iii) Break Even Point

(iv) The sales required to earn a profit of Rs. 0,000

(v) The profit when sales are Rs. 5,00,000

(vi) Margin of safety at a point of Rs. 1,00,000.

(vii) Variable costs of the two periods.

Solution.

(i) P/V Ratio= $\frac{Change\ in\ profits}{Change\ in\ sales} = \frac{10,000}{40,000} = \frac{1}{4} or\ 25\%$

(ii) Fixed Expenses= Contribution-Profit

= (P/V Ratio x Sales)-Profit

(1/4x3, 00,000)-40,000

= Rs. 75,000-Rs. 40,000

= Rs. 35,000

(iii) Break Even Point=

$$\frac{Fixed\ Costs}{\frac{P}{V}\ Ratio} = \frac{35,000}{\frac{1}{4}} = Rs.\ 1,50,000$$

(iv) Sales required to earn a profit of Rs. 80,000

$$= \frac{35000 + 80{,}000}{\frac{1}{4}} = 1,15,000 \times \frac{4}{1}$$

=Rs.4, 60,000

(v) The profit when sales are Rs5 ,00,000

Profit= (P/V Ratio x Sales)-Fixed Expenses

= $(1/4 * 500{,}000)$ -Rs.35, 000

= Rs. 1, 25,000-Rs. 35,000 = Rs. 90,000

(vi) Margin of safety of a profit of Rs. 1,00,000

Margin of Safety

$$\frac{Profit}{\frac{P}{V}Raio} = \frac{1{,}00{,}000}{\frac{1}{4}} = \text{Rs. 4, 00,000}$$

(vii) Variable Cost= (100-P/V Ratio) or

100-2%=7% of sales

Variable cost of year 1= % of 3,00,000=Rs. 2,2,000

Variable cost of Year II= 0f 3,40,000+Rs. 2,,000

SOLVED TYPICAL PROBLEMS ON MARGINAL COSTING

Illustration: A company is considering expansion. Fixed costs amount to Rs. 4,20,000 and are expected to increase by Rs. 1,25,000 when plant expansions completed. The present plant capacity is 80,000 units a year. Capacity will increase by 0 percent with he expansion. Variable costs are currently Rs. 6.0 per unit and are expected to go down by Rs.0.40 per unit with the expansion. The current selling price is Rs. 16 per unit and is expected to remain under either alternative. What are the break even points? Which alternative is better and why?

Solution:

	Present Position	After Expansion
	Rs.	Rs.
Fixed Costs	4,20,000	5,45,000
Capacity	80,000 units	1,20,000 units
Selling price per unit	Rs.16.00	Rs.16.00
Less Variable costs	Rs.6.80	Rs.6.40
Contribution per unit	9.20	9.60
Break Even Point:	$\frac{Fixed\ Cost}{Contribution\ per\ unit} = \frac{4{,}20{,}000}{9.20}$	$\frac{545000}{9.60}$
	=45,652 units	=56.771

Assuming that production up to plant capacity can be sold, profit under the two alternative will be as follows:

	Present capacity Rs.	Capacity after expansion Rs.
Sale: 80,000 units Rs16 1,20,000 units Rs.16	12,80,000	 19,20,000
Less variable cost		
80,000 units Rs. 6.80 1,20,000 units Rs.6.40	5,44,000	 7,68,000
contribution	7,36,000	11,52,000
Less fixed costs	4,20,000	5,45,000
profit	3,16,000	6,07,000

From the above it is clear that profit it is nearly twice of the present profit after the expansion so alternative of expansion. So alternative of expansion is better than the present.

Solution.

At 100% capacity:

	Plant 1 Rs. (lakhs)	Plant II Rs. (lakhs)	Merged plan Rs.(lakhs)
sales	300	200($\frac{120}{60}$*100)500	500
Variable cost	220	150($\frac{90}{60}$*100)370	
Variable cost	220	150($\frac{90}{60}$*100)370	
contribution	80	50	130
Fixed costs	40	20	60
profit	40	30	70

(1) Break even sale of Merged plant = $\frac{fixed\ cost}{sale - varible\ cost}$

$$= \frac{60 * 500}{130} * 100 = 46.15\%$$

(II) At 75% capacity working contribution = $\frac{130 * 75}{100}$ =Rs. 97.5 lakhs.

Profit=Rs.97.5 lakhs –Rs. 60 lakhs fixed cost)=Rs.37.5 lakhs.

Illustration: The following figures have been extracted from the accounts of a manufacturing undertaking, which produces a single product for the previous (base)

units produce and sold	10,000
	Rs.
	20,000
Variable cost per units :	
Labour	4
Material	2
Overheads	0.80
Selling price per unit	10

In preparing the Budget for the current (budget) year the undernoted changes have been envisaged:

Units to be produced and sold 15,000

Fixed overheads increased by Rs.3,000

Fall in labour efficiency 20%

Special additional discount for bulk

Purchase of material

Variable overhead per unit educed

Fall per unit in selling price 10%

Calculate:

(i) The number of units which must be sold to break even in each of the two years.

(ii) The number of units which would have had to be sold to double the profit in the base year under base year conditions.

(iii) Te number of units which would have to be sold in the budget year to maintain the profit level of the preceding year.

Solution:

Summary of Costs

	Base Year		**Current Year**	
Units produced	10,000		15,000	
And sold				
	Rs/units	Total Amount	Rs./Units	Total Amount
1. Sales	10.0	1,00,000	9.00	1,35,000
2. Variable Costs:				
Direct Wages	4.0	40,000	5 .00	75,000
Direct materials	2.0	20,000	1.95	29,250

Variable overheads	0.80	8,000	.79	11,850
Total variable cost	6.80	68,000	7.74	1,16,100
Contribution (1-2)	3.20	32,000	1.26	1,900
Fixed overheads		20,000		25,000
Net profit/ (Loss)		12,000		61,00

(i) Units to sell for breaking even

= Fixed overhead/ Contribution per unit

= Rs. 20,000/ Rs. 3.20 Rs. 25,000 / Rs. 1.26

= 6,20 units = 19,841 units.

(ii) Units to sell for doubling profit in Base year

$$\frac{(Profit\ x\mathbf{2}) + \ Fixed\ Over\mathbf{h}ead}{Contributed\ per\ unit}$$

$$\frac{(Rs.12{,}000 * 2 + 20{,}000)}{Rs.3.2\mathbf{0}}$$

$$\frac{44{,}00\mathbf{0}}{Rs.3.2\mathbf{0}} = 13{,}750\ units$$

(iii) Units to sell in current year for maintenance of profit of the base year

$$= \frac{Profit\ of\ base\ year + Fixed\ over\mathbf{h}ead\ of\ current\ year}{Rs.1.2\mathbf{6}}$$

$$\frac{Rs.12{,}000 + Rs.25{,}00\mathbf{0}}{Rs.1.2\mathbf{6}} = \frac{Rs.35{,}00\mathbf{0}}{Rs.1.2\mathbf{6}}$$

=2,365 unit

Working notes:

Changes of data to current year from the base year.

(i) Total fixed overhead = Rs. 20,000+Rs. 5,000= Rs.25,000

(ii) Labour cost per units:

(Fall in labour efficiency by 20% implies that 20 less output is now produced by labour in the same working hours).

	Out put	**Wages**
Base year	1 unit	Rs. 4.00
Current year with 20% lower efficiency	0.8 unit	Rs.4.00
Hence in current year labour cost Per unit	Rs. 4/0.8	Rs.5

(iii) Material cost per unit:

Base year= Rs. 2 less discount is current year 21/2 % = Rs.1.9.

(iv) Variable overheads per units:

Base year=Rs. 0.80 less reduction by 1% in current year

=0.80 x0125=0.01. There, variable overheads per unit in current period=0.9

(v) Selling price per unit

Base year=Rs. 10 less 10 falling current year = Rs.9.00

7.4 Application of Marginal Costing

The marginal costing technique is very useful o he management in taking many valuable policy decisions. Such decisions, if taken by the management with the help of absorption costing method will lead to wrong conclusions. The following are he some of he managerial problems which can be solved wish he help of marginal cost in technique.

1. Fixation of Selling Price.

Fixation of sell in price is one of the important functions of management and is to be performed under the normal circumstance in ices of completion of trade depression, accepting additional orders for utilizing idle capacity and in exploring and exporting new markets

In normal circumstance the price must be fixed by the forces of demand and supply and must cover the total cost plus a reasonable margin of profit. I can also be fixed on the marginal costing basis provided the contribution must be able to cover the fixed cost and a reasonable margin of profit. The real test of management will be when prices are to be fixed in cut throat competition or depression or additional capacity is to be utilised or new markets are to be explored or goods are to be exported. In such cases, the price can be below total cost but must be above the marginal cost i.e., marginal cost plus some contribution towards the fixed expenses. The more the contribution is towards the fixed expenses the more the beneficial t he price will be in the interest of the concern.

In times of depression in order to clear the stocks of the concern, the concern may adopt the price which is just covering the marginal cost. This policy may be good for short period to tide the period of difficulty but this policy will not be good in the long term.

Sometimes the concern is required to reduce the price below cost in order to tide over the sort period difficulties. This policy may be good for shore term but cannot be adopted in the long period. Such policy becomes necessary:

(i) When the concern is required to introduce a new product in the market.

(ii) When foreign mare is to be explored to earn foreign exchange.

(iii) When the concern has purchased a large quantity of material and the materials become obsolete. In order o reduce the loss, it becomes necessary to produce and sell it to below marginal cost.

(iv) When the closure of business may mean breaking up the connections with the existing purchasers and in order to regain much expenditure is to be done for advertisement and sales promotion.

(v) The sale of one product may push up the sale of another product and it becomes necessary to produce such product and sell it below marginal cost.

(vi) When on the closure of business heavy compensations are required to be paid to the workers on retrenchment.

(vii) When competitors are to be eliminated form the market.

(viii) When goods are of perishable nature.

Sometimes a concern may get a foreign order but the price which is to be received may be less than the home price. Under such circumstances it is to be seen whether the order should be accepted r not. If the home mare price is compensating the loss which the concern is required to bear and the concern may get some direct or indirect benefits such as prestige of exporting, import entitlements, subsidies or any other special favours from the government than the foreign order can be accepted provided the concern as idle capacity and can manufacture that quantity without increasing any fixed expenses. But if the concern is not having any idle capacity then the cost must be increased reasonably in order to adjust the charges which the concern is required to incur because of fixed additional facilities. This will be more clear from the following illustrations.

Illustration:

The cost sheet of a product is given as under:

		Rs.
Direct Materials		10.00
Direct wages		6.00
Factory Overheads		
Fixed	Re.1.00	
Variable	Re.1.00	2.00
Administration Expenses		
Selling and Distribution Overheads:		
Fixed	Re.0.50	
Variable	Re. 1.00	1.50
		21.00

The selling price is Rs.24

The above figures are for an output of 1, 00,000 units. The capacity of the firm is 1,0,000. A foreign customer is desirous of buying 30,000. Units at a price of Rs. 20.00 per unit. Advice the manufacture whether the order should be accepted. What will be your advice if the orders were from local merchant?

Solution:

Marginal cost or additional cost of addition 30,000 units

	Per unit	For 30,000 units
	Rs.	Rs.
Direct Materials	10.00	3, 00,000
Direct Wages	6.00	1, 80,000
Prime cost	16.00	4, 80,000
Variable Overheads:		
Factory	1.00	30,000
Selling and Distribution	1.00	30,000
	18.00	5,40,000
Sales	20.00	6,00,000

Contribution	2.00	60,000

The order from the foreign customer will give an additional contribution of Rs. 60,000. Hence, he order should be accepted because additional contribution of Rs. 60,000 will increase the profit by this amount because fixed expenses have already been met from the internal market.

The order from the local merchant should not be accepted at a price of Rs. 20. This price will affect relationship with other customers and there will be general tendency of reduction in the price.

Illustration:

Asha Ltd has been working well below normal capacity due to recession. The directors of Asha Ltd have been approached by a company with an enquiry for special purpose job. The costing department estimated the following in respect of the job:

Direct Materials Rs. 20,000 Direct Labours 1,000 hours @ Rs. 4 per hour; Overhead Costs: (Normal recovery rates):

Variable	Re. 1.00 per hour
Fixed	Rs. 2.00 per hour

The directors ask you to advice them on the maximum price to be changed. Assume that there are no production difficulties regarding the job.

Solution:

Statement showing the minimum price to be charged.

	Rs.
Direct Material	20,000
Direct labour 1,000 hours Rs. 4 per hour	4,000
Variable Overheads	1,000
Marginal Cost	25,000

Hence the absolute minimum price Rs. 25,000 i.e., total of marginal costs. As this will not make any contribution a proportion of fixed costs of Rs. 2,000 may be added to make the job worthwhile. The amount to be added will depend upon the circumstances of the case.

2. Make or Buy Decisions.

A concern may have idle capacity which may be utilized in manufacturing components parts or similar items instead of buying them from market. While making such decisions, the marginal cost of manufacturing the components should be compared with the price quoted by the supplier. If the marginal cost is less it is better to purchase from the market but on the other hand if the marginal cost is more than the purchase price it is desirable to purchase the same from the market. Fixed cost are entirely ignored on the assumption that such cost will not be increased with the manufacturing of components. But if the manufacturing of the components increase the fixed cost then it becomes necessary to find out the minimum volume which would justify making instead of buying. This volume is determined as follows:

Increase in fixed costs

Contribution (i.e. price less variable cost of production) per unit.

While doing this if there is any impugn factor (discussed afterwards in the lesson) it should be taken into consideration

Illustration:

A firm can purchase a spare part from an outside source a Rs. 6 per unit. There is a proposal that the spare part be produced in the factory itself. For the purpose a machine costing Rs. 1,00,000 with an annual capacity of 20,000 units and a life of 10 years, will be required. A foreman with a monthly salary of Rs. 800 p.m. will have to be engaged. Materials required will be Rs. 1.75 per unit and wages 90 paisa per unit. Variable overheads are 150% of direct labour. The firm can easily raise funds at 7%. Advise the firm whether the proposal should be accepted.

Solutions:

The variable cost is compared as under:

	Rs.
Materials	1.75
Wages	0.90
Able overheads	1.35
Marginal cost	4.00

In order to decide whether spare part should be manufactured or not, marginal cost is compared with the purchase price in order to find out the contribution. In this case the contribution is Rs. 2/- (Rs.6-Rs.4). But in order o find out the volume at which it will be economical, we must divide he fixed cost by he contribution. Fixed costs in this case will be as under:

	Rs.
Depreciation (annual)	10,000
Salary of the foreman (annual)	9600
Interest on Rs. 1,00,000 7% p.a.	7,000
Increase in total fixed cost	26,600

In order to accept the proposal it is essential that the volume should be at least 13,300 as calculated here:

$$\frac{Increase\ in\ fixed\ costs}{Contribution\ per\ unit} = \frac{26{,}600}{Rs.\,2} = 13{,}300$$

If there is no idle capacity and making of the component in the factory involves putting aside other work, then the loss from displaced work should also be taken ino consideration along with the marginal cost of production. It will be more profitable to manufacture if the purchase price is more than he marginal cost plus traceable fixed cost plus the loss of contribution. The loss of contribution is to be found with reference to the key factor.

Illustration:

K. Ltd. produces a variety of products each having a number of component parts. Product B takes 5 hours to process on a machine working to full capacity. B has a selling price of Rs. 50 and a marginal cost of Rs.30 per unit. A-10 a component part used for product. A could be made on te same machine in 2 hours for a marginal cost of Rs. 5 per unit. This supplier's price is Rs. 12.50 per unit. Should one make or buy A-10? Assume the machine hours is the limiting factor.

Solution

Contribution of B=Selling price-Marginal Cost

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

Contribution of B per hour=Rs. 20 ours=Rs.4 per our

Loss of contribution for 2 hours= Rs. 4x2=Rs.8 per hour

For deciding whether to manufacture the component or to purchase it from outside, marginal cost plus loss of contribution must be compared with the purchase price. In this case the marginal cost is Rs. 5 and loss of contribution is Rs.8. The total cost i.e. Rs.13 when compared with the purchase of Rs.12.0 it will be concluded that outside purchase is preferable.

3. Key or Limiting Factor:

A key factor is that factor whose influence must be taken into consideration before making any programme of production or sales. In general, sales are the limiting factor as a concern is not able to sell as much as it can produce. But Sometimes a concern can sell all what it can produce but production is affected by some limiting factor. It may be material, labour machine capacity or capital act. In such cases it becomes necessary to see the profitability of the product with reference to limiting factor. This can be determined by dividing the contribution of a product by the limiting factor in order to calculate the profitability per limiting factor. Only then decision can be taken by the management as to which product is more profitable.

Illustration.

From the following data, which product would you recommend to be manufactured in a factory, time being he key factor

	Per unit of Product A	**Per unit of Product B**
Direct Material	24	14
Direct Labour at Re. 1 per hour	2	3
Variable Overhead at Rs.2 per hour	4	6
Selling price	100	110
Standard time to produce	2 hours	3 hours
Contribution per hour	Rs.35	Rs. 29

From the above it is clear at contribution per hour of product A is more than that of product B Rs.6. Therefore product A is more profitable and is recommended to be manufactured.

4. Effect of Changes in Sale price

Because of competition, or expansion programme or government regulations, the management is required to reduce the price. The effect of reduction in price will be reduction in contribution per unit. This aspect has to be studied thoroughly by the management in order to see the justification of reduction in price or the product.

Illustration:

The directors of a company are considering the results of treading during the last year. The Profit and Loss Statement of the company appeared as follows:

	Rs.	**Rs.**
Sales		7,50,000

Direct materials	2,25,000	
Direct wages	1,50,000	
Variable overheads	60,000	
Fixed, overheads	2,20,000	6,55,000
Profit		95,000

The budgeted capacity of the company is Rs. 10,00,000 but the key factor is sales demand. The sales manager is proposing that in order to utilise the existing capacity, the selling price of the only product manufactured by the company should be reduced by 5%.

You are required to prepare to forecast statement which should show the effect of the proposed reduction in selling price and to indicate any changes in costs expected during the coming year. The following additional information is given:

Sales forecast : Rs.9,50,000

Direct material prices are expected to increase 2%

Direct wages rates are expected to increase by 5% per unit.

Variable overhead cost expected to increase by % per unit.

Fixed overheads will increase by Rs. 10,000

Solution;

Statement showing the effect of Change in selling

	Rs.	**Rs.**
Sales		9,50,000
Less marginal cost:		
Direct Materials	3,06,000	
Direct wages	2,10,000	
Variable overheads	84,000	6,00,000 Contribution 3,50,000
Fixed overheads		2,30,000
Profit		1,20,000

The above statement will show that although costs have increased and selling price has been reduced, the profit forecast for coming year is still more than achieved last year. This is because increased volume of sales at reduced sales price has resulted in increased contribution more than sufficient to cover increase in costs, variable and fixed.

Working Notes:

Rs.

(a) Sales (after 5% price reduction)	9,50,000
Add reduction in selling price	
5/95 X9, 50,000	50,000

Sales before price reduction	10, 00,000
Less: Sales last year	7,50,000
Increase in sales	2,50,000

or 2, 50,000/7,50,000 X100

=33X1/3%

This is to be taken into account in adjusting increase in cost.

Thus

	Rs.
(b) Direct materials:	
Last year's figures	2, 25,000
Add 33 1/3 X ----- due to increase In volume	75,000
	3, 00,000
Add: 2% increase in price	6,000
	3, 06,000
(c) Direct wages	
Last year's FIGURE	1, 50,000
Add 33 1/3 X -----	50,000
	2, 00,000
Add:5 % increase in rate	10,000
	2, 10,000
(d) Variable overheads:	60,000
Last year's figure	
Add 33 1/3 X ----- %	20,000
	80,000
Add: 5% increase in rate	4,000

84,000

5. Maintaining a desired level of profits.

A management may be interested to have a desired level of profit. For this necessary volume of sales can be ascertained with the help of marginal costing. This will be more clear from the following illustration.

Illustration:

A company produces and markets industrial containers and packing cases. Due o increase in competition the company proposes to reduce the selling price. If the present level of profit is o be maintained indicate the number of units to be sold if he proposed reduction in selling price is:

(a) 5% (b) 10% (c) 15%

The following additional information is available

		Rs
Present sales Turnover		6,00,000
(60,000 units)		
Variable costs		
(60,000 units)	3,60,000	
Fixed costs	1,40,000	5,00,000
Net profit		1,00,000

Solution:

	5% Rs.	10% Rs.	15% Rs.
Selling price after reduction	9.50	9.00	8.50
Less variable cost	6.00	6.00	6.00
Contribution per unit	3.50	3.00	2.50

Thus the total contribution required to maintain the present level of profit is as follows:

Fixed Expenses	Rs. 1,40,000
Profit as per statement above	Rs. 1,00,000
	Rs. 2,40,000

Units to be sold to earn the total contribution of Rs. 2, 40,000 to maintain the present level of profit.

(a) At a price reduced by 5% = Rs. 2, 40,000/3.50 = 68,571 units.

(b) At a price reduced by 10% = 2, 40,000/3.00 = 80,000 units.

(c) At a price reduced by 15% = 2, 40,000/2.50 =96,000 units.

6. Selection of a suitable mix: When a factory is producing more than one product then the problems faced by the management is the determination of suitable mix i.e. the proportion in which the concern should produce and sell the products. The best product mix will be that which gives the maximum contribution. The products

which are giving maximum contribution their production and sales are to be increased whereas those products where contribution is comparatively less their production should be reduced or closed down altogether.

7. Alternative Methods of Production: Marginal costing is helpful in selecting the best method of production i.e., whether the production is to be done by hand or by machine. That method of production which gives the maximum contribution will be the best.

Illustration:

Product X can be produced either by machine A or machine B. Machine A can produce 109 units of X per hour and Machine B 150 units per hour .Total machine hour available during the year are 2,500. Taking into account the following data determine the profitable method of manufacture:

	Per unit of Product	
	Machine A	Machine B
Marginal cost	10	12
Selling price	18	18
Fixed cost	4	4

Solution:

Profitability Statement

	Machine A	**Machine B**
Selling price per unit	18	18
Less marginal cost	10	12
Contribution per unit	8	6
Output per hour	100	100
Contribution per hour	800	900
Machine hour per year	2,500	2,500
Annual Contribution	20,00,000	22,50,000

Hence production by machine B is more profitable.

8. **Diversification of Products:** Sometimes a new product is to added to the existing product or products to utilize the capacity of the concern to capture a new market or for any other purpose. Whether the new product should be added or not it will depend on the profitability of the product. The new product may be manufactured if it is capable of giving some contribution after meeting its variable cost. This is on the assumption that the concern will not require incurring any thing on fixed expenses and the new product can be manufactured with the help of existing resources and manpower etc. Marginal costing will definitely help in this respect.
9. **Level of Activity:** Marginal costing is also helpful to the management in deciding the level of activity. While deciding it has to be seen that the level of activity is the best where the contribution is the maximum. This is true up to 100% capacity.
10. **Closing down or suspending activities:** Sometimes management is required to take decision whether to close the business or continue its operation. Marginal costing helps to make decisions in this context. Till the products are giving contribution i.e., marginal cost is less than the price available it is desirable for the concern to continue its operations.

11. **Alternative course of action:** Management is confronted in most cases with the problem of taking decisions as to the effect of alternative course of action. This problem can be tackled with the help of marginal costing technique. That course of action will be more profitable which gives the maximum contribution to the concern.

7.5 Limitations of Marginal Costing:

a) It is very difficult to separate all costs into fixed and variable costs clearly, since all costs are variable in the long run. Hence such classification sometimes may give misleading results. Furthermore, in a firm with many different kinds of products, marginal costing can prove less useful.

b) Since the closing stock consists only of variable costs and ignores fixed costs ,this gives a distorted picture of profits to shareholders.

c) Semi-variable costs are either excluded or incorrectly analyzed, leading to distortions.

d) With marginal costing, there is often the problem of under or over-recovery of overheads, since variable costs are apportioned on an estimated basis and not on actual value.

e) Marginal costing *cannot* be used in external reports, which must have a complete view of all indirect and overhead costs.

f) Since it is based on historical data, marginal costing can give an inaccurate picture in the presence of increasing costs or increasing production.

Self Assessment

Fill in the blanks:

1. Absorption costing technique is also known by other names as “Full costing” or _____.
2. _____ is the cost nothing but a change occurred in the total cost due to changes taken place on the level of production.
3. The _____ is the cost involved in the procurement of indirect materials, indirect labour and indirect expenses.
4. The initial absorption of _____ led the marginal cost to become as variable cost.
5. Profit depends upon a large number of factors, the most important of which are the costs of the manufacturer and the _____ effected.
6. The Cost-Volume-Profit (CVP) analysis helps management in finding out the relationship of _____ to profit.
7. Cost-volume-profit analysis furnishes a picture of the _____ at various levels of activity.
8. The ratio or percentage of contribution margin to sales is known as _____
9. Marginal cost helps management to make decision involving consideration of _____.
10. A decision involves the act of choice and the _____ chosen out of the available alternatives.
11. Marginal costing furnishes information regarding _____ to be incurred if an additional activity is to be taken up or the saving in costs which may be expected if an activity is given up.
12. _____ is the ratio of contribution to sales.
13. A _____ decision is possible when the various factors, and relationships between them, are measurable.

14. A _____ involves the act of choice and the alternative chosen out of the available alternatives.
15. _____ describes the process by which a course of action is selected as the way to deal with a specific problem.

7.6 Summary:

The technique of marginal costing is very simple to operate and easy to understand. Marginal costing removes the complexities of under-absorption of overheads. It helps the management in production planning, facilitates the calculation of breakeven point etc.Marginal costing also helps in calculating other factors such as, effect on profit due to changes of raw material prices, increased wages and changes on sales mixture etc.

7.7 Glossary:

Variable Cost: It varies along with the level of production.

Contribution: It is an amount of balance available after the deduction of variable cost from the sales.

Fixed Cost: It is a cost which is fixed or remains the same for irrespective level of production.

Marginal Cost: Change occurred in the cost of operations due to change in the level of production.

BEP (Units): It is the level of units at which the firm neither incurs a loss nor earns profit t.

BEP (Volume): It is the level of sales in Rupees at which the firm neither incurs a loss nor earns profit t.

PV Ratio: Profit volume ratio which is nothing but the ratio in between the contribution and sales.
Decision-making: Decision-making describes the process by which a course of action is selected as the way to deal with a specific problem.

Desired Profit: It is a profit level desired by the firm to earn at the given level of sales volume.

Key Factor: Factor of influence on the component of contribution.

7.8 Answers: Self Assessment

1. Traditional costing
2. Marginal cost
3. Variable overhead
4. fixed overhead
5. Volume of sales
6. Costs and revenues
7. profit
8. P/V ratio
9. Cost and revenue
10. Alternative
11. Additional costs
12. Profit-Volume (P/V) Ratio
13. Quantitative
14. Decision
15. Decision-making

7.9 Terminal Questions:

1. Write a note on marginal costing.
2. Discuss the following:
   a) P/V Ratio
   b) Margin of Safety
   c) Angle of incidence
3. From the following data, calculate:
   (1) P/V Ratio.
   (2) Profit when sales are Rs.20,000 and
   (3) New Break Even Point if selling price is reduced by 20%

Fixed Expenses	Rs. 4,000
Break Even Point	Rs.10,000

7.10 Suggested Readings:

1 Pandey, I.M. Financial Management, Vikas Publishing House Pvt. Ltd., New Delhi.

2 Monga J.R. Fundamentals of Corporate Accounting, Mayur Paperbacks, New Delhi.

3 Lall, B.M. Jain, I.C. Cost Accounting: Principles and Practice, Prentice Hall, Delhi.

4 Man Mohan and S. N. Goyal, Principles of Management Accounting, Sahitya Bhawan Agra

5 Bhattacharyya, Debarshi. Management Accounting, Pearson Education in India, New Delhi

Lesson – 8

BREAK EVEN ANALYSIS

Structure

8.0 Learning Objectives:-

After studying the lesson, you should be able to understand:-

1. The concept of Break Even Analysis
2. Calculation of Break Even Point through various ways
3. Construction of different Break Even Charts
4. Assumption and limitations of Break Even Chart.

8.1 Introduction

Some industries today are encountering the problems raised by expansion through increased sales and the introduction of new products. Many on the other hand, are facing problems of contraction due to the introduction of substitute materials or products, or reduced demand for their product. Whichever is the case, it is vitally important that management should be in a clear position to plan for these changing levels of activity. Information must be available showing the forecasted sales, fixed and variable costs for the period so that a general picture can emerge of the company have expected position. Profit planning has been simplified by the introduction of several new techniques. One of the most important is the preparation and analysis of profit graphs.

8.2 Break Even Analysis:-

The term Break even analysis may be interpreted in two ways. In its narrow sense, it can be termed as a system of determining that level of operations where total revenue equals total expenses i.e. where there is neither any profit nor loss. When interpreted in the broader sense, it refers to a system of analysis that can be used to determine the profit at any level of operations. Break-even analysis is very much an extension or even a part of marginal costing. Basically it is concerned with finding the point at which revenues and costs agree exactly-hence the term “breakeven”. The breakeven point is, therefore, the volume of output at which neither a profit is made nor a loss is incurred.

As a result of calculating break-even points accountants have come to realize that many valuable facts, all essential for operating a business enterprise, can emerge from the exercise. Typical problems which may be solved with the help of break even analysis are as follows:

(1) What volume of sales will be necessary to cover:

(a) A reasonable return on capital employed.

(b) Preference dividends.

(c) Ordinary dividends

(2) To compare a number of companies by arranging probable earnings from each in order of magnitude.

(3) Determination of the price of a product which will give the desired breakeven point and profit.

(4) Calculation of costs and revenues for all possible volumes of output thereby aiding is fixing budgeted sales.

(5) Variable cost per unit can be quite easily calculated from a breakdown chart.

(6) The cash involved in calculating a particular volume of output.

8.3 Calculation of the Break even point:

The point at which the total cost line intersects the turn-over line, that point is known as break even point. The spread to the right of this point between the two lines represent the profit potential while the spread to the left would represent the losses. The break even point may be found by the use of the following formula:

$$\text{Break even point} = \frac{F}{1 - \frac{V}{P}}$$

Where F = Fixed cost

I = A whole number (ONE)

V=Variable cost per unit (or total variable cost)

P= Selling price per unit (or total sales value may be substituted, symbol “S”)

Unit variable cost and selling price should be used together in the formula. Alternatively, these may be substituted by total variable cost and sales values.

Example, we are given that:

Fixed Costs	=	Rs. 4, 00,000
Variable costs	=	Rs. 20 per unit
Selling price	=	Rs. 100 per unit
Total Sales value	=	Rs. 10, 00,000

Now using for formula the breakdown point is:

$$\frac{\text{Rs. 4, 00,000}}{1 - \frac{20}{100}} = \frac{\text{Rs. 4, 00,000}}{1 - \frac{1}{5}}$$

$$= \frac{\text{Rs. 4, 00,000}}{\frac{4}{5}} \qquad = \frac{\text{Rs. 4, 00,000}}{4} \times 5$$

= Rs. 5, 00,000

This calculation may be checked as follows:

Fixed costs	=	Rs. 4, 00,000
Variable costs $\left[\frac{1}{5} of\ Rs. 5{,}00{,}000\right]$	=	Rs. 1.00,000

Break even point	=	Rs. 5, 00,000

An alternative formula is:

$$\frac{F}{P-V} = \text{Units needed to breakdown}$$

When F = Fixed costs

P = Selling price

V = Variable cost per unit

Using the same facts, the new formula will give:

$$\frac{4{,}00{,}000}{100-20} = \frac{4{,}00{,}000}{80} = 5000 \text{ units}$$

5000 units @ Rs. 100 = Rs. 5, 00,000 Break even point.

The other alternative formula for calculating Break even point may be noted:

$$\text{Break even Point} = \frac{\text{Fixed Costs x Sales}}{\text{Sales} - \text{Variable Cost}}$$

Calculation of turnover for Desired Profit: Once the profit target has been fixed it will be desirable to fix the turnover necessary to earn that profit. Thus may be done by using following formula:

$$Turn - over\ for\ Stated\ Profit\ F + \frac{PT}{1} - \frac{V}{P}$$

When F = Fixed costs

P = Profit

I = One unit

U = Variable cost per unit

P = Selling price

This formula, therefore, is the break even point formula given earlier with the addition or desired profit. If a profit target of Rs. 3, 00,000 is budgeted then using the facts of our example, the turnover required is :

$$= \frac{\text{Rs. 4, 00,000} - \text{Rs. 3, 00,000}}{1 - \frac{20}{100}}$$

$$= \frac{\text{Rs. 7, 00,000}}{1-0.2}$$

$$= \frac{\text{Rs. 7, 00,000}}{0.8} \qquad = \text{Rs. 8, 75,000}$$

8.4 Related Terms and Techniques:

Many terms and techniques have been developed which now form part of Break-even analysis. Before going to explain breakeven charts the most important of these terms are explained:

Additional Calculation: Calculation, which are additional to those given above for the breakeven point are also a part of the breakeven analysis:

Calculation of Profit for Different turnovers: When it is found that Rs. 8, 00,000 will be the likely sales turnover for the next budget period and the costs and selling price remain the same then estimated contribution and profit can be calculation by the following formula:

$$Contribution = S\left(1 - \frac{V}{P}\right)$$

When S = Sales turnover of total sales.

I = one unit

V = Variable cost per unit

P= Selling price per unit

Profit = C-F

Where C = Contribution

And F = Fixed Cost

In the present example, therefore, necessary calculations are:

$$Contribution = Rs.8{,}00{,}000\left[1 - \frac{20}{100}\right]$$

= Rs. 8,90,000 (1-0.2)

= Rs. 8,00,000 x 0.8

= Rs. 6,40,000

Profit = 6,40,000 – Rs. 4,00,000

= Rs. 2,40,000

Contribution theory: The contribution theory is the term used to describe the relationship between variable cost and selling price. The use of the word theory may be regarded by many accountants as rather a grandiose description to give to the rules and procedures involved. In summary these are:

1. The difference between selling price and variable cost per unit is the contribution
2. If nothing is produced the loss involved will be the total fixed costs.
3. Variable cost per unit remains the same for different levels of outputs (liner relationship).

Margin of safety: "Margin of Safety" is the difference between the total sales and the sales figure at the breakeven point. This represents the amount by which volume of sales exceeds the breakeven point. It may be expressed in monetary terms or as a percentage- the margin of safety in relation to total sales.

It is important that there should be a reasonable margin of safety, otherwise, a reduced level of activity may prove disastrous. A low margin usually indicates high fixed overheads so that profits are not made until there is a high level of activity to absorb the fixed costs. The margin of safety is important, particularly, in times of depression when sales are receding. The greater the margin of safety, the further sales can fall before the break-even point is reached. Of course, this point is passed, a loss will result. If the margin of safety is unsatisfactory, some of the possible steps to rectify the matter are:

1. Increase the selling price where company is in a strong favorable position and the demand is inelastic.
2. Reduce fixed costs.
3. Reduce variable costs.
4. Substitution of existing product or products by more profitable lines.
5. Increase the volume of output.

How the margin of safety is calculated is shown below:

	Company A	Company B
	Rs.	Rs.
Total Sales	10, 00,000	6, 00,000
Break even point	5, 00,000	5,00,000
Margin of Safety	5, 00,000	1, 00,000
Margin of Safety As a percentage	50%	16.67%

If the rate of profit earned on sales above the break-even point is the same for both companies then it is clear that company A is in a much stronger position than the other company. At break-even point the following applies:-

Fixed costs + Variable Cost = Sales Value

Both sides of equation agree exactly so that there is neither a profit nor a loss. The fixed costs are covered so it follows that once the break-even point is reached, only variable cost have to be deducted from all sales above that level (the margin of safety).

The following formula may be used for calculating margin of safety:

$$\frac{\text{Profit + Sales}}{\text{Sales – Variable Costs}}$$

Angle of incidence: This is the angle at which the sales line cuts the total cost line. The Management's aim will be to have as large an angle as possible, because this indicated a high rate of profit once the fixed overheads are absorbed. A narrow angle would show that even when fixed overheads are absorbed profit accrues at a relatively low rate of return, indicating that variable costs form a large part of cost of sales. This angle of incidence is important in boom times when sales are expanding. Once break even point is reached, additional sales show a good profit return.

Profit Volume Ratio: The Profit/Volume (P/V) ratio often expressed as a percentage is a guide to the profitability of the business. This ratio shows the relationship between the contribution and volume of sales. A more appropriate term might be the "Contribution/Sales Ratio".

A formula for determining the Profit/Volume ratio is a follows:

$$= \frac{S-V}{S} \times \frac{100}{1} \text{ which when simplified becomes}$$

$$= \frac{C}{S} \times \frac{100}{1}$$

Where S = Sales Value

C = Contribution

V = Variable costs (Total)

For example, when contribution is Rs. 8, 00,000 and total sales are Rs. 10, 00,000 then.

$$\text{P/V ratio} = \frac{8,00,000 \times 100}{10,00,000} = 80\%$$

As with other marginal costing techniques, there is an assumption that costs can be separated into two definite groups-variable (marginal) costs and fixed costs. Moreover, so far as variable costs are concerned, a linear relationship is assumed.

It is interesting to note that although 'Volume' appears in the terms; the actual volume of output or sales is not indicated in the ratio. In fact it is possible to calculate the P/V ratio by comparing the contribution is Rs. 80 and selling price Rs. 100 then P/V is 80% as in the above example. Obviously, if in one period sales are Rs. 5,00,000 and in other Rs. 10,00,000 with no change in the P/V ratio, then the positions cannot be said to be equal. Therefore, other relevant information must also be considered along with P/V ratio.

Some of the uses to which P/V ratio can be put are:

1. Determination of variable costs for any volume sales.

   It is arrived at by deducting the P/V ratio from 100 percent and then, using the percentage, arriving at the total variable cost.

   Example: If P/V ratio = 20%

   Company A turnover = Rs. 6, 00,000

   Company B turnover = Rs. 10, 00,000

Then variable costs for each company will be:

Company A

100% - 20% = 80%

80% of Rs. 6, 00,000 = Rs. 4, 80,000 variable cost.

Company B

80% of Rs. 10, 00,000 = 8, 00,000 variable cost.

2. Comparison can be made by calculating the P/V ratio for each factor to be compared; viz.

   (a) Line of product.
   (b) Sales area
   (c) Method of sale: e.g. sale through wholesalers or retailers.
   (d) Individual factories
   (e) Separate companies

Example: Line of Products.

The following products are made by a company. Variable costs and prices are shown alongside.

Product	Prices	Variable Cost
X	Rs. 10	Rs. 5
Y	Rs. 20	Rs. 15
Z	Rs. 40	Rs. 25

Then P/V ratio for each line will be:

C	Product	C/S x 100/1	P/V Ratio
10-5-5	X	$\frac{5 \times 100}{10}$	50%
20-15-5	Y	$\frac{5 \times 100}{20}$	25%
40-25-15	Z	$\frac{15 \times 100}{40}$	37%

3. Calculation of desired volume of output, profit or other essential facts.

Management has to aim at increasing the P/V ratio. This may be done by reducing variable costs or by raising prices. If a composite P/V ratio (average ratio for a number of products) is being considered an afford should be made to improve the sales mixture by increasing the volume of products with a high P/V ratio and reducing the volume of those products with a low P/V ratio. However, it may pointed out again that just like the margin of safety, P/V ratio is not to be considered in isolation, rather the margin of safety P/V ratio, the volume of sales, and fixed costs all are to be studied together.

The principal budget factors or limiting factors or limiting factors or key factors, like shortage of labour, raw material, plant capacity available, cash available etc. may also be very important when considering which product have the highest P/V ratio. The object of assessing principal budget factor is to "weight" the P/V ratios, thereby giving due recognition to special circumstances. For example, consider the following case where direct labour acts as principal budgeting factor.

	Product X	Product Y
Selling price	Rs. 15	Rs. 25
Variable Cost	Rs. 10	Rs. 10
Contribution	Rs. 5	Rs. 10
P/V	33 ½	60%

There is shortage of skilled labour necessary for producing both products. Products X takes 1 hour to produce, whereas product Y involves 4 hours.

If we gave due weight to the fact that the hours involved for the products are different then the position may be as follows:

	Product X	Product Y
Amended P/V ratio	33%	15%
Contribution per direct	Rs. 5	Rs. 3/75
Labour hour		

According to these attended figures Products X is more desirable than product Y. the significant fact is the contribution per direct labour hour.

8.5 The Break-Even Charts:

Break even chart is a very useful device for presenting management with information showing the effect of costs and revenue at varying levels of output. It is an elementary form of profit graph and has the advantage of being easily prepared and more easily understood. This chart shows quite clearly the break even point of the business, hence the name. no doubt, it has certain limitations, but is nevertheless an important aid to profit planning. A break even chart is then a chart or graph which partly says-

1. Likely profits or losses at different levels of output.
2. The relationship between marginal (variable) costs and fixed costs.
3. The margin or safety.
4. The rate of growth of profit earning for a suitable multiple of output.
5. The break even point i.e. the point at which total cost line and sales revenue line intersect, thereby, indicating the state of no profit, no loss.
6. On an appropriately designed chart, the contribution and the P/V ratio may be shown.

Construction of Breakeven Charts:

1. Select a scale for sales on horizontal axis.
2. Select a scale for costs and revenue on the vertical axis.
3. Draw the fixed cost line parallel to the horizontal axis.
4. Draw the variable cost line, starting from the point on the vertical axis which represent fixed costs.
5. Draw the sales line, starting from the point of orgin (zero) and finishing at a point of maximum sales.

Example:

Fixed Cost = Rs. 3, 00,000

Variable Cost Per Unit = Rs. 25

Selling Price Per Unit = Rs. 40

Now, the break even point will be calculated. The contribution per unit is Rs. 15 (i.e. Rs. 40-25). Therefore the BEP= Rs. 3, 00,000 + 15 = 20,000 units with the help of this calculations are shown in the table below and a break even chart prepared.

No. of Units	Fixed Cost	Variable Cost	Total Cost	Sale Proceeds	Profits/Loss
0	3,00,000	0	3,00,000	-	-
10,000	3,00,000	2,50,000	5,50,000	4,00,000 (-)	1,50,000
20,000	3,00,000	5,00,000	8,00,000	8,00,000	B.E.P
30,000	3,00,000	7,50,000	10,50,000	12,00,000 (+)	1,50,000

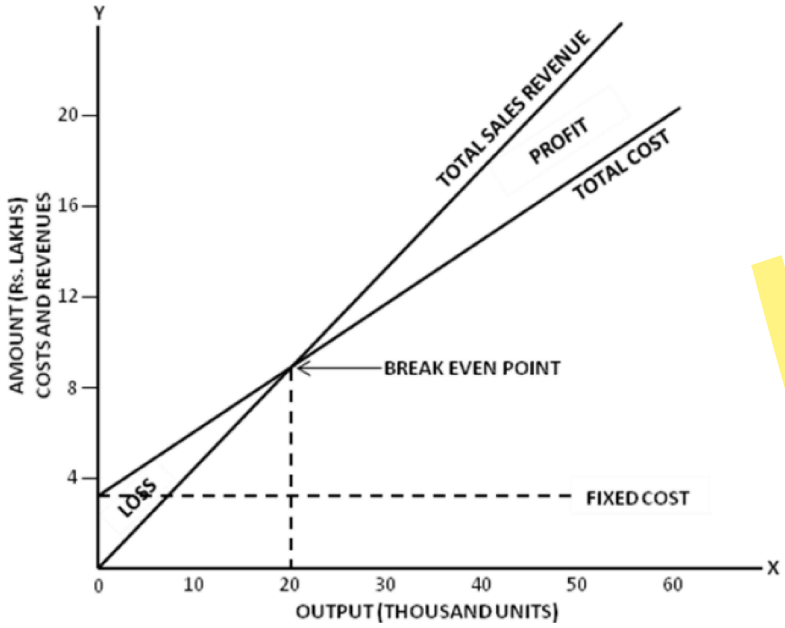

Fig. 1 Break Even Chart

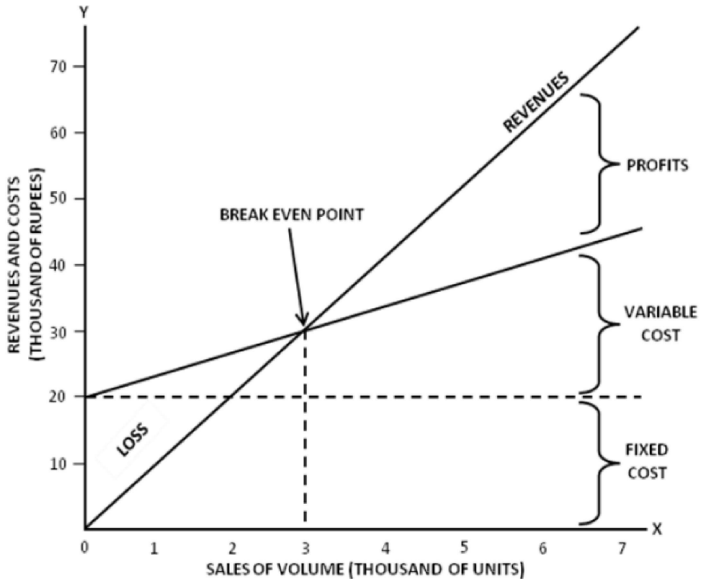

Fig. 2

In the diagram, the output and sales have been plotted on X-axis and Revenue and costs on Y-axis. Fixed costs remaining constant are shown by means of a line across the face of the graph parallel to horizontal axis. The line representing variable costs has been plotted from the point where fixed costs have finished and rises steadily as to give the total cost curve, Break-even point is calculated where lines representing total cost and sales intersect.

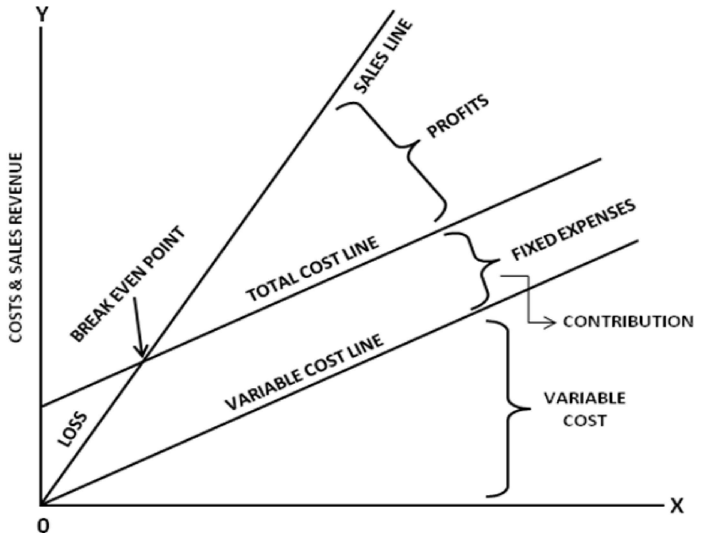

Fig. 3 Contribution Break Even Chart

A variation of first method is that fixed costs are shown above variable costs. This is also known as contribution Breakeven chart as contribution at different levels of activity are seen quite easily from the chart.

This method has the advantage of indicating the recovery of fixed costs at various levels of production before profits are realized. Therefore, contributions at various levels of production are automatically depicted in the chart as in following figure.

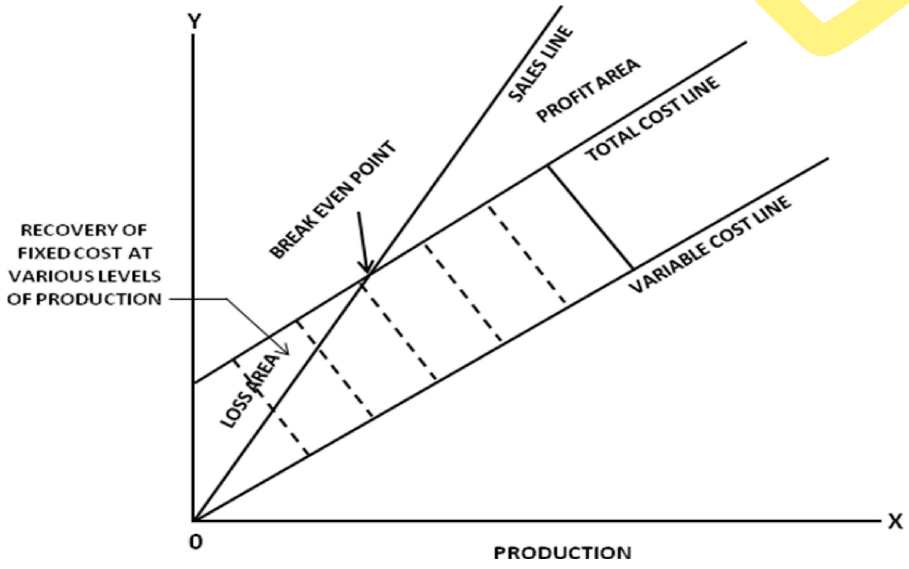

Fig. 4

Another method is of showing the variable costs in a particular sequence, for instance, in the order of profit and fixed costs are plotted for corresponding sales volume and the points major cost classifications, such as direct material cost, direct labour cost, fixed factory overheads etc. This is known as Analysis Breakeven chart.

Profit Volume graph: Developed from simple break even chart presented in conventional style, profit volume graph is the graphical representation of the relationship between profit and volume. It is based on the same information as is required for the traditional Break-even chart and is characterized by the same limitations.

Steps:

(1) Profit and fixed costs are represented on the vertical axis.

(2) Sales are shown on the horizontal axis.

(3) Fixed costs are represented on the vertical axis below the sale line and profit on the same axis above sales line are joined by a line which is profit line.

(4) Profit and fixed costs are plotted for corresponding sales volume and the points are joined by a line which is profit line.

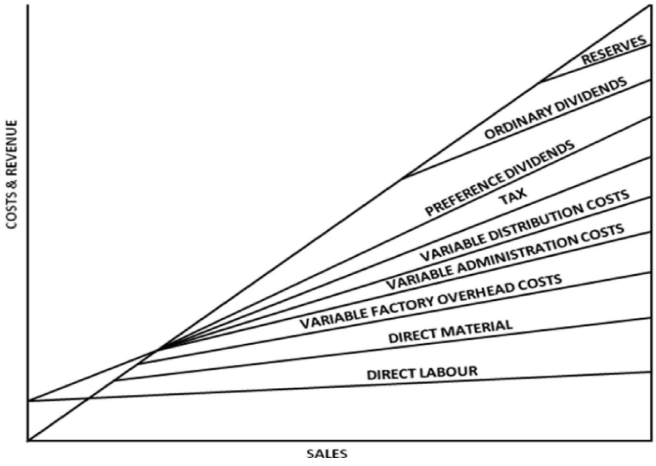

Fig. 5. Analysis Break Even Charts

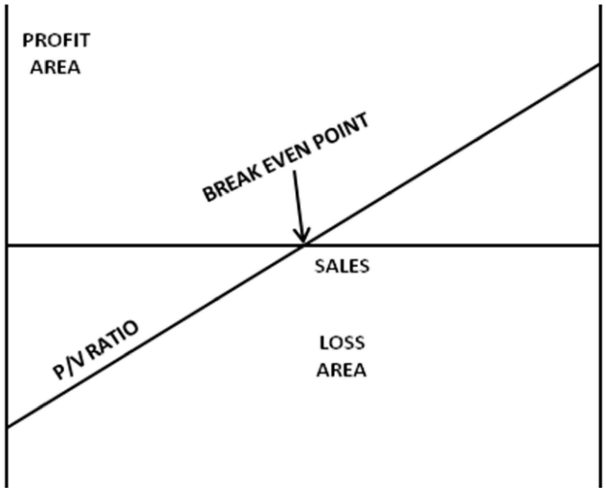

Fig. 6

Cash Break –even Charts: The cash break even chart follows the conventional form except that fixed costs are divided into two groups:

(1) Fixed costs requiring immediate cash viz, rent, rates insurance salaries, “Immediate”, means during the course of the period covered by the chart.

(2) Fixed costs not requiring immediate cash:

Some Other types of Breakeven Chart: Break even chart (showing profit appropriations). The Break-even chart which shows profit appropriations is the orthodox type with the additional information relating to how profit is to be divided.

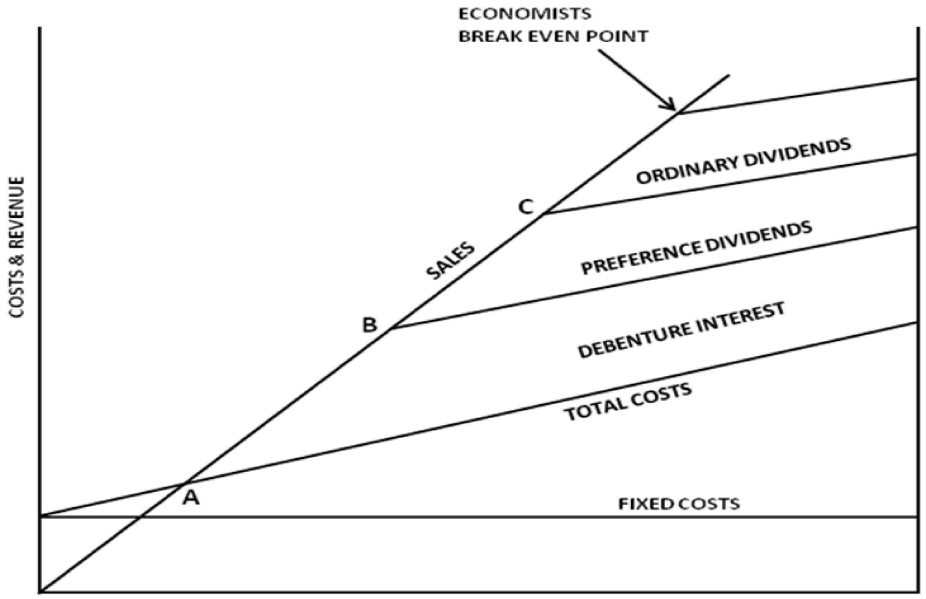

Fig. 7. Breakeven Chart (showing profit appropriations)

e.g. depreciation and other deferred expenses such as advertising and research and development expenditures, which have already been incurred and which refer to a number of years; also where a national cost, such as reasonable rent when an asset is fully depreciated, is included in the annual fixed costs.

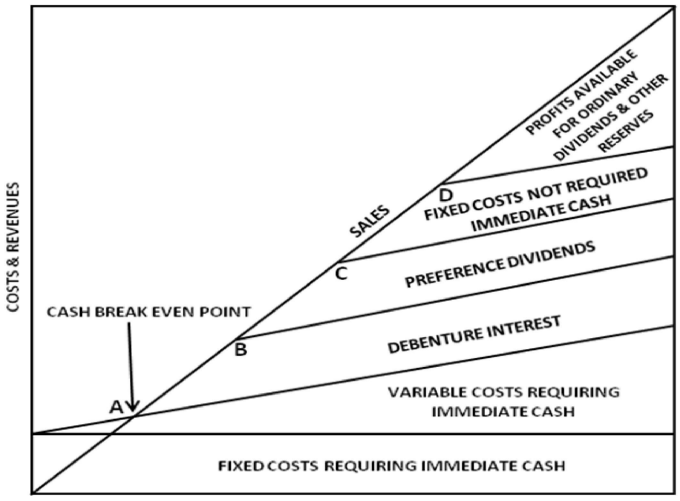

Fig. 8 Cash Break-even Chart

The former (1) is shown at the base of the Break even Chart. On the other hand, the fixed costs not requiring immediate cash shown last. In this way it is possible to see what ash be required to break-even (point "A") to pay Debenture interest ("B") and to pay preference dividends ("C"). The fixed costs already paid are left until the end. Later, when fixed assets are to be replaced, it will be necessary to increase the fixed costs requiring immediate cash. Therefore, fixed costs in the sense meant in this context will vary in total depending upon the cash to be spent within the period.

The variable costs are assumed to be payable in cash. If credit transactions are involved then their effect should be measured and the cash payment adjusted.

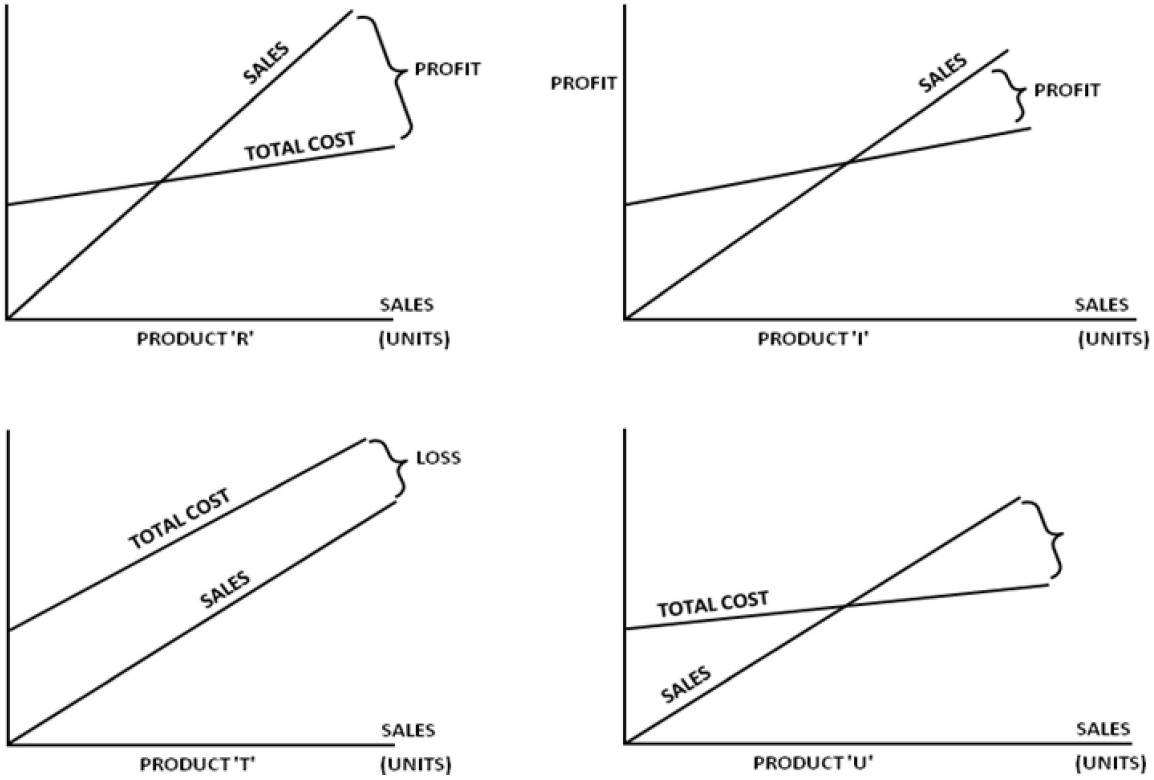

Fig. 9 & 10 Break even chart (for comparing product profitability)

Control Break Even Charts: The control Break Even chart is extremely useful for comparing budgeted and actual profits, break-even point and sales.

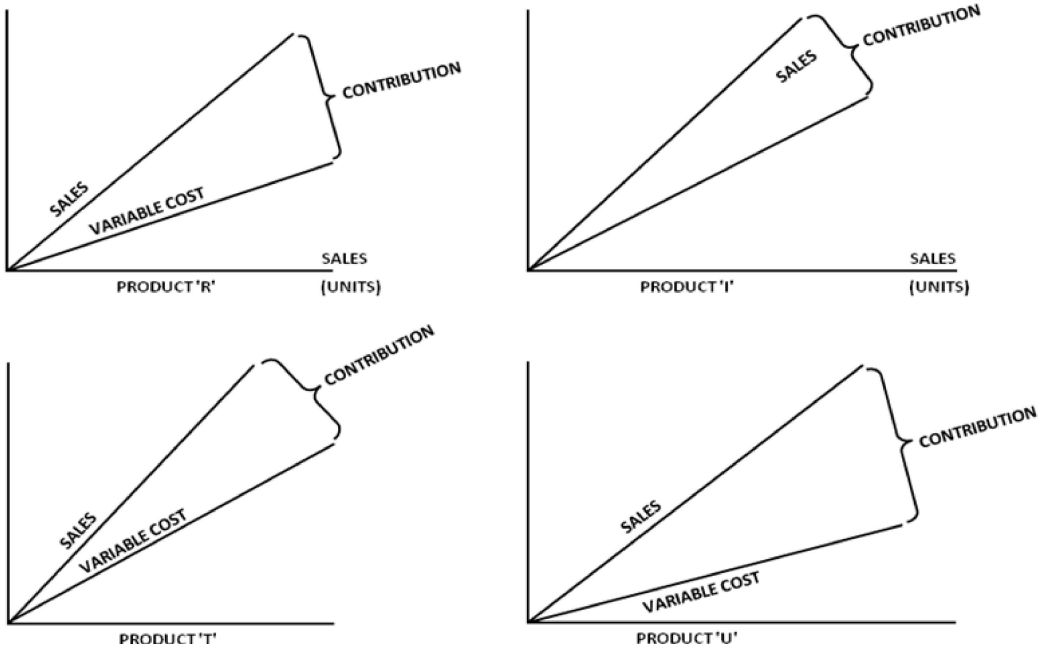

Fig. 11 Break Even Chart (for comparing product contribution)

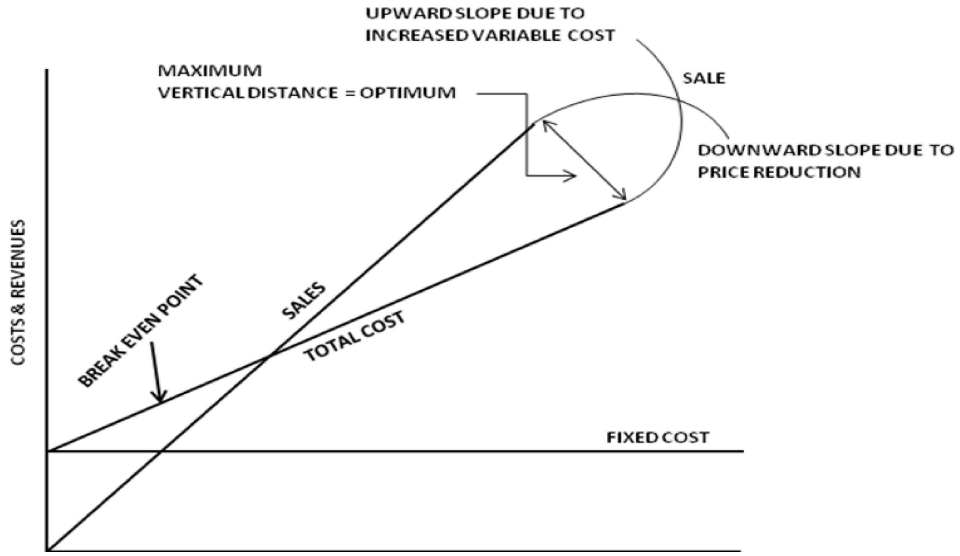

Fig. 12 Break Even chart (showing optimum output)

Breakeven Chart for products: Breakeven charts may be prepared to cover single products. If one chart is used for each product the relative profitability of a number of products may be seen easily from a series of charts.

Four products are taken and compared as regards costs, sales and profits (Fig.10). In the examples it has been assumed that the same volume of sales is feasible for all products. If this is not so then clearly the different potential sales volumes should be shown on the charts. Many accountants prefer to use the contribution breakeven chart (Fig. 11) The significant fact regarding relative profitability/contributability are:

RANKING

Product	Profitability	Contribution	Breakeven
R	1	1	1
I	2	3	2
T	3	4	4
U	2	2	3

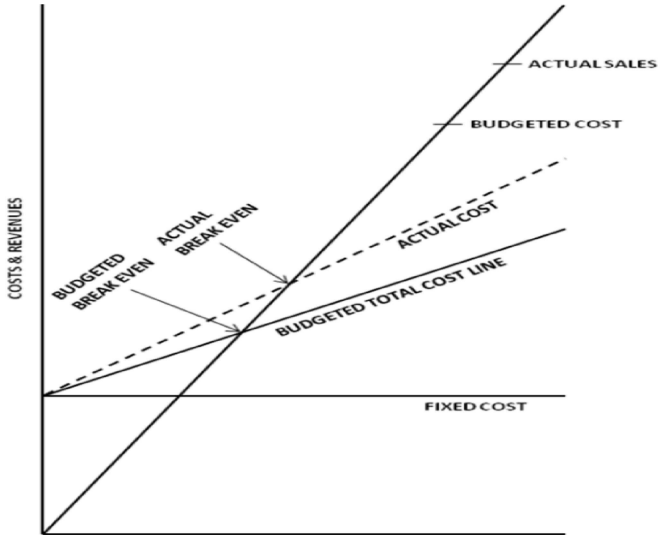

Fig. 13 Control Break Even Charts (Comparing Budgeted and Actual profits)

From the above comparative data, it is obvious that the product "R" is given the first order in the ranking. However product "T" does contribute to fixed costs and therefore, management will have to consider the matter very carefully before discontinuing the production and sale of the product.

Breakeven chart for optimum output:

Selection of the point which gives maximum profit involves the determination the greatest vertical distance which exists between the sales and total cost lines. This is the point where marginal revenue and marginal cost agree. In the fig. 12 optimum output is signified by the arrow.

8.6 Assumption and limitations of breakeven charts: The very concept of economics is based on assumption. Without assumption the validity of the analysis weakens. The important assumption underlying breakeven analyses are:

(1) Principle of cost variability is valid.

(2) Costs are resolvable into the fixed and variable components.

(3) Fixed cost always constant.

(4) Variable costs vary proportionately with the volume of production.

(5) Selling price is not ahead with the change in volume.

(6) Only one product is in existence and in case of multiple, products, sales mix is always constant.

(7) There is no change in the price level.

(8) There exists a synchronization between product and sales.

(9) Productivity per workers is assumed to be constant.

(10) Revenue and costs are compared with a common activity base e.g. sale value of production or units produced.

(11) The efficiency of plant can be predicted.

A change in any one of the mentioned facts can after the breakeven point thereby necessitating that breakeven point be interpreted in the light of the above assumptions.

However, these assumptions cannot so easily be held in practice. These certain limitations, most important of which are:

(1) In practice all costs cannot be separated easily into fixed and variable costs as there are many border line cases.

(2) Fixed costs do not remain constant throughout rather they tend to increase in steps.

(3) Breakeven analysis assumes that variable cost gives a straight line chart. Many of the overhead costs do not observe this tendency. They move no doubt in sympathy with volume of output but not necessarily in direct proportion

(4) In practice, selling price may not remain fixed and thus it may set give subject revenue line. It may be necessary to give extra discounts to sell extra units.

(5) The horizontal base lone X axis cannot measure the units sold in as much as different types of products are sold by the same company. This is true in actual practice.

(6) The assumption that only one product is produced or product mix is constant is difficult to find in practice.

(7) Synchronization between production and sales is also difficult to meet.

Despite this, breakeven analysis is a useful management device, if constructed and used by those who understand fully its limitations. When prepared scientifically from reliable data, it is an indispensable tool.

Self Assessment:

Fill in the blanks:

1. Break-even analysis helps in determining the …… of output below which it would not be profitable for a firm to produce.
2. Break-even point is the point of ……
3. Break-even point is that volume of …… where the firm breaks even.
4. The _____shows the extent of profit or loss to the firm at different levels of activity.
5. _____profit analysis provides a useful format for examining a variety of price and output decisions.

8.7 Summary

Break Even Analysis is the most widely known form the cost-volume profit analysis. Breakeven analysis refer to the study of relationship between costs, volume and profit at different levels of sales or production. It is a useful management device, if constructed and used by those who understand fully its limitations. When prepared scientifically from reliable data, it is an indispensable tool.

8.8 Glossary:

Break even point: The point at which the total cost line intersects the turn-over line, that point is known as break even point.

Contribution theory: The contribution theory is the term used to describe the relationship between variable cost and selling price.

Margin of safety: "Margin of Safety" is the difference between the total sales and the sales figure at the breakeven point. This represents the amount by which volume of sales exceeds the breakeven point.

Angle of incidence: This is the angle at which the sales line cuts the total cost line.

Profit Volume graph: Developed from simple break even chart presented in conventional style, profit volume graph is the graphical representation of the relationship between profit and volume.

8.9 Answers: Self Assessment

1. Optimum level
2. Zero profit
3. Sales
4. Break-even chart
5. Contribution

8.10 Terminal Questions

1. Enumerate some of the more important problems which may be solved with the help of breakeven analysis.
2. What do you understand by the breakeven point. Give the formulae. Illustrate your answer.
3. Give the formulae for calculating turnover for desired profits.
4. Explain the concept of contribution theory.
5. Explain the following terms.
   (i) Angle of incidence
   (ii) Profit volume ratio
   (iii) Margin of Safety
6. Explain control breakeven chart.
7. Give some of the more important limitations and assumptions of breakeven charts.

8.11 Suggested Readings

1 Pandey, I.M. Financial Management, Vikas Publishing House Pvt. Ltd., New Delhi.
2 Monga J.R. Fundamentals of Corporate Accounting, Mayur Paperbacks, New Delhi.
3 Lall, B.M. Jain, I.C. Cost Accounting: Principles and Practice, Prentice Hall, Delhi.
4 Man Mohan and S. N. Goyal, Principles of Management Accounting, Sahitya Bhawan Agra
5 Bhattacharyya, Debarshi. Management Accounting, Pearson Education in India, New Delhi

Lesson – 9

FINANCIAL STATEMENT ANALYSIS