POSTAL BOOK PACKAGE 2026

MECHANICAL ENGINEERING

CONVENTIONAL Practice Sets

CONTENTS

INDUSTRIAL ENGINEERING

1 CHAPTER
Break Even Analysis

Practice Questions : Level-I

Q.1 A company manufactures pocket transistors. The details of its monthly expenditure are as follow:

Direct material - ₹10000

Direct labour - 200 hours at the rate of ₹5 per hour

125 hours at the rate of ₹4 per hour

Applied overheads (factory overheads) = 10% of prime cost

Other overheads = 10% of works cost

Profit = 20% of total cost

Number of units manufactured per month = 200

Estimate the selling price unit.

Solution:

$$\text{Prime cost} = \text{Cost of direct material} + \text{Cost of direct labour} + \text{Direct expenses}$$
$$= 10000 + 200 \times 5 + 125 \times 4 = ₹11500$$

$$\text{Factory overheads} = \frac{10}{100} \times 11500 = ₹1150$$

$$\text{Works cost (Factory cost)} = \text{Prime cost} + \text{Factory overheads}$$
$$= 11500 + 1150 = ₹12650$$

$$\text{Other overheads} = \frac{10}{100} \times 12650 = ₹1265$$

$$\text{Total cost} = ₹12650 + ₹1265 = ₹13915$$

$$\text{Profit} = \frac{20}{100} \times 13915 = ₹2783$$

$$\text{Selling price for 200 units} = 13915 + 2783 = ₹16698$$

$$\text{Selling price per unit} = \frac{16698}{200} = ₹83.49$$

Q.2 A standard machine tool and an automatic machine tool are being compared for the production of a component. Following data refers to the two machines.

	Standard Machine tool	Automatic Machine tool
Setup time	30 min.	2 hours
Machining time per piece	22 min.	5 min
Machine rate	Rs. 200 per hour	Rs. 800 per hours

What is the breakeven production batch size above which the automatic machine tool will be economical to use?

Solution:

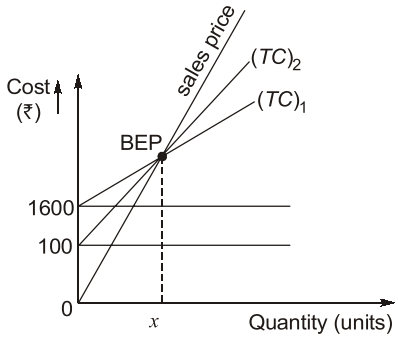
Total cost of x_1 component by using standard machine tool

$$(TC)_1 = \left(\frac{30}{60} + \frac{22x_1}{60}\right) \times 200 = 100 + \frac{2200}{30} x_1$$

Total cost x_2 component by using automatic machine tool.

$$(TC)_2 = \left(2 + \frac{5}{60} \times x_2\right) \times 800$$

$$= 1600 + \frac{2000}{30} x_2$$



Let break even quantity be x.

At break even point,

$$(TC)_1 = (TC)_2$$

$$\therefore \quad 100 + \frac{2200}{30} x = 1600 + \frac{2000}{30} x$$

or $\quad 6.667x = 1500$

$$\therefore \quad x = \mathbf{225}$$

Q.3 A factory producing only one item of selling price ₹ 13.5 per piece and has fixed cost equal to ₹ 80,000 and variable cost ₹ 8.5 per piece find:

(i) Break even-point

(ii) Number of pieces to be produced to earn the profit of ₹ 15,000.

(iii) The profit, if 30,000 pieces are produced and sold.

Solution:

Given data: Selling prices, S = ₹ 13.5 per unit fixed cost, FC = ₹ 80000; Variable cost, V = ₹ 8.5 per unit

Let the quantity produced is Q

$$\therefore \quad \text{Total cost, } TC = FC + VC$$

$$= 80{,}000 + 8.5\,Q$$

$$\text{Sales, } S = Q \times 13.5 = 13.5\,Q$$

(i) At Break even point

$$\text{Sales} = \text{Total cost}$$

$$13.5\,Q = 80{,}000 + 8.5\,Q$$

$$5\,Q = 80{,}000$$

$$Q_{BE} = 16{,}000 \text{ Units}$$

(ii) No. of units for ₹ 15,000 profit

$$\text{Profit} = \text{Sales} - \text{Total cost}$$

$$15000 = 13.5\,Q - 80{,}000 - 8.5\,Q$$

$$5\,Q = 15{,}000 + 80{,}000$$

$$Q = 19{,}000 \text{ units}$$

(iii) Profit when 30000 units produced

$$\text{Profit} = \text{Sales} - \text{Total cost}$$

$$= 13.5 \times 30{,}000 - 80{,}000 - 8.5 \times 30{,}000$$

$$= 150{,}000 - 80{,}000 = ₹\,70{,}000$$

Q.4 The fixed cost of ₹24000 and a break-even-quantity of 34000 unit are estimated for a productions. Draw profit graph and calculate profit at a sales volume of 50000 units.

Solution:

As we know, $S = F + V + P$

At BEP, $P = 0$

$$x_{BEP} = 34000 \text{ unit}$$

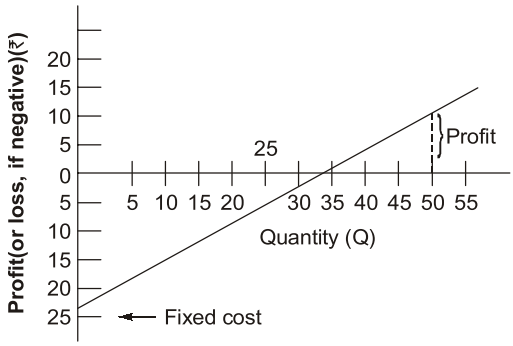
$$sx_{BEP} - vx_{BEP} = F$$

$$s - v = \frac{F}{x_{BEP}} = \frac{24000}{34000} = 0.706$$

Profit, when $x = 50000$, $P = (s - v)x - F$

$= 0.706 \times 50000 - 24000$

$= ₹11300$



Q.5 Following is information regarding a manufacturing enterprises:
Total fixed cost = ₹ 4,500
Total variable cost = ₹ 7,500
Total sales = ₹ 15,000
Units Sold = 5000
Find out :

(i) Break even point in units
(ii) Margin of safety
(iii) Profit
(iv) Volume of sales to earn a profit of ₹ 6000.

Solution:

(i) Break even points in units

$$\text{Sale price, } S = \frac{15000}{5000} = ₹ 3 \text{ per unit}$$

$$\text{Variable price, } V = \frac{7500}{5000} = ₹ 1.5 \text{ per unit}$$

Let Q is units of break even point

$$S.Q. = F.C. + V.Q. \text{ at BEP}$$

$$3Q = 4500 + 1.5Q$$

$$1.5Q = 4500$$

$$Q = 3000 \text{ units}$$

(ii) Margin of safety

(a) In terms of unit produced = 5000 – 3000 = 2000 units

(b) In terms of money = 15000 – 3000 × 3 = ₹ 6000

(iii) Profit = Total Sales– Total cost

= 15000 – (4500 + 1.5 × 5000)

= 15000 – 12000 = ₹ 3,000

(iv) Volume of sales to earn profit of ₹ 6000

$\therefore$ $6000 = Q \times 3 - (4500 + 1.5Q)$

$10500 = 1.5Q$

$Q = 7000$ Units

Q.6 A machine shop manager has two machine that can do this same operation. The setup cost and variable costs are as

Machine	Setup Cost (₹)	Variable cost/unit (₹)
A	**80**	**2.4**
B	**800**	**0.9**

A decision has to be taken to select the machine *A* or *B* to minimise the total cost of production when an order comes.

(i) Determine the total cost equation for two machines

(ii) At what volume of production do machine *A* or *B* break-even?

(iii) What in the decision rule?

Solution:

Let *Q* denotes the volume of production

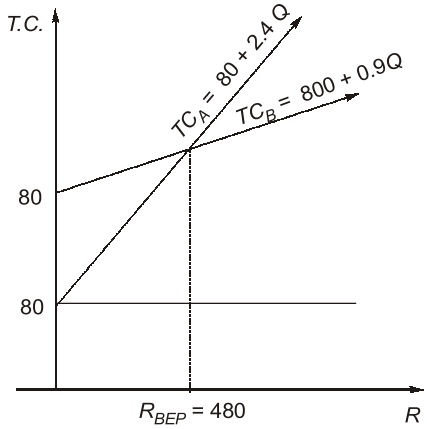
(i) Total cost equation

Total cost equation for *A*, $TC_A = 80 + 2.4\,Q$

Total cost equation for *B*, $TC_B = 800 + 0.7\,Q$

(ii) The break even for machines

$$TC_A = TC_B$$
$$80 + 2.4\,Q = 800 + 0.9\,Q$$
$$1.5\,Q = 800 - 80 = 720$$
$$Q_{BEP} = 480 \text{ Units}$$



(iii) Decision Rule

(a) if the production is less than 480 units select machine *A*

(b) if the production is more than 480 units, select machine *B*

Q.7 An analysis of a company reveals the following sales and cost information: Current capacity = 1,00,000 units. At current level of operations, its margin of safety is 5% of its break-even point, whereas contribution margin P/V ratio is 25% and unutilised capacity is 10,000 units. For the sale price of ₹ 40 per unit, determine the following: (i) Break-even point in sales volume, (ii) Fixed costs, (iii) Variable costs per unit, (iv) Margin of safety in units

Solution:

Given: Current capacity = 1,00,000 units, (P/V) ratio = 25%, Sale price (S) = ₹ 40/ unit

Margin of safety = 5% of break even point

$$\text{Margin of safety} = \text{Actual sale} - \text{Break even sales} = \frac{5}{100} \times \text{Break even sale}$$

$$\text{Actual sales} = 1.05 \times \text{break-even sales}$$

and actual sales = (1,00,000 – 10,000) × 40 = ₹ 36,00,000

(i) Break-even point in sales volume $= \dfrac{36,00,000}{1.05} =$ ₹34,28,571.4

(ii) Fixed costs = Break even sales × P/V ratio

= ₹34,28,571.7 × 0.25 = ₹ 8, 57, 142.85

(iii) $\text{P/V ratio} = \dfrac{\text{Sales} - \text{variable cost}}{\text{sales}} \Rightarrow 0.25 = \dfrac{\text{Sales} - \text{variable cost}}{\text{sales}}$

Variable cost = 0.75 × sales per unit = 0.75 × 40 = ₹ 30 per unit

(iv) $\text{Break-even sales (in units)} = \dfrac{8,57,142.85}{40 - 30} = 85715$ units

Then margin of safety = 0.05 × 85715 = 4285.75 units

Practice Questions : Level-II

Q.8 The P/V ratio of Alpha Pvt. Ltd. is 50% and Margin of Safety is 40%. The company sold 500 units for ₹500000. Calculate:

(i) Break even point (in units)

(ii) Fixed cost

(iii) Profit earned at present level of sales.

(iv) Sales in units to earn a profit of 10% on sales.

(v) Units to be sold to earn a target net profit of ₹ 500000 for the next year.

(vi) Selling price per unit if BEP is to be brought down by 50 units.

Solution:

Selling price per unit, $s = \frac{500000}{500} = ₹1000$ per unit

$$\left(\frac{P}{V}\right)_{\text{ratio}} = \frac{s-v}{s} \times 100$$

$$50 = \frac{1000-v}{1000} \times 100$$

Variable cost per unit, $v = ₹\,500$

(i) Given: Total sale, $x = x_{BEP} + 0.4x$,

$$x_{BEP} = 0.6x = 0.6 \times 500$$

$$x_{BEP} = 300 \text{ units}$$

(ii) $$x_{BEP} = \frac{F}{s-v}$$

$$300 = \frac{F}{1000-500}$$

Fixed cost, $F = ₹150000$

(iii) Sale in units, $$x = \frac{P+F}{s-v}$$

$$500 = \frac{P+150000}{1000-500}$$

Profit at present level of sales, $P = ₹100000$

(iv) $$x' = \frac{P'+F}{s-v} = \frac{0.1sx'+150000}{1000-500} = \frac{0.1\times 1000x'+150000}{500}$$

$$500x' = 100x' + 150000$$

$$x' = 375 \text{ units}$$

(v) $$x'' = \frac{P''+F}{s-v} = \frac{500000+150000}{1000-500} = 1300 \text{ units}$$

(vi) $$(x_{BEP})_{new} = (x_{BEP})_{old} - 50 = 300 - 50 = 250 \text{ units}$$

$$(x_{BEP})_{new} = \frac{F}{s_{new} - v}$$

$\Rightarrow$ $$250 = \frac{150000}{s_{new} - 500}$$

$$s_{new} = ₹1100 \text{ per unit}$$