

LEARNING CURVE THEORY

Question 1

Explain distinctive features of learning curve theory in manufacturing environment.

(4 Marks)(Nov., 2010)

Answer

The production quantity of a given item doubled the cost of that item decrease at a fixed rate. This phenomenon is the basic premise on which the theory of learning curve has been formulated.

The distinctive features of a learning curve are:

1. Better tooling methods are developed and used
2. More productive equipments are designed and used to make the product.
3. Design bugs are detected and corrected.
4. Better design engineering reduces material and labour costs.
5. Early teething problems are overcome. As production progresses management is prompted to achieve better planning and better management.
6. Rejections and rework tend to diminish over time.
7. As quantity produced increases the Cost per unit decreases, since each unit entails:
 - (i) Lesser labour (ii) Greater productivity of material and labour (iii) Fewer delays and lesser time losses.

Question 2

The Gifts Company makes mementos for offering chief guests and other dignitaries at functions. A customer wants 4 identical pieces of hand-crafted gifts for 4 dignitaries invited to its function.

For this product, the Gifts Company estimates the following costs for the 1st unit of the product

	₹/unit
Direct variable costs (excluding labour)	2,000

Direct labour (20 hours @ ₹ 50 hour)	1,000
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90 % learning curve ratio is applicable and one labourer works for one customer's order.

- (i) What is the price per piece to be quoted for this customer if the targeted contribution is ₹ 1,500 per unit?
- (ii) If 4 different labourers made the 4 products simultaneously to ensure faster delivery to the customer, can the price at (i) above be quoted? Why? (6 Marks)(Nov., 2009)

Answer

		Rs/u
	1 st unit	Avg/u after 4 th at
Variable Cost	2000	2000
Labour	1000	810
Target Contribution		1500
Price to be quoted		4310 (₹ /u)

- (ii) No, the company cannot quote this price for varying products because the learning curve Ratio does not apply to non-repeated jobs. Each product will carry a different price according to its direct labour hours.

Question 3

An electronics firm which has developed a new type of fire-alarm system has been asked to quote for a prospective contract. The customer requires separate price quotations for each of the following possible orders: (11 Marks)

Order	Number of fire-alarm systems
First	100
Second	60
Third	40

The firm estimates the following cost per unit for the first order:

Direct Materials	₹ 500
Direct Labour	
Deptt. A (Highly automatic)	20 hours at ₹ 10 per hour.
Deptt. B (Skilled labour)	40 hours at ₹ 15 per hour.
Variable overheads absorbed	20% of direct labour
Fixed overheads absorbed	
Deptt. A	₹ 8 per hour

Deptt. B

₹ 5 per hour

Determine a price per unit for each of the three orders, assuming the firm uses a mark up of 25% on total costs and allows for an 80% learning curve. Extract from 80% learning curve table:

X	1.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Y(%)	100.0	91.7	89.5	87.6	86.1	84.4	83.0	81.5	80.0

X represents the cumulative total volume produced to date expressed as a multiple of the initial order.

Y is the learning curve factor, for a given X value, expressed as a percentage of the cost of the initial order.

Answer**(i) Price /Unit for First 100 Units**

		₹
Direct materials		500
Direct labour : Deptt. A 20 hrs. @10	200	
Deptt. B 40 hrs. @ 15	600	800
Variable O/H 20% of ₹ 800/-		160
Fixed O/H Deptt. A 20 hrs. @ 8	160	
Deptt. B 40 hrs @ 5	200	360
Total cost		1,820
Profit		455
Selling price per unit		2,275

(ii) Price/Unit for Second Order of 60 Units :

Learning will be applicable only in Dept. B

Cumulative output becomes 100 units + 60 units = 160 units

i.e. i.6 times for which learning is 86.1% from the table.

\ total hours for 160 units = $160 \times 40 \times 0.861 = 5510.4$ units.

\ hours for 60 units = Hrs for 160 units – Hrs for 100 units.

= $5510.40 - 4000 \text{ hrs} = 1510.40 \text{ hrs.}$

\ Hours per unit = $1510.40 / 60 = 25.17$

Calculation of selling Price unit :

		₹
Direct materials		500.00
Direct labour: Deptt. A 20 hrs@ 10	200.00	
Deptt. B 25.17 hrs@ 15	<u>377.55</u>	577.55
Variable O/H 20% of ₹ 577.55		115.51
Fixed O/H : Deptt. A 20 hrs@ 8	160.00	
Deptt. B 25.17@ 5	<u>125.85</u>	<u>285.85</u>
Total Cost	1478.91	
Profit		<u>369.73</u>
Selling price per unit		1848.64

(iii) Price/Unit for Third Order of 40 Units:

Cumulative Output becomes $100+60+40 = 200$ units

i.e. 2 times for which Learning is 80% from the table

\ Total hours for 200 units = $200 \times 40 \times .80 = 6400$ hrs

\ Hours for 40 units = Hrs for 200 units – Hrs for 160 units. = $6400 - 5510.4 = 889.6$ hrs.

\ Hours per unit = $889.6/40 = 22.24$ hrs

Calculation of selling price/ unit : ₹

Direct material		500.00
Direct labour: Deptt. A 20 hrs @ 10	200.00	
Deptt. B 22.24 hrs @ 15		333.60
Variable O/H 20% of ₹ 533.60		106.72
Fixed O/H : Deptt. A 20 hrs @ 8		160.00
Deptt. B 22.24 @ 5		<u>111.20</u>
Total Cost		1411.52
Profit		<u>352.88</u>
Selling Price/Unit		<u>1764.40</u>

Alternative solution

Particulars	Amt. in First order	Second Order at *86.1%	Third Order at **80%
	(₹)	(₹)	(₹)
Direct Material	500.00	500.00	500.00
Direct Labour			
Dept A (20 hours @ ₹ 10 per hour)	200.00	200.00	200.00
Dept B (40 hours @ ₹ 15 per hour)	600.00	516.60	480.00
Variable overheads (20% of direct labour)	160.00	143.32	136.00
Fixed Overheads			
Dept A (20 hours @ ₹ 8 per hour)	160.00	160.00	160.00
Dept B (40 @ ₹ 5 per hour)	200.00	172.20	160.00
Total Cost	1820.00	1692.12	1636.00
Profit (25% of Cost)	455.00	423.03	409.00
Selling Price per Alarm	2275.00	2115.15	2045.00

Note : Learning Curve is not applicable for Department A as it is highly automated.

*Second Order – 60 fire-alarms, Cumulative Total = 160 fire-alarms

The cumulative total is now 160 Alarm, which is denoted by the multiple of 160/100 i.e. 1.6. From the 80% learning curve table the relevant percentage factor is 86.1% of the labour cost.

Cumulative order 160 @ ₹ 2115.15	3,38,424
Previous order 100 @ ₹ 2275	2,27,500
Increment order 60	1,10,924
Therefore, charge price per Alarm	1848.73

**Third Order-40 Alarm, Cumulative Total = 200 Alarm

The cumulative total is now 200 fire alarms, which is denoted by the multiple of 200/100 i.e. 2. From the 80% learning curve table the relevant percentage factor is 80% of the labour cost.

Cumulative orders 200 @ ₹ 2045	409000
Previous order 160 @ 2115.15	338424
Incremental order 40	70576
Therefore, charge price per Alarm (₹)	1764.40