UNIT 1   BREAK EVEN ANALYSIS

Structure

1.0   OBJECTIVES

After going through this unit you should be able to:

- discuss the major Cost Volume Profit (CVP) analysis technique known as break even analysis;

- apply the break even analysis with a view to determine the level of sales needed to be achieved to avoid losses;

- determine sales level required to earn a target profit;

- determine sale price needed to avoid losses; and

- determine further BEP with the changed conditions to avoid loss.

1.1   INTRODUCTION

During the course of your study, you must have learnt about the importance of Cost Volume Profit (CVP) analysis. You must have also learnt about break even analysis the most widely known form of CVP analysis. In this unit we will firstly revise the basic concept and theory and then work on practical exercises. This will enable you to prepare and present break even analysis in various formats in support of your proposals in the course of your duties as managers. The purpose of this unit is essentially to help you prepare for the actual application of the theory in practical form.

1.2   BROAD CONCEPT OF BREAK EVEN ANALYSIS

An important indicator of an organisation's performance is the profit. An analysis of the effects of various factors on profit is an essential step in financial planning and decision making.

A break even analysis is a specific technique of studying and presenting the inter-relationship between costs, volumes and profits. It is an efficient and effective method of financial reporting and planning.

At the start of any financial activity for profit say introduction of a new facility in a hospital; it becomes logical and essential to analyse with facts and figures to whether the venture would be profitable in near future. However, before the actual profit, one would come to a point of level of operation where there is no profit or loss i.e. the costs and revenues of the activity have become even and further efforts would take the organisation on the profit side. This is a point of equilibrium and is commonly known break even point. Thus the break even point is that point of sales volume for a given project or activity at which there is no profit and no loss i.e. total revenue is equal to total cost. For the purpose of further studies it is essential to know about the fixed costs, variable costs, total costs and contribution. These are briefly explained in subsequent paragraphs before taking up practicals.

Fixed Costs

These are the costs that cannot be avoided and are essential for the business. These remain fixed irrespective of the changes in the volume i.e. the number of units of goods produced. For example, the total rent of hospital facilities may be Rs. 1 lakh a year. This cost will remain the same whether patient traffic is zero or 1,00,000 patients. In nursing home the rent will have to be paid irrespective of number of x-ray images or other clinical tests performed. The other examples are:

a) Depreciation

b) Insurance

c) General administrative expenses like salaries, and maintenance of office

d) Repairs and maintenance

Variable Costs

These are the costs (expenses) which vary in direct proportion to the changes in volume of production. The examples are:

a) Cost of raw materials; say x-ray film the quantity of which will go on increasing in direct proportion to the x-ray images made.

b) Direct labour cost.

c) Direct activity cost say electric power, which will go on being consumed in direct proportion to the number of units of goods or number of units of service provided say with every x-ray image made.

d) Commission payable on unit basis.

Variable costs are those that go on increasing in direct proportion to the production activity. The recovery of this cost is by the way of sales. Each unit of product sold will cover its own variable cost and leave a balance to cover fixed costs and profit.

Contribution

This difference between selling price per unit and variable cost per unit is called contribution per unit or simply unit contribution. The sum total of all unit contribution is called 'Total Contribution'. The total contribution is contribution per unit multiplied by number of units produced. In break even point the total contribution is equal to the fixed cost. Thus at break even point the fixed cost has been overcome by the contribution and any further activity would have additional contribution to generate profit. In a break even analysis we would determine this point break even point (BEP).

Contribution Ratio: The contribution ratio is defined as contribution divided by the selling price. It can also be written as

$$\text{Contribution ratio} = \frac{\text{Selling price} - \text{Unit Variable cost}}{\text{Selling price}}$$

$$= \frac{\text{Sales} - \text{Variable cost}}{\text{Sales}}$$

1.3 APPROACHES TO COMPUTE BREAK EVEN POINT

There are two approaches to determine the break even point. These are (a) the formula approach and (b) the chart approach as described in succeeding paragraphs.

1.3.1 Formula Approach

This approach stems from a very simple logic as under :

Unit selling price – unit variable cost = unit contribution

Unit contribution × units sold = total contribution

Total contribution = total fixed cost + profit

At break even point (BEP), the profit by definition is zero, and hence, total contribution will be equal to total fixed cost. The BEP can be expressed in term of number of units sold, or in terms of rupees of sale or as a percentage of the total estimated/budgeted sales. This is brought in subsequent paragraphs.

1.3.2 Determination of BEP as Number of Units/Events

BEP (units) = (Total Fixed Costs) / ((Selling price) – (Variable costs per unit))   ... (1)
      = (Total Fixed Costs) / (Unit Contribution)   ... (2)

The above equations will give the units required to be produced and sold so that the break even point is achieved. The following example will illustrate the point:-

Example 1

A nursing home laboratory has priced its x-ray test and report for Rs. 200/- each. The variable cost is Rs. 120/ per test. The annual fixed cost is Rs. 2,40,000/-. Find out the number of x-ray tests to be performed per year at break even.

Solution

Total fixed cost   =   2,40,000

Unit selling price   =   200

Unit variable cost   =   120

Therefore BEP (units) = 240000/(200 – 120) = 3000 as per Eqn. 1

Thus a minimum of 3000 x-ray tests must be carried out so that the nursing home breaks even.

Example 2

A manufacturing firm produces a single product whose selling price is Rs. 100/- per unit and a variable cost of Rs. 60/-. The annual fixed cost is Rs. 10,00,000/-. How many units the firm must produce at BEP.

Solution

Total fixed cost   =   1000000

Unit selling price   =   100

Unit variable cost   =   60

Unit contribution = unit selling price – unit variable = 100 – 60 = 40

Therefore BEP (units) = 100000/40 = 25000 numbers as per Eqn. 2

Thus a minimum number of 25000 must be produced so that the firm achieves breaks even point.

1.3.3 Break Even Point in Rupees Term

In the above examples we have calculated the break even point in terms of number of units of the product. It is sometimes convenient to express the BE point in terms of monetary value i.e. in terms of say rupees of sale. One way would be to calculate in terms of number of units and then multiply with the sales price. In the Example 2 above the number of units at BEP is 25000. The corresponding value of BEP sales can be calculated by simply multiplying by 100 (sales price) i.e. 25000 × 100 = Rs 25,00,000/-.

Alternatively by simple mathematics this value can be expressed with the following formula:

BEP (rupees)   =   Total fixed cost/contribution ratio   ... (3)

The term contribution ratio is defined as (unit contribution/selling price). Thus,

Contribution ratio   =   Unit contribution/selling price

                     =   (Selling price – unit variable cost)/(selling price)   ... (4)

                     =   1 – (unit variable cost)/(selling price)

                     =   1 – (total variable cost)/(total sales)   ... (5)

Apply Eqn. 4 above

Contribution ratio   =   (100 – 60) ÷ 100 = 0.40

BEP (rupees)   =   10,00,000 ÷ 0.40 = 25,00,000 as calculated above.

1.3.4 Break Even Point as a Percentage of Capacity

Many a time it may be required to compute the BEP as a percentage of the capacity. In this case we need to know additional information about the estimated capacity (units)/budgeted sales. Assume in the Example 2 above the budgeted income from an ECG equipment is Rs. 40,00,000/- which correspond to the estimate usage of 40,000 times at the assumed selling price of Rs. 100/-. We can summarize the data as under :

a)	Estimated budgeted sales	Rs. 40,00,000
b)	Estimated usage in units	40,000 times
c)	Actual sales at BEP	Rs. 25,00,000
d)	Actual sales units at BEP	25000 nos.
e)	Fixed cost	Rs. 10,00,000
f)	Selling price	Rs. 100
g)	Unit variable cost	Rs. 60
h)	Unit contribution 100 – 60	Rs. 40
j)	Total contribution 40 × 40000	Rs. 16,00,000

BEP (% of capacity)   =   (BEP (units)/Sales (units)) × 100

                      =   (25000 ÷ 40000) × 100 = 62.5 %. Also

                      =   ((Actual sales at BEP) ÷ (Estimated Budgeted Sales)) × 100

                      =   (25,00,000 ÷ 40,00,000) × 100 = 62.5%

This can also be expressed in a simple formula as under:

BEP (% of capacity)   =   (Fixed Cost) ÷ (Total contribution) × 100   ... (6)

   =   (10,00,000) ÷ (16,00,000) × 100 = 62.5 %

Thus you have seen that in the above examples we have calculated the BEP in terms of number of units of sales in rupees term and as a percentage of Budgeted sales or estimated number of units i.e. as a percentage of capacity over a period of time usually a year. Now we will solve Example 2 by means of chart.

1.4 CHART APPROACH

A graphical presentation, which gives a pictorial view, is far more quickly and easily understood by the senior manager whose time is at premium. A break even chart is thus a convenient tool of BEP analysis. The chart basically consists of drawing a two dimensional chart showing costs and revenues Y-axis (vertical) on and volumes on the X-axis (horizontal). We will plot the above data in the chart by drawing the following as under :

a) **Sales volume lines** : Sales volumes are plotted on X-axis. Sales volumes may be expressed in rupees, units or as a percentage of capacity. Convenient equal distances are marked along X-axis to show sales volume at different activity level i.e. 0, 8,16,24,32,40 lakhs, and 0,8,16,24,32,40 in thousand of numbers. We can also mark these in percentage of sales i.e. 0,20,40,60,80,100.

b) **Cost and revenue lines** : The fixed, variable costs and revenues from sales are plotted on the Y-axis, which correspond to the activity level. These can be plotted in Rs. lakhs from Rs. 0 to Rs. 40 lakhs. A similar vertical line may also be drawn on the right hand side of the chart to complete the square.

c) **Fixed cost line** : As the fixed cost does not change in value it becomes a horizontal line parallel to the X-axis at the fixed cost point. In an alternative form this can be drawn marking fixed cost on both sides of the variable cost line and joining the same. The fixed cost is Rs. 10,00,000 (10 lakhs). This can be represented by 10 units.

d) **Variable cost line** : This line can be drawn starting from the origin i.e.point (0,0) rising upto the total variable cost marked on the right hand side corresponding to the budgeted sales in Rs./units. In our case this value is Rs. 24,00,000/- at Rs. 40,00,000 sales/40,000 units. Alternatively the start point of this would be above the fixed cost line and end point Rs. 10 lakhs + Rs. 24 lakhs = Rs. 34 lakhs.

e) **Total cost line** : As the total cost represents sum of fixed and variable costs, this can be drawn either by drawing the variable cost line first and the marking fixed cost over it on both left hand and right hand side or drawing the fixed cost line first and then marking variable cost (0) on the left hand side and Rs. 24,00,000 on the right hand side. In both the cases the final line would be the same. LHS Rs. 10,00,000; RHS 10,00,000 + 24,00,000 = Rs. 34,00,000.

f) **Sales line** : As the name suggests this line shows sales revenue on the Y-axis plotted against the volume at the X-axis. In our case the line will start from the origin and join on the right hand Y-axis at budgeted sales; in our case this is Rs. 40,00,000.

g) **Profit** : The difference between the Sales Revenues and the Total Cost is profit. It would be seen the sales and the total cost lines intersect. At the point of intersection the value total cost is equal to sales revenue thereby meaning that the profit at this point is zero. This is thus the BE point. The BE point can be scaled and easily seen in terms of rupees, units or percentage of capacity.

h) Both alternative forms of charts have accordingly been drawn below.

Alternative Chart 1 with Variable Cost above the Fixed Cost Line
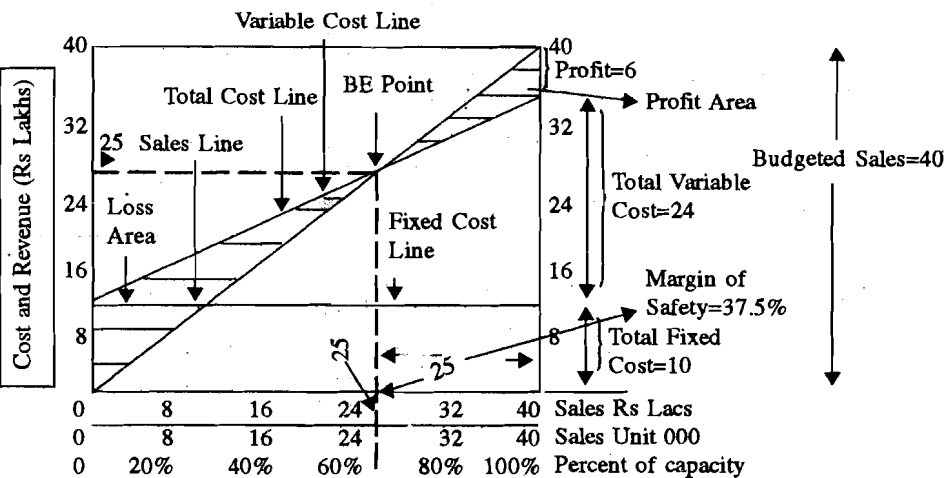
Alternative Chart 2 with Fixed Cost Line above the Variable Cost Line
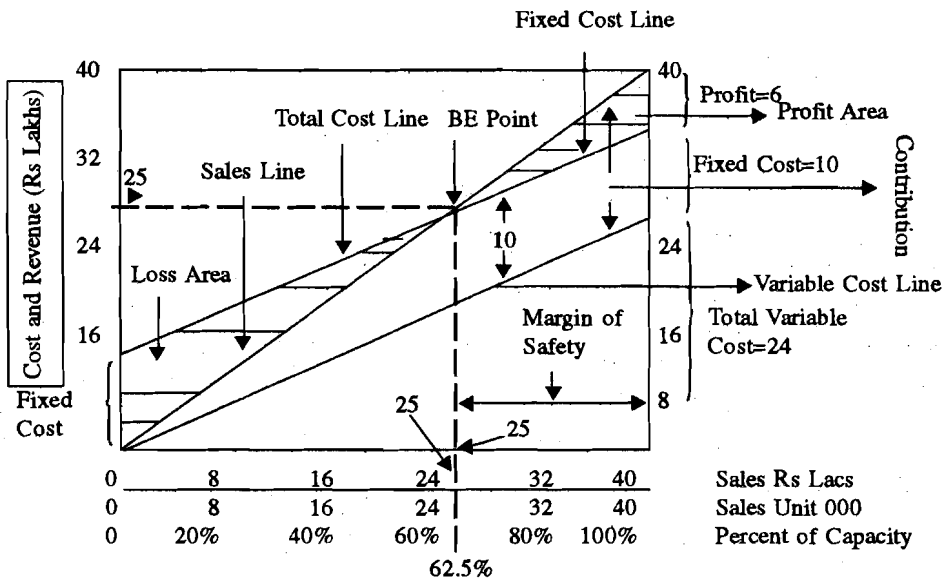
It would further be seen from these charts that before the BE point the total cost line is above the sales revenue line meaning thereby that the cost is more than the revenue hence there is loss upto this point. However beyond this the sales revenue line is above this point hence there is profit beyond this point. The area on the left of the break even point is the "Loss area" while to the right there is profit area. A comparison of both the alternative charts would indicate that there is no changes in the sales line, total cost line and break even point. Only the fixed and variable cost lines have changed. It would also be noticed that in addition it also indicates the value of contribution at different levels of sale. At BE point the contribution is equal to the fixed cost.

1.5 MORE ON BREAK EVEN ANALYSIS

In examples 1 and 2 consolidated figures for the fixed and variable cost have been given. This was to present a simplified understanding of the break even analysis. Now we will examine the same example in greater detail nearing the practical problems. The same data has been detailed as under:

S.No	Description	Rs.	Rs.	Rs.
1)	Estimated Sales	40,000 units @ Rs. 100		40,00,000
2)	Variable Costs	a) Direct materials	8,00,000	
		b) Direct labour	10,00,000	
		c) Consumption of electric power in manufacturing (E)	3,00,000	
		d) Commission on sales (C)	3,00,000	24,00,000
3)	Fixed Costs	a) Factory rent (R) @ 30,000 pm	3,60,000	
		b) Depreciation (D)	50,000	
		c) Fixed Administrative charges i/c insurance and maintenance (FA)	5,90,000	10,00,000

We shall draw a detailed BE chart by the following steps:

a) Draw the sales line as done in the earlier at alternatives 1 and 2

b) Mark variable costs on the Y-axis one over the other and join these points to the origin. The top most line will become the total variable cost line as before.

c) On both sides of the variable cost line mark fixed costs one above the other and join these points. The resultant line would become the total cost line and would intercept the sales line at BEP. This detailed chart 3 is given below :

Chart 3
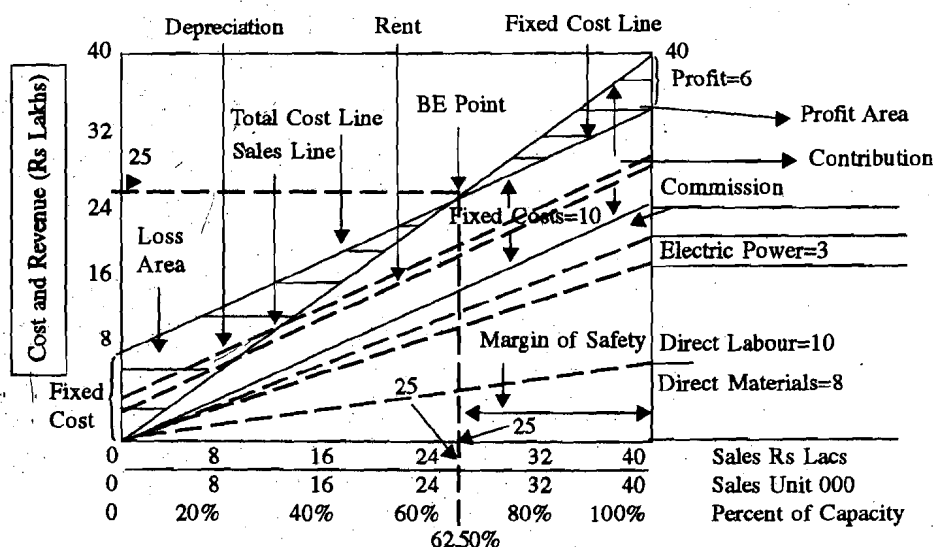
Even though as expected there is no change in the BE point but detailed graphical presentation gives a direct appreciation of the breakup of costs. You would observe that the above chart shows separate lines for every individual cost and effect of each on the final fixed and variable cost and total cost. On examining this BE chart a manager would visualize the various costs. For instance a reference to the graph he may think of having an own building rather than to go on paying high rent or he may consider to cut down the direct labour or direct materials cost. Additionally the chart above also shows the following:

a) **Profit** : This is indicated by the intercept between the total cost line and the sales line. It would also be seen that before the BEP there is no profit and the profit zone starts only from this point onwards. In case of the above chart the profit in lakhs is 6. By actual measurement you can read the profit at any sale level. It would be observed from the chart that in order to increase the profit, either the sales line should be higher or the total cost line should be lower or a combination of both.

b) **Contribution** : The value of contribution, which is represented by the intercept between the sales line and the variable cost line. A closer look would also indicate that this value is equal to the total fixed cost plus the profit. At BEP this value is equal to the total fixed cost. This has already indicated in the formula approach.

c) **Margin of safety** : The excess of actual or budgeted sales over the break even point is known as margin of safety. In case of the above chart equal to 40,000 – 25,000 = 15000 units, which correspond to Rs. 15,00,000 of sale and 100 – 62.5 = 37.5% capacity. This value is indicative of the extent to which the sales may fail before the firm suffers a loss. It therefore follows that larger the margin of safety, safer would be the firm. In order to increase the margin of safety, it would be seen from the chart above that the BEP be lowered for which again either the sales line should be higher or the total cost line should be lower or a combination of both.

Break Even Analysis for a Target Profit

As already explained, at the BEP the profit is zero. The difference between the sales in excess of the break even sales and the variable cost is the organisation profit. The reason is that the total fixed cost has already covered at break even point; therefore, any extra sales will simply add to the profit (after deducting variable costs). This can also be seen from the charts above that the profit is the vertical distance between the sales line and the total cost line is the profit and at the BEP it is zero. It would also be seen from the chart that Fixed cost + Profit = Contribution.

This equation can be written as under:

Contribution = Fixed cost + Profit

Sales volume × Contribution ratio = Fixed cost + Profit

Therefore, Sales Volume (to earn desired profit) = $\dfrac{\text{Fixed cost} + \text{Profit}}{\text{Contribution ratio}}$

Thus, if the desired profit is to be achieved we can apply the above formula to calculate the same. In our previous example the profit as seen from the chart is Rs. 6 lakh i.e. Total sale – Total cost = 40 – (24+10) = 6. Suppose we target a profit of Rs. 10 lakhs, what should be the increased sales; various cost remaining the same.

Solution

Sale price per unit	=	Rs. 100/-
Variable cost per unit	=	Rs. 60/-
Unit contribution	=	100 – 60 = 40
Contribution ratio	=	$\dfrac{\text{Unit contribution}}{\text{Sale price}}$ 40 ÷ 100 = 0.40
Fixed cost	=	Rs. 10 lakhs
Sales volume	=	$\dfrac{\text{Fixed cost} + \text{Profit}}{\text{Contribution ratio}}$ (10+10) ÷ 0.4 = 50 i.e. Rs. 50 lakhs

Thus instead of a sale of Rs. 40 lakhs with a profit of Rs. 10 lakhs in the previous case, the sale should be Rs. 50 lakhs for a target profit of Rs. 10 lakhs. This corresponds to a sale of 50000 units instead of 40,000 units in the previous case. The sales must be increased by ((50 – 40) ÷ 40) × 100 = 25%.

Let us now check the above

Total Sale amount for 50,000 units @ Rs 100/- per unit	=	50,00,000
Fixed cost	=	10,00,000

Variable cost for 50,000 units @ Rs 60/- per unit   =   30,00,000

Total Cost = fixed cost + variable cost = 10,00,000 + 30,00,000 = 40,00,000

Profit = Total Sale amount – Total cost = 50,00,000 – 40,00,000
         = 10,00,000 i.e. Rs. 10 lakhs

Exercise 1

With the revised data of sales draw a BE chart to indicate

a)   Cost and sales line

b)   BEP in terms of units, rupees, as percentage of sales

c)   Profit and loss zones

d)   Profit

e)   Contribution

f)   Margin of safety

Thus we have learnt how to apply break even analysis to determine the sale so as to achieve target profit costs and sales price remaining unchanged. Now we will foresee a situation where it is not possible to increase the production i.e. 40, 000 units and cost and target profit is to be achieved. It now required to determine the Sale price to achieve a profit of Rs. 10/- lakhs.

Solution

Variable cost per unit = Rs. 60/-

Variable cost for 40,000 units @ Rs. 60/- each = 40,000 × 60 = 24,00,000 i.e. 24 lakhs

Fixed cost = Rs. 10 lakhs

Total cost = 24 + 10 = 34 lakhs

Target profit = Rs. 10 lakhs

Total sales = total cost + profit = 34 + 10 = 44 lakhs. Therefore sale price = 44,00,000 ÷ 40,000 = 110 i.e. Rs. 110/- each. The selling price should be increased by 10% to get a target profit of Rs. 10 lakhs.

Thus it would be seen that for the same target profit, the number of units had to be increased by 25% in the first case and the same has been achieved by only 10% increase in the selling price. Increase in selling price does increase the profit faster but the price is determined by the market forces and at higher price the product may not sell.

1.6 A CASE STUDY FOR INSTALLATION OF A NEW FACILITY IN A NURSING HOME BY BREAK EVEN ANALYSIS

A nursing home plans to install ultra sound equipment in their existing complex but have to construct an extension of the building. They have planned to take loan from the bank, purchase and install equipment, recruit staff for this facility. The current price for this test in the area is between Rs. 400-450/-. After studying the various aspects the following data emerges:

S.No	Description	Amount Rs.	Remarks
1)	Cost of equipment	500000	Including installation
2)	Cost of extension of the building	500000	Extension on existing land
3)	Cost of new furniture	30000	
4)	Salary of staff and other incidentals	300000	

5)	Loan from the bank	1050000		
6)	Yearly installment of loan	200000		
7)	Rate of depreciation per year (equipment)	20%		
8)	Rate of depreciation per year (building)	2%		
9)	Rate of depreciation per year (furniture)	15%		
10)	Other incidentals; property tax, maintenance of equipment, building, furniture and administrative expenses.	300000		
11)	Average number of tests that may reasonably be expected to be carried out per day	12		
12)	Average working days in a year	275		
13)	Market price per test	400-450		
14)	Cost of electricity per test	50		
15)	Other consumable and stationery per test	50		
16)	Targeted profit after tax	200000		
17)	Tax rate	20%		

It is proposed to charge @ Rs. 400/- per test. It is required to examine if the price planned is feasible. If not what should be the price per test.

Solution

	Fixed Costs			
1)	Yearly installment of loan	200000		
2)	Depreciation equipment 5,00,000 @ 20%	100000		
3)	Depreciation building 5,00,000 @ 2%	10,000		
4)	Depreciation furniture 30000 @ 15%	4500		
5)	Other incidentals; property tax	300000		
6)	Salary of staff and other incidentals	300000		
	Total Fixed Cost	**914500**		
	Variable Costs			
1)	Cost of electricity per test	50		
2)	Other consumable and stationary per test	50		
3)	Variable cost per test (1) + (2) above	100		
4)	Total number of test per year = no. of test per day × average working days =12 × 300 = 3600	3600		
5)	Total Variable Cost = (3) × (4)	360000		
	Profit			
1)	Targeted Profit after tax	200000		
2)	Profit before tax = 200000 ÷ (1 − 0.2) = 250000	250000		
	Sales Revenue			
1)	Proposed charges per test	400		

Contribution per test = proposed charges per test – variable cost per test = 400 – 100 = 300

Total contribution = contribution per test × No. of tests proposed = 300 × 3600 = 1080000

Fixed cost + proposed profit after tax = 914500 + 250000 = 11,64,500

Against the above figure of 11,64,500, the total contribution expected is only 10,80,000 thus there is a shortfall of 11,64,500 – 10,80,000 = 84500/-

It is seen that the proposals falls short of the expectation and requires additioffal revenue of Rs. 84500/-. This can be met by increase in the proposed price per test. This increase is = 84500 ÷ 3600 = 23.47 say Rs. 24/-

Therefore, the proposed price per test = 400 + 24 = 424/-

Let us now find out the BEP.

BEP units　　　= (Total Fixed Costs)/((Selling price) – (Variable costs per unit))　　... (1)

　　　　　　　= (Total Fixed Costs)/(Unit Contribution)　　　　　　　... (2)

With the increase in the price to Rs 424, the unit contribution would be 424 – 100 = 324

Therefore, BEP units = 914500 ÷ 324 = 2882 nos. Thus after carrying 2882 tests the Nursing home would be breaking even i.e. at no profit, no loss situation. This would incidentally after 2882 ÷ 300 = 9.6 months after the yearly plan of 300 test per year.

You are now required to find:

a)　BEP in rupee term.

b)　BEP as a percentage of capacity.

c)　Draw a BEP chart and verify.

1.7　A CASE STUDY FOR COMPARISON OF TWO PLANS FOR RUNNING OF A DIETARY SERVICE IN A HOSPITAL

Break even analysis is a simple tool for financial analysis so as to make a right decision in business proposals when more than one alternative is available. Here is a case study for a hospital that wants to run dietary service by constructing an extension to the existing building. The management has visualized two practical options as under:

a)　Purchase, install and maintain costly kitchen equipment with completely running the catering. The furniture and building including its maintenance has also be carried out by them. Further they plan to take loan from a bank and pay fixed annual repayment that includes interest and return of principal.

b)　Get into a contract with a firm who is willing to install the kitchen equipment (including the cost of the equipment and cost of installation) and maintain it in good working condition at a fixed commission per meal. The hospital will however make provision of building, furniture including its maintenance as in the previous option.

The problem has to be analysed by break even analysis to select the better option financially.

The data and calculation of profit in both the cases is given in the following tables:

Option 1

S.No.	Description Plan 1	Amounts	Fixed costs	Remarks
1)	Cost of kitchen equipment	5,000,000		
2)	Depreciation of kitchen equipment @ 15% per year		750000	

S.No.	Description	Amounts	Fixed costs	Remarks
3)	Cost of extension of the building	1,000,000		
4)	Depreciation of building cost @ 2% per year		20000	
5)	Cost of new furniture	200000		
6)	Depreciation of furniture cost @ 2% per year		30000	
7)	Loan from the bank	7500000		
8)	Yearly installment of loan		1000000	Includes interest and principal
9)	Salary of maintenance staff for equipment	2000000	200000	
10)	Salary of maintenance staff for building	1000000	1000000	
11)	Salary of cooks, waiters and other kitchen staff	1200000	1200000	
12)	Administrative charges	60000	60000	
	Total Fixed cost		**4,260,000**	

	Variable costs		**Variable costs**
1)	Cost of materials per meal		20
2)	Cost of electricity, water etc.		3
			23
3)	Sale price per average meal = 55	55	**55**

Contribution

1)	Contribution per meal = 55 – 23	32
2)	Average No. of meals per day = 450	
3)	Total contribution per year = 32 × 450 × 365 =	5,256,000

Profit before Tax

1) Profit = Total Contribution – fixed cost

   4260000 – 5356000   996,000

2) Tax rate = 30%

3) Tax = 996000 × 0.30 =   298,800

4) Net profit after tax = 1374750 – 41425=   **697,200**

Option 2

S.No.	Description Plan l	Amounts	Fixed costs	Remarks
1)	Cost of kitchen equipment	0	0	being supplied by the contractor
2)	Depreciation of kitchen equipment @ 15% per year	0	0	Contractors' equipment
3)	Cost of extension of the building	1,000,000		
4)	Depreciation of building cost @ 2% per year		20000	

5)	Cost of new furniture	200,000	
6)	Depreciation of furniture cost @ 2% per year		30000
7)	Loan from the bank	1,200,000	
8)	Yearly installment of loan		160,000
9)	Salary of maintenance staff for equipment	0	0
10)	Salary of maintenance staff for building	1000000	1000000
11)	Salary of cooks, waiters and other kitchen staff	1200000	1200000
12)	Administrative charges	40000	40000
	Total Fixed cost		**2450000**

Variable costs   **Variable costs**

1) Cost of materials per meal — 20
2) Cost of electricity, water etc. — 3
3) Payment per meal to the equipment contractor — 10
4) Total variable cost per meal — **33**

Contribution

1) Sale price per average meal = 55   55   **55**
2) Contribution per meal = 55 – 23   **22**
3) Average No. of meals per day = 450
4) **Total contribution per year = 22 × 450 × 365 = 3,613,500.00**

Profit

Profit before tax = Total contribution – Fixed cost = 1,163,500.00

3613500 – 2450000

Tax rate = 30%

Tax = 1153500 × 0.30 = 349050

Net profit after tax = 1374750 – 41425 = **814,450.00**

Summary

	Option 1	Option 2
Loan from bank	7500000	1200000
Profit after tax	697,200	814450
Maintenance of equipment	hospital	contractor

Clearly option 2 is more profitable and logical better option.

Thus we have seen that by break even analysis we can come to logical financial conclusions.

1.8 LET US SUM UP

The break even analysis is a most widely form of cost volume profit analysis. It indicates the level of sales at which the total revenues are equal to the total costs. For the purpose of this analysis the various costs are divided in two parts i.e. fixed costs and the variable costs. The fixed costs are the costs that cannot be avoided and are essential for the business. These remain fixed irrespective of the changes in the volume i.e. the number of units of goods produced such as rent, insurance etc. Variable costs are expenses, which changes in direct proportion to the changes in volume of production like raw materials etc. For every unit of goods produced the sale/activity generate revenue and the difference of the price minus variable cost is called unit contribution. The following simple equations lead to its determination applications to study cost, volume and profit analysis:

Unit selling price – Unit variable cost = Unit contribution

Unit contribution × units sold = Total contribution

Total contribution = Total fixed cost + Profit

At BEP the profit is zero and hence at this point, Total contribution = Total fixed cost. This is known as the formula approach.

Apart from the formula approach the financial analysis can be effectively presented in chart form for easy understanding. A BE chart essentially consists of (a) Sales line, (b) Fixed costs line, (c) Variable costs line. The chart also shows BEP (no profit, no loss point), loss area, profit area, contribution, and margin of safety. Thus a chart becomes specific technique of studying and presenting the inter-relationship between costs, volumes and profits. It is an efficient and effective method of financial reporting and planning and easily understood by the senior executives when compared to accounting data.

You would have also persued two case studies specific to a hospital and learnt how:

● to determine the level of sales needed to be achieved to avoid losses;

● to determine sales level required to earn a target profit;

● to determine sale price needed to avoid losses; and

● to determine further BEP with the changed conditions to avoid loss.

The break even analysis is based on certain assumptions like variable per unit remaining constant and thus being directly proportional to the manufacture or other business activity. Also the cost should be separated into fixed and variable costs. The selling price is also assumed to be constant and the fixed cost remaining fixed. These assumptions may not be valid as the situation may go on changing. Hence constant reviews are necessary. The breakdown of various costs must also be done with great care to represent the actual position. As a final word of caution the decision making cannot be based on this analysis alone in view of the limitations mentioned above.

1.9 EXERCISES FOR THE STUDENTS

Exercise 1

The following data has been collected after analysis of the accounts of a manufacturing firm:

S.No.	Description	Amount (Rs.) (breakup)	Amount (Rs.) (total)
1)	Sales		2000000
	Variable Costs		
1)	Raw materials	600000	

2)	Direct labour	600000	
3)	Electric power for manufacturing	60000	
4)	Commission for sales	40000	
5)	Total Variable cost		**1300000**
	Contribution = Sale – Variable costs		**700000**
	Fixed Costs		
1)	Rent	60000	
2)	Administrative expenses	100000	
3)	Total Fixed cost		**160000**
4)	Net profit before tax = Contribution – fixed cost		**540000**

You are required to compute:

a) Contribution ratio

b) BE point

c) Revised BEP, contribution ratio and profit due to planned modernization which requires an increase in the fixed cost by Rs. 40000/-. Also as a result of this modernization, the firm is expected to decrease its cost of electricity for manufacturing process by 20% and direct labour by 30%.

d) Draw BEP chart in both cases and mark the BEP in rupees and as a percentage of sales. Also mark profit and loss zones, contribution and margin of safety.

Exercise 2

Two firms A and B, deal in identical diagnostic equipment in the same market. Their budgeted profit and loss accounts for the same year are as follows:

S.No. Description	Amount (Rs). (breakup)	Amount (Rs.) (total)	Amount (Rs.) (breakup)	Amount (Rs.) (total)
1) **Sales**		600000		600000
Costs				
1) Variable costs	400000		360000	
2) Fixed costs	50000	450000	90000	450000
Net Profit = total sales – total cost		150000		150000

You are required to:

a) Calculate the BEP for each firm

b) State what shall be the effect on the profits with increase in demand by 10% and decrease in demand by 10%.

c) Draw BEP charts with changed conditions.