Paper15-Strategic Cost Management- Decision Making

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Time allowed:3 hours **Full Marks: 100**

The figures in the margin on the right side indicate full

PART – I

Answer Question Number 1 which is compulsory (20 marks)

1. **Choose the most appropriate answer to the following questions giving justification.**
[10 × 2= 20]

(i) A Ltd. has fixed its price to earn a 30% return on investment of ₹7,00,000, when full cost per unit is ₹100. What would be the target selling price if it manufactures & sell 7500 units of the product?

(a) ₹ 120

(b) ₹ 130

(c) ₹ 128

(d) ₹ 210

(ii) A Ltd. manufactures 4 products A,B,C & D with sales value mix of 33 1/3%, 41 2/3%, 16 2/3% & 8 1/3% and P/V ratio is 40%, 352%, 20% & 60% respectively; Calculate overall P/V ratio if budget sale value is ₹1,20,000.

(a) 40%

(b) 35%

(c) 28%

(d) 32%

(iii) PN Company makes a single product which it sells at ₹10 per unit. Fixed costs are ₹ 60,000 per month and the variable cost ratio is 60%. When actual salws were ₹1,70,000, what would be company's warning of safety in units?

(a) 2,000 units

(b) 17,000 units

(c) 15,000 units

(d) 5,000 units

(iv) A Company makes a product & sells it to its 100% subsidiary & also to outside market at ₹24 per piece, which gives a contribution of 40%. For outside sales, variable cost constitutes ₹3 per unit as distribution cost. What would be the transfer price to subsidiary if there is no capacity constraint?

(a) ₹ 24

(b) ₹ 21

(c) ₹11.40

(d) ₹ 14.40

(v) ABC Ltd is in automobile manufacturing industry.
Information from its last budget period is as follows:

Actual production 2, 75,000 Units
Budgeted Production 2, 50,000 Units
Actual fixed production Overheads ₹52, 60, 00,000
Budgeted fixed production Overheads ₹50, 00, 00,000
Then fixed overhead volume variance and expenditure variance will be:

(a) ₹5,00,00,000 (A), ₹2,60,00,000 (F)

(b)₹5,00,00,000 (F), ₹2,60,00,000 (F)

(c)₹5,00,00,000 (F), ₹2,60,00,000 (A)

(d)₹5,00,00,000 (A),₹2,60,00,000 (A)

(vi) Calculate the total time taken to produce the 5th to 8th unit of the product under 90% learning curve if the first unit of a product is produced using 4000 hours.

(a) 10,500 hours

(b) 12,968 hours

(c) 9,560 hours

(d) 10,368 hours

(vii) AB company is a supermarket group that incurs the following costs :

(a)The bought-in price of the goods

(b) Inventory finance costs

(C) Self refilling costs

(D) Costs of repacking or 'pack out' prior to storage before sale

AB company's calculating of direct product profit (DPP) would include

(a)Costs (A) and (C) only.

(b)All of the above cost except (b)

(c)All of the above costs except (d)

(d) All of the above costs.

(viii) Currently XYZ Ltd. has PBIT of ₹19.20 lakhs on total assets of ₹96 lakhs. It has been decided to increase assets by ₹24 Lakh which will lead to an increase the operating profit before depreciation by ₹8.40 lakhs. If, depreciation increases by ₹4.80 lakhs what will be ROI?

(a) to increase by 1%

(b) to decrease by 1%

(c) to decrease by 1-5%

(d) to remain the same

(ix) An organization estimated that 40,000 units could be sold annually at ₹60 each. For improvement of the product ₹40 lakh is needed as investment. If, the company desires to get a ROI of 15% then what would be the target cost per unit?

(a) ₹ 37.50

(b) ₹40.00

(c) ₹45.00

(d) ₹48.60

(x) The information relating to the direct material cost of a company is as follows:

Standard price per unit	**₹ 7.20**
Actual quantity purchased (in units)	**1600**
Standard quantity allowed for actual production (in units)	**1450**
Material price variance on purchase (Favourable)	**₹ 480**

Find out the actual purchase price per unit?

(a) ₹ 7.50

(b) ₹ 6.40

(c) ₹ 6.50

(d) ₹ 6.90

Answer:

1

(i) c

Target Sale Price per unit = Full Cost + Target Profit = ₹100 + {(7,00,000X 30%)}/7500

= 100 + 28 = ₹128

(ii) b

Product	A	B	C	D	Total
Sales	40,000	50,000	20,000	10,000	1,20,000
Variable Cost	24,000	34,000	16,000	4,000	78,000
Contribution					42,000

P/V ratio = 42,000/1,20,000 X 100 = 35%

(iii) a

BEP = FC/CS ratio = 60,000/0.40 = ₹150000 or 15000 units

When sales is ₹170000, Margin of safety = (170000- 150000) = ₹20000 or 2000 units

(iv) c

Transfer Price = Marginal Cost – Opportunity Cost = ₹24 × 60% - 3 = ₹11.40

(v) c

Fixed Overhead Absorption Rate = budgeted fixed overheads/budgeted output

= 50,00,00,000/2,50,000 units

= ₹ 2,000 per unit

Fixed Overhead Volume Variance:

Budgeted Fixed Overheads	₹ 50,00,00,000
Less: Absorbed Fixed Overheads (275000x2000)	₹ 55,00,00,000
Variance	₹ 5,00,00,000 (F)

The variance is favourable because XYZ Ltd. yielded a higher output than anticipated in the budget.

Fixed Overhead Expenditure Variance:

Actual fixed production overheads	₹ 52,60,00,000
Less: Budgeted fixed production overheads	_₹ 50,00,00,000
Variance	₹2,60,00,000 (A)

(vi) d

Units	Average Time per Unit (hours)	Total Time (hours)
1	4000	40
2	3600	72
4	3240	129
8	2916	233

Total time for 5th to 8 units = 23328 - 12960 = 10368 hrs

(vii) d

Because all of the costs mentioned can be identified with specific goods/product and would be deducted from the selling price to determine the direct product profit.

(viii) b

	Before installing new assets	After installing new assets
PBIT	₹ 19.20 lakhs	= ₹19.20 lakhs+(₹8.40lakhs - ₹4.80lakhs)= ₹ 22.80 lakhs
Value of Assets	₹ 96.00 lakhs	₹ 96.00 lakhs + ₹24.00 lakhs = ₹120lakhs
ROI	=20%	19%

Conclusion: There will be a decrease of 1 % in ROI under the proposed dispensation.

(xi) c

Projected sales (40,000 mixers X `60 per mixer) (A	= ₹ 24,00,000
Less desired profit (15% of ₹40,000) (B)	= ₹ 6,00,000
Target Cost for 40,000 mixers (A – B)	= ₹ 18,00,000
Target cost per mixer (₹ 18,00,000 / 40,000 mixer)	= ₹ 45.00 per unit

(x) d

Material Price Variance (MPV) = Standard cost of Actual Quantity - Actual Cost 480 = 7.20

x 1,600 - Actual Cost or, Actual Cost = 11,520 - 480 = 11,040 Actual Price / Unit = 11,040 ÷ 1,600 = ₹6.90.

PART – II

Answer any five questions from question numbers 2 to 8. Each question carries 16 marks

[16x5= 80]

2.(a) A Ltd. engaged in manufacturing of 3 products. Details of these 3 products are given below:

Particulars	Product X	Product Y	Product Z
Selling Price (₹)	66	75	90
Material and other variable cost (₹)	24	30	40
Bottleneck resource time (minutes)	15	15	20

Budgeted factory costs for the period are ₹2,21,600. The bottleneck resources time available is 75,120 minutes per period. Required:

(i) Company adopted throughput accounting and products are ranked according to 'product return per minute'. Select the highest rank product.

(ii) Find out throughput accounting ratio and comment on it. **[8]**

(b) T Ltd. has two processes Processing and Finishing. The normal output per week is 7,500 units (Completed) at a capacity of 75% V Ltd. had production problems in preparing and requires 2,000 units per week of prepared material for their finishing processes.

The existing cost structure of one prepared unit of T Ltd. at existing capacity

Material	₹2.00 (Variable 100%)
Labour	₹2.00 (Variable 50%)
Overhead	₹4.00 (Variable 25%)

Construct the effect on the profits T Ltd., for six months (25 weeks) of supplying units to V Ltd. If the following are adopted as transfer prices:

(i) Marginal Cost

(ii) Marginal Cost + 25%

(iii) Marginal Cost + 15% Return on capital(assume capital employed ₹20 lakhs)

(iv) Existing Cost

(v) Existing Cost + a portion of profit on the basis of (preparing cost / Total Cost) x Unit Profit

(vi) At an agreed market price of ₹8.50 Assume no increase in fixed cost. **[8]**

Answer:2(a)

(i) Calculation of Rank According to product return per minute (₹)

Particulars	X	Y	Z
Selling Price	66	75	90
Less: Variable cost	24	30	40

Throughput Contribution (a)	42	45	50
Minutes per unit (b)	15	15	20
Contribution per minute (a)/(b)	2.8	3	2.5
Ranking	II	I	III

(ii) Calculation of Throughput Accounting Ratio (₹)

Particulars	X	Y	Z
Factory cost per minutes (2,21,600/75,120 minutes)()	2.95	2.95	2.95
TA ratio (contribution per minute/Cost per minute)	0.95	1.02	0.85
Ranking based TA ratio	II	I	III

Analysis – Product Y yields more contribution compared to average factory contribution per minute, whereas X and Z yield less.

2(b)

Transferred units	25X2000	50000
Existing Profit	7500 X 25 X4	₹ 7,50,000

Effect on profit of transfer price is

(i) Marginal Cost

	₹
Material	2.00
Labour	1.00
OHs	1.00
	4.00

At this transfer price there is no effect on profit of T ltd.

(ii) Profit = 50,000

(iii) Profit per unit =4+{(2000000 X 15% X.5)/50000}=7

Under this method profit of T ltd is increases by Rs.150000 i.e 50000 X(7-4)

(iv) Profit increases by 50000 X (8-4) = Rs.200000

(v) Transfer price

	₹
{8+(8/12)4}	=10.67
(-)Profit	=4.00
	6.67

Profit increases by 50000 X6.67 = ₹ 3,33,500

(vi) Transfer price = ₹8.50

Profit increase by 4.5 X50000 = ₹ 2,25,000

3. (a) ABC Ltd. produces three products. The cost data are as under:

Particulars	X	Y	Z
Direct Materials (₹)	**66**	**75**	**90**
Direct Labour	**24**	**30**	**40**
	15	**15**	**20**

Dept	Rate per Hour (₹)	Hrs.	Hrs.	Hrs.
I	5	18	10	20
II	6	5	4	6.5
III	4	10	5	20
		16	9	24

Fixed overheads ₹4,00,000 per annum.

The budget was prepared at a time, when market was sluggish. The budgeted quantities and selling price are as under:

Product	Budget Quantity	Selling price (/per
X	9,750	270
Y	7,800	280
Z	7,800	400

Later the market improved and the sale quantities could be increased by 20% for product X and 25% each for products Y and Z. The sales manager confirmed that the increased quantities could be achieved at the prices originally budgeted. The production Manager has stated that the output cannot be increased beyond the budgeted level due to limitation of direct labour hours in Department 2.

Required: (i) Propox optimal product mix.

(ii) Find out the profit under the optimal product mix. 6+6=12

(b) A company is engaged in manufacturing 3 products. Find out the profitability of products.

(i) Total sales potential in unit is limited,

(ii) Total sales potential in vale is limited

(iii) raw materials are in short supply,

(iv) production capacity (machine hours) is limited. 4

Answer:3(a)

Product		X	Y	Z
Budged Quanity (units):		9,750	7,800	7,800
Selling price (p.u):	(i)	270	280	400
Variable cost (p.u):				
Direct materials		64	152	117
Direct labour		160	94	219
Variable overheads		16	9	24
Total variable cost(p.u)	(ii)	244	255	360
Contribution(p.u) (`)	(i)-(ii)	30	25	40

Statement of optima product mix and profit.

Product:		X	Y	Z	Total
Contribution (p.u) (Rs.)	(a)	30	25	40	
Direct labour hours in Dept.2	(b)	5	4	6.5	
Contribution per hr:	(a)/(b)	6	6.25	6.15	
		III	I	II	

Optimal product mix units (c)	5655 (28275 hrs)	9750 (39000 hrs)	9750 (63375 hrs)	
Total Contribution (Rs) (a) X(C)	169650	243750	390000	803400
Less: Fixed Cost (Rs)				400000
Optimal Profit				403400

Working Notes

(1) Total Hours available in Department 2

Product	Units(b)	Hrs(p.u)(c)	Total hrs.(d) =(b) X(c)
X	9,750	5	48,750
Y	7,800	4	31,200
Z	7,800	6.5	50,700
Total available hrs for budgeted production			1,30,650

(2) Maximum Sales Quantities of Products (under improved market conditions)

Product	Units	Increase in %	Total Number of Units
X	9,750	20	11,7
Y	7,800	25	9,750 X4 =39,000
Z	7,800	625	9,750 X6.5=63,375

Required hours for Y+Z =1,02,375

Hours available for X:1,30,650-1,02,375 =28,275

Production for X 28275/5 =5655units

The Section process will be based on optimization of contribution in relation to constraint. (i) Unit contribution

(ii) P/V or C/S ratio

(iii) Contribution per Kg of RM

(iv) Contribution per machine hour

4. (a) A company manufacturing a special type of fencing tile 12” × 8” × 1/2” used a system of standard costing. The standard mix of the compound used for making the tiles is:
1,200 kg. of material A @ ₹ 0.30 per kg.
500 kg. of Material B @ ₹ 0.60 per kg
800 kg. of Material C @ ₹ 0.70 per kg

The compound should produce 12,000 square feet of tiles of 1/2” thickness. During a period in which 1,00,000 tiles of the standard size were produced, the material usage was:

Kg		
7,000	Material A @ ₹0.32 per kg	2,240
3,000	Material B @ ₹0.65 per kg	1,950
5,000	Material C @ ₹ 0.75 per kg.	3,750
15,000		7,940

Present the cost figures for the period showing Material price, Mixture, Sub-usage Variance. **10**

(b) Distinguish between Standard Costing and Budgetary Control? **6**

Answer:4(a)

Area of tile =12" X8" =2/3 sq ft
No of tiles that can be laid in 12000 sq ft is 12000/(2/3)=18000

	Standard			Actual		
	Quantity	Price	Value	Quantity	Price	Value
A	6,666.67	0.30	2000	7,000	0.32	2,240
B	2,777.77	0.60	16,667	3,000	0.65	1,950
C	4444.44	0.70	3,111	5,000	0.75	3,750
	13,888,.89		6,778	15,000		7,940

Q for A =1200 X1,00,000/18,000=6,666.67
Q for B =500 X 1,00,000/18,000 =2,777,.77
Q for C=800 X 1,00,000/18,000=4,444.44

(₹)

	SQSP	RSQP	AQSP	AQAP
A		7,200 X0.3=2,160	7,000 X0.3=2,100	
B		3,000 X0.6=1,800	3,000 X0.6=1,800	
C		4,800X0.7=3,360	5,000 X0.7=3,500	
	6,778	7,320	7,400	7,940

RSQ for A = (15000/13888.89) x 666667

- Material sub usage variance = ₹542(A)
- Material mix variance = ₹80(A)
- Material usage variance = ₹ 622(A)
- Material price variance = ₹ 540(A)
- Material cost variance = ₹1162(A)

4(b)

Like Budgetary Control, principles of Standard Costing assume that costs are controllable along definite lines of supervision and responsibility and it aims at managerial control by comparison of actual performances with suitable predetermined yardsticks. The basic principles of cost control, viz., setting up of targets or standards, measurement of performance, comparison of actual with the targets and analysis and reporting of variances are common to both standard costing and budgetary control systems. Both techniques are of importance in their respective fields and are complementary to each other. Thus, conceptually there is not much of a difference between standard costs and budgeted and the terms budgeted performance and standard performance mean, for many concerns one and the same thing.

Despite the similarity in the basic principles of Standard Costing and Budgetary Control, the two systems vary in scope and in the matter of detailed techniques. The difference may be summarized as follows:

(a) A system of Budgetary Control may be operated even if no Standard Costing system is prevailing in th concern.

(b) While standard is a unit concept, budget is a total concept.

(c) Budgets are the ceilings or limits of expenses above which the actual expenditure should not normally rise; if it does, the planned profits will be reduced. Standards are minimum targets to be attained by actual performance at specified efficiency.

(d) Budgets are complete in as much as they are framed for all the activities and functions of a concern such as production, purchase, selling and distribution, research and development, capital utilization, etc. Standard Costing relates mainly to the function of production and the related manufacturing costs.

(e) A more intensive analysis of the variances from standards is necessary than in the case of variations from the budget.

(f) Budgets are indices, adherence to which keeps a business out of difficulties. Standards are pointers for further possible improvements.

5. (a) P.H. Ltd. has two manufacturing departments organised into separate profit centres known as the Basic unit and Processing unit. The Basic unit has a production capacity of 4,000 tonnes per month of Chemvax but at present its sales are limited ₹ 2,000 tonnes to outside market and 1,200 tonnes to the Processing unit.

The transfer price for the year 1986 was agreed at ₹400 per tonne. This price has been fixed in line with the external wholesale trade price on 1st January 1986. However due to heavy competition the Basic unit has been forced to reduce the wholesale trade price to ₹360 per tonne with effect from 1st June, 1986. This price however was not made applicable to the sales made to the Processing unit of the company. The Processing unit applied for revision of the price as applicable to the outside market buyers as from 1st June 1986 but the same was turned down by the basic unit.

The Processing unit refines Chemvax and packs the output Known as Colour-X in drums of 50kgs each. The selling price of colour-X is ₹40 per drum. The Processing unit has a potential of selling a further quantity of 16,000 drums of colour-X provided the overall price is reduced to ₹ 32 per drum. In that event it can buy the additional 800 tonnes of Chemvex from the basic unit whose capacity can be fully utilised. The outside market will not however absorb more than the present quantity of 2,000 tonnes

The cost data relevant to the operations are:

	Basic Unit (₹)	Processing Unit(₹)
Raw Materials/tonne	70	Transfer Price
Variable Cost/tonne	140	170
Fixed Cost/month	3,00,000	1,20,000

You are Required:

(i) Prepare statement showing the estimated profitability for June 1986 for each uint and the company as a whole on the following bases:

(a) At 80% and 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹400 per tonne.

(b) At 80% capacity utilisation of the basic unit at the market price of ₹360 per tonne and the transfer price to the Processing unit of ₹ 400 per tonne.

(c) At 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹ 360 per tonne.

(ii) Comment on the effect of the company's transfer pricing policy on the profitability of the Processing Unit. 10

(b) Explain the limitations & of Advantages of Activity Based Costing.

Answer:5(a)

Statement showing computation of profit at 80% capacity when transfer price is ₹400/- ton:

	Basic Unit	Processing Unit	Total
i)No.of Units	3,200	(1200X1000)/50	24,000
ii)Contribution per units	{400-(140+70)}=190	{40-(570/20)}	11.5
iii)Total Contribution	608000	276000	884000
iv)Fixed cost	300000	120000	420000
v)Profit	308000	156000	464000

At 100% capcity:

	Basic Unit	Processing Unit	Total
i)No.of Units	4000	40000	
ii)Contribution per units	190	3.5	
iii)Total Contribution	760000	140000	900000
iv)Fixed cost	300000	120000	420000
v)Profit	460000	20000	480000

(b)computation of profit

	Basic Unit		Processing Unit	Total
	Out Side sale	Internal Transfer		
i)No.of Units	2000	1200	24000	
ii)Contribution per units	150	190	11.5	
iii)Total Contribution	300000	228000	276000	
	528000		276000	804000
iv)Fixed cost	300000		120000	420000
v)Profit	228000		156000	3840000

(c) Computation of Profit:

	Basic Unit	Processing Unit	Total
i)No.of Units	4000	40000	
ii)Contribution per units	150	5.5	
iii)Total Contribution	600000	220000	820000
iv)Fixed cost	300000	120000	420000
v)Profit	300000	100000	400000

Overall profit is more at 100% capacity of basic unit with a transfer price of ` 400/- per ton being the market price. If individual interests are not considered this may be adopted. However, from the view point of the processing unit, it will not be interested to buy more than 1200tonnes from the basic unit, because its profit gets reduced when it takes additional units. Therefore, the resent policy of the management is not at all attractive to the processing unit.

5.(b) Advantages of Activity Based Costing

(i)It provides more accurate product costing information by reducing arbitrary cost allocations.

(ii)It improves the quality of information available for decision making by answering the questions such as what activities and events are driving cost and where efforts should be made to control cost ?

(iii)It is easiest way to allocate overhead in the product. (iv)It helps to identify the activities that can be eliminated.

(v)It links up cause and effect relationship.

(vi)ABC helps to identify the value added activities (that increase the customer's satisfaction)and non- value added activities (that creates the problems in customer's satisfaction)

(vii)ABC translates cost in to a language that people can understand and that can be linked up to business activities.

Limitations of Activity Based Costing

(i)More time consuming to collect data

(ii)Cost of buying, implementing and maintaining activity based system

(iii)In some cases, the establishment of cause and effect relationship between cost driver and costs not be a simple affair.

(iv)ABC does not conform to generally accepted accounting principles in some areas.

6. (a) In a village dispensary patients are treated by a doctor on a first-come-first-serve basis. The inter-arrival time of the patients is known to be uniformly distributed between 0 and 80 minutes, while their service time is known to be uniformly distributed between 15 and 40 minutes. To simulate the system and determine the average time a patient has to be in the queue for getting service and the proportion of time the doctor would be idle.

Carry out the simulation using the following sequences of random numbers. The numbers have been selected between 00 and 80 to estimate inter-arrival times and between 15 and 40 to estimate the service time required by the patients.

Series 1	07	21	12	80	08	03	32	65	43	74
Series 2	23	37	16	28	30	18	25	34	19	21

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(b) A manufacturer has three distribution centres P, Q, and R. These centres have 40,20 and 40 units of his product. His retail outlets at A, B, C, D and E require 25,10,20,30 and 15 units respectively. The transport cost in (Rupees/Unit) between each centre and each outlet is given in the following table:

Distribution Centre	Retail outlets				
	A	B	C	D	E
P	55	30	40	50	40
Q	35	30	100	45	60
R	40	60	95	35	30

We have to find out the optimum distribution cost. **8**

Answer:6(a)

Simulation of data village dispensary							
No.of patients	Inter arrival Time Random No. (minutes)	Entry time in to queue (hrs)	Service Time Random No. (minutes)	Service Start time (hrs)	End time (hrs)	Waiting time of patient (minutes)	Idle time of doctor (minutes)
1	07	8.07	23	8.07	8.30	-	07
2	21	8.28	37	8.30	9.07	2	-
3	12	8.40	16	9.07	9.23	27	-
4	80	10.00	28	10.00	10.28	-	37
5	08	10.08	30	10.28	10.58	20	-
6	03	10.11	18	10.58	11.16	47	-
7	32	10.43	25	11.16	11.41	33	-
8	65	11.48	34	11.48	12.22	-	07
9	43	12.31	19	12.31	12.50	-	09
10	74	01.45	21	01.45	02.06	-	55
						129	115

Average waiting time of patient = 19/10 =12.9 minutes
Average waiting time of doctor= 115/10 =11.5 mintutes

It has been assumed that starting time be 8.00 A.M

(b)

	A	B	C	D	E		
P	55 5	30 10	40 20	50 5	40	40/20/10/5/0	10/10*/10/5
Q	35 20	30	100	45	60	20/0	5/5/10/10
R	40	60	95	35 25	30 15	40/25/0	5/5/5/5/5
	25/5/0	0	10/0	20/5/0	30/0	15	

A: 5, 5, 5, 5, 15
B: 0, 0
C: 55*
D: 10, 10, 10, 10, 15*
E: 10, 10, 10*

						U_i
	55 / 5	30 / 10	40 / 20	50 / (-) 5	40 / (+) 10	0
	35 / 20	30 / 20	100 / 80	45 / 15	60 / 30	-20
	40 / 0	60 / 45	95 / 70	35 / (+) 25	30 / (-) 5	-20
V_j	55	30	40	50	50	

						U_i
	55 / (-) 5	30 / 10	40 / 20	50 / 5	40 / (+) 5	0
	35 / 20	30 / 20	100 / 80	45 / 20	60 / 40	-20
	40 / (+) -5	60 / 40	95 / 65	35 / 30	30 / 10 (-)	-10
V_j	55	30	40	45	40	

						U_i
	55 / 5	30 / 10	40 / 20	50 / 5	40 / 10	0
	35 / 20	30 / 15	100 / 75	45 / 15	60 / 35	-15
	40 / 5	60 / 40	95 / 65	35 / 30	30 / 5	-10
V_j	55	30	40	45	40	

Since ?$_{ij}$ is ≥ 0

The solution is optimum

			Qty	Minimum Cost
P	→	B	10 x 30 =	300
	→	C	20 x 40 =	800
	→	E	10 x 40 =	400
Q	→	A	20 x 35 =	700
R	→	A	5 x 40 =	200
	→	D	30 x 35 =	1050
	→	E	5 x 30 =	150
			100	**₹ 3600**

7. (a) ABC an **Automobile company prepared a design of its latest model for which various activities adopted as follows:**

Activity	Description of activity	Preceding activity
A	Prepare drawing	-
B	Carry out cost analysis	A
C	Carry out financial analysis	A
D	Manufacture tools	C
E	Prepare bill of material	B,C
F	Receive material	D,E
G	Order sub-accessories	E
H	Receive sub-accessories	G
I	Manufacture components	F
J	Final Assembly	I,H
K	Testing and Shipment	J

Prepare an appropriate network diagram. **8**

(b) For selecting the best mix of five possible products A, B, C, D and E. The management of A Ltd. wants to use linear programming model and the following information is available:

Particulars	Per Unit of Product				
	A	B	C	D	E
Selling Price (₹)	96	84	76	62	54
Cost (₹)					
Material	30	28	32	30	32
Direct Labour	36	32	12	8	8
Fixed Overhead	18	16	6	4	4
Total Costs	84	76	50	42	44

Expected maximum unit demand per week for each product at the prices indicated:

A	B	C	D	E
3000	2400	1800	1200	1200

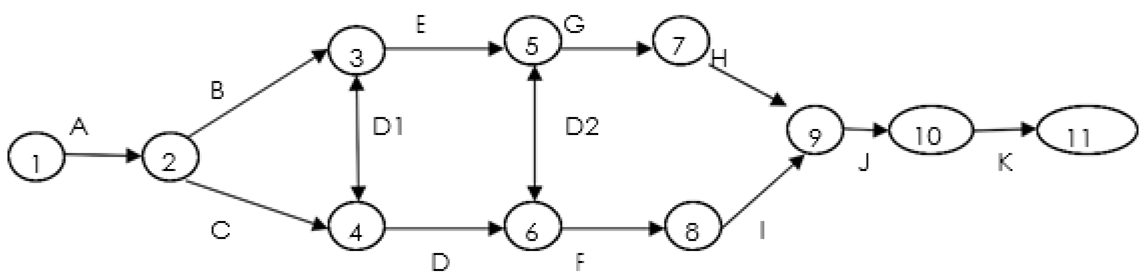
Cost of material includes a special component which is in short supply. It costs ₹6 per unit. Only 11,600 units are available to the company during the week. The number of units of the special component needed for a unit of each product is:

A	B	C	D	E
2	1	4	3	6

The management of A Ltd. has ruled that expenditure on materials must not exceed a sum of ₹60,000.All other resources are freely available in sufficient quantities for planned need.

Formulate a linear programming model stating clearly the criterion you use. **8**

Answer:7(a)



7(b)

	A	B	C	D	E
Selling Price	96	84	76	62	54
Variable Cost	66	60	44	38	40
Contribution	30	24	32	24	14

Let a, b, c, d, e be the number of units respectively of A,B,C,D and E to b produced.

Objective function: Maximise contribution: Z = 30a+24b+32c+24d+14e

Subject to: Demand Constraint

a	≤	3000
b	≤	2400
c	≤	1800
d	≤	1200
e	≤	1200

Special Raw Material availability constraint

$2a + b + 4c + 3d + 6e \leq 11600$

Special raw material cost constraint

$12a + 6b + 24c + 18d + 36e \leq 60,000$,

Non negativity constraint:

$a,b,c,d,e \geq 0$

8. Write short notes on any four of the following: 4×4= 16

(a) Business Process Re-engineering
(b) Value Engineering
(c) Simulation Technique
(d) Four P's of TQM
(e) Usefulness of Pareto Analysis.

Answer

8(a) Business Process Re-engineering (BPR) refers to fundamental rethinking and redesign of business processes to achieve improvement in critical measures of performance such as cost, quality, service, speed and customer satisfaction. In contrast, the concept of Kaizen, which involves small, incremental steps towards gradual improvement, re-engineering involves a giant leap. It is the complete redesign of a process with an emphasis on finding creative new way to accomplish an objective. It has been described as taking a blank piece of paper and starting from scratch to redesign a business process. Rather than searching continually for minute improvement, reengineering involves a radical shift in thinking about how an objective should be met. Re-engineering prescribes radical, quick and significant change. Admittedly, it can entail high risks, but it can also bring big rewards. These benefits are most dramatic, when new models are discovered for conducting business.

8(b) Value Engineering is an organized/systematic approach directed at analyzing the function of systems, equipment, facilities, services, and supplies for the purpose of achieving their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety. Value Engineering is an effective problem solving technique. Value engineering is essentially a process which uses function analysis, team-work and creativity to improve value. Value Engineering is not just –"good engineering"

It is not a suggestion program and it is not routine project or plan review. It is not typical cost reduction in that it doesn't —cheapen the product or service, nor does it –"cut corners".

Value Engineering methodology is a powerful tool for resolving system failures and designing improvements in performance of any process, product, service or organization.

8(c)

Simulation:

Simulation is a modelling and analysis tool that is widely used for the purpose of designing, planning and control of manufacturing systems. Simulation in general is to pretend that one deals with a real thing while really working with an imitation. In Operations Research, the imitation is a computer model of the simulated reality. The task of executing simulations provides insight and a deep understanding of physical processes that are being modelled.

Simulation is generally referred to as computer simulation, which simulates the operation of a manufacturing system. A computer simulation or a computer model is a computer program, which attempts to simulate an abstract model of a particular system.

A simple example of a simulation involves the tossing of a ball mto the air. The ball can be said to "simulate" a missile, for instance. That is, by experimenting with throwing balls starting at different initial heights and initial velocity vectors, it can be said that we are simulating the trajectory of a missile.

Monte Carlo method of simulation is the most popular method of simulation. In Linear Programming, Simulation is called as the 'technique of last resort'. It means, when all other methods fails, we resort to Simulation as the last resort.

8(d) Four P's of TQM

Four P's of TQM	
People	To ovoid misdirection, TQM teams should consist of team spirited individuals who have a flair for accepting and meeting challenges Individuals who are not ideally suited to the participatory process of TQM. Should not be involved at all. e.g. lack of enthusiasm, non-attendance at TQM meetings, failure to complete delegated work, remaining a "Mute Spectator" at
Process	It is essential to approach problem-solving practically and to regard the formal process as a system designed to prevent participants from jumping to conclusions. As such, it will provide a means to facilitate the generation of alternatives while ensuring that important discussion stages are not omitted
Problem	Problems need to be approached in a systematic manner, with teams tackling solvable problems with a direct economic impact, allowing for immediate feedback together with recognition of the contribution made by individual participants.
Preparation	Additional training on creative thinking and statistical processes are needed in order to give participants a greater appreciation of the diversity of the process. Thistraining must quickly be extended beyond the immediate accounting circle to include employees at supervisory levels

8.(e) Pareto analysis is useful to:

1. Prioritize problems, goals, and objectives to Identify root causes,
2. Select and define key quality improvement programs,
3. Select key customer relations and service programs,
4. Select key employee relations improvement programs,
5. Select and define key performance improvement programs,
6. Maximize research and product development time,
7. Verify operating procedures and manufacturing processes,
8. Product or services sales and distribution,
9. Allocate physical, financial and human resources.