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MECHANICAL ENGINEERING

Objective Practice Sets

Industrial Engineering

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CHAPTER

Break-even Analysis

MCQ and NAT Questions

Q.1 Which one of the following conditions warrants that a business should be closed?
(a) Flat variable cost line
(b) Vertical variable cost line
(c) Steep revenue line
(d) Capacity utilization can never reach 100%

Q.2 Which one of the following does not form a part of the direct cost of a component?
(a) Cost of special tooling used
(b) Cost of material used
(c) Cost of material wasted
(d) Wages of the labour actually involved

Q.3 Which of the following is the expression for the market price?
(a) Selling price + discount to distributor
(b) Selling price – discount to distributor
(c) Total cost + discount to distributor
(d) Office cost + selling & distribution express

Q.4 Which one of the following is the correct statements? In cost estimation at the break-even point, the cost of production is
(a) Greater than the sales
(b) less than the sales
(c) Equal to total sales
(d) profit sales

Q.5 If break-even point = Total fixed cost
$$\div \left(1 - \frac{\text{Variable Cost per unit}}{X} \right) \text{ then } X \text{ is the}$$
(a) Overheads (b) Price per unit
(c) Direct cost (d) Materials cost

Q.6 Process I requires 20 units of fixed cost and 3 units of variable costs per piece, while process II required 50 units of fixed costs and 1 unit of variable cost per piece. For a company producing 10 pieces per day
(a) process I should be chosen
(b) process II should be chosen

(c) either of the two processes should be chosen
(d) a combination of process I and process II should be chosen

Q.7 Two machine produce a specific part in batches. The setup cost per patch and the variable unit production cost are

| Cost in Rupees	Semiautomatic	Automatic
Setup cost/batch	50.0	20.0
Unit variable cost	0.4	0.6

Which of the following alternative is advisable?
(a) Buy automatic machine if batch size is greater than 150 units
(b) Buy automatic machine if batch size is greater than 140 units
(c) Buy semi automatic machine if batch size is greater than 200 units
(d) Buy semiautomatic machine if batch size is greater than 150 units.

Q.8 Details of cost for make or buy decision are shown in the given graph. A discount is offered for volume of purchase above '*V*'. Which one of the following ranges would lead to the economic decision?
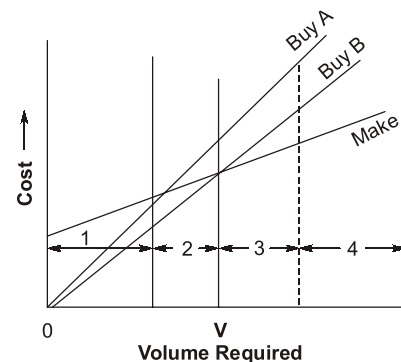
Buy *A, B*	Make
(a) 1 and 2	3 and 4
(b) 1 and 3	2 and 4
(c) 2 and 4	1 and 3
(d) 1 and 4	2 and 3

Q.9
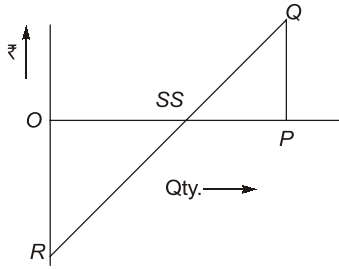
Match **List-I (symbols)** with **List-II (Meaning)** and select correct answer using the codes given below the lists, related to P/V chart on Break-Even Analysis as shown in the above figure

List-I	List-II
A. OR	1. Profit
B. PQ	2. Break-even Point
C. SS	3. Profit/Volume Ratio
D. RQ	4. Cost for new design
	5. Fixed cost

Codes:

	A	B	C	D
(a)	5	4	2	3
(b)	2	1	3	5
(c)	5	1	2	3
(d)	2	4	3	5

Q.10 A company is producing circuit breaker. The fixed cost of land, building etc. is ₹ 40,000.

The variable cost is ₹10 per unit production. If the selling price is ₹ 20 per unit. The break-even is achieved at
(a) 6000 units
(b) 4000 units
(c) 10,000 units
(d) 4500 units

Q.11 It a company is producing circuit breaker has a fixed cost of ₹ 40,000 and variable cost of ₹10/-. selling price of circuit breaker is ₹ 20/- per unit. The level of production for a profit of ₹ 10,000 is
(a) 4000 units   (b) 8000 units
(c) 5000 units   (d) 6000 units

Q.12 The fixed cost of ₹ 24,000 and a break-even quantity of 34,000 unit are estimated for a production. The profit at a sales volume of 50,000 unit is

(a) 20000   (b) 10290
(c) 11295   (d) 9000

Q.13 Which of the following form the overhead expenses?
1. Factory expenses
2. Material expenses
3. Administrative expenses
4. Sales and distribution expenses
Select the correct answer using the code given below:
(a) 1, 2 and 3   (b) 1, 3 and 4
(c) 1 and 2   (d) 3 and 4

Q.14 The low break-even point is due to which one of the following factors?
(a) High productivity
(b) Low revenue
(c) Large angle of incidence
(d) High revenue

Q.15 Break-even analysis can be used for which of the following?
1. Profit analysis
2. Production method cost comparison
Select the correct answer using the code given below:
(a) 1 only   (b) 2 only
(c) Both 1 and 2   (d) Neither 1 and 2

Q.16 M/s. ABC & Co. is planning to use the most competitive manufacturing process to produce an ultramodern sports shoe. They can use a fully automatic robot-controlled plant with an investment of ₹ 100 million; alternately they can go in for a cellular manufacturing that has a fixed cost of ₹ 80 million. There is yet another choice of traditional manufacture that needs in investment of ₹ 75 million only. The fully automatic plant can turn out a shoe at a unit variable cost of ₹ 25 per unit, whereas the cellular and the job shop layout would lead to a variable cost of ₹ 40 and ₹ 50 respectively. The break-even analysis shows that the break-even quantities using automatic plant vs traditional plant are in the ratio of 1 : 2. The per unit revenue used in the break-even calculation is
(a) ₹ 75   (b) ₹ 87
(c) ₹ 57   (d) ₹ 65

Q.17 Following details for a small manufacturing company is available,

Actual sale = ₹45000

Fixed cost = ₹10000

Profit at given sale = ₹8000

What will be the profit when the sale is ₹125000?

(a) ₹40000
(b) ₹36000
(c) ₹32000
(d) ₹44000

Q.18 A factory produces three products such that

	Products		
	A	B	C
Sales (unit)	300	200	400
Unit selling price (Rs.)	5	8	7
Unit variable price (Rs.)	2	5	4

What will be the break-even sale for the factory if fixed cost of the products is Rs. 1200?

(a) Rs. 400
(b) Rs. 2670
(c) Rs. 2620
(d) Rs. 8000

Q.19 The profit to volume ratio for an item is 40% and margin of safety is 50%. The net profit and the breakeven point sale if the sales volume is ₹800000 are respectively,

(a) ₹160000, ₹400000
(b) ₹160000, ₹80000
(c) ₹400000, ₹160000
(d) ₹80000, ₹160000

Direction (Q.20 to Q.22): The following questions consist of two statements, one labelled as 'Assertion (A)' and the other labelled as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below.

Codes:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not a correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q.20 Assertion (A): A large margin of safety in break-even analysis is helpful for management decision.

Reason (R): If the margin of safety is large, it would indicate that there will be profit even when there is serious drop in production.

Q.21 Assertion (A): It is possible to have more than one BEP in break-even charts.

Reason (R): All variable costs are directly variable with production.

Q.22 Assertion (A): Indirect cost is more difficult to assess than direct cost.

Reason (R): Overhead cost apportioning is approximate and time consuming.

Q.23 Total monthly costs equations for production and distribution are as follows:

Production cost = $4x^2 - 19x + 25000$

Distribution cost = $3x^2 - 37x + 26000$

Number of units should be produced to minimize total cost is _____.

Q.24 A company sells 14000 units of its product. It has a variable cost of ₹ 15 per unit. Fixed cost is ₹ 47000 and the required profit is ₹ 23000. Per unit product price (in ₹) will be _____.

Q.25 For a product, the direct labour cost is ₹ 5 and direct material cost is ₹ 10. The annual cost of direct materials is expected to be ₹ 200000 and the annual overhead to be absorbed is ₹ 120000. The total cost of product (in ₹) is _____.

Q.26 The fixed costs for a year is ₹ 8 lakhs, variable cost per unit is ₹ 40 and the selling price of each unit is ₹ 200. If the annual estimated sales is ₹ 200000, then the break-even volume is _____.

Q.27 If a company's total sales is ₹ 50000 and (P/V) ratio is 50% and margin of safety percentage is 40%, then break-even point sale (in ₹) is _____.

Q.28 Suppose a firm has the following budget for a particular year:

Sales = ₹ 20,00,000

Variable costs = ₹ 10,00,000

Fixed cost = ₹ 4,60,000

Units sold = 1,00,000

If the following changes take place:

Increase in sales price = 20%

Decrease in sales volume = 25%

Increase in variable cost = 10%

Increase in fixed cost = 6%

The net change in profit with respect to initial case will be _____%.

Multiple Select Questions (MSQ)

Q.29 For a small manufacturing company following details are available:
Fixed cost = Rs. 20000
Profit at a sale of Rs. 100000 is Rs. 20000
Which of the following options is/are correct?

(a) Value of $\left(\dfrac{P}{V}\right)$ ratio is 0.4.

(b) Profit at a sale of Rs. 200000 is Rs. 45000.
(c) Profit at a sale of Rs. 200000 is Rs. 60000.
(d) Break-even point sale of Rs. 80000.

Q.30 The $\left(\dfrac{P}{V}\right)_{ratio}$ of Pankaj enterprises is 50% and margin of safety is 40%. The company sold 500 units for Rs. 100000.
Which of the following options is/are correct?
(a) Variable cost is Rs. 100/unit.
(b) Fixed cost is Rs. 30,000.
(c) Breakeven point quantity is 300 units.
(d) Profit earned at given sell is Rs. 30000.

Q.31 For a firm following data is given for a particular year:

Case-A:
Selling price per unit = Rs.20
Variable cost per unit = Rs.10
Fixed cost = Rs.400000
Number of units sold = 100000

Case-B:
There are following changes in product cost and demand:
Selling price per unit increases by 20%.
Variable cost per unit increases by 20%.
Fixed cost increases by 10%.
Sales volume decreases by 10%.
Which of the following options is/are correct?
(a) Profit in case A is Rs.600000.
(b) Profit in case B is Rs.600000.
(c) There is 0% change in profit.
(d) There is 6.67% change in profit.

Q.32 For a product selling price per unit is Rs.200 and total sale is Rs.80000. The fixed cost is Rs.20000 and contribution margin is Rs.35000.
Which of the following options is/are correct?
(a) The variable cost per unit is Rs.87.5.
(b) The profit earned for this sale is Rs.15000.
(c) The breakeven point sale quantity is 178 units.
(d) The breakeven point sale is Rs.45720 approx.

■■■■

Answers	**Break-even Analysis**

1. (b)	2. (c)	3. (a)	4. (c)	5. (b)	6. (a)	7. (d)	8. (a)	9. (c)
10. (b)	11. (c)	12. (c)	13. (b)	14. (d)	15. (c)	16. (d)	17. (a)	18. (c)
19. (a)	20. (a)	21. (d)	22. (a)	23. (4)	24. (20)	25. (420000)	26. (5000)	
27. (30000)	28. (–9.7407)	29. (a, c)	30. (a, b, c)	31. (a, d)	32. (b, d)			

Explanations	**Break-even Analysis**

1. (b)

A vertical variable cost means that the total cost would never be equal to the revenue and hence BEP would not be reached. So, the business should be closed.
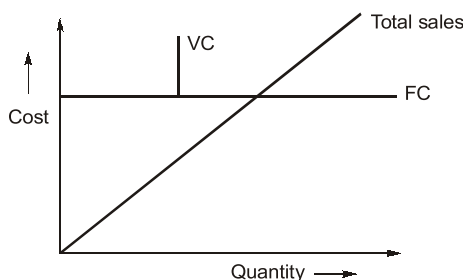
2. (c)

Direct costs are costs which directly contribute to the final product and can be directly allocated to the manufacturing of a specific product. Direct costs include the cost of raw materials, labour processing the materials, cost of the equipment, special tooling and engineering costs used in the manufacturing of the product.

3. (a)

Selling price = Market price – discount
Market price = Selling price + discount

4. (c)

At BEP, Profit = 0

∴ Cost of production = Total sales

5. (b)

At break-even point,

$$\text{Profit} = 0$$

$$\Rightarrow FC + n \times VC = n \times SC$$

when FC = Total fixed cost

n = Number of units at BEP

VC = Variable cost per unit

SC = Selling cost per unit

$FC = n(SC - VC)$

$$n = \frac{FC}{SC\left(1 - \dfrac{VC}{SC}\right)}$$

$$n \times SC = \frac{FC}{\left(1 - \dfrac{VC}{SC}\right)} = \text{BEP}$$

6. (a)

Cost = $20 + 3X$ (for Process 1) = ₹50

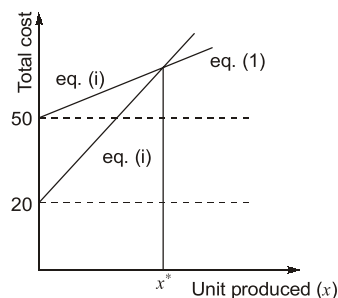Cost = $50 + 1X$ (for Process 2) = ₹60

So, Process 1 is to be chosen

7. (d)

Total cost by semiautomatic method,

$$= 50 + 0.4x \qquad \ldots\text{(i)}$$

where, x is the number of units produced.

Total cost by automatic method = $20 + 0.6x$ ...(ii)

Equating total cost at $x = x^*$

$50 + 0.4x^* = 20 + 0.6x^*$

$\Rightarrow \qquad x^* = 150$ units

So, buying semiautomatic machine if batch size is greater than 150 units will be advisable.

8. (a)

For volume region 1 and 2, it is better to buy than to make, so buy A, B, while in region 3 and 4, it is right decision to make.

9. (c)

OR = Fixed cost

PQ = Profit

SS = Break-even point

RQ = Profit / volume ratio

10. (b)

$$x = \left(\frac{F}{s - v}\right) = \frac{40000}{20 - 10} = 4000 \text{ units}$$

11. (c)

$$x = \left(\frac{F + \text{Profit}}{S - V}\right) = \frac{40000 + 10000}{20 - 10}$$

$$= 5000 \text{ units}$$

12. (c)

$$\text{BEP} = \left(\frac{F}{S - V}\right)$$

$$S - V = \left(\frac{24000}{34000}\right) = \left(\frac{24}{34}\right)$$

Profit = (Sales in unit)$(S - V)$

– fixed cost

$$= 50000 \times \frac{24}{34} - 24000 = 11295$$

13. (b)

Apart from material expenses, all other expenses mentioned come under overhead expenses category.

14. (d)

$$S_x = F + V_x + P$$

$$\therefore \qquad x = \frac{F + P}{S - V}$$

At BEP, $P = 0$

$$\therefore \qquad x = \frac{F}{S - V}$$

Higher the value of S, lesser will be x (i.e. BEP)

15. (c)

Both profit analysis and production method cost analysis can be done using break-even analysis.

16. (d)

$$(BEP)_{Automatic} = \frac{100}{(s - 25)}$$

$$(BEP)_{Traditional} = \frac{75}{(s - 50)}$$

Given:

$$\frac{(BEP)_{Automatic}}{(BEP)_{Traditional}} = \frac{1}{2} = \frac{100}{(s - 25)} \times \frac{(s - 50)}{75}$$

$$8(s - 50) = 3(s - 25)$$

$$5s = 325$$

$$s = 65$$

Per unit revenue cost = ₹ 65.

17. (a)

$$\left(\frac{P}{V}\right)_{ratio} = \frac{\text{Contribution Margin}}{\text{Sales}}$$

$$= \frac{S - V}{S} = \frac{F + P}{S}$$

$$= \left(\frac{10000 + 8000}{45000}\right) = 0.4$$

$$= \frac{F + P_1}{S_1} = \frac{F + P_2}{S_2}$$

$$= \frac{10000 + 8000}{45000}$$

$$= \frac{10000 + P_2}{125000}$$

$$(0.4) \times 125000 - 10000 = P_2$$

$$P_2 = ₹40000$$

18. (c)

Break-even point,

$$= \frac{\text{Total fixed expenses}}{\left(\begin{array}{c} \text{Weighted average selling price} \\ -\text{ weighted average variable expenses} \end{array}\right)}$$

Weighted average unit selling price,

$$= \frac{300}{900} \times 5 + \frac{200}{900} \times 8 + \frac{400}{900} \times 7 = \text{Rs. } 6.556$$

Weighted average unit variable expense,

$$= \frac{300}{900} \times 2 + \frac{200}{900} \times 5 + \frac{400}{900} \times 4 = \text{Rs. } 3.566$$

$$\text{Break-even point} = \frac{1200}{(6.556 - 3.556)} = 400 \text{ units}$$

Break-even sale = 400 × (weighted avg. selling price)

= 400 × 6.556 = Rs. 2622.4 ≃ Rs. 2620

19. (a)

Margin of safety percentage,

$$= \frac{\text{Actual sales} - \text{Breakeven sales}}{\text{Actual sales}} \times 100$$

$$\frac{50}{100} = \frac{800000 - BES}{800000}$$

$$BES = ₹400000$$

$$BES = \frac{\text{Fixed cost}}{P/V \text{ ratio}}$$

$$400000 = \frac{\text{Fixed cost}}{0.4}$$

$$\text{Fixed cost} = ₹160000$$

$$\text{Actual sales} = \frac{\text{Fixed cost} + \text{Profit}}{P/V \text{ ratio}}$$

$$800000 = \frac{160000 + \text{Profit}}{0.4}$$

$$\text{Profit} = ₹160000$$

20. (a)

A large margin of safety in break-even analysis is helpful for management decision regarding production, as even drop occurs in production, there will be profit due to large margin of safety.

21. (d)

It is not possible to have more than one BEP is break-even charts.

22. (a)

Overhead cost calculation is approximate and time consuming and it forms part of indirect cost, so it is correct to say, indirect cost assessing is more difficult compared to direct cost.

23. (4)

Total cost $= 4x^2 - 19x + 25000 + 3x^2 - 37x + 26000$

$$\frac{dT}{dx} = 8x - 19 + 6x - 37$$

For minimum cost, $\dfrac{dT}{dx} = 0$

$$0 = 14x - 56$$

$$x = \frac{56}{14} = 4$$

24. (20)

$$\text{Total price} = \text{F.C.} + \text{V.C.} + \text{Profit}$$

$$s.x = 47000 + 23000 + V.x$$

$$(s - 15) \times 14000 = 70000$$

$$s = ₹20$$

25. (420000)

$$\text{No of units } (x) = \frac{200000}{10} = 20000$$

$$\text{Total cost} = \text{F.C.} + \text{Overhead cost}$$
$$+ \text{ labour cost}$$

$$= 200000 + 120000 + 20000 \times 5$$

$$\text{Total cost} = ₹420000$$

26. (5000)

$$\text{BEP} = \frac{\text{F.C.}}{\text{Selling price} - \text{Variable cost}}$$

$$= \frac{800000}{200 - 40} = 5000 \text{ units}$$

27. (30000)

$$\text{MOS} = \frac{\text{Sales} - \text{BEP sales}}{\text{Sales}}$$

$$0.4 = \frac{50000 - BEP \text{ Sales}}{50000}$$

$$\text{BEP sales} = ₹30000$$

28. (−9.7407)

Profit in first case,

$$P_1 = 2000000 - (1000000 + 460000)$$

$$P_1 = ₹540000$$

Profit, $P_2 = (s_2 - v_2) \times n_2 - F_2$

$$= \left[\left(\frac{2000000}{100000}\right) \times 1.2 - \left(\frac{1000000}{100000}\right) \times 1.1\right]$$
$$\times (100000 \times 0.75) - 460000 \times 1.06$$

$$= [20 \times 1.2 - 10 \times 1.1] \times 75000 - 487600$$

$$P_2 = ₹487400$$

Percentage change in profit,

$$= \left(\frac{P_2 - P_1}{P_1}\right) \times 100\%$$

$$= \left(\frac{487400 - 540000}{540000}\right) \times 100\%$$

$$= -9.7407\%$$

29. (a, c)

$$\left(\frac{P}{V}\right)_{\text{ratio}} = \frac{F + P}{S} = \frac{20000 + 20000}{100000} = 0.4$$

$$\because \quad \frac{F + P_1}{S_1} = \frac{F + P_2}{S_2} = \left(\frac{P}{V}\right)_{\text{ratio}}$$

$$0.4 = \frac{20000 + P_2}{200000}$$

$$P_2 = \text{Rs. } 60000$$

At break-even point, $\left(\dfrac{P}{V}\right)_{\text{ratio}} = \dfrac{F}{S_{\text{BEP}}}$

$$S_{\text{BEP}} = \frac{20000}{0.4} = \text{Rs. } 50000$$

30. (a, b, c)

$$\text{Selling price per unit, } s = \frac{100000}{500} = \text{Rs. } 200/\text{unit}$$

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

$$50 = \left(\frac{200 - v}{200}\right) \times 100$$

$$V = \text{Rs.100/unit}$$

$$x = x_{BEP} + 0.4x$$

$$x_{BEP} = 0.6 \times 500 = = 300 \text{ units}$$

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

$$F = 300 \times (200 - 100) = \text{Rs. } 30000$$

$$\because \qquad x = \frac{F + P}{s - v}$$

$$P = (200 - 100) \times 500 - 30000$$

$$= \text{Rs. } 20000$$

31. (a, d)

Profit in case A:

$$S = F + V + P$$

$$P_A = 100000 \times 20 - 400000 - 10 \times 100000$$

$$= \text{Rs. } 600000$$

Profit in case B:

$$P_B = x(s - v) - F$$

$$P_B = 0.9 \times 100000(1.2 \times 20 - 1.2 \times 10) - 1.1 \times 400000$$

$$P_B = \text{Rs.640000}$$

% change in profit, $\Delta p\% = \left(\dfrac{P_B - P_A}{P_A}\right) \times 100$

$$= \left(\frac{640000 - 600000}{600000}\right) \times 100$$

$$= 6.67\%$$

32. (b, d)

Given, $s = \text{Rs } 200$, $F = \text{Rs } 20,000$

$$\text{Number of units sold} = \frac{\text{Total sale}}{\text{Selling price/unit}}$$

$$= \frac{80000}{200} = 400 \text{ units}$$

Contribution margin = Total sale – Total variable cost

$$35000 = 80000 - v \times 400$$

Variable cost/unit, $v = \dfrac{45000}{400} = \text{Rs.112.5/units}$

Profit = Contribution margin – Fixed cost

$$= 35000 - 20000 = \text{Rs.15000}$$

Breakeven point quantity, $x_{BEP} = \dfrac{F}{(s - v)}$

$$= \frac{20000}{(200 - 112.5)}$$

$$= 228.57 \text{ units or } 228.6 \text{ units approx.}$$

Breakeven point sale, $S_{BEP} = s \times x_{BEP}$

$$S_{BEP} = 228.6 \times 200 = \text{Rs. } 45720$$

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