

## Ch- 1 Decision Making Techniques

### ILLUSTRATION 1

Chung Lee Electronics Ltd. manufacturers 4 types of electronics products: 'A', 'B', 'C' and 'D' All these products have good market demand. The company supplied following data:

Particulars	Product 'A'	Product 'B'	Product 'C'	Product 'D'
1. Material Cost (₹./Unit)	64	72	45	56
2. Machining Cost (₹./Unit) @ ₹.8/hour	48	32	64	24
3. Variable Expenses (₹./Unit)	32	36	44	20
4. Selling Price (₹./Unit)	162	156	173	118
5. Market Demand (Number of Units)	52000	48500	26500	30000

Fixed cost varies according to production level (hours), as below:

- Upto 150000 hours      ₹.10 Lakhs
- 150001 – 300000 Hours   ₹.10.50 Lakhs
- 300001 – 450000 Hours   ₹.11.00 Lakhs
- 450001 – 600000 Hours   ₹.11.50 Lakhs

Current production capacity is 498000 machine hours, that is not enough to fulfill the market demand. Production manager wants to increase the capacity. The capacity enhancement is likely to take some time and the Company wants to avail the market sentiment and cater to its requirement. It can subcontract a part of its production. Subcontract price per unit is offered as follows:

- Product A – ₹.146/unit
- Product B – ₹.126/unit
- Product C – ₹.155/unit
- Product D – ₹.108/unit

Please advise the management for quantities to be produced and or sub contracted, so as to achieve maximum possible profit. Show the quantum of profit earned.

### Solution:

#### i. Statement of Ranking

Particulars	A	B	C	D
1. Subcontract Price (₹./Unit)	146	126	155	108
2. Material Cost (₹./Unit)	64	72	45	56
3. Machining Cost (₹./Unit) @ ₹.8/hour	48	32	64	24

4. Variable Expenses (₹./Unit)	32	36	44	20
5. Total Variable Cost	144	140	153	100
6. Saving in Manufacturing (1 - 5)	2	-14	2	8
7. Decision	Make	Buy	Make	Make
8. Machine Hours Required (₹./Unit) (3/8)	6	4	8	3
9. Saving (₹. Per Hours) (6/9)	0.33	N A	0.25	2.6
10. Ranking	II		III	I
11. Market Demand (Number of Units)	52000	48500	26500	30000
12. Hours Required for Full Demand (8 × 11)	312000	NIL	106000	90000

ii. Machine Hours Allocation

Product	150000 Hours		300000 Hours		450000 Hours		600000 Hours	
	Hours	Units	Hours	Units	Hours	Units	Hours	Units
D	90000	30000	90000	30000	90000	30000	90000	30000
A	60000	10000	210000	35000	312000	52000	312000	52000
C					48000	6000	198000	24750
Total	150000		300000		450000		600000	

iii. Profitability at Different Levels of Operations

Product	150000 Hours	300000 Hours	450000 Hours	600000 Hours
I	<b>Contribution from Own Production</b>			
D	30000×18 =540000	30000×18 =540000	30000×18 =540000	30000×18 =540000
Product	150000 Hours	300000 Hours	450000 Hours	600000 Hours
A	10000×18 =180000	35000×18 =630000	52000 × 18 = 936000	52000×18 = 936000
C			6000×20 = 120000	24750×20 = 495000
II	<b>Contribution from Subcontracted Sale</b>			
A	42000×16 =672000	17000×16 =272000		
B	48500×30 =1455000	48500×30 =1455000	48500×30 =1455000	48500×30 =1455000

<b>C</b>	26500×18 =477000	26500×18 =477000	20500×18 =369000	1750×18 =31500
<b>Total Contribution</b>	3324000	3374000	3420000	3457500
<b>Fixed Cost</b>	1000000	1050000	1100000	1150000
<b>Profit</b>	2324000	2324000	2320000	2307500

Decision: Operations at 1.50 Lakh and 3.00 lakh hours are equally profitable. Since the Company is already having 4.98 lakh hours, it would be advisable to operate at 3.00 lakh hours, to avoid market dependence to cater the demand for own products.

**Working Note 1**

Per Unit Contribution for Own Production

Product A= 162-64-48-32 =18

Product C= 173-45-64-44 =20

Product D= 118-56-24-20=18

**Working Note 2**

Per Unit Contribution for Sub Contracted Sale

Product A= 162-146 =16

Product B= 156-126 =30

Product C= 173-155 =18



**ILLUSTRATION 2:**

Leo Toys are the leading manufacturer and exporters of toys. They have been approached by a US company to supply a special toy. The order will be for 3000 pieces per month for a period of 3 years. Sale price will be ` .200 per unit. Associated costs are:

- Materials: ` .60/unit
- Labour: ` .25/unit
- Variable Overheads: ` .20/unit
- Primary Packing: ` .15/unit
- Secondary packing will be done in special boxes of 50 pieces each @ ` .400 per box.
- A special machine is to be imported for the purpose at the initial cost ` .24 lakhs and duty @12% thereon. The expected life of machine is 3 years.
- Annual fixed overheads are estimated to be ` .4.00 lakhs with an annual increase of 6%.

You are required to prepare

- i. Monthly and yearly profitability statement for first 2 years
- ii. Compute monthly break even units for year 1

### Solution:

#### i. Statement of Profitability for 2 Years ( ` Lakhs)

Particulars	Year 1		Year 2	
	Monthly	Annual	Monthly	Annual
A. Sale Revenue	6.00	72.00	6.00	72.00
B. Costs				
i. Material Cost	1.80	21.60	1.80	21.60
ii. Labour Cost	0.75	9.00	0.75	9.00
iii. Variable Cost	0.60	7.20	0.60	7.20
iv. Primary Packing	0.45	5.40	0.45	5.40
v. Secondary Packing	0.24	2.88	0.24	2.88
vi. Fixed Overheads	1.08	12.96	1.10	13.20
vii. Total Cost (i...vi)	4.92	59.04	4.94	59.28
Profit (A - B)	1.08	12.96	1.06	12.72

#### i. Computation of BEP

Fixed Cost for the month = `108000

Contribution per Unit = `80

BEP Sale quantity = Fixed Cost / Contribution per unit = 108000/80 = 1350 unit

Secondary packing is to be considered for 1350/50 = 27 boxes

Additional Semi fixed cost = 27 × 400 = 10800

So revised BEP will be (108000+10800)/80 = 1485 units

For 1485 units we need 30 boxes, so BEP will be either 1500 units or 30 boxes.

#### Working Note 1

##### Computation of Fixed Cost: Year 1

Annual Fixed Overheads + Depreciation for new machine

= `4.00 Lakhs+ (24 lakhs + Duty @12%)/3

= 4.00 + 8.96 = 12.96 Lakhs

Monthly Fixed Overheads =  $12.96/12 = 1.08$  Lakhs

**Computation of Fixed Cost: Year 2**

Annual Fixed Overheads + 6% annual increment + Depreciation for new machine

= **4.00 Lakhs + 6% of 4.00 Lakhs + 8.96 = 13.20 Lakhs**

Monthly Fixed Overheads =  $13.20/12 = 1.10$  Lakhs

**ILLUSTRATION 3**

Geo life ltd is a home appliances manufacturer. The company is using JIT and there by carrying no inventory. Manufacturing is done in the small batches of 100 units each. Current batch size can be altered with significant cost implications. There is no batch size for sale. Following table shows the product wise details of 4 existing products:

Particulars	Product 'A'	Product 'B'	Product 'C'	Product 'D'	Total
Sale Quantity (Units)	2,00,000	2,60,000	1,60,000	3,00,000	9,20,000
Revenue ( ` . Lakhs)	26.00	45.20	42.40	32.00	145.60
Material Cost ( ` . Lakhs)	6.00	18.20	18.80	10.00	53.00
Particulars	Product 'A'	Product 'B'	Product 'C'	Product 'D'	Total
Labour Cost ( ` . Lakhs)	8.00	20.80	12.80	12.00	53.60
Overheads ( ` . Lakhs)	8.00	7.80	3.20	12.00	31.00
Profit/(Loss) ( ` . Lakhs)	4.00	(1.60)	7.60	(2.00)	8.00
Machine Hours (Numbers)	4.00	3.90	1.60	6.00	15.50
Labour Hours (Numbers)	1.00	2.60	1.60	1.50	6.70

Since the company is concerned about the loss incurrence of two products. It has approached a Management Accountant to clear picture on its products and cost. He has submitted the following findings:

- The overhead absorption rate of ` .2 per machine hour has been used to allocate overheads into the above product costs.
- Further analysis of overheads reveal that certain costs are related to number of machine hours utilized and batches produced. Some overheads are product specific that can be avoided if the product is discontinued. Other general fixed overheads cannot be curtailed. Summary of Overheads in ` . Lakhs is given below:
  - Overheads related to machine hours : ` .6.20
  - Batch Related overheads : ` .4.60



**ILLUSTRATION 4:**

A company manufacturing agricultural machinery is preparing its budget for year 2025-26. An initial review shows that it will not be possible to manufacture all requirements for its 4 products 'A', 'B', 'C' & 'D' due to restricted availability of normal pressing capacity of 20000 hours.

The company can choose between the alternative courses of action given below to obtain the products in excess of available production capacity

- i. to buy entirely from outside supplier
- ii. to buy partially from outside supplier and make partially in second shift.

Standard cost in ₹. per unit is estimated as given below:

Cost Heads	Product 'A'	Product 'B'	Product 'C'	Product 'D'
Direct Material	18.50	13.00	12.50	22.00
Cost Heads	Product 'A'	Product 'B'	Product 'C'	Product 'D'
Direct Wages	5.00	4.00	11.00	20.00
Direct Expenses	5.00	10.00	5.00	30.00
Fixed Overheads	2.50	2.00	5.50	10.00
Total Production Cost	31.00	29.00	34.00	82.00
Requirement (in units)	2000	3500	1500	2800

Direct expenses relate to the use of metal press that costs ₹.5 per machine hour.

Fixed overheads are absorbed as a % of direct wages

Quotations obtained from outside suppliers are ₹.30, ₹.29.50, ₹.26 and ₹.84 per unit for 'A', 'B', 'C' and 'D' respectively.

Second shift would increase wages by 25% and fixed overheads by ₹.250 for every 1000 hours or part thereof.

You are required to work out

- a. the quantities to be produced in available 20000 machine hours.
- b. Work out the viability of 2nd shift operations.
- c. Work out the impact on profit as a result of decision at a & b above.

**Solution:**

**a. Comparative Statement**

Sr	Particulars	Product 'A'	Product 'B'	Product 'C'	Product 'D'
1	Machine Hours per Unit (Direct Expenses/5)	5/5=1	10/5 = 2	5/5 = 1	30/5 =6
2	Market Rate ( ₹. per unit)	30.00	29.50	26.00	84.00
3	Inhouse Production Cost ( ₹. per unit)	31.00	29.00	34.00	82.00

4	Cost Difference (₹. per unit) (2-3)	(1.00)	0.50	(8.00)	2.00
5	Difference per Machine Hour (4/1)	(1.00)	0.25	(8.00)	0.33

Since 'A' and 'C' are available at prices lower than own production cost, so these two items should be procured from outside.

Product 'D' is giving higher per hour cost saving, so complete market demand should be catered by using inhouse facility. Demand for product 'D' is 2800 units and per unit 6 hours are required. So, hours utilized for product of 'D' =  $2800 \times 6 = 16800$ .

Since only 20000 machine hours are available, remaining 3200 hours (20000- 16800) can be utilized for producing product 'B'.

Maximum number of units of 'B' to be produced inhouse =  $3200/2 = 1600$  units

Since total demand of 'B' is 3500 units, 1600 can be produced inhouse and remaining 1900 can be either procured from market or produced in second shift.

**b. Viability of second shift operations:**

Sr	Particulars	Product 'A'	Product 'B'	Product 'C'
1	Variable Cost (₹. per unit)	28.50	27.00	28.50
2	25% Increase in Wages (₹. per unit) (1 × 25%)	1.25	1.00	2.75
3	Total Variable Cost (₹. per unit) (1+2)	29.75	28.00	31.25
4	Additional Fixed Cost (₹. per unit) (Working Note 1)	0.25	0.526	0.33
5	Total Production Cost (₹. per unit) (3 +4)	30.00	28.526	31.58
6	Procurement Price (₹. per unit)	30.00	29.50	26.00
7	Cost Difference (₹. per unit) (5 – 6)	0	0.974	(5.58)
8	Number of units to be manufactured (Working Note 2)	200	1900	0
9	Savings for inhouse production	0	1850.60	0

**Overall savings**

1. Product A & C to be procured from outside Nil
2. Product 'B' inhouse production
  - Shift 1 -  $1600 \times 0.50$  800
  - Shift 2-  $1900 \times 0.974$  1850
3. Product 'D' Shift 1:  $2800 \times 2$  5600
4. Additional Saving in Fixed overheads if

200 units of 'A' are produced inhouse $200 \times 0.25$	50
(Working Note 2)	
Total Savings	8300

**Conclusion:** A total saving of ₹.8300 can be made by inhouse production of 2800 units of 'D' in shift 1, 1600 units of B in shift 1 & 1900 units in shift 2, 200 units of 'A' in shift 2. Remaining units of A & C can be outsourced.

#### Working Note 1:

Additional Fixed Cost = ₹.250 per 1000 hours or fraction thereof worked =  $250/1000 = 0.25$  per hour.

**For Product A** =  $250/1000 \times 1 = 0.25/\text{unit}$

**For Product B** = Hours required for 1900 Units =  $2 \times 1900 = 3800$ ,

So additional overheads cost will be =  $250 \times 4 = ₹.1000$ ,

Cost per unit will be  $1000/1900 = 0.526$

**For Product C** = Hours required for 1500 Units =  $1 \times 1500 = 1500$ ,

So additional overheads cost will be =  $250 \times 2 = ₹.500$ ,

Cost per unit will be  $500/1500 = 0.33$

#### Working Note 2:

Since it is cost effective to produce Product B inhouse, we need to incur fixed overheads for 4000 hours. But for making of Product B hours utilized are only 3800 and 200 hours remain unutilised.

Since the saving in making of product A is zero, it is advisable to utilize additional 200 hours to produce Product A.

Saving in making of 200 units of Product A will be  $200 \times 0.25 = ₹. 50$

#### ILLUSTRATION 5

**Electro Life Ltd. is a leading Home Appliances manufacturer. The company uses just-in-time manufacturing process, thereby having no inventory. Manufacturing is done in batch size of 100 units which cannot be altered without significant cost implications. Although the products are manufactured in batches of 100 units, they are sold as single units at the market price. Due to fierce competition in the market, the company is forced to follow market price**

of each product. The following table provides the financial results of its four unique products:

	Alpha	Beta	Gamma	Theta	
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	<b>Total</b>
	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)
Revenue	26,00,000	45,20,000	42,40,000	32,00,000	145,60,000
Less: Material Cost	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Less: Labour Cost	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Less: Overheads	8,00,000	7,80,000	3,20,000	12,00,000	31,00,000
Profit / (Loss)	4,00,000	(1,60,000)	7,60,000	(2,00,000)	8,00,000

Since, company is concerned about loss in manufacturing and selling of two products so, it has approached you to clear picture on its products and costs. You have conducted a detailed investigation whose findings are below:

The overhead absorption rate of Rs. 2 per machine hour has been used to allocate overheads into the above product costs. Further analysis of the overhead cost shows that some of it is caused by the number of machine hours used, some is caused by the number of batches produced and some are product specific fixed overheads that would be avoided if the product were discontinued. Other general fixed overhead costs would be avoided only by the closure of the factory. Numeric details are summarized below:

	Rs.	Rs.
Machine hour related...	6,20,000	
Batch related	4,60,000	
Product specific fixed overhead:		
Alpha...	10,00,000	
Beta	1,00,000	
Gamma...	2,00,000	
Theta.....	<u>1,00,000</u>	14,00,000
		0
General fixed overheads...		<u>6,20,000</u>
		31,00,000
		0

The other information is as follows:-

	Alpha	Beta	Gamma	Theta	Total
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Machine Hours	4,00,000	3,90,000	1,60,000	6,00,000	15,50,000
Labour Hours	1,00,000	2,60,000	1,60,000	1,50,000	6,70,000

Required

- (i) Prepare a profitability statement that is more useful for decision making than the profit statement prepared by Electro Life Ltd.
- (ii) Calculate the break-even volume in batches and also in approximate units for Product 'Alpha'.

**Solution**

Statement Showing "Profitability of Electro Life Ltd"

	Products (Amount in Rs.)				
	Alpha	Beta	Gamma	Theta	Total
Sales	26,00,000	45,20,000	42,40,000	32,00,000	1,45,60,000
Direct Materials	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Direct Wages	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Overheads (W.N.2):					
Machine Related	1,60,000	1,56,000	64,000	2,40,000	6,20,000
Batch Related	1,00,000	1,30,000	80,000	1,50,000	4,60,000
Contribution	9,40,000	3,34,000	9,36,000	6,10,000	28,20,000
Product Specific Fixed Overheads	10,00,000	1,00,000	2,00,000	1,00,000	14,00,000
Gross Profit	(60,000)	2,34,000	7,36,000	5,10,000	14,20,000
General Fixed Overheads					6,20,000
Profit					8,00,000

**(ii) Break-even Point**

$$\text{Total Sale Value of Product 'Alpha'} = \text{Rs. } 26,00,000$$

$$\begin{aligned} \text{Total Contribution of Product 'Alpha'} &= \text{Rs. } 9,40,000 \\ \text{Specific Fixed Overheads (Product Alpha)} &= \text{Rs. } 10,00,000 \end{aligned}$$

$$\begin{aligned} \text{Break-even sales (Rs.)} &= \frac{\text{Specific FC}}{\text{Total Contribution}} \times \text{Total Sales Value} \\ &= \frac{10,00,000}{9,40,000} \times \text{Rs. } 26,00,000 \\ &= \text{Rs. } 27,65,957.45 \\ \text{Break-even sales (Units)} &= \frac{\text{Rs. } 27,65,957.45}{\text{Rs. } 13} \\ &= 2,12,766 \text{ units} \end{aligned}$$

However, production must be done in batches of 100 units. Therefore, **2,128 batches** are required for break even. Due to the production in batches, 34 units (2,128 batches × 100 units – 2,12,766 units) would be produced extra. These 34 units would add extra cost Rs.282.20 (34 units × Rs.8.3\*). Accordingly, break-even units as calculated above will increase by 22 units

$$\frac{\text{Rs. } 282.20}{\text{Rs. } 13} = \text{Rs. } 22$$

$$(*) \left( \frac{600000 + 800000 + 160000 + 100000}{200000 \text{ units}} \right)$$

Break-even units of product 'Alpha' is 2,12,788 units (2,12,766 units + 22 units)

**Workings W.N.-1**

Overhead's Related Factors	Overhead Cost (Rs.) [a]	Total No. of Units of Factors [b]	Overhead Rate (Rs.) [a] / [b]
Machining Hours	6,20,000	15,50,000 hrs.	0.40
Batch Production	4,60,000	9,200 batches	50.00

**W.N.-2**

**Statement Showing - Overhead Costs Related to Product**

Particulars	Alpha	Beta	Gamma	Theta
Machining hrs. related	Rs. 1,60,000	Rs. 1,56,000	Rs. 64,000	Rs. 2,40,000

overheads	(4,00,000 hrs × Rs.0.40)	(3,90,000 hrs × Rs.0.40)	(1,60,000 hrs × Rs.0.40)	(6,00,000 hrs × Rs.0.40)
Batch related overheads	Rs.1,00,000 (2,000 batches × Rs.50)	Rs.1,30,000 (2,600 batches × Rs.50)	Rs.80,000 (1,600 batches × Rs.50)	Rs.1,50,000 (3,000 batches × Rs.50)

**ILLUSTRATION 6**

You have been approached by a friend who is seeking your advice as to whether he should give up his job as an engineer, with a current salary of Rs.14,800 per month and go into business on his own assembling and selling a component which he has invented. He can procure the parts required to manufacture the component from a supplier.

It is very difficult to forecast the sales potential of the component, but after some research, your friend has estimated the sales as follows-

- (i) Between 600 to 900 components per month at a selling price of Rs.250 per component.
- (ii) Between 901 to 1,250 components per month at a selling price of Rs.220 per component for the entire lot.

The costs of the parts required would be Rs.140 for each completed component. However if more than 1,000 components are produced in each month, a discount of 5% would be received from the supplier of parts on all purchases.

Assembly costs would be Rs.60,000 per month up to 750 components. Beyond this level of activity assembly costs would increase to Rs.70,000 per month.

Your friend has already spent Rs.30,000 on development, which he would write – off over the first five years of the venture.

Required

- (i) Calculate for each of the possible sales levels at which your friend could expect to benefit by going into the venture on his own.
- (ii) Calculate the 'Break – Even Point' of the venture for each of the selling price.
- (iii) Advise your friend as to the viability of the venture

**Solution**

The salary of Rs.14,800 per month is a benefit foregone by going into business.

It should therefore be considered as a minimum profit which must be earned p.m. from the new venture in order to be not worse – off than before.

Sum of Rs.30,000 spent on the development work of the new venture cannot be recovered irrespective of the decision and thus it should be ignored.

At a Selling Price of  
140)

Rs.250 Contribution *per unit* (Rs.250 –  
Rs.110

Minimum Sales (units) to recover *assembly costs* of Rs.60,000 p.m. and earn a *profit* of Rs.14,800 p.m. (Break – even Sales Level)

$$\frac{Rs. 60000 + Rs 14800}{Rs. 110} = 680 \text{ Units}$$

Note that at 600 units and up to 679 units i.e. units below the break-even level the loss would be Rs.110/- per unit. From 680 units up to 750 units i.e. on additional 70 units the total profit would be Rs.7,700 (70 units × Rs.110).

Minimum Sales (units) to recover *assembly cost* of Rs.70,000 p.m. and earn a *profit* of Rs.14,800 p.m. (Break – even Sales Level)

$$\frac{Rs. 70000 + Rs 14800}{Rs. 110} = 770.909 \text{ Units}$$

If the sales units are more than 770.909 units and up to 900 units, profit would be made. The total amount of profit comes to Rs.14,200 [(900 units – 770.909 units) × Rs.110]

It is not worthwhile to proceed if the demand of components is less than 680 units or between 750 to 770.909 units.

At a Selling Price of

Rs.220

Minimum Sales (units) to recover *assembly cost* of Rs.70,000 p.m. and earn a *profit* of Rs.14,800 p.m. (Break even – Sales Level)

$$\frac{Rs. 70000 + Rs 14800}{Rs. 220 - Rs 140} = 1060 \text{ Units}$$

Minimum Sales (units) to recover *assembly cost* of Rs.70,000 p.m. and earn a profit of Rs.14,800 p.m.; after availing a discount of 5% on the purchases of all parts.

$$\frac{Rs. 70000 + Rs 14800}{Rs. 220 - (Rs 140 - \frac{5}{100} \times Rs 140)} = 974.712 \text{ Units}$$

Or = 975 units

#### Conclusion

It is not worthwhile to sell between 900 and 1,000 units when no discount is available. Also, it is worthwhile selling at Rs.220 if sales units are in excess of 1,000 units and a discount of 5% is available on the purchase of all components–

parts.

Profit on the Sale (1,250 units) Rs.23,950 (1,250 units × Rs.87 – Rs.84,800)

**Advice** on the viability of the venture

At a selling price of Rs.250 he will not be at a loss if the demand of the component exceeds 680 units to 750 units and 770.909 units to 900 units.

At a selling price of Rs.220, it is not worthwhile to sell if the demand is less than 1,000 components without availing a discount of 5%.

### ILLUSTRATION 7

XY Ltd. makes two products X and Y, whose respective fixed costs are F1 and F2. You are given that the unit contribution of Y is one-fifth less than the unit contribution of X, that the total of F1 and F2 is Rs. 1,50,000, that the BEP of X is 1,800 units (for BEP of X F2 is not considered) and that 3,000 units is the indifference point between X and Y. (i.e. X and Y make equal profits at 3,000 unit volume, considering their respective fixed costs). There is no inventory buildup as whatever is produced is sold.

Required

Find out the values F1 and F2 and units contributions of X and Y.

### Solution

Let  $C_x$  be the Contribution per unit of Product X.

Therefore Contribution per unit of Product Y =  $C_y = \frac{4}{5}C_x = 0.8C_x$  Given F1

+ F2 = 1,50,000,

F1 = 1,800 $C_x$  (Break even Volume × Contribution per unit)

Therefore F2 =

1,50,000 – 1,800 $C_x$ . 3,000 $C_x$  – F1 = 3,000 × 0.8 $C_x$  – F2

or

3,000 $C_x$  – F1 = 2,400  $C_x$  – F2

(Indifference Point) i.e.,

3,000 $C_x$  – 1,800 $C_x$  = 2,400 $C_x$  –

1,50,000 + 1,800 $C_x$  i.e., 3,000 $C_x$

= 1,50,000,

Therefore  $C_x$  = Rs. 50/-

(1,50,000 / 3,000) Therefore,

Contribution per unit of X = Rs. 50

Fixed Cost of X = F1 = Rs. 90,000 (1,800 × 50)

Therefore, Contribution per unit of Y is Rs. 50 × 0.8

= Rs. 40 and Fixed Cost of Y = F2 = Rs. 60,000

(1,50,000 – 90,000)

The Value of F1 = Rs. 90,000, F2 = Rs. 60,000 and X = Rs. 50 and Y = Rs. 40

**ILLUSTRATION 8:**

A company manufactures 3 lakh units of product X & 2 lakh units of Product Y per annum. The following figures are extracted from its cost records

Sale Value	₹. 38.00
Direct Material	₹.7.00
Direct Labour	9.50
Factory overheads	9.50
Admin, S &D Overheads	6.00

50% of all overheads are fixed.

The selling price of X is ₹.6/u & Y ₹.10/unit. Direct Material & Labour ratio for X is 1:1.5 & for Y 1:1.25. For both the product selling price is 400% of direct labour. The factory overheads are charged in the ratio of direct labour. Admin, S&D are recovered at a flat rate of Re1/ unit of X & 1.50/unit of Y. 50% Overheads are variable.

Due to fall in demand of the above products, the company has a plan to diversify and make product Z using 40% of the present capacity. It has been estimated that for Z direct material and direct labour will be ₹.1.25 and 1.50 respectively. Other variable costs to be same as that of X and selling price of Z will be ₹. 7 per unit and production will be of 3 lakh units.

Assuming that balance 60% capacity is used for manufacturing of X & Y. Calculate,

- present costs and profits
- costs and profits after diversification is implemented
- your recommendation for or against diversification.

**Solution:**

**Statement of Contribution (₹. per unit)**

Sr	Particulars	Product X	Product Y	Product Z
1	Selling Price	6.00	10.00	7.00
2	Direct Labour 25%×(1) for X & Y	1.50	2.50	1.50

3	Direct Material	1.00	2.00	1.25
4	Factory Overheads: Variable 50%	0.75	1.25	0.75
5	Admin & Selling Overheads: Variable 50%	0.50	0.75	0.50
6	Total Variable Cost	3.75	6.50	4.00
7	Contribution	2.25	3.50	3.00

a. Statement of Present Costs & Profits (in ` Lakhs)

Sr	Particulars	Product X	Product Y	Total
1	Sale Value	18.00	20.00	38.00
2	Direct Material	3.00	4.00	7.00
Sr	Particulars	Product X	Product Y	Total
3	Direct Labour	4.50	5.00	9.50
4	Variable Factory Overheads	2.25	2.50	4.75
5	Variable Admin & Selling Overheads	1.50	1.50	3.00
6	Total Variable Cost (2...5)	11.25	13.00	24.25
7	Contribution (1 - 6)	6.75	7.00	13.75
8	Fixed Factory Overheads			4.75
9	Fixed Admin & Selling Overheads			3.00
10	Profit (7 - 8 - 9)			6.00

a. Statement of Costs & Profits After Diversification (in ` Lakhs)

Sr	Particulars	Product X	Product Y	Product Z	Total
1	Sale Units (60% × existing units for X & Y)	180000	120000	300000	600000
2	Sale Value	10.80	12.00	21.00	43.80
3	Total Variable Cost	6.75	7.80	12.00	26.55
4	Contribution (2 - 3)	4.05	4.20	9.00	17.25
5	Fixed Overheads				7.75
6	Profit (4 - 5)				9.50

b. Recommendations:

It is recommended to diversify, as profit goes up by `3.50 lakhs.

Further, it is advisable that if market permits, the sale of product 'Y' can be increased as it gives maximum contribution and sale of product 'X' can be reduced as it is giving lowest contribution.

**ILLUSTRATION 9:****RELEVANT COST**

A company has 2,000 units of an obsolete item which are carried in inventory at the original purchase price of ₹30,000. If these items are reworked for ₹10,000, they can be sold for ₹18,000. Alternatively, they can be sold as scrap for ₹3,000 in the market.

In a decision model used to analyse the reworking proposal, the opportunity cost should be taken as relevant or not.

Advise the Company.

**Solution:**

Original price ₹30,000 is not relevant. It would be treated as a sunk cost. Further items which are reworked generate income of ₹18,000 is considered as relevant; Cost of rework is ₹10,000 is considered as relevant;

Net inflow ₹8,000 (relevant cash in-flow)

The other alternative relevant cash flow is from sale as scrap = ₹3,000.

As reworked generates more relevant cash flow, we would not opt for sale of scrap. This would lead to loss of cash flow in context of sale of scrap, known as opportunity loss/cost.

Thus we would consider sale of scrap as an opportunity loss/cost

Thus, opportunity cost should be taken as ₹3,000/-

Advise: The Company should opt for rework and sell. This will earn a cash profit of ₹8,000.

**ILLUSTRATION 10:****RELEVANT COST**

The accountant of Zeta Ltd. has prepared the following estimate on the basis of which he has advised that a contract should not be accepted at the price offered. The estimate (₹) was as follows:

Material X in stock at original cost	₹1,50,000
Material Y on order at contract price	₹1,80,000
Material Z to be ordered at current price	₹3,00,000
Skilled Labour	₹5,40,000
Unskilled Labour	₹3,00,000
Supervisory Cost	₹1,00,000
General Overheads	₹1,80,000

Total Cost	₹ 17,50,000
Price offered	₹ 14,00,000
Net Loss (Price offered – Total Cost)	₹ 3,50,000

The following details are available about the cost components listed above

- Material X is an obsolete material. It can be used on another product W, the material for which is available at ₹ 1,35,000 (Material X requires some adaptation to be used which costs ₹ 15,000). It may take some time before W's order is confirmed. Until then storage will cost ₹ 12,000.
- Material Y is ordered for some other product which is no longer required. It now has a residual value of ₹ 1,25,000.
- Skilled labour can work on other contracts which are presently operated by semiskilled labour at a cost of ₹ 4,00,000
- Unskilled labour are specifically employed for this contract.
- Supervisory staff will remain whether or not the contract is accepted. Only two of them can replace other positions where the salary is ₹ 50,000.
- Overheads are charged at 33⅓% of skilled labour. Only ₹ 1,00,000 would be avoidable.

You are required to answer the following questions using relevant cost approach:

- Relevant costs of material X, Y and Z
- Relevant cost of labour-skilled and unskilled
- Relevant cost of Supervisory cost and General overheads
- If the contract is accepted, what would be the resulting financial impact on XYZ's profit?

### Solution:

#### (i) Relevant costs of material X, Y and Z

Material X (Obsolete)

Material X in stock at original cost = ₹ 1,50,000

Reuse Value = ₹ 1,35,000

Adaptation Cost = ₹ 15,000

Storage Cost = ₹ 12,000

Relevant Cost of Material X = ₹ (1,50,000 – 15,000 – 12,000) = ₹ 1,08,000

Material Y (No longer required)

Material Y on order at contract price = ₹ 1,50,000

Residual Value = ₹ 1,25,000 Relevant Cost of Material Y = ₹ 1,25,000

Material Z (To be ordered)

Material Z to be ordered at current price = ₹ 3,00,000

Relevant Cost of Material Z = ₹ 3,00,000

**(ii) Relevant cost of labour-skilled and unskilled**

Skilled Labour (Can replace unskilled labour) Cost of skilled labour = ₹ 5,40,000

Replacement Cost (in place of unskilled labour) = ₹ 4,00,000

Relevant Cost of Skilled Labour = ₹ 4,00,000 [Lower of the above]

Unskilled Labour (Specifically Employed)

Cost of unskilled labour = ₹ 3,00,000

Relevant Cost of Unskilled Labour = ₹ 3,00,000

**(iii) Relevant cost of Supervisory cost and General Overheads**

Supervisory cost = ₹ 1,00,000

Replacement Value for others = ₹ 50,000

Relevant Supervisory Cost = ₹ 50,000

Avoidable General Overheads = ₹ 1,00,000

Relevant Costs of General Overheads = ₹ 1,00,000

**(iv) Computation of Financial Impact**

Serial	Element	Amount in ₹
A	Price Offered	14,00,000
B	Relevant Costs	
	1. Material X	1,08,000
	2. Material Y	1,25,000
	3. Material Z	3,00,000
	4. Skilled Labour	4,00,000
	5. Unskilled Labour	3,00,000
	6. Supervisory Cost	50,000
	7. General Overheads	1,00,000
	8. Total (1 to 7)	13,83,000
C	Financial Impact (A - B)	17,000

**Observation:** Actually, there is no loss in accepting the order. However, if the contract is accepted,

XYZ's profit will be increased by `17,000.

### ILLUSTRATION 11

**A company had nearly completed a job relating to construction of a specialised equipment, when it discovered that the customer had gone out of business. At this stage, the position of the job was as under:**

(Rs.)	
Original cost estimate	1,75,200
Costs incurred so far	1,48,500
Costs to be incurred	29,700
Progress payment received from original customer	1,00,000

After searches, a new customer for the equipment has been found. He is interested to take the equipment, if certain modifications are carried out. The new customer wanted the equipment in its original condition, but without its control device and with certain other modifications. The costs of these additions and modifications are estimated as under:

Direct Materials (at cost)	Rs. 1,050
Direct Wages Dept.: A	15 men days
Dept.: B	25 men days
Variable Overheads	25% of Direct Wages in each Dept.
Delivery Costs	Rs. 1,350

Fixed overheads will be absorbed at 50% of direct wages in each department. The following additional information is available:

- (1) The direct materials required for the modification are in stock and if not used for modification of this order, they will be used in another job in place of materials that will now cost Rs. 2,250.
- (2) Department A is working normally and hence any engagement of labour will have to be paid at the direct wage rate of Rs. 120 per man day.
- (3) Department B is extremely busy. Its direct wages rate is Rs. 100 per man day and it is currently yielding a contribution of Rs. 3.20 per rupee of direct wages.

- (4) Supervisory overtime payable for the modification is Rs. 1,050
- (5) The cost of the control device that the new customer does not require is Rs. 13,500. If it is taken out, it can be used in another job in place of a different mechanism. The latter mechanism has otherwise to be bought for Rs. 10,500. The dismantling and removal of the control mechanism will take one man day in department A.
- (6) If the conversion is not carried out, some of the materials in the original equipment can be used in another contract in place of materials that would have cost Rs. 12,000. It would have taken 2 men days of work in department A to

make them suitable for this purpose. The remaining materials will realize Rs. 11,400 as scrap. The drawings, which are included as part for the job can be sold for Rs. 1,500

**Required**

Calculate the minimum price, which the company can afford to quote for the new customer as stated above

**Solution**

Statement of Minimum Price Which the Company Can Afford to Quote for the New Customer (Based on Relevant Cost)

	(Rs.)	(Rs.)
Cost to be incurred <i>to bring the equipment in its original condition</i>		29,700
Direct Material (Replacement Value)		2,250
Direct Wages		
Dept. A: (15 men days × Rs.120)	1,800	
Dept. B: (25 men days × Rs.100)	2,500	
Opportunity Cost of Contribution Lost by Dept. B (Rs.2,500 × Rs.3.20)	8,000	12,300
Variable Overheads [25% × (Rs.1,800 + Rs.2,500)]		1,075
Delivery Costs		1,350
Supervisory Overtime <i>payable for modification</i>		1,050
Saving Due to Alternative Use of Control Device		
Bought Out Price	10,500	
<i>Less: Dismantling &amp; Removal Cost (1 man day × Rs.120)</i>	120	
<i>Less: Variable Cost (25% × Rs.120)</i>	30	(10,350)
Net Loss on Material Cost Savings (W.N.)		11,700

Opportunity Cost of Remaining Materials <i>which can be sold as scrap</i>	11,400
Opportunity Cost of Sale of Drawings	1,500
Total Minimum Price which may be quoted	61,975

**Working Note-**

	(Rs.)
Loss on Material Cost Saving of Equipment	12,000
<i>Less: Conversion Cost (2 man days × Rs.120)</i>	240
<i>Less: Variable Overheads (25% × Rs.240)</i>	60
Net Loss on Material Cost Saving of Equipment	11,700

**ILLUSTRATION 12**

**B Ltd. is a company that has, in stock, materials of type XY that cost Rs. 75,000, but that are now obsolete and have a scrap value of only Rs. 21,000. Other than selling the material for scrap, there are only two alternative uses for them.**

**Alternative-1**

Converting the obsolete materials into a specialized product, which would require the following additional work and materials:

Material A      600 units    Material B      1,000 units    Direct Labour

5,000  
hours  
unskilled

5,000  
hours semi  
skilled

5,000  
hours  
highly  
skilled

Extra selling and delivery expenses	Rs. 27,000 Extra
advertising	Rs. 18,000

The conversion would produce 900 units of saleable product and these could be sold for Rs. 300 per unit.

Material A is already in stock and is widely used within the firm. Although present stocks together with orders already planned, will be sufficient to facilitate normal activity and extra material used by adopting this alternative will necessitate such materials being replaced immediately. Material B is also in stock, stock, but is unlikely that any additional supplies can be obtained for some considerable time, because of an industrial dispute. At the present time material B is normally used in the production of product Z, which sells at Rs. 390 per unit and incurs total variable cost (excluding Material B) of Rs. 210 per unit. Each unit of product Z uses four units of Material B. The details of Materials A and B are as follows

	Material A (Rs. )	Material B (Rs. )
Acquisition cost at the time of purchase	100 per unit	Rs. 10 per unit
Net realizable value	85 per unit	Rs. 18 per unit
Replacement cost	90 per unit	-

Alternative-2

Adopting the obsolete materials for use as a substitute for a sub-assembly that is regularly used within the firm. Details of the extra work and materials required are as follows:

- Material C      1,000 units
- Direct Labour:
- 4,000 hours unskilled
- 1,000 hours semi-skilled 4,000 hours highly skilled

1,200 units of the sub-assembly are regularly used per quarter at a cost of Rs. 900 per unit. The adaptation of material XY would reduce the quantity of the sub-assembly purchased from outside the firm to 900 units for the next quarter only. However, since the volume purchased would be reduced, some discount would be lost and the price of those purchased from outside would increase to Rs. 1,050 per unit for that quarter.

Material C is not available externally thought 1,000 units required would be available from stocks, it would be produced as extra production. The standard cost per unit of Material C would be as follows:

	(Rs.)
Direct labour, 6 hour unskilled labour	18
Raw materials	13
Variable overhead: 6 hours at Rs. 1	06
Fixed overhead: 6 hours at Rs. 3	<u>18</u>
	55

The wage rate and overhead recover rates for B Ltd. are:

Variable overhead Rs. 1 per direct labour hour  
 Fixed overhead Rs. 2 per direct labour hour  
 Unskilled labour Rs. 3 per direct labour hour  
 Semi-skilled labour Rs. 4 per direct labour hour  
 Highly skilled labour Rs. 5 per direct labour hour

The unskilled labour is employed on a casual basis and sufficient labour can be acquired to exactly meet the production requirements. Semi-skilled labour is part of the permanent labour force, but the company has temporary excess supply of this type of labour at the present time. Highly skilled labour is in short supply and cannot be increased significantly in the short-term, this labour is presently engaged in meeting the demand for product L, which requires 4 hours of highly skilled labour. The contribution from the sale of one unit of product L is Rs. 24.

**Required**

Present cost information advising whether the stocks of Material XY should be sold, converted into a specialized product (Alternative 1) or adopted for use as a substitute for a sub-assembly (Alternative 2)

**Solution**

**Alternative 1 – Conversion Vs Immediate Sale**

(Rs.)	
Sales Revenue (900 units at Rs. 300 per unit) [Refer to W.N.-1]	2,70,000
<i>Less: Relevant Costs</i>	
Material XY Opportunity Cost [Refer to W.N.-2]	21,000
Material A (Rs.90 per unit) [Refer to W.N.-3]	54,000

Material B (1,000 units @ Rs. 45 per unit) [Refer to W.N.-4]	45,000
Direct Labour, Un-skilled (5,000 hours @ Rs.3 per hour)	15,000
Direct Labour, Semi-skilled	Nil
Direct Labour, Highly-skilled (5,000 hours @ Rs.11) [Refer to W.N.-5]	55,000
Variable Overheads (15,000 hours @ Rs.1) [Refer to W.N.-6]	15,000
Extra Selling and Delivery Expenses	27,000
Extra Advertising	18,000
Fixed Advertising (Remain Same, Not Relevant)	---
Net Relevant Savings	20,000

### Alternative 2 – (Adaptation Vs Immediate Sale)

(Rs.)	
Normal Spending (1,200 units @ Rs. 900 per unit)	10,80,000
Less: Revised Spending (900 units @ Rs. 1,050 per unit) [Refer to W.N.-7]	9,45,000
Saving on Purchase of Sub-Assembly	1,35,000
Less: Relevant Costs	
Material XY Opportunity Cost [Refer to W.N.-2]	21,000
Material C (1,000 units @ Rs.37) [Refer to W.N.-8]	37,000
Direct Labour, Unskilled (4,000 hours @ Rs. 3 per hour)	12,000
Direct Labour, Semi-skilled	Nil
Direct Labour, Highly-skilled (4,000 hours @ Rs.11 per hour) [Refer to W.N.- 5, 6]	44,000
Variable Overheads (9,000 hours @ Rs.1 per hour) [Refer to W.N.-6]	9,000
Fixed Overheads	---
Net Relevant Savings	12,000

### Evaluation

The evaluation of two alternatives clearly shows that Alternative 1, yields higher net revenue of Rs.8,000 (Rs.20,000 – Rs.12,000). Hence because of higher net revenue of Alternative 1, it is advisable to convert material XY into a specialized product.

## Working Notes

1. There will be a additional sales revenue of Rs.2,70,000 if Alternative 1 is chosen.
2. Acceptance of either Alternative 1 or 2 will mean a loss of revenue of Rs.21,000 from the sale of the obsolete material XY and hence it is an opportunity cost for both of the alternatives. The original purchase cost of Rs.75,000 is a sunk cost and thus not relevant.
3. Acceptance of Alternative 1 will mean that material A must be replaced at an additional cost of Rs.54,000.
4. Acceptance of Alternative 1 will mean diversion of material B from the production of product Z. The excess of relevant revenues over relevant cost for product Z is Rs.180 (Rs.390 – Rs.210) and each unit of product Z uses four units of material B. The lost contribution (excluding the cost of material B which is incurred for both alternatives) will therefore be Rs.45 for each unit of material B that is used for converting the obsolete materials into a specialised product.
5. Unskilled labour can be matched exactly to the company's production requirements. Hence acceptance of either alternative 1 or 2 will cause the company to incur additional unskilled labour cost at Rs.3 for each hours. It is assumed that the semi-skilled labour will be able to meet the extra requirements of either alternatives at no extra cost to the company. Hence, cost of semi-skilled labour will not be relevant. Skilled labour is in short supply and can only be obtained by reducing the production of product L, resulting in a loss of contribution of Rs.24 (given) or Rs.6 per hour of skilled labour. Hence the relevant labour cost will be Rs.6 (contribution lost per hour) + Rs.5 (hourly rate of skilled labour) i.e. Rs.11 per hour
6. It is assumed that for each direct labour of input, variable overhead will increase by Rs.1 hence for each alternative using additional direct labour hours, variable overheads will increase.
7. The cost of purchasing the sub-assembly will be reduced by Rs.1,35,000 if the second alternative is chosen and so these savings are relevant to the decision.
8. The company will incur additional variable costs of Rs.37 for each unit of material C that is manufactured, so the fixed overheads for material C viz. Rs.18/- per unit is not a relevant cost

**ILLUSTRATION 13**

AXE Ltd. manufactures four products A, B, C and D. The following details are available for a production period:

	A	B	C	D
Selling price	100	109	121	124
Material cost	40	42	46	40
Labour cost				
Assembly Dept. @ Rs. 10 per hour	15	20	15	20
Machine Dept. @ Rs. 12 per hour	18	24	36	30
Variable overheads @ Rs. 4 per labour hour in assembly dept.	6	8	6	8
Maximum external demand (units)	40,000	55,000	36,000	30,000

Total fixed cost is dependent on the output level and is tabulated below at different levels of output:

Production units (any combination of one or more of any A, B, C or D)	Total fixed cost (Rs.)
Zero to 1,00,000 units	8,43,000
1,00,001 to 1,50,000 units	12,50,000
1,50,001 to 2,00,000 units	16,00,000

Production facilities can be interchangeably used among the products.

Labour availability in the assembly department is limited to 2,20,000 hours for the production period. A local firm has offered to make any quantity of any of the products on a sub-contract basis at the following rates:

	A	B	C	D
Sub-contract Price (Rs. /unit)	85	95	101	100

Required

- (i) Advise the management on how many units of each product are to be manufactured or subcontracted to fulfill maximum market demand. What would be the corresponding profits?
- (ii) What is the minimum number of units to be produced to achieve break-even point?
- (iii) What would you advise as the best strategy to maximize profits if assembly labour is not a limiting factor and if there is no compulsion to fulfill market demand?

(Only relevant figures need to be discussed. A detailed profitability statement is not required).

## Solution

- (i) Assembly Labour is a Limiting Factor & to fulfill Maximum Market Demand Contribution per unit as well as Contribution per assembly hour

	Demand (Units)			
	40,000	55,000	36,000	30,000
	A	B	C	D
Selling Price (Rs./u)	100	109	121	124
Material Cost (Rs./u)	40	42	46	40
Labour Cost (Rs./u)				
Assembly Dept.	15	20	15	20
Machine Dept.	18	24	36	30
Variable Overheads (Rs./u)	6	8	6	8
Contribution (Rs./u)	21	15	18	26
Assembly Hours <i>per unit</i>	1.5	2	1.5	2
Contribution (Rs./hr.)	14	7.5	12	13
Rank [Contribution (Rs./hr.)]	I	IV	III	II
Sub-Contract Price (Rs./u)	85	95	101	100
Contribution (Rs./u) [Sub-Contract]	15	14	20	24

It is more profitable to **sub-contract C**, since contribution is higher in sub -contracting.

### Allocation of Assembly Hours on the basis of ranking

Produce A as much as possible	=	<b>40,000 units</b>
Hours Required	=	60,000 hrs (40,000 units × 1.5 hrs.)
Balance Hours Available	=	1,60,000 hrs (2,20,000 hrs. – 60,000 hrs.)
Produce the Next Best	=	<b>30,000 units of D</b>
Hours Required	=	60,000 hrs (30,000 units × 2 hrs.)
Balance Hours Available	=	1,00,000 hrs (1,60,000 hrs. – 60,000 hrs.)
Produce the Next Best	=	<b>50,000 units of B</b>

### Profit on the basis of ranking

Product	Particulars	Contribution/unit (Rs.)	Contribution (Rs.)
A	Produce: 40,000 units	21	8,40,000
	Subcontract: NIL units	15	---
B	Produce: 50,000 units	15	7,50,000
	Subcontract: 5,000 units	14	70,000
C	Produce: NIL units	18	---
	Subcontract: 36,000 units	20	7,20,000
D	Produce: 30,000 units	26	7,80,000
	Subcontract: NIL units	24	---
Total Contribution			31,60,000
Less: Fixed Cost			12,50,000
Net Profit			19,10,000

Decision

However AXE Ltd. can save fixed cost of Rs. 4,07,000 (Rs. 12,50,000 – Rs. 8,43,000) if it keeps its production limited to 1,00,000 units. But in this case AXE Ltd. has to subcontract 20,000 units of B to fulfill maximum market demand. Contribution Lost from subcontracting of 20,000 units is amounting to Rs. 20,000 [20,000 units × (Rs. 15 – Rs. 14)]. Hence optimum profit would be Rs. 22,97,000 [Rs. 19,10,000 + Rs. 4,07,000 – Rs. 20,000].

Production Vs Sub Contract (units) and Profit – Best Strategy

Prod	Produced [Units]	Sub-Contract [Units]	Contribution [Production] (Rs.)	Contribution [Sub-Contract] (Rs.)	Total Contribution (Rs.)
A	40,000	---	8,40,000	---	8,40,000
B	30,000	25,000	4,50,000	3,50,000	8,00,000
C	---	36,000	---	7,20,000	7,20,000
D	30,000	---	7,80,000	---	7,80,000
Total Contribution					31,40,000
Less: Fixed Cost					8,43,000
Net Profit					22,97,000

(i) Break Even Point Recovery of Fixed Cost

Particulars	Amount (Rs.)
-------------	--------------

Fixed Cost (at Best Strategy)	8,43,000
Less: Recovered from Product 'D' (Rs.26 × 30,000 units)	7,80,000
Balance	63,000
Less: Recovered from Product 'A'	63,000

Minimum number of units to be produced to achieve

break-even point: Product D = 30,000

units Product A = 3,000

units Accordingly, earliest BEP at 33,000 units

**(ii) Assembly Labour is Not a Limiting Factor & No Requirement to Fulfil Maximum Market Demand**

**Comparison of Contribution per unit (Make Vs Sub-Contracting)**

	Demand (Units)			
	40,000 A	55,000 B	36,000 C	30,000 D
Contribution (Rs./u) [Make]	21	15	18	26
Contribution (Rs./u) [Sub-Contract]	15	14	20	24
Best Strategy	Make	Make	Sub Contracting	Make
Ranking for Production	II	III	---	I

**Decision**

From the above comparison table it can be seen manufacturing of product A, B and D gives higher contribution per unit as compared to sub-contracting. Therefore, AXE Ltd. should manufacture the entire quantity of product A, B and D and Subcontract the production of product C. However AXE Ltd. can save fixed cost of Rs.4,07,000 (Rs.12,50,000 – Rs.8,43,000) by limiting its production level to 1,00,000 units only. In this case AXE Ltd. will make 30,000 units, 40,000 units and 30,000 units of product D, A and B respectively. But in this case AXE Ltd. has to subcontract 25,000 units of B to earn maximum profit.

**Production Vs Sub Contract (units) and Profit – Best Strategy**

Prod.	Produced [Units]	Sub-Contract [Units]	Contribution [Production] (Rs.)	Contribution [Sub-Contract] (Rs.)	Total Contribution (Rs.)

A	40,000	---	8,40,000	---	8,40,000
B	30,000	25,000	4,50,000	3,50,000	8,00,000
C	---	36,000	---	7,20,000	7,20,000
D	30,000	---	7,80,000	---	7,80,000
Total Contribution					31,40,000
<i>Less: Fixed Cost</i>					8,43,000
Net Profit					22,97,000

**ILLUSTRATION 14**

**HTM Ltd., by using 12,00,000 units of a material M produces jointly 2,00,000 units of H and 4,00,000 units of T. The costs and sales details are as under-**

Direct Material M @ Rs. 5 per unit...	60,00,000
Other variable costs	42,00,000
Total fixed costs...	18,00,000
Selling price of H per unit...	25
Selling price of T per unit	20

The company receives an additional order for 40,000 units of T at the rate of Rs. 15 per unit. If this order has been accepted, the existing price of T will not be affected. However, the present price of H should be reduced evenly on the entire sale of H to market the additional units to be produced.

**Required**

Find the minimum average unit price to be charged on H to sustain the increased sales

**Solution**

Product H & T are joint products and produced in the ratio of 1:2 from the same direct material- M.

Production of 40,000 additional units of T results in production of 20,000 units of H.

Statement Showing "Contribution under Existing Situation"

Particulars	Amount (Rs.)	Amount (Rs.)
Sales Value:		
H – 2,00,000 units @ Rs. 25 per unit	50,00,000	
T – 4,00,000 units @ Rs. 20 per unit	80,00,000	1,30,00,000
<i>Less: Material- M (12,00,000 units @ Rs. 5 per unit)</i>		60,00,000
<i>Less: Other Variable Costs</i>		42,00,000

Contribution	28,00,000
--------------	-----------

Let Minimum Average Selling Price *per unit* of H is Rs. X

Statement Showing "Contribution after Acceptance of Additional Order of 'T'"

Particulars	Amount (Rs.)	Amount (Rs.)
Sales Value:		
H – 2,20,000 units @ Rs. X per unit	2,20,000 X	
T – 4,00,000 units @ Rs.20 per unit	80,00,000	
40,000 units @ Rs.15 per unit	6,00,000	
		2,20,000 X + 86,00,000
Less: Material- M (12,00,000 units × 110%) @ Rs.5 per unit		66,00,000
Less: Other Variable Costs (Rs.42,00,000 × 110%)		46,20,000
Contribution		2,20,000 X – 26,20,000

**Minimum Average Selling Price *per unit* of H**

Contribution after additional order of T	=	Contribution under existing production
2,20,000 X – 26,20,000	=	28,00,000
2,20,000 X	=	54,20,000
X	=	Rs.24.64

**Minimum Average Selling Price *per unit* of H is Rs. 24.64**

**ILLUSTRATION 15:**

**TARGET COSTING**

Ashay Ltd. sells its product 'Beta' at `1,000 per unit. Due to competition, its competitors are likely to reduce price by 15%. B wants to respond aggressively by cutting price by 20% and expects that the present volume of 1,50,000 units p.a. will increase to 2,00,000 units. The Company wants to earn a 10% target profit on sales. Calculate per unit target cost for the product.

**Solution:**

Target selling price : `1,000 less 20%	` 800
Less: Target profit margin (10%)	` 80
Target costs per unit	` 720

**ILLUSTRATION 16:****TARGET COSTING**

ABC Limited has a production capacity of 80,000 units and presently sells 20,000 units at ₹100 each. The demand is sensitive to Selling Price and it has been observed that for every reduction of ₹10 in Selling Price, the demand is doubled. Calculate:

- the Target Cost at full capacity, if Profit Margin on Sale is 25%?
- the quantum of Cost Reduction at full capacity with same profit %, if 40% of Cost is variable,
- the maximum investment at full capacity, if desired Rate of Return is 16%,

**Solution:****i. Target Cost at Full Capacity**

Selling Price per unit	₹100	₹90	₹80
Demand(units)	20,000	40,000	80,000= Full Capacity

Target Cost per unit at Full Capacity = Sale Price less Profit Margin = ₹80 less 25% thereon = ₹60 p.u.

**ii. Determination of Target Cost Reduction**

(a) Since Present Price is ₹100 p.u. and Profit is 25% thereon, Present Cost p.u. = 75, of which 40% is variable. So, Fixed Cost is 60% of 75 = 45 p.u. So, Total Fixed Cost =	$45 \times 80,000 = ₹36$ Lakhs
(b) Variable Cost at Full Capacity = (40% of ₹75 p.u.) $\times$ 80,000 units =	₹24 Lakhs
(c) Estimated Cost at Full Capacity = Fixed Cost (constant at all levels) +Variable Cost (a + b)	₹60 Lakhs
(d) Target Cost at Full Capacity = ₹60 p.u. for 80,000 units =	₹48 Lakhs
(e) Cost Reduction Target = Estimated Cost - Target Cost = (c - d)	₹12 Lakhs

**i. Computation of Investment required**

(a) Profit at full capacity = 25% of ₹80 = ₹20 p.u. $\times$ 80,000 units	₹16 Lakhs
(b) Since ROCE desired is 16%, Maximum Required Investment = ₹16 Lakhs / 16%	₹100 Lakhs

**ILLUSTRATION 17:****TARGET COSTING**

You the manager of Zest Ltd. that is in the business of refining the edible oil and have recently come

across a particular type of blended oil, which is being sold at substantially lower rate (by another company-ABC Ltd.) than the price charged by your company. The value chain for one MT of such oil for ABC Ltd is follows,

ABC Ltd sells this particular oil to the merchant at the rate of ₹.1,26,600 per MT. ABC Ltd pays for the freight which amounts to ₹. 300 per MT

Average returns and allowances amount to 4% of sales and approximately equal ₹.5000 per MT.

The value chain of your company, through which the oil reaches the ultimate customer is similar to that of ABC Ltd. However, your mill does not sell directly to the merchant, the latter receiving the oil from a huge distribution centre maintained by your company at Haryana. Shipment costs from the mill to the Distribution Center amount to ₹.110 per MT while the operating costs in the Distribution Center have been estimated to be ₹.250 per MT. The ROI required by the Distribution Center for the investments made amount to an estimated ₹.580 per MT.

You are required to compute the “Ex Factory Target Cost” for this particular type of blended oil for your company. You may assume that the return on the investment expected by your company equals ₹.5500 per MT of sale.

**Solution:**

Computation of Target Cost Per MT		(in ₹.)
ABC Ltd selling price to the merchant		126600
Less: freight paid by ABC Ltd	300	
Less normal sales returns and allowances	5000	
Required ROI of Zest Ltd.	5500	10800
Total Target cost		115800
Less: Shipment cost Distribution Centre	110	
Operating cost in the Distribution Centre	250	
ROI required by Distribution centre	580	940
Ex Factory Target cost		114860

**Q. NEC Ltd. manufactures two parts ‘P’ and ‘Q’ for Computer Industry.**

**P : Annual production and sales of 1,00,000 units at a selling price of Rs. 100.05 per unit.**

**Q : Annual production and sales of 50,000 units at a selling price of Rs. 150 per unit. Direct and Indirect costs incurred on these two parts are as follows:**

(Rs. in thousand)

Particulars of Costs	P	Q	Total
Direct Material Cost (Variable)	4,200	3,000	7,200

Labour Cost (Variable)		1,500	1,000	2,500
Direct	Machining Cost (See Note)*	700	550	1,250
Indirect Costs				
Machine Setup Cost			462	
Testing Cost			2,375	
Engineering Cost			2,250	

Note: Direct machining costs represents the cost of machine capacity dedicated to the production of each product. These costs are fixed and are not expected to vary over the long- run horizon.

Additional information is as follows:

	P	Q
Production Batch Size	1,000 units	500 units
Set-up Time per batch	30 hours	36 hours
Testing Time per unit	5 hours	9 hours
Engineering Cost incurred on each product	8.40 lakhs	14.10 lakhs

A foreign competitor has introduced product very similar to 'P'. To maintain the company's share and profit, NEC Ltd. has to reduce the price to Rs. 86.25. The company calls for a meeting and comes up with a proposal to change design of product 'P'. The expected effect of new design is as follows:

- ▢ Direct Material cost is expected to decrease by Rs. 5 per unit.
- ▢ Labour cost is expected to decrease by Rs. 2 per unit.
- ▢ Machine time is expected to decrease by 15 minutes, previously it took 3 hours to produce 1 unit of 'P'. The machine will be dedicated to the production of new design.
- ▢ Set up time will be 28 hours for each set up.
- ▢ Time required for testing each unit will be reduced by 1 hour.
- ▢ Engineering cost and batch size will be unchanged.

Required

- (i) Company management identifies that cost driver for Machine set-up costs is 'Set up hours used in batch setting' and for testing costs is 'testing time'. Engineering costs are assigned to products by special study. Calculate the full cost per unit for 'P' and 'Q' using Activity-Based Costing.
- (ii) What is the Mark-up on full cost per unit of P?
- (iii) What is the Target Cost per unit for new design to maintain the same markup

percentage on full cost per unit as it had earlier? Assume cost per unit of cost drives for the new design remains unchanged.

- (iv) Will the new design achieve the cost reduction target?
- (v) List four possible management actions that the NEC Ltd. should take regarding new design.

**Solution**

Working Notes

Particulars		P	Q
(a)	Production / Sales Quantity (units)	1,00,000	50,000
(b)	Batch Size (units)	1,000	500
(c)	No. of Batches...(a ÷ b)	100	100
(d)	Setup Time per Batch (hours)	30	36
(e)	Total Setup Hours (hours) ...(c × d)	3,000	3,600
(f)	Machine Setup Cost Rs. 4,62,000		
(g)	Cost Driver per Machine Setup Hour = $\frac{4,62,000}{6,600 \text{ hours}}$	= Rs.70	
(h)	Testing Time per Unit (hours)	5	9
(i)	Total Testing Time (hours) ...(a × h)	5,00,000	4,50,000
(j)	Testing Cost Rs.23,75,000		
(k)	Cost Driver per Testing Hour = $\frac{23,75,000}{9,50,000 \text{ hours}}$	= Rs.2.5	

(i) Statement Showing “Cost per unit- Activity Based Costing”

Particulars of Costs	Basis	P	Q
Direct Material	Direct	42,00,000	30,00,000
Direct Labour	Direct	15,00,000	10,00,000
Direct Machine Cost	Direct	7,00,000	5,50,000
Machine Setup Cost	3,000 hrs. @ Rs.70	2,10,000	----
	3,600 hrs. @ Rs.70	----	2,52,000
Testing Cost	5,00,000 hrs. @ Rs.2.50	12,50,000	----
	4,50,000 hrs. @ Rs.2.50	----	11,25,000
Engineering Cost	Allocated	8,40,000	14,10,000
Total Cost (Rs.)		87,00,000	73,37,000
Cost per unit (Rs.)		87.00	146.74

(i) Statement Showing “Mark-up (full cost basis)- Product P”

Particulars	Per unit
Selling Price	100.05
<i>Less:</i> Full Cost	87.00
Markup	13.05
Percentage of Markup on Full Cost $\frac{13.05}{87} \times 100$	15%

(ii) Statement Showing “Target Cost of Product P”

(After New Design is Implemented)

Particulars	(Rs.)
Target Price (given)	86.25
— Mark-up $\frac{86.25 \times 15}{115}$	11.25
Target Cost <i>per unit</i>	75.00

(iii) Statement Showing “Cost of P (New Design)”

Particulars of Costs	Basis of Costs	Rate*	Total Cost
Direct Material	Decrease by Rs. 5 p.u.	37.00	37,00,000
Direct Labour	Decrease by Rs. 2 p.u.	13.00	13,00,000
Direct Machining Cost	No Change as Machine is Dedicated	7.00	7,00,000
Machine Setup Cost	100 Setup $\times$ 28 hrs. $\times$ Rs. 70	1.96	1,96,000
Testing Cost	1,00,000 units $\times$ Rs. 2.50 $\times$ 4 hrs.	10.00	10,00,000
Engineering Cost	No Change	8.40	8,40,000
Total Cost		77.36	77,36,000

\* Rate per unit

The target cost is Rs. 75 p.u. and estimated cost (new design) is Rs. 77.36 p.u. The new design does not achieve the target cost set by NEC Ltd. Hence the target mark up shall not be achieved.

(iv) Possible Management Action

- ▮ Value engineering and value analysis to reduce the direct material costs.
- ▮ Time and motion study in order to redefine the direct labour time and related costs.
- ▮ Exploring possibility of cost reduction in direct machining cost by using appropriate techniques.
- ▮ Identification of non-value added activities and eliminating them in order to reduce overheads.

The expected selling price based on estimated cost of Rs. 77.36 per unit is (Rs.77.36 +15%) Rs. 88.96. Introduce sensitivity analysis after implementation of new design to study the sales quantity changes in the price range of Rs. 86.25 to Rs. 88.96.

#### ILLUSTRATION 18

Ice-Cream Ltd. is engaged in production of three types of ice-cream products: Coco, Strawberry and Vanilla. The company presently sells 50,000 units of Coco @ Rs. 25 per unit, Strawberry 20,000 @ Rs. 20 per unit and Vanilla 60,000 units @ Rs. 15 per unit. The demand is sensitive to selling price and it has been observed that every reduction of Rs. 1 per unit in selling price, increases the demand for each product by 10% to the previous level. The company has the production capacity of 60,500 units of Coco, 24,200 units of Strawberry and 72,600 units of Vanilla. The company marks up 25% on cost of the product.

The Company management decides to apply ABC analysis. For this purpose it identifies four activities and the rates as follows:

<u>Activity</u>	<u>Cost Rate</u>
Ordering	Rs. 800 per purchase order
Delivery	Rs. 700 per
delivery Shelf stocking...	Rs. 199
per hour	
Customer support and assistance...	Rs. 1.10 p.u. sold

The other relevant information for the products are as follows:

Particulars	Coco	Strawberry	Vanilla
Direct Material p.u. (Rs.)	8	6	5
Direct Labour p.u. (Rs.)	5	4	3
No. of Purchase Orders	35	30	15
No. of Deliveries	112	66	48
Shelf Stocking Hours	130	150	160

Under the traditional costing system, store support costs are charged @ 30% of prime cost. In ABC these costs are coming under customer support and assistance.

Required

- (i) Calculate target cost for each product after a reduction of selling price required to achieve the sales equal to the production capacity.
- (ii) Calculate the total cost and unit cost of each product at the maximum level using traditional costing.
- (iii) Calculate the total cost and unit cost of each product at the maximum level using activity based costing.
- (iv) Compare the cost of each product calculated in (i) and (ii) with (iii) and comment on it.

**Solution**

- (i) Cost of Products Under 'Target Costing' Statement

Showing "Demanded Unit and Selling Price"

Coco		Strawberry		Vanilla	
Selling Price	Demand	Selling Price	Demand	Selling Price	Demand
25	50,000	20	20,000	15	60,000
24	55,000	19	22,000	14	66,000
23	60,500	18	24,200	13	72,600

Statement Showing "Cost per unit"

Particulars	Coco	Strawberry	Vanilla
Selling Price after reduction	23.00	18.00	13.00

Profit Mark up 25% on Cost (20 % on Selling Price)	4.60	3.60	2.60
Target Cost of Production (per unit)	18.40	14.40	10.40

(ii) **Cost of Product Under “Traditional**

**Costing’ Statement Showing “Cost per unit”**

Particulars	Coco (Rs.)	Strawberry (Rs.)	Vanilla (Rs.)
Units	60,500	24,200	72,600
Material Cost <i>per unit</i>	8.00	6.00	5.00
Labour Cost <i>per unit</i>	5.00	4.00	3.00
Prime Cost <i>per unit</i>	13.00	10.00	8.00
Store Support Costs (30% of Prime)	3.90	3.00	2.40
<i>Cost per unit</i>	16.90	13.00	10.40

(iii) **Cost of Product Under ‘Activity Based**

**Costing’ Statement Showing “Cost per unit”**

Particulars	Coco (Rs.)	Strawberry (Rs.)	Vanilla (Rs.)
Units	60,500	24,200	72,600
Material Cost	4,84,000	1,45,200	3,63,000
Labour Cost	3,02,500	96,800	2,17,800
Prime Cost	7,86,500	2,42,000	5,80,800
Ordering Cost @ Rs. 800 (35, 30, 15)	28,000	24,000	12,000
Delivery Cost @ Rs. 700 (112, 66, 48)	78,400	46,200	33,600
Shelf Stocking @ Rs. 199 (130,150,160)	25,870	29,850	31,840
Customer Support Rs. 1.10	66,550	26,620	79,860
Total Cost	9,85,320	3,68,670	7,38,100
Cost Per unit	16.29	15.23	10.17

(i) **Comparative Analysis of ‘Cost of Production’**

Particulars	Coco (Rs.)	Strawberry (Rs.)	Vanilla (Rs.)
(a) As per Target Costing	18.40	14.40	10.40
(b) As per Traditional Costing	16.90	13.00	10.40
(c) As per Activity Based Costing	16.29	15.23	10.17
(a) – (c)	2.11	(-) 0.83	0.23
(b) – (c)	0.61	(-) 2.23	0.23

**Comment**

The cost of product of strawberry is higher in ABC method in comparison to target costing and traditional methods. It indicated that actual profit under ABC is less than targeted. For remaining two products, ABC is most suitable.

**ILLUSTRATION 19**

Transnet Ltd. is engaged in the production of four products: A, B, C and D. The price charged for the four products are Rs. 180, Rs. 175, Rs. 130 and Rs. 180 respectively, Market research has indicated that if Transnet Ltd can reduce the selling prices of its products by Rs. 5, it will be successful in getting bulk orders and gain a significant share of market of those products. The company’s profit markup is 25 per cent on cost of the product. The relevant information of products are as follows:

Products	A	B	C	D
Output in units	600	500	400	600
Cost per unit -				
Direct material (in Rs.)	40	50	30	60
Direct labour (in Rs.)	28	21	14	21
Machine hours (per unit)	4	3	2	3

The four products are usually produced in production runs of 20 units and sold in batches of 10 units. The production overhead is currently absorbed by using a machine hour rate, and the total of the production overheads for the period has been analysed as follows:

(Rs.)

Machine department costs.....	.. 52,130
Setup costs...	26,250

Stores receiving...	18,000
Inspection / Quality control...	10,500
Material handling and dispatch...	23,100

The cost drivers to be used for the overhead costs are as follows:

<u>Cost.</u>	<u>Cost drivers</u>
Setup costs...	Number of production runs
Store receiving...	Requisitions raised
Inspection / Quality control...	Number of production runs
Materials handling and dispatch	Order executed

The number of requisitions raised in the stores was 100 for each product and the number of orders executed was 210, each order being for a batch of 10 units of a product.

Required

- (i) To compute the target cost for each product.
- (ii) To compute total cost of each product using activity based costing.
- (iii) Compare target cost and activity based cost of each product and comment whether the price reduction is profitable or not.

### Solution

(i) Statement Showing "Target Cost of Product A, B, C, D"

Product	Present Price (Rs.)	Proposed Price (Rs.)	Target Cost (Rs.) (with 25% Margin)
A	180	175	140
B	175	170	136
C	130	125	100
D	180	175	140

(i) Statement Showing "Cost/unit of Driver- ABC"

Cost	Amount	Driver	No.	Cost / unit of Driver (Rs.)

Setups	26,250	Production Runs	105	250.00
Stores Receiving	18,000	Requisition	400	45.00
Inspection / Quality	10,500	Production Runs	105	100.00
Handling / Dispatch	23,100	Orders	210	110.00
Machine Department	52,130	Machine Hrs.	6,500	8.02

Production Runs = 105

Production Runs = 105

$$\frac{600 \text{ units}}{20 \text{ units}} + \frac{500 \text{ units}}{20 \text{ units}} + \frac{400 \text{ units}}{20 \text{ units}} + \frac{600 \text{ units}}{20 \text{ units}}$$

No. of Requisitions = 400

[100 for each product]

Machine Hours = 6,500 hours

[600 units x 4 hrs. + 500 units x 3 hrs. + 400 units x 2 hrs. + 600 units x 3 hrs.]

No. of Orders = 210

$$\frac{600 \text{ units}}{10 \text{ units}} + \frac{500 \text{ units}}{10 \text{ units}} + \frac{400 \text{ units}}{10 \text{ units}} + \frac{600 \text{ units}}{10 \text{ units}}$$

Statement Showing "Total Cost & Cost per unit- ABC"

Particulars of Costs	A (Rs.)	B (Rs.)	C (Rs.)	D (Rs.)
Direct Material	24,000	25,000	12,000	36,000
Direct Labour	16,800	10,500	5,600	12,600
Setup	7,500 [30Runs x Rs.250]	6,250 [25Runs x Rs.250]	5,000 0 [20Runs x Rs.250]	7,500 [30Runs x Rs.250]
Stores Receiving	4,500 [100Req.x]	4,500 [100Req.x Rs.45]	4,500 0 [100Req. x]	4,500 [100Req.x Rs.45]

	Rs.45]		Rs.45]	
Inspection / Quality	3,000 [30Runs xRs.100 ]	2,500 [25Runs xRs.100]	2,000 [20Runs xRs.100]	3,000 [30Runs xRs.100]
Handling / Dispatch	6,600 [60 Orders xRs.110]	5,500 [50 Orders xRs.110]	4,400 [40 Orders x110]	6,600 [60 Orders xRs.110]
Machine Dept. Cost	19,248 [2,400hrs. xRs.8.02]	12,030 [1,500hrs. xRs.8.02]	6,416 [800hrs. xRs.8.02]	14,436 [1,800hrs. xRs.8.02]
Total Cost	81,648	66,280	39,916	84,636
Output (Units)	600	500	400	600
Cost per unit	136.08	132.56	99.79	141.06

(i) Statement Showing “Target Cost Vs Actual Cost”

Cost	A (Rs.)	B (Rs.)	C (Rs.)	D (Rs.)
Actual	136.08	132.56	99.79	141.06
Target	140.00	136.00	100.00	140.00
Difference	(-) 3.92	(-) 3.44	(-) 0.21	(+) 1.06

**Comment**

The total actual cost of A, B and C product is less than the target cost so there is no Que in reducing the cost of these product by Rs. 5 from the present price. It will increase the profitability of the company but the cost of D is slightly more than the target cost, it is therefore, suggested that the company should either control it or redesign it.

**ILLUSTRATION 20:**

**TRANSFER PRICING**

Alpha Ltd. fixes the inter divisional transfer price for its products on the basis of cost plus estimated return of 28% on the investments in respective segment. The relevant portion of budget of Segment ‘S’ for current year is given. Determine the transfer price for Segment ‘S’ considering the fact that

it is single product segment.

Serial	Particulars	Data
1	Fixed Assets	₹ 5.00 Lakhs
2	Current Assets (Other than debtors)	₹ 3.00 Lakhs
3	Sundry Debtors	₹ 2.00 Lakhs
4	Annual Fixed Cost	₹ 8.00 Lakhs
5	Variable Cost Per Unit of the product	₹ 10 per unit
6	Budgeted Volume of Production	4.00 Lakh units

**Solution:**

#### Computation of Transfer Price

Serial	Particulars	Data
1	Production Volume	400000 units
2	Total Variable Cost @ ₹.10/each	₹ 40.00 Lakhs
3	Fixed Cost pa	₹ 8.00 Lakhs
4	Total Cost	₹ 48.00 Lakhs
5	Return on Investment @28%	₹ 2.80 Lakhs
6	Required Revenue	₹ 50.80 Lakhs
7	Transfer Price (6/1)	₹ 12.70 per unit

**Working Note:**

Total Investment = Fixed Assets + Current Assets + Debtors = 5+3+2 = ₹ 10 Lakhs

### ILLUSTRATION 21:

#### TRANSFER PRICING

A Company has two divisions: LD and KD operating at 100% and 50% capacity respectively. LD produces LX & LY using the common labour force @ ₹.5 per hour. For next year it has budgeted capacity of 42000 labour hours and has commitment to sell 6000 kgs of LY and balance can be used for LD. Cost data is as below:

Particulars	LX (₹./Kg)	LY (₹./Kg)
Direct Materials	36	28
Direct Labour	30	20

Total Overheads amount to ₹.7.56 lakhs per annum relating to LX & LY in the proportion of direct wages incurred. At 100% capacity level ₹.4.20 lakhs are variable overheads. LD prices its products

at 50% mark up of total cost.

KD wishes to buy 2000 kgs of LX for being processed into KX that fetches a sale price of ` .300 per kg. Per kg direct material and labour cost is ` 30 and variable overheads ` .4. The fixed costs of the division are ` .1.00 lakh pa. Variable overheads of LD include ` .4 towards selling and distribution expenses, that will be saved in case of sale to KD.

Prepare the profitability Statement in case of

- i. LD transfers LX @ applicable to outside customers
- ii. LD transfers LX @ applicable to outside customers considering impact of saving in S&D overheads
- iii. LD transfers LX @marginal cost applicable to KD

**Solution:**

**Computation of Unit Selling Price ( ` )**

Sr	Particulars	LX	LY
1	Material Cost	36	28
2	Labour Cost	30	20
3	Variable Overheads @ ` .10/hour (including S&D of ` .4)	60	40
4	Total Variable Cost (1...3)	126	88
5	Fixed Overheads @ ` .8/hour	48	32
6	Total Cost (4 + 5)	174	120
7	Mark up 50% (6 × 50%)	87	60
8	Selling Price (6 + 7)	261	180

**i. Profit Statement: Transfer at Market Price**

Particulars	Computation	LD	KD	Total
<b>A. Revenue</b>				
LX	3000×261	783000		783000
LY	6000×180	1080000		1080000
KX	2000×300		600000	600000
Total Revenue		1863000	600000	2463000
<b>B. Costs</b>				
LX - Market	1000×174	174000		174000
LX - Transfer	2000×170	340000		340000

LY - Market	6000×120	720000		720000
KX - Transferred Cost	2000×261		522000	522000
KX -Own Cost	2000×34		68000	68000
Fixed Cost			100000	100000
Total Costs		1234000	690000	1924000
<b>Profit</b>		<b>629000</b>	<b>-90000</b>	<b>539000</b>

**i. Profit Statement: Transfer at Market Price minus cost saving impact**

Particulars	Computation	LD	KD	Total
<b>A. Revenue</b>				
LX Market	1000×261	261000		261000
LX Transfer	2000×257	514000		514000
LY	6000×180	1080000		1080000
KX	2000×300		600000	600000
Total Revenue		1855000	600000	2455000
<b>B. Costs</b>				
LX - Market	1000×174	174000		174000
LX - Transfer	2000×170	340000		340000
LY - Market	6000×120	720000		720000
KX - Transferred Cost	2000×257		514000	514000
KX -Own Cost	2000×34		68000	68000
Fixed Cost			100000	100000
Total Costs		1234000	682000	1916000
<b>Profit</b>		<b>621000</b>	<b>-82000</b>	<b>539000</b>

**ii. Profit Statement: Transfer at Marginal Cost**

iii. Particulars	Computation	LD	KD	Total
<b>A. Revenue</b>				
LX Market	1000×261	261000		261000
LX Transfer	2000×122	244000		244000
LY	6000×180	1080000		1080000
KX	2000×300		600000	600000
Total Revenue		1585000	600000	2185000
<b>B. Costs</b>				

LX – Market	1000×174	174000		174000
LX - Transfer	2000×170	340000		340000
LY - Market	6000×120	720000		720000
KX – Transferred Cost	2000×257		244000	244000
KX –Own Cost	2000×34		68000	68000
Fixed Cost			100000	100000
Total Costs		1234000	412000	1646000
<b>Profit</b>		<b>621000</b>	<b>-82000</b>	<b>539000</b>

**Learning Take: Change in Transfer price does affect Divisional Profit but Does not impact Overall profit of the Organisation.**

**Working Note 1:**

**Computation of Product Mix for next year**

Product	Hours per Unit	Units	Total Hours
LY	20/5 = 4	6000	24000
LX	30/5 = 6	18000/6 = 3000	18000 (balance)
<b>Total</b>			<b>42000</b>

**Computation of Overheads cost per hour**

Variable Overheads per Hour = Total variable overheads/total hours = `420000/42000 = `.10 per hour

Fixed Overheads = 336000/42000 = `.8 per hour

**ILLUSTRATION 22:**

**PRODUCT LIFE CYCLE COST**

Ideas Furniture limited has designed a new range of prefab office furniture. It is ready to be launched in the market with a sale price of `2.50 lakhs per set. An anticipated sale of 1000 sets is expected over a period of 3 years. Other relevant details are as follows:

1. Cost of Design and development	₹ 125 Lakhs
2. Variable Manufacturing Cost	₹ 1.10 lakh per Set
3. Brand Promotion Cost	₹ 200 lakhs
4. Selling & Marketing Expenses	₹ 5000 per set
5. Installation Expenses	₹ 25000 per set
6. Warranty Expenses	₹ 8900 per set
7. Administrative Expenses	₹ 50.00 Lakhs per annum

You are required to compute Product life cycle cost and related profits.

**Solution:**

**Life Cycle Profit Statement**

₹. In Lakhs

Serial	Particulars	Amount
1	Revenue (1000×2.50)	2500
2	Design Development Cost	125
3	Brand Promotion	200
4	Variable Manufacturing Cost @ ₹ 110000/ Set	1100
5	Selling & Marketing Expenses @ ₹ 5000/Set	50
6	Installation Expenses @ ₹ 25000/Set	250
7	Warranty Expenses @ ₹ 8900/Set	89
8	Administrative Expenses ( ₹ 50 × 3 years)	150
9	Total Cost ( 2.....8)	1964
10	Profit (1 – 9)	536

**ILLUSTRATION 23**

Great Eastern Appliances Ltd. (GEAL) manufactures consumer durable products in a very highly competitive market. GEAL is considering launching a new product ‘Kitchen Care’ into the market and gathered the following data:

Expected Market Price... Rs.5,000 per unit

Direct Material Cost Rs.1,850 per unit

Direct Labour Cost Rs.80 per

hour Variable Overhead Cost... Rs.1,000

per unit

Packing Machine Cost (specially to be purchased for this product)...Rs.5,00,000

GEAL expects the selling price for the new product will continue throughout the product's life and a total of 1,000 units can be sold over the entire lifetime of the product.

Direct labour costs are expected to reduce as the volume of output increases due to the effects of 80% learning curve (index is -0.3219). The expected time to be taken for the first unit is 30 hours and the learning effect is expected to end after 250 units have been produced. Units produced after first 250 units will take the same time as the 250th unit.

Required

- (i) Calculate the expected total labour hours over the life time of the product 'Kitchen Care'.
- (ii) Profitability of product 'Kitchen Care' that GEAL will earn over the life time of the product.
- (iii) Average target labour cost per unit over the life time of the product if GEAL requires average profit of Rs. 800 per unit, to achieve its long term objectives.

Note:  $250^{-0.3219} = 0.1691$ ,  $249^{-0.3219} = 0.1693$

### Solution

- (i) Calculation of 'Total Labour Hours' over the Life Time of the Product 'Kitchen Care'

The average time per unit for 250 units is

$$\begin{aligned}
 Y_x &= ax^b \\
 Y_{250} &= 30 \times 250^{-0.3219} \\
 Y_{250} &= 30 \times 0.1691 \\
 Y_{250} &= 5.073 \text{ hours}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total time for 250 units} &= 5.073 \text{ hours} \times 250 \text{ units} \\
 &= 1,268.25 \text{ hours}
 \end{aligned}$$

The average time per unit for 249 units is

$$\begin{aligned}
 Y_{249} &= 30 \times 249^{-0.3219} \\
 Y_{249} &= 30 \times 0.1693
 \end{aligned}$$

Total time for 249 units = 5.079 hours × 249 units  
 = 1,264.67 hours

Time for 250th unit = 1,268.25 hours – 1,264.67 hours  
 = 3.58 hours

Total Time for 1,000 units = (750 units × 3.58 hours) + 1,268.25 hours  
 = 3,953.25 hours

(ii) Profitability of the Product ‘Kitchen Care’

Particulars	Amount (Rs.)	Amount (Rs.)
Sales (1,000 units)		50,00,000
Less: Direct Material	18,50,000	
Direct Labour (3,953.25 hours × Rs. 80)	3,16,260	
Variable Overheads (1,000 units × Rs.1,000)	10,00,000	31,66,260
Contribution		18,33,740
Less: Packing Machine Cost		5,00,000
Profit		13,33,740

(i) Average ‘Target Labour Cost’ per unit

Particulars	Amount (Rs.)
Expected Sales Value	50,00,000
Less: Desired Profit (1,000 units × Rs. 800)	8,00,000
Target Cost	42,00,000
Less: Direct Material (1,000 units × Rs. 1,850)	18,50,000
Variable Cost (1,000 units × Rs. 1,000)	10,00,000
Packing Machine Cost	5,00,000
Target Labour Cost	8,50,000
Average Target Labour Cost per unit (Rs. 8,50,000 ÷ 1,000 units)	850

**ILLUSTRATION 24**

P & G International Ltd. (PGIL) has developed a new product ‘ $\alpha^3$ ’ which is about to be launched into the market. Company has spent Rs. 30,00,000 on R&D of product ‘ $\alpha^3$ ’. It has also bought a machine to produce the product ‘ $\alpha^3$ ’ costing Rs. 11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value.

The company has decided to charge price that will change with the cumulative numbers of units sold.

Cumulative Sales (units)	Selling Price Rs. per unit
0 to 2,200	750
2,201 to 7,700	600
7,701 to 15,950	525
15,951 to 59,950	450
59,951 and above	300

Based on these selling prices, it is expected that sales demand will be as shown below:

Weeks	Sales Demand per week (units)
1-10	220
11-20	550
21-30	825
31-70	1,100
71-80	880
81-90	660
91-100	440
101-110	220
Thereafter	NIL

Unit variable costs are expected to be as follows:

Rs. per unit	
First 2,200 units	375
Next 13,750 units	300
Next 22,000 units	225
Next 22,000 units	188
Thereafter	225

PGIL uses just-in-time production system. Following is the total contribution statement

of the product 'α<sup>3</sup>' for its Introduction and Growth phase:

Introduction		Growth	
Weeks	1 - 10	11 - 30	
Number of units Produced and Sold	2,200	5,500	8,250
Selling Price per unit (Rs.)	750	600	525
Variable Cost per unit (Rs.)	375	300	300
Contribution per unit (Rs.)	375	300	225
Total Contribution (Rs.)	8,25,000	16,50,000	18,56,250

Required

- (i) Prepare the total contribution statement for each of the remaining two phases of the product's life cycle.
- (ii) Discuss Pricing Strategy of the product 'α<sup>3</sup>'.
- (iii) Find possible reasons for the changes in cost during the life cycle of the product 'α<sup>3</sup>'. Note: Ignore the time value of money.

### Solution

#### (i) Total Contribution Statement

Statement Showing "Total Contribution- for remaining two phases"

Particulars	Maturity		Decline
	31 - 50	51 - 70	
Weeks	31 - 50	51 - 70	71 - 110
Number of units Produced and Sold	22,000	22,000	22,000
Selling Price per unit (Rs.)	450	450	300
Less: Unit Variable Cost (Rs.)	225	188	225
Unit Contribution (Rs.)	225	262	75
Total Contribution (Rs.)	49,50,000	57,64,000	16,50,000

#### (ii) Pricing Strategy for Product α<sup>3</sup>

- PGIL is following the skimming price strategy that's why it has planned to launch the product α<sup>3</sup> initially with high price tag.
- A skimming strategy may be recommended when a firm has incurred large sums of money on research and development for a new product.
- In the problem, PGIL has incurred a huge amount on research and development. Also, it is very difficult to start with a low price and then raise the price. Raising a low price may annoy potential customers.
- Price of the product α<sup>3</sup> is decreasing gradually stage by stage. This is happening

- because PGIL wants to tap the mass market by lowering the price

(iii) **Possible Reasons for the changes in cost during the life cycle of the product '  $\alpha^3$  '** Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Possible reasons for the changes in cost during the life cycle of the product are as follows:

PGIL is expecting reduction in unit cost of the product  $\alpha^3$  over the life of product as a consequence of economies of scale and learning / experience curves.

Learning effect may be the possible reason for reduction in per unit cost if the process is labour intensive. When a new product or process is started, performance of worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of worker improves, time taken per unit reduces and thus his productivity goes up. The amount of improvement or experience gained is reflected in a decrease in cost.

Till the stage of maturity, PGIL is in the expansion mode. The PGIL may be able to take advantages of quantity discount offered by suppliers or may negotiate the price with suppliers. Product  $\alpha^3$  has the least variable cost Rs.188 in last phase of maturity stage; this is because a product which is in the mature stage may require less marketing support than a product which is in the growth stage so, there is a saving of marketing cost per unit.

Again the cost per unit of the product  $\alpha^3$  jumps to Rs.225 in decline stage. As soon as the product reaches its decline stage, the need or demand for the product disappear and quantity discount may not be available. Even PGIL may have to incur heavy marketing expenses for stock clearance.

### Workings

#### Statement of Cumulative Sales along with Sales Price and Variable Cost

Weeks	Demand per week	Total Sales	Cumulative Sales	Selling Price per unit (Rs.)	Variable Cost per unit (Rs.)
1 - 10	220	2,200	2,200	750	375
11 - 20	550	5,500	7,700	600	300
21 - 30	825	8,250	15,950	525	300
31 - 50	1,100	22,000	37,950	450	225

51 - 70	1,100	22,000	59,950	450	188
71 - 80	880	8,800	68,750	300	225
81 - 90	660	6,600	75,350	300	225
91 - 100	440	4,400	79,750	300	225
101 - 110	220	2,200	81,950	300	225

**ILLUSTRATION 25:**

**USE OF PROBABILITY IN DECISION MAKING**

A Company is selling a product @ ` 10 per unit in the market, its marginal cost is ` 7.50 per unit and fixed cost ` 58000 for the period. It has following demand probability:

Sales Volume (Units)	20000	22000	24000	26000	28000
Probability	0.10	0.25	0.20	0.30	0.15

You are required to Calculate the probability of

- i. break even in the period
- ii. earning profit of ` 10000 in the period

**Solution:**

- i. Probability of break even in the period

To calculate probability of attaining Break even sale, we first need to work out the Break even Point.

$$BEP = \text{Fixed Cost} / \text{Contribution per unit} = 58000 / 2.50 = 23200 \text{ units}$$

The probability that sales will be more than or equal to 23200 units is the probability that sales will be 24000, 26000 & 28000 units, i.e.  $0.20 + 0.30 + 0.15 = 0.65$  or 65% probability.

- ii. Probability of earning profit of ` 10000 in the period

$$\text{Contribution needed} = \text{Fixed Cost} + \text{Desired profit} = 58000 + 10000 = 68000$$

$$\text{Sales volume to earn contribution of ` 68000} = 68000 / 2.50 = 27200 \text{ units}$$

The probability that sales will be more than or equal to 27200 units is the probability that sales will be 28000 units, i.e.  $0.15 = 0.15$  or 15% probability.