Paper 15- Management Accounting: Enterprise Performance Management

1. (a) Expand the following abbreviations:

(i) PLCM
(ii) EFQM
(iii) OSHAS
(iv) AQL
(v) CWTQM
(vi) OPT
(vii) FMEA
(viii) SCRS
(ix) PDSA
(x) JUSE
(xi) VAM
(xii) DRP
(xiii) SCP
(xiv) QFD
(xv) DBR

Answer:

(i) PLCM-Product Life Cycle Management
(ii) EFQM – European Foundation for Quality Management
(iii) OSHAS- Occupational safety and hazard system
(iv) AQL- Acceptable Quality Level
(v) CWTQM – Company Wide Total Quality Management
(vi) OPT – Optimised Production Technology
(vii) FMEA- Failure modes and effects analysis
(viii) SCRS – Setup cost reduction system
(ix) PDSA – Plan-Do-Study Act
(x) JUSE - Japanese union of Scientists & Engineers
(xi) VAM- Value Analysis Method
(xii) DRP- Distribution Requirement Planning
(xiii) SCP- Supply Chain Planning
(xiv) QFD- Quality Function Deployment
(xv) DBR – Drum Buffer Rope

(b) Define the following terms

(i) Learning Curve effect
(ii) Data Mining
(iii) Quality Function Deployment
(iv) Succession Planning
(v) Bench Marking

Answer:

(i) Learning Curve Effect states that the more times a task has been performed, the less time will be required on each subsequent iteration.

(ii) Data mining or the process of analysing empirical data, allows for the extrapolation of the information.
(iii) Quality Function Deployment (QFD) is a structured approach to defining customer needs or requirements and translating them into specific plans to produce products to meet those needs.
(iv) Succession Planning is the systematic process of defining future management requirements and identifying candidates who best meet those requirements. It involves using the supply of labour within the organization for future staffing needs.
(v) Benchmarking is a process of continuously comparing and measuring an organizations business process against business leader anywhere in the world to gain information that will help the organization take action to improve performance.

(c) State if each of the following statements is True or False.

(i) **The key factors of Theory of Constraints are contribution and profit.**
(ii) Life Costing is a technique to establish the total cost of ownership.
(iii) One of the goals JIT seeks to achieve is batch sizes of one.
(iv) Theory Y style of Management is a highly autocratic style.
(v) EVA encourage short term performance.
(vi) Black Flash Accounting COMPARES PROFIT WITH THE COST OF PRODUCING A PRODUCT.
(vii) The key factors ' Theory of Constraints" are Contribution & Profit.
(viii) Life Costing is a technique to establish the total cost of ownership.
(ix) The experience curve effect is broader in scope than the learning curve.
(x) The concept of quality Circle is primarily based upon recognition of the value of the worker.

Answer:
(i) False
(ii) True
(iii) True
(iv) False
(v) False
(vi) False
(vii) False
(viii) True
(ix) True
(x) True

Q.2.(a) S Ltd. is about to replace its rapidly deteriorating boiler equipment. Three types of boiler system are being considered as a suitable replacement: (A) coal-fired, (B) Gas-fired, and (C) Oil-fired. The associated costs are as follows.

Boiler system	A	B	C

Costs of boiler (including installation and	55,000	74,000	67,000
commissioning) Fuel cost per annum	27,000	23,000	25,000
Operating labour costs per annum Maintenance	8,000	-	-
costs per annum Electricity costs per annum	4,000	3,000	3,000
Operating costs per annum	1,000	1,000	1,000
	40,000	27,000	29,000

The new boiler system is expected to last at least ten years. The company has an opportunity cost of finance of 15% per year. Which system should be chosen? If the new system is expected to last for five years, which system is most economical?

Q.2.(b) After observing heavy congestion of customers over a period of time in a petrol station, Mr. X has decided to set up a petrol pump facility on his own in a nearby site. He has compiled statistics relating to the potential customers arrival pattern and service pattern as given below. He has also decided to evaluate the operations by using the simulation technique.

Arrivals		Services	
Inter-arrival time (minutes)	Probability	Inter-arrival time (minutes)	Probability
2	0.22	4	0.28
4	0.30	6	0.40
6	0.24	8	0.22
8	0.14	10	0.10
10	0.10		

Assume:

(i) The clock starts at 8.00 hours
(ii) Only one pump is set up
(iii) The following 12 Random Numbers are to be used to depict the customer arrival pattern.
(iv) 78, 26, 94, 08, 46, 63, 18, 35, 59, 12, 97 and 82.
(v) The following 12 Random Numbers are to be used to depict the customer service pattern.
(vi) 44, 21, 73, 96, 63, 35, 57, 31, 84, 24, 05 and 37.

Your are required to find out the
(i) Probability of the pump being idle and
(ii) Average time spent by a customer waiting in queue

Solution:

Answer (i)

If the decision is taken on the basis of initial cost only, then the Coal-fired boiler system would be selected. However, over its life time (at least ten years) the annual operating costs are much higher than for the Gas-fired and Oil-fired system. The life cycle costs for ten years are as follows :

(₹)

Boiler system	A	B	C
Costs of boiler	55,000	74,000	67,000
Operating costs (Annual costs × 10 years) Total costs	4,00,000	2,70,000	2,90,000
	4,55,000	3,44,000	3,57,000

However, we need to discount the annual costs at a 15% discount rate to arrive at the present value cost of each system. The discount factor for year 1-10 at 15% is 5.019.

The present value of each system then is :

(₹)

Boiler system	A	B	C
Cost of boiler	55,000	74,000	67,000
Operating costs (Annual costs × 5.019) Present value of total costs	2,01,000	1,36,000	1,46,000
	2,56,000	2,10,000	2,13,000

If the expected life is reduced to five years, the Oil-fired system (C) becomes the most economical, as follows :

(₹)

Boiler system	A	B	C
Cost of boiler	55,000	74,000	67,000
Operating costs (Annual costs × 3.353) Present value of total costs	1,34,000	91,000	97,000
	1,89,000	1,65,000	1,64,000

(ii) Random no. Table:

Inter-arrival time				Service time			
Minutes	Probability	Cumulative Probability	Range	Minutes	Probability	Cumulative Probability	Range
2	0.22	0.22	00-21				
4	0.30	0.52	22-51	4	0.28	0.28	00-27
6	0.24	0.76	52-75	6	0.40	0.68	28-67
8	0.14	0.90	76-89	8	0.22	0.90	68-89
10	0.10	1.00	90-99	10	0.10	1.00	90-99

Sl.no.	Random no. for inter arrival	Inter arrival time	Entry time in queue	Service start time	Random no. for service	Service time	Service end time	Waiting time of customer	Idle time
1	78	8	8.08	8.08	44	6	8.14	-	8
2	26	4	8.12	8.14	21	4	8.18	2	-
3	94	10	8.22	8.22	73	8	8.30	-	4
4	08	2	8.24	8.30	96	10	8.40	6	-
5	46	4	8.28	8.40	63	6	8.46	12	-
6	63	6	8.34	8.46	35	6	8.52	12	-
7	18	2	8.36	8.52	57	6	8.58	16	-
8	35	4	8.40	8.58	31	6	9.04	18	-
9	59	6	8.46	9.04	84	8	9.12	18	-
10	12	2	8.48	9.12	24	4	9.16	24	-
11	97	10	8.58	9.16	05	4	9.20	18	
12	82	8	9.06	9.20	37	6	9.26	14	

Total time	140	12

Average waiting time spent by the customer = 140/12 = 11.67 mins.

Probability if idle time of petrol station = 12/86 = 0.1395 i.e., 14%

Q3. All-Win Co. manufactures and sells 15,000 Units of a product. The Full Cost per Unit is ₹200. The Company has fixed its price so as to earn a 20% Return on an Investment of ₹18,00,000.

Required:

1. **Calculate the Selling Price per unit from the above. Also, calculate the Mark-up % on the Full Cost per unit.**
2. **If the Selling Price as calculated above represents a Mark-up % of 40% on Variable Cost per unit, calculate the variable cost per unit.**
3. **Calculate the Company's Income if it had increased the Selling Price to ₹230. At this price, the Company would have sold 13,500 units. Should the Company have increased the selling price to ₹230?**
4. **In response to competitive pressures, the Company must reduce the price to ₹210 next year, in order to achieve sales of 15,000 units. The Company also plans to reduce its investment to ₹16,50,000. If a 20% Return on Investment should be maintained, what is the Target Cost per unit for the next year?**

Solution:

1. Target Sale Price per unit = Full Cost + Target Profit = ₹200 + $\frac{\text{Rs.}18,00,000 \times 20\%}{15,000 \text{ units}}$	₹224
So, Mark-up on Full Cost = ₹24 ÷ ₹200	12%
2. Above Sale Price ₹224 = VC + 40% thereon, i.e. 140% on VC. So, Var. Cost = $\frac{Rs.224}{140\%}$	₹160
3. Present Contribution at 15,000 units = (₹224 – ₹160) × 15,000 units = Revised Contribution at 13,500 units = (₹230 – ₹160) × 13,500 = Hence, Increase in Sale Price is not beneficial, due to reduction in Contribution by	₹9,60,000 ₹9,45,000 ₹15,000
4. Target Profit for next year = $\frac{Rs.16,50,000 \times 20\%}{15,000\ units}$ = ₹22 So, Target Cost for next year = New Sale Price less Target Profit = ₹210 – ₹22	Rs188

Q 4. A Company has sales of 1,00,000 units at a price of Rs200.00 per unit and profit of ₹40.00 Lakhs in the current year. Due to stiff competition, the Company has to reduce its price of product next year 5% to achieve same volume target of sales. The cost structure and profit for the current year is given as below:

Particulars	(₹ Lakhs)
Direct Materials	**60.00**
Direct Wages	**45.00**
Variable Factory Overheads	**20.00**
Fixed Overheads including Sales & Admin Expenses	**35.00**
Total Cost	**160.00**

To achieve the Target Cost to maintain the same profit, the Company is evaluating the proposal to reduce Labour Cost and Fixed Factory Overheads. A Vendor supplying the Machine suitable for the Company's operations has offered an advanced technology Semi-Automatic Machine of ₹20 Lakhs as replacement of Old Machine worth Rs5.0 Lakhs. The Vendor is agreeable to take back the Old Machine at Rs2.70 Lakhs only. The Company's policy is to charge depreciation at 10% on WDV. The Maintenance Charge of the Existing Machine is ₹1.20 Lakhs per annum whereas there will be warranty of services free of cost for the New Machine first two years. There are ten (10) Supervisors whose Salary is ₹1.50 Lakhs per annum. The New Machine having Conveyor Belt is expected to help in cost cutting measures in the following ways –

1. **Improve productivity of workers by 20%**
2. **Cut-down Material Wastage by 1%**
3. **Elimination of services of Supervisors because of automatic facilities of the machine**
4. **Saving in Packaging Cost by 1.5 Lakhs**

Assuming Cost of Capital to be 15%, calculate how many supervisors should be removed from the production activities to achieve the Target Cost.

Solution: For the same quantity, Sales Value will reduce by 5% of (1,00,000 units × ₹200.00) = ₹10.00 lakhs. For maintaining the same amount of profit, cost also has to be reduced by ₹10.00 Lakhs, which can be achieved as under –

Particulars	₹ Lakhs
Savings: Reduction in Wages (**Note:** Due to higher Labour Productivity, Wages will be $\frac{45}{1.20}$ = ₹37.50 Lakhs)	7.50
Elimination of wastage of Materials = 1% of ₹60 Lakhs	0.60
Savings in Packing Cost (given)	1.50
Saving in Maintenance Cost (given)	1.20
Sub-Total (A)	**10.80**
Costs: Loss in Disposals of Old Machine (₹5 Lakhs – ₹2.70 Lakhs)	-2.30
Difference in Depreciation (₹20 Lakhs – ₹5 Lakhs) × 10%	-1.50
Cost of Capital Investment ₹20 Lakhs × 15%	-3.00
Sub-Total (B)	**6.80**
Effective Cost Reduction before considering removal of Supervisors	4.00
Additional Reduction required for meeting Target Cost, by removing Supervisors = (₹10 Lakhs – ₹4 Lakhs)	**6.00**

Hence, number of Supervisors to be removed = $\frac{Rs.6\ Lakhs}{Rs.1.50\ Lakhs\ per\ Supervisor}$ = 4 Supervisors.

Q5. A Company produces three products A, B and C. The following information is available for a period:

Product	A	B	C	Throughout Accounting Ratio
Contribution (₹ per unit) (Sales – Direct Materials)	**30**	**25**	**15**	

Machine hours required per unit of production:				
Machine 1	**10 hours**	**2 hours**	**4 hours**	**133.33%**
Machine 2	**15 hours**	**3 hours**	**6 hours**	**200.00%**
Machine 3	**5 hours**	**1 hour**	**2 hours**	**66.67%**

Estimated Sales Demand for A, B and C are 500 units each and machine capacity is limited to 6,000 hours for each machine. You are required to analyze the above information and apply Theory of Constraints process to remove the constraints. How many units of each product will be made?

Solution: TA Ratio is highest for 'Machine 2'. So, 'Machine 2' is the bottleneck. Total 'Machine2' hours available = 6,000

Particulars	A	B	C
1. Throughput Contribution per unit (given) (₹)	30	25	15
2. 'Machine 2' hours required per unit	15	3	6
3. Contribution per 'Machine 2' hour (1÷ 2) (₹)	2	8.33	2.5
4. Ranking	III	I	II
5. Maximum Sales Demand (units)	500	500	500
6. 'Machine 2' hours required (2 × 5)	7,500	1,500	3,000
7. 'Machine 2' hours allocated based on ranking	(bal. fig) 1,500	(I Rank) 1,500	(II Rank) 3,000
8. Possible Output Quantity (7 ÷ 2) (units)	100	500	500

Q6. TP Ltd produces a Product which passes through two processes – Cutting and Finishing. The following data is given –

Particulars	**Cutting**	**Finishing**
Hours available per annum	**50,000 hours**	**60,000 hours**
Hours needed per unit of product	**5**	**12**
Fixed Operating Costs per annum excluding Direct Materials	**₹10,00,000**	**₹10,00,000**

The Selling Price of the product is ₹1,000 per unit and the only Variable Cost per unit is Direct Material, which Cost ₹400 per unit. There is demand for all units produced.

Evaluate each of the following proposals independent of each other:

1. **An Outside Agency is willing to do the Finishing Operation of any number of units between 5,000 and 7,000 at ₹400 p.u.**
2. **An Outside Agency is willing to do the Cutting Operation of 2,000 units at ₹200 per unit.**
3. **Additional Equipment of cutting can be bought for ₹10,00,000 to increase the Cutting facility by 50,000 hours, with annual Fixed Costs increased by ₹2 Lakhs.**

Solution:

1. Basic Computations

Throughput Contribution p.u. = Selling Price ₹1,000 – Variable Cost ₹400 = ₹600

Particulars	**Cutting**	**Finishing**
Hours available p.a.	50,000	60,000
Hours required p.u. of product	5	12
Capacity in units	50,000 ÷ 5 = 10,000 units	60,000 ÷ 12 = 5,000 units

Whether Bottleneck Resource?	**No**	**Yes**

Observation:

- Even though Cutting process has a capacity of 10,000 units, the Finishing process has capacity to complete only 5,000 units. Hence, the overall Effective Output of the Company is only 5,000 units.
- Finishing Process will operate to full capacity (5,000 units), and there will be spare capacity of 10,000 – 5,000 = 5,000 units in the Cutting process

2. Evaluation of Options

1. **Option 1 – Outsourcing the Finishing Operation:** There is spare capacity in Cutting Process for additional 5,000 units, in order to supply the required cut material to the Outside Agency. So, Finishing Process can be outsourced for 5,000 units, since Additional Contribution = (Throughput Contribution ₹600 – Outsourcing Cost ₹400) × 5,000 units = ₹10,00,000.
2. **Option 2 – Outsourcing the Cutting Operation:** Cutting process already has spare capacity upto 5,000 units. Outsourcing the Cutting process will not lead to any saving in Fixed Operating Costs, but will increase outsourcing cost and pile up WIP Inventory, without generating any saleable output. Hence, this proposal of outsourcing Cutting process for 2,000 units at ₹200 p.u. is not worthwhile
3. **Purchase of additional Cutting Equipment:** Cutting process already has spare capacity upto 5,000 units. Purchasing additional equipment for ₹10,00,000 will lead increase in Fixed Operating Costs and pile up WIP inventory, without generating any saleable output. Hence, this proposal of purchasing Cutting Equipment is not worthwhile.

Q7: An oil Refinery can blend 3 grades of crude oil to produces Quality A & Quality B Petrol. Two possible blending processes are available. For each production run, the older process uses 5 units of Crude Q, 7 units of Crude P and 2 Units of Crude R and produces 9 Units of A and 7 Units of B. The newer process uses 3 units of Crude Q, 9 units of Crude P & 4 units of Crude R to produces 5 units of A & 9 units of B.

Because of prior contract commitments, the refinery must produce at least 500 units of A and at least 300 units of B for the next month. It has 1,500 units of Crude Q, 1900 units of Crude P and 1,000 units of Crude R. For each unit of A, refinery receives ₹60 while for each unit of B, it receives ₹90.

Solution:

Crude Oil type	Older Process	Newer Process	Available Crude Oil
Q	5 units	3 units	1,500 units
P	7 units	9 units	1,900 units
R	2 units	4 units	1,000 units
Output obtained per process	A = 9 units, B = 7 units	A = 5 units, B = 9 units	
Revenue obtained per process	(60 × 9) + (90 × 7) = ₹1,170	(60 × 5) + (90 × 9) = ₹1,110	

Let X, Y the number of times the refinery decides to use Older process and Newer process respectively.

The LPP is: **Objective:** Maximize Revenue Z = 1,170X + 1,110Y

Subject to
$5X + 3Y \leq 1,500$ (Crude Old Q available)
$7X + 9Y \leq 1,900$ (Crude Old R available)
$2X + 4Y \leq 1,000$ (Crude Oil P available)
$9X + 5Y \geq 500$ (Demand of A)
$7X + 9Y \geq 300$ (Demand of B)
$X, Y \geq 0$ (Non-Negativity Assumption)

Q8: A farmer has a farm with 125 acres. He produces Carrot, Beetroot and Potato. Whatever he produces is fully sold in the market. He gets ₹5 per kg for Carrot, ₹4 kg for Beetroot and ₹5 per kg for Potato. The average yield is 1500 kg of Carrot per acre, 1800 kg of Beetroot per acre and 1200 kg of Potato per acre. To produce each 100 kg of Carrot and Beetroot and 80 kg of Potato, a sum of ₹12.50 has to be spent for manure. Labour required for each acre to raise the crop is 6 man – day for Carrot and Potato each and 5 man – day for Beetroot. A total of 500 man – days of labour at the rate of ₹40 per man –day are available. Formulate & LPP to maximize the farmer's total profit.

Solution: Let C, B and P be the number of acres allotted for cultivating Carrot, Beetroot and Potato respectively. The Profit from the produces is determined in the following manner –

Particulars Per acre	Carrot	Beetroot	Potato
Selling Price	₹5 / kg × 1500 kgs = ₹7500	₹4 / kg × 1800 kgs = ₹7200	₹5 / kg × 1200 kgs = ₹6000
Less: Manure Cost	1500 kgs × ₹12.50/100 = ₹187.50	1800 kgs × ₹12.50/100 = 225.00	1200 kgs × ₹12.50/80 = ₹187.50
Less: Labour Cost	₹40 × 6 = ₹240	₹40 × 5 = ₹200	₹40 × 6 = ₹240
Profit per acre	₹7072.50	₹6775	₹5572.50

Maximise Profit Z = 7072.50 C + 6775 B + 5572.5 P
Subject to $C+B+P \leq 125$ (Land Availability)
$6C + 5B + 6P \leq 500$ (Man Days Availability)
$C, B, P \geq 0$ (Non-Negativity Assumption)

Q9 XYZ Ltd., supports the concept of the Life Cycle Costing for new investment decisions, covering its engineering activities, XYZ LTD., is to replace a number of its machines and the Chief Engineer is to decide between the 'AB' machine, a more expensive machine, with a life of 10 years and the 'CD' machine with an estimated life of 5 years. If the 'CD' machine is chosen, it is likely that it would be replaced at the end of 5 years. If the 'CD' machine is chosen, it is likely that it would be replaced at the end of 5 years by another 'CD' machine.

The pattern of maintenance and running costs differs between two types of machine and the relevant data are as given below:

₹

	AB	CD
Purchase price	**19,000**	**13,000**
Trade-in-value	**3,000**	**3,000**
Annual repair cost	**2,000**	**2,600**
Overhaul cost (p.a.)	**4,000**	**2,000**
	(at year 8)	**(at year 4)**
Estimated financing cost averaged		
Over machine life (p.a.)	**10%**	**10%**

Required: Recommend, with supporting figures, which machine to be purchased, stating any assumptions made.

[Given PVIF (10,10) = 0.39
PVIF (10,5) = 0.62
PVIFA (10,10) = 6.15
PVIFA (10,5) = 3.80

PV factor @ 10% for 4 years = 0.68
PV factor @10% for 8 years = 0.47]
PVIF means present value interest factor.
PVIFA means present value interest factor for an Annuity.

Answer: AB M/c- 10yrs. Life.

	Year	Cost (₹)	P/V factor	Discounted Cost (₹)
Purchase Price	0	19,000	1.00	19,000
Overhaul Costs	8	4,000	0.47	1,880
Trade-in-value	10	(3,000)	0.39	(1,170)
Annual Repair Cost	1-10	2,000	6.15	12,300
				32,010

Annualized equivalent = ₹32,110/6.15 = ₹5,221

CD M/c– 5 yrs. Life.

	Year	Cost (₹)	P/V factor	Discounted Cost (₹)
Purchase Price	0	13,000	1.00	13,000
Overhaul Costs	4	2,000	0.68	1,360
Trade-in-value	5	(3,000)	0.62	(1,860)
Annual Repair Cost	1-5	2,600	3.80	9,880
				22,380

Annualized equivalent = ₹22,380/3.80 = ₹5,890.

Conclusion: AB M/c should be purchased.

Q.10. The management of A Ltd. is considering which of the two mutually exclusive project is to select.

Details of each project are as follows –

Project K (₹ '000)		**Project L (₹ '000)**	
Probability	**Profit**	**Probability**	**Profit**

0.3	**300**	**0.2**	**(800)**
0.3	**400**	**0.6**	**600**
0.4	**500**	**0.1**	**800**
		0.1	**1600**

Solution:

Project K			Project L		
Probability	**Profit**	**EV**	**Probability**	**Profit**	**EV**
0.3	300	90	0.2	(800)	(160)
0.3	400	120	0.6	600	360
0.4	500	200	0.1	800	80
			0.1	1,600	160
		410			440

On the basis of EV above, it is observed that project L is marginally preferable to K by ₹ 30,000. Project L
is however more risky, offering ₹ 16,00,000 but also loss the extent ₹ 8,00,000.

Let us compute standard deviation of each project as follows:
Project K –

Probability (P)	Profit (x) (₹ '000)	$x - \bar{x}$	$P(x-\bar{x})^2$ (₹ '000)
0.3	300	–110	3,630
0.3	400	–10	30
0.4	500	90	3,240
			6,900

Hence $\bar{x}$ = 410; Standard deviation = $\sqrt{P(x-\bar{x})^2} = \sqrt{6,900} =$ 83.066 i.e., ₹ 83,066

Project L:

Probability (P)	Profit (x) (₹ '000)	$x - \bar{x}$	$P(x-\bar{x})^2$ (₹ '000)
0.2	(800)	(1,240)	3,07,520
0.6	600	160	15,360
0.1	800	360	12,960
0.1	1,600	1,160	1,34,560
			4,70,400

Hence $\bar{x}$ = 440; Standard deviation = $\sqrt{P(x-\bar{x})^2} = \sqrt{4,70,400} =$ 685.857; i.e., ₹ 6,85,857

As the EV of the projects differs, we have to find out coefficient of variation of each project, as follows –

	Project K	**Project L**

(a) Standard deviation	83,066	6,85,857
(b) EV of profit	410	440
Coefficient of variation = (a)/(b)	202.6	1588.8

Q11. DKD Ltd. makes tow products – X and Y, with the following cost patterns.

	Product X	Product Y
Direct materials	**27**	**24**
Direct Labour at ₹ 5 per hour	**20**	**25**
Variable production overheads at ₹ 6 per hour	**3**	**6**
	50	**55**

Production fixed overheads total ₹3,00,000 per month and these are absorbed on the basis of direct labour hours. Budgeted direct labour hours are 25,000 per month. However, the company has carried out an analysis of its production support activities and found that its 'fixed cost' actually vary in accordance with non-volume-related factors.

Activity	Cost-driver	Product X	Product Y	Total cost
Set-ups	**Production runs**	**30**	**20**	**₹40,000**
Materials handing	**Production runs**	**30**	**20**	**1,50,000**
Inspection	**Inspections**	**880**	**3,520**	**1,10,000**
				3,00,000

Budget Production is 1,250 units of product X and 4,000 units of product Y.

Required:

Given that the company wishes to make a profit of 20% on full production costs calculate the prices that should be charged for products X and Y using the following.

(a) Full cost pricing

(b) Activity based cost pricing

(c) Offer your comments on the figures arrived at (a) and (b)

Solution.

(a) The full cost and mark-up will be calculated as follows.

	Product X	Product Y
Variable Costs	50.00	55.00
Fixed Production overhead (₹3,00,000/ 25,000 = ₹12 per direct labour hour)	48.00	60.00
	98.00	115.00
Profit mark-up (20%)	19.60	23.00
Selling Price	117.60	138.00

(b) Using activity based costing, overheads will allocated on the basis of cost drivers.

	X	Y	Total
Set-ups (30:20)	₹24,000	₹16,000	₹40,000
Materials handling (30:20)	90,000	60,000	1,50,000
Inspections (880:3,520)	22,000	88,000	1,10,000
	1,36,000	1,64,000	3,00,000
Budget units	1,250	4,000	

Overheads per unit (₹)	108.80	41.00

The price is then calculated as before

	Product X	Product Y
Variable cost	50.00	55.00
Production overheads	108.80	41.00
	158.80	96.00
Profit (mark-up) (20%)	31.76	19.20
	190.56	115.20

(c) Comments. The result in (b) are radically different from those in (a). On this basis it appears that the company has previously been making a huge loss on every unit of Product X sold for ₹117.60. If the market will not accept a price increase, it may be worth considering ceasing production of product X entirely. It also appears that there is scope for a reduction in the price of product Y, and this would certainly be worthwhile if demand for the product Is elastic.

Q12 (a) A factory has a key resource (bottleneck) of Facility A which is available for 6,260 minutes per period. Budgeted factory costs and data on two products, X and Y, are shown below:

Product	Selling price/unit	Material cost/unit	Time in Facility A
X	₹7	₹4.00	1 minutes
Y	7	3.50	2 minutes

Budgeted factory cost per week

Direct Labour	₹5,000
Indirect Labour	2,500
Power	350
Depreciation	4,500
Space Costs	1,600
Engineering	700
Administration	1,000

Calculate:
(i) Total Factory Costs (TFC)
(ii) Cost per Factory Minute for both products
(iii) Return per Factory Minute for both products
(iv) TA ratios for both products.

12(b). Based on the data in the 12(a)during a week actual production was 4,750 units of Product X and 650 units of Product y. Actual factory costs were ₹15,650.
Calculate:
(i) Throughput cost for the week
(ii) Efficiency percentage
and comment on the possible reasons for the efficiency percentage calculated.

Solution (a).
(i) Total Factory Costs = Total of all costs except materials
= ₹5,000 + ₹2,500 + ₹350 + ₹4500 + ₹1,600 + ₹700 + ₹100 = ₹15,650

(ii) Cost per Factory Minute = Total Factory cost ÷ Minutes available
= ₹15,650 ÷ 6,260 = ₹2.50

(iii) (a) Return per bottleneck minute for product X = $\frac{Selling\ Price - Material\ Cost}{Minutes\ in\ bottleneck}$

= $\frac{Rs.7-4}{1}$ = ₹3

(b) Return per bottleneck minute for product Y = $\frac{Selling\ Price - Material\ Cost}{Minutes\ in\ bottleneck}$

= $\frac{Rs.7-Rs.3.50}{2}$ = ₹1.75

(iv) Throughput Accounting (TA) Ratio for product X

= $\frac{Return\ per\ Minute}{Cost\ per\ Minute}$ = ₹3/2.5 = 1.2

TA Ratio for product Y = $\frac{Return\ per\ Minute}{Cost\ per\ Minute}$

= ₹1.75 ÷ 2.5 = 0.7

Based on the review of the Ta ratios relating to two products, it is apparent that if we only made product Y, the enterprise would suffer a loss, as its TA ratio is less than 1. Advantage will be achieved, when product X is made.

Solution (b).

Working

Standard minutes of throughput for the week:
= (4,750 × 1) + (650 × 2) = 6,050

Throughput cost for the week:
= 6,050 × ₹2.5 per min (From preceding example)
= ₹15,125

Efficiency % = $\frac{Throughput\ cost}{Actual\ TFC}$ %

= $\frac{Rs.15,125}{Rs.15,650} \times 100$

= 96.6%

The bottleneck resource of Facility A is available for 6,260 minutes per week but produced only 6.050 standard minutes. This could be due to:
(a) the process of a 'wandering' bottleneck causing facility A to be under utilized.
(b) inefficiency in facility A.

Q13. (Simulation through Random Numbers.) A company trading in motor vehicle spares wishes to determine the level of stock it should carry for the item in its range. Demand is not certain and replenishment of stock takes 3 days. For one item X, the following information is obtained:

Demand (units per day)	Probability
1	0.1
2	0.2
3	0.3
4	0.3
5	0.1

Each time an order is placed, the company incurs an ordering cost of ₹20 per order. The company also incurs carrying cost of ₹2.50 per unit per day. The inventory carrying cost is calculated on the basis of average stock.

The manager of the company wishes to compare two options for his inventory decision.
(a) Order 12 units when the inventory at the beginning of the day plus order outstanding is less than 12 units.
(b) Order 10 units when the inventory at the beginning of the day plus order outstanding is less than 10 units.
Currently (on first day) the company has a stock of 17 units. The sequence of random number to be used is 08, 91, 25, 18, 40, 27, 85, 75, 32, 52 using first number for day one.
You are required to carry out a simulation run over a period of 10 days, recommend which option the manager should chose.

Solution.
Step 1. First, the random numbers are assigned for daily demand

Demand	Probability	Cumulation Probability	Random Number
1	0.1	0.1	00-09
2	0.2	0.3	10-29
3	0.3	0.6	30-59
4	0.3	0.9	60-89
5	0.1	1.0	90-99

Option I. Order 12 units are per conditions mentioned

Day	Random Number	Opening Stock	Demand	Closing Stock	Order Placed	Order in	Average Stock
1	08	17	1	16	-	-	16.5
2	91	16	5	11	12	-	13.5
3	25	11	2	9	-	-	10.0
4	18	9	2	7	-	-	8.0
5	40	7	3	4	-	12	5.50
6	27	16	2	14	-	-	15.00
7	85	14	4	10	12	-	12.00
8	75	10	4	6	-	-	8.00
9	32	6	3	3	-	-	4.50
10	52	3	3	-	-	12	1.50
							94.5

Carrying cost (94.5 × 2.5) = ₹236.25
Ordering cost (2 × ₹20) = 40.00
276.25

Option II. Order for 10 units as per conditions mentioned

Day	Random Number	Opening Stock	Demand	Closing Stock	Order Placed	Order in	Average Stock
1	08	17	1	16	-	-	16.50
2	91	16	5	11	-	-	13.50
3	25	11	2	9	10	-	10.00
4	18	9	2	7	-	-	8.00
5	40	7	3	4	-	-	5.50
6	27	4	2	2	-	10	3.00
7	85	12	4	8	10	-	10.00

8	75	8	4	4	-	-	6.00
9	32	4	3	1	-	-	2.50
10	52	1	3	-	-	-	0.50
							75.5

Carrying cost (75.5 × 2.5) = ₹188.75
Ordering cost (2 × 20) = 40.00
Stock-out cost (not given) = -
228.75

It should be noticed that there will be stock-out on 10th day in II option. Since no stock-out cost is given, it is taken as nil for this comparison. Based on this given information, option II appears to be better.

Illustration 14: VEEJAY Ltd makes and sells two products, Vee and Jay. The budgeted Selling Price of Vee is ₹1,800 and that of Jay is ₹2,160. Variable Costs associated with producing and selling the Vee ₹900 and with Jay ₹1800. Annual fixed Production and Selling Costs of Veejay Ltd are ₹88,000. The Company has two production / sales options. Vee and Jay can be sold either in the ratio of two Vees to three Jays or in the ratio of one Vee to two Jays. What will be the optimal mix and why?

Solution:

Particulars	**Vee**	**Jay**	**Total**
1. Sale Price pu	₹1,800	₹2,160	
2. Variable Cost pu	₹900	₹1,800	
3. Contribution pu (1-2)	₹900	₹360	
4. PVR = (3÷ 1)	**50%**	**16.67%**	
5. Ranking (based on PVR)	**I**	**II**	
6. Sales Mix Option I (2:3)	2 units	3 units	
7. Contribution Ratio under Sales Mix I (3 × 6)	₹1,800	₹1,080	₹2,880
8. To achieve BEP, Contribution required = Fixed Cost of ₹88,000 apportioned in ratio of 7 (180:108)	₹55,000	₹33,000	₹88,000
9. BEQ under Sales Mix I (8 ÷ 3)	(approx) **62 units**	(approx) **92 units**	**154 units**
10. Sales Mix Option (1:2)	1 unit	2 unit	
11. contribution Ratio under Sales Mix II (3 × 10)	₹900	₹720	₹1,620
12. To achieve BEP, Contribution required = Fixed Cost of ₹88,000 apportioned in ratio of 11 (900:720)	₹48,889	₹39,111	₹88,000
13. BEQ under Sales Mix II (12 ÷ 3)	(approx) **54 units**	(approx) **109 units**	**163 units**

Contribution: Option I Sales Mix of 2:3 for Vee:Jay is preferable, due to – (a) lower BEP, and (b) higher share given for the most profitable product

Q15.(a) What is life Cycle Costing? Explain the stages in product life cycle?

(b) What is Intranet? What are its advantages?

Answer

(a) Life cycle costing is a technique which takes account of the total cost of owning a physical asset, or making a product, during its economic life. It includes the costs associated with acquiring, using, caring for and disposing of physical assets, including the feasibility studies, research, design, development, production, maintenance, replacement and disposal, as well as support, training and operating costs generated by the acquisition, use, maintenance and replacement of permanent physical assets.

Stages in Product Life Cycle:

There are five distinct stages in the life cycle of a product as follows :

Introduction stage – Research and engineering skill leads to product development. The product is put on the market and its awareness and acceptance are minimal. Promotional costs will be high, sales revenue low and profits probably negative. The skill that is exhibited in testing and launching the product will rank high in this phase as critical factor in securing success and initial market acceptance. Sales of new products usually rise slowly at first.

Growth Stage – In the growth stage product penetration into the market and sales will increase because of the cumulative effects of introductory promotion, distribution. Since costs will be lower than in the earlier stage, the product will start to make a profit contribution. Following the consumer acceptance in the launch stage it now becomes vital or secure wholesaler / retailer support. But to sustain growth, consumer satisfaction must be ensured at this stage. If the product is successful, growth usually accelerates at some point, often catching the innovator by surprise.

Maturity Stage – This stage begins after sales cease to rise exponentially. The causes of the declining percentage growth rate the market saturation – eventually most potential customers have tried the product and sales settle at a rate governed by population growth and the replacement rate of satisfied buyers. In addition there were no new distribution channels to fill. This is usually the longest stage in the cycle, and most existing products are in this stage. The period over which sales are maintained depends upon the firm's ability to stretch the cycle by means of market segmentation and finding new uses for it.

Saturation stage – As the market becomes saturated, pressure is exerted for a new product and sales along with profit begin to fall. Intensified marketing effort may prolong the period of maturity, but only by increasing costs disproportionately.

Declining Stage – Eventually most products and brands enter a period of declining sales. This may be caused by the following factors :

- Technical advances leading to product substitution
- Fashion and changing tastes
- Exogenous cost factors will reduce profitability until it reaches zero at which point the product's life is commercially complete.

(b) An intranet is a private computer network that uses Internet protocols and network connectivity to securely share part of an organization's information or operations with its employees. Sometimes the term refers only to the most visible service, the internal website. Briefly, an intranet can be understood as "a private version of an Internet," or as a version of the Internet confined to an organization. Through such devices and systems off-site employees can access company information, computing resources and internal communications.

Advantages of intranets

1. Workforce productivity – Intranets can help users to locate and view information faster and use applications relevant to their roles and responsibilities. Users can access data held in any database the organization wants to make available, anytime and - subject to security provisions - from anywhere within the company workstations.
2. Time – With intranets, organizations can make more information available to employees on a "pull" basis (i.e.: employees can link to relevant information at a time which suits them) rather than being deluged indiscriminately by emails.
3. Communication – Intranets can serve as powerful tools for communication within an organization, vertically and horizontally. From a communications standpoint, intranets are useful to communicate strategic initiatives that have a global reach throughout the organization. The type of information that can easily be conveyed is the purpose of the initiative and what the initiative is aiming to achieve, who is driving the initiative, results achieved to date, and who to speak to for more information. By providing this information on the intranet, staff have the opportunity to keep up-to-date with the strategic focus of the organization.
4. Knowledge Management – Web publishing allows 'cumbersome' corporate knowledge to be maintained and easily accessed throughout the company using hypermedia and Web technologies. Examples include: employee manuals, benefits documents, company policies, business standards, news feeds, and even training, can be accessed using common Internet standards (Acrobat files, Flash files, CGI applications). Because each business unit can update the online copy of a document, the most recent version is always available to employees using the intranet.
5. Business operations and management – Intranets are also being used as a platform for developing and deploying applications to support business operations and decisions across the internetworked enterprise.
6. Cost-effective – Users can view information and data via web-browser rather than maintaining physical documents such as procedure manuals, internal phone list and requisition forms.
7. Promote common corporate culture – Every user is viewing the same information within the Intranet.
8. Enhance Collaboration – With information easily accessible by all authorised users, teamwork is enabled.

Q 16 (a) Write a note on Total Quality Management

(b) Differentiate between Quality Planning, Quality Control & Quality Improvement.

Answer

(a) Quality is considered a by-product of the manufacturing system, i.e. each individual process has some variation that will lead to the production of some defective units. If the resulting defective rate is too high, compared to the established quality standards, quality inspectors will identify and send them back for rework. The approach is expensive and does not guarantee the desired quality, because quality maintenance and ensuring itself cannot be inspected into a product. This approach assigns the responsibility for quality to quality control managers

A more unlighted approach to quality emphasizes building quality into the product by studying and improving activities that affect quality, from marketing through design to manufacturing. This new approach is referred to as Total Quality Management (TQM).

It is an active approach encompassing a company-wide operating philosophy and system for continuous improvement of quality. It demands co-operation from everyone in the company, from the top management down to workers.

The principles of TQM are as follows:

(i) Customer focus,
(ii) Managerial Leadership,
(iii) Belief in continuous improvement.
(iv) The current thinking on TQM is moving from Quality of product and service to Quality of people to embrace also Quality of environment. ISO 14000 standard supports this.

(b) Difference between Quality Planning, Quality Control & Quality Improvement:

Quality Planning	Quality Control	Quality Improvement
Determine who are the Customers	Choose control subjects what to control?	Establish the infrastructure needed to secure annual quality improvement
Determine the needs of the Customers	Choose units of measurements - Evaluate Measurements	Identify the specific needs for improvement - the improvement projects
Develop product features that respond to the customer's needs.	Establish standards of performance	For each project establish a project team with clear responsibility for bringing the project to a successful conclusion
Develop processes that are able to product feature	Measure actual performance	Provide the resources, motivation and training needed by the teams to:
Transfer the resulting plans to the operating forces.	Interpret the difference (actual versus standard)	Diagnose the causes

	Take action on difference	Stimulate establishment of a remedy
		Establish controls to hold the gains

Q17. Division K is a profit centre which produces three products L,M & N. Each Product has an external market.

Products	**L**	**M**	**N**
External Market Price per unit	**Rs48**	**Rs46**	**Rs40**
Variable Cost of Production in Division L	**Rs33**	**Rs24**	**Rs28**
Labour Hours required per unit in Div L	**3**	**4**	**2**

Product M can be transferred to Division J, but the maximum quantity that might be required for transfer is 300 units of M.

Products	**L**	**M**	**N**
The maximum External Sales are	**800 units**	**500 units**	**300 units**

Instead of receiving transfers of Product M from Division K, Division J could buy similar product in the open market at a slightly cheaper price of Rs45 per unit.

What should the transfer price be for each unit for 300 units of Y, if the total labour hours available in Division K are

(i) 3800 hours

(ii) 5600 hours

Solution

Computation of Contribution per labour hour from external Sales

Products	L	M	N
External Market Price per unit	Rs48	Rs46	Rs40
Variable Cost of Production in Division L	Rs33	Rs24	Rs28
Contribution	Rs15	Rs22	Rs12
Labour Hours required per unit in Div L	3	4	2
Contribution per Labour hour	Rs5	Rs5.50	Rs6
Ranking	III	II	I

Computation of Transfer Price when the capacity is 3800 hours

Hours required for N=300*2= 600

Hours required for M=500*4=2000

2600

L=800*3=2400

5000

The existing capacity is not sufficient to produce the units to meet the external sales. In order to transfer 300 units of M,1200 hours are required in each division K will give up the production of L to this extent.

Variable Cost of M	Rs24
(+) Contribution lost by giving up the production	
Of L to the extent of 1200 hours	
=1200*5=6000	
Opportunity Cost per unit	Rs20
Required Transfer Price	Rs44

Computation of Transfer Price when the capacity is 5600 hours

Variable Cost of M	Rs24
(+) Contribution lost by giving up the production	
Of L to the extent of 600 hours	
=600*5=3000	
Opportunity Cost per unit	Rs10
Required Transfer Price	Rs34

Q18.S Ltd engaged in manufacturing activities. It has received a request from one of its important customers to supply a product which will require conversion of Material M, which is a non moving item. The following details are available

Book Value of Material M	**₹60**
Realizable value of Material M	**₹80**
Replacement Cost of Material M	**₹100**

It is estimated that conversion of one unit of M into one unit of finished product will require one unit of labour hour. At present labour is paid @₹20 per hour. Other costs are as follows

Out of Pocket Expenses	**₹30 per unit**
Allocated Overheads	**₹10 per unit**

The labour will be re-deployed from other activities. It is estimated that the temporary redeployment will not result in loss of contribution. The employees to be redeployed are permanent employees of the Co.
Estimate the minimum price to be charged from the customer so that the company is not worse off by executing the order.

Solution

Statement Showing Minimum price to be charged based on Relevant Cost

Particulars	**Nature & Computation**	**₹**
Material M	Slow moving material. Realizable value is relevant as opportunity cost	80.00
Labour Cost	The workers are permanent employees. Assume no retrenchment policies exist. Committed Cost are not relevant	Nil
Out of Pocket Expenses	Specially Incurred. Hence relevant.	30.00
Allocated Overhead	Allocation are not specifically incurred. Hence irrelevant	Nil
	Minimum Price to be charged	**110.00**

19.(a) "Purpose of Sensitivity Analysis is to identify the critical variable in the project analysis." – Discuss.

(b) What are the major components of Balanced Score Card?

Answer.

(a) In management accounting parlance, all quantitative and financial figures are best estimates, made on the basis of experience and of the study of macro-economic factors and industry-specific matters. In actual practice, while executing the project, all factors are subject to variation.

Sensitivity Analysis is one of the objective methods to ascertain the impact on final probability by taking specific changes in each critical factor variable. Thus if a company is to operate in a highly competitive market, with many rivals, Sales volumes and Price will be critical variables and hence, one would like to assess how sensitive the project is to changes in Sales volume and price.

Sensitive Analysis, when applied to a capital project, will allow the margin of error in various parameters of a project which can be allowed before the project ceases to be profitable. Sensitivity Analysis does not directly measure risk and it is limited by being able to examine the effect of a change in one variable while the others, remaining constant, are unlikely occurrence in practice.

Answer:
(b)

1. A well designed Balanced Score Card combines financial measures of past performance with measures of the Firm's drivers of future performance.
2. The specific objectives and measures of a Firm's BSC are derived from the Firm's vision and strategy.
3. Generally, the BSC has the following perspectives from which a Company's activity can be evaluated.

a) **Customer perspective i.e., How customers see us?** In order to translate effective internal processes into organizational success, customers/clients must be happy with the service they receive. The Customer perspective considers the business through the eyes of the customers, measuring and reflecting upon customer satisfaction.

b) **Internal business perspective i.e., in what processes must the Firm excel?** The Internal perspective focuses attention on the performance of the key internal processes, which drive the business. The nature of the processes is dependent on the nature of the organization.

c) **Innovation and learning perspective i.e. Can we continue to improve and create value?** The learning and Growth perspective is a measure of potential future performance – it directs attention to the basis of all future success – the organization's people and infrastructure. Adequate investment in these areas is critical to all long term success.

d) **Financial perspective i.e., How we look to our shareholders?** The Financial perspective measures the results that the organization delivers to its stakeholders.

Q 20. B Ltd manufactures two types of bags-L & T Both bags are produced on the same equipment and use similar processes. The following budgeted data has been obtained for the year ended 31st December 2009.

Product	L	T
Production Quantity	25,000	2,500
Number of Purchase Orders	400	200
Number of Set ups	150	100
Resources required per unit		
Direct Material (₹)	25	62.5
Direct Labour (hours)	10	10
Machine Time (hours)	5	5

Budgeted Production overheads for the year have been analyzed as follows:

	₹
Volume Related Overheads	2,75,000
Purchase Related Overheads	3,00,000
Set up Related Overheads	5,25,000

The budgeted wage rate is ₹ 20/- per hour. The companies present system is to absorb overheads by product units using rates per labour hour.
However, the company is considering implementing a system of activity based costing. An activity base investigation revealed that the cost drivers for the overhead costs are as follows:

Volume Related Overhead	Machine Hours

Purchase Related Overhead **No of Purchase Orders**
Set up related Overheads **No of Set ups**
Calculate the unit cost for each type of bag using

(i) The current absorption Costing method
(ii) The proposed activity based costing approach
Compare your results and briefly comment on your findings.

	L	T	Total
Production Quantity	25,000	2,500	
Direct Labour hours required	250,000	25,000	275000
Total Production Overhead			₹1,1,00,000
Overhead absorption rate per labour hour			₹ 4.00
Machine hours required	125,000	12,500	1,37,500
Total Purchase Order	400	200	600
Total Set ups	150	100	250

Cost per cost driver	
Volume Related Overheads	₹2,75,000
Machine hours required	1,37,500
Volume related overheads/machine hour	₹ 2.00
Purchase related overhead	₹ 3,00,000
Total Purchase orders	600
Purchase related overheads/order	₹ 500
Set ups related overheads	₹ 5,25,000
Total Set ups	250
Set up related overheads per set up	₹2100

(a) (i) Unit cost using existing overhead absorption rate

Product	L	T
	₹	₹
D. Material	25.00	62.50
D. labour Cost	200.00	200.00
Overheads (10 lab hrs*Rs4)	40.00	40.00
	265.00	302.50

(a) (ii)

Product	L	T	
	₹	₹	
D.Material	25.00	62.50	
D.labour Cost	200.00	200.00	
Overheads			
Volume Related (₹ 2 per machine hour)	10.00	10.00	
Purchase Related (₹ 500*400orders/25000)	8.00	40.00	(₹500*200/2500)
Set up related (₹2100*150 set ups/25000)	12.60	84.00	(₹2100*100/2500)
	255.60	396.50	

(b) Cost p.u. traditional method ₹265.00 ₹302.50

Cost p.u. ABC	₹255.60	₹396.50
Difference	9.40	-94.00
% change	3.55%	31.07%

The ABC approach attributes the cost of resources to each product which those resources on a more appropriate are basis than the traditional absorption costing method. The price of T should be reviewed in the light of the new unit cost.

Q21 (a) Define Activity Based Costing. And Define a Cost Object and Cost Driver.

(b) Enumerate the steps in Activity Based Costing.

Answer 21. (a)

Activity based Costing (ABC) is a technique which involves identification of cost with each cost driving activity and making it as the basis for apportionment /assignment of costs over different cost objects/jobs/products/customers/services.

Cost Object : It is an item for which cost measurement is required, e.g., a product, a job or a customer.

Cost Driver : It is the factor that causes a change in the cost of an activity. Cost Drivers are classified into–

(a) **Resources Cost Driver :** It is a measure of the quantity of resources consumed by an activity. It is used to assign the cost of a resource to an activity or cost pool.

(b) **Activity Cost Driver :** It is a measure of the frequency and intensity of demand, placed on activities by cost objectives. It is used to assign activity costs to cost objects.

Examples of Cost Drivers :

Function	**Cost Drivers**
Research and	Numbers of Research Projects
Development	Personnel Hours on a project
	Number of Service Cells
Customer Service	Number of Products serviced
	Hours spent on servicing products
Design of products,	Number of Products in design
services and	Number of parts per product
processes	Number of Engineering Hours
	Number of Advertisements/Insertions
Marketing	Number of Sales Personnel
	Sales Revenue
	Number of items distributed
Distribution	Number of customers
	Weight of items distributed

Note : Multiple Cost Drivers may be indentified for each activity. However, for fixing ABC rate, the most relevant/dominant Cost Driver will be considered.

Answer 21. (b)

Step 1 : Identify the various significant Activities within the Firm. Classify the Activities into: Primary Activities and Secondary Activities.

Step 2 : Relate the Overheads to the Activities using Resources Cost Drivers.

(a) Overheads will be related to support and primary activities, using resource cost drivers (the quantity of resources used by an activity);

(b) All costs will be indentified under the activities, thus creating activity cost pools/activity cost buckets.

Step 3 : Apportion the costs of support Activities over the Primary Activities on suitable basis.

(a) This is similar to re-appointment of service department expenses to production departments;

(b) Cost of support activities are spread over to primary activities to collect cost only under the latter. For this purpose, the measure of how support activities are used, will form the allocation base. For example, canteen expenses will be apportioned based on the number of employees in the primary activities.

Step 4 : Determine the Activity Cost Drivers for each Activity/ Cost Pool.

(a) Activity cost drivers are used to relate the OH collected in the cost pools to cost objects (products);

(b) Activity cost drivers constitute the reason governing cost, i.e. casual factory for cost in each activity. This is based on the factor that derives the consumption of the activity, i.e., the answer to the question: what causes the activity to incur costs?

Step 5 : Calculate Activity Cost Driver Rate = Total Cost of Activity (Cost Pool) ÷ Activity Cost Driver

Activity Cost Driver Rates are computed for each activity, just like overhead absorption rates. This rate can be used – (i) to ascertain cost of products, [as in Traditional Absorption costing], (ii) to ascertain cost of other cost objects such as customers/customer segments & distribution channels.

Step 6 : Assign costs to the Cost objects using the formula

Resourced Consumed × Activity Cost Driver Rate

Q. 22. (a) What is Bench trending and how does it differ from Bench Marking?

(b) What are the stages in the process of Bench Marking?

Answer 22. (a)

Bench Trending : Continuous monitoring of specific process performance with a selected group of benchmarking is a systematic and continuous measurement process of comparing through measuring an organization business processes against business leaders (role models) anywhere in the world, to gain information that will help organization take action to improve its performance. The continuous process of enlisting the best practices in the world for the processes, goals and objectives leading to world class levels of achievement.

Benchmarking is the process of comparing the cost, time or quality of what one organization does against what another organization does. The result is often a business case for making changes in order to make improvements.

Benchmarking is a powerful management tool because it overcomes "poaradigm blindness". Paradigm Blindness can be summed up as the mode of thinking, "the way we do it is the best because this is the way we've always done it". Bench Marking opens organizations to new methods, ideas and tools to improve their effectiveness. It helps crack through resistance to

change by demonstrating other methods of solving problems than the one currently employed and demonstrating that they work, because they are being used by others.

(a) Identify your problem areas.
(b) Identify other industries that have similar processes.
(c) Identify organizations that are leaders in these areas.
(d) Survey companies for measures and practices
(e) Visit the "best practice" companies to identify leading edge practices.
(f) Implement new and improved business practices.

Answer 22 (b)

The process of benchmarking involves the following stages :

Stage	Description
1	Planning - (a) Determination of Benchmarking goal statement, (b) Identification of best performance (c) Establishment of the benchmarking or process improvement team, and (d) Defining the relevant benchmarking measures
2	Collection of Data and Information
3	Analysis of the findings based on the data collected in Stage 2
4	Formulation and implementation of recommendations
5	Constant monitoring and reviewing

Q23 (i) What is lean manufacturing? Briefly describe the lean/JIT system.

(ii) Explain how adoption of JIT affects profitability of an organization.

Answer

Just in time (JIT) philosophy was first developed in Japan. Toyota introduced it in 50's and later, other companies in Japan have adopted it.

The overriding feature of JIT is that materials or parts are generated in the exact quantity required and just at the time they are needed. A classic JIT system consists of a series of manufacturing units each delivering to one another in successive stages of production. The amount delivered by each unit to the next unit is exactly what the needs for the next production period (usually one day). There are no safety margins in the form of buffer stock, live storage or work-in-progress. JIT is a sophisticated approach in eliminating wastage in the process of manufacturing in different stages, say, from the production design stage to the stage of delivery of finished product. JIT is sometimes regarded as an inventory control technique or a purchasing method. It aims at eliminating all activities which do not add 'value' to the product.

JIT seeks to achieve the following goals:

- Elimination of non value added activities
- Zero inventory
- Zero defects

- Batch size of one
- Zero Breakdown
- A 100% on time delivery service

Schonberger defines JIT as being 'to produce and deliver finished goods just in time to be sold, sub assemblies just in time to be assembled into finished goods, fabricated parts just in time to go into sub assemblies and purchased materials just in time to be transformed into fabricated parts'.

(b) The introduction of a JIT system can be expected to affect profit as follows:

- There will be a reduction in inventory holding costs since inventories of raw materials and finished goods will be eliminated.
- There will probably be an increase in the price paid for raw materials to compensate the supplier for the additional flexibility that they are required to offer.

- There may be cost increase as a result of peaks and troughs of demand which cause fluctuating production levels and results in high labour costs through overtime.

- More management time may be spent on planning the resource utilization rather than on making strategic decisions to improve the profitability.

Q 24. The operating results of a department provide the following information for a particular week:

Average output per week	**48,000 units**
Saleable value of output	**₹60, 000**
Contribution on above	**₹24, 000**

The management is contemplating to bring about more mechanization in the department at a capital cost of ₹16, 000 which will result in reduction in number of workmen from the present strength of 160 nos. to 120 nos. However, due to mechanical help, the output of individual workmen will increase by 60%. The existing piece rate is Re.0.10 per article and as an incentive; the management propose to increase the existing piece rate by 5% for every 10% increase in the individual output achieved. There will be a reduction in sale price by 4% to sell the increased production. You are required to calculate extra weekly contribution resulting due to proposed changes.

(b) In what circumstances is a company justified in selling its products at a price below variable cost?

Answer

(a) Working:

		₹
(i)	Sales per week	60,000
	Contribution	24,000
	Variable cost	36,000
	Less wages (0.10×48000pc)	4,800

Variable cost excluding wages 31,200 i.e. 31,200/48,000 = ₹ 0.65 per pc

(ii) Future expected production units/employee

Production per employee=48,000/160= 300

Add increase by 60% 180

480

Total future production from 120 workmen = 57,600.

(iii) Expected selling price ₹

Present price ₹60,000/48,000=1.25

Less reduction by 4% = 0.05

Revised price 1.20

(iv) Revised piece rate wages ₹

Present rate 0.10

Incentive 0.03

(5% × 60% =3%) 0.13

(v) Forecast of profitability ₹

Sales (57600 units X Re 1.20)		69,120
Less Variable cost	₹	
Wages @ Re 0.13	7,488	
Other overheads		
(excluding wages @ Re 0.65)	37,440	44,928
Contribution		24,192
Present contribution		24,000
Increase in contribution		₹ 192

(b) A company is justified in selling its product below the variable cost in the following circumstances:

(i) Where the product is of perishable nature
(ii) Where heavy stocks have been accumulated.
(iii) where it is decided to use the product as loss leader i.e. to boost the sales of other products
(iv) where the product is intended to be popularized by an introductory/temporary offer
(v) where it is intended to be an entry barrier to the would-be competitor
(vi) Where it is to serve some social purpose.

Q 25 . A review, made by the top management of Sweat and Struggle Ltd. which makes only one product, of the result of the first quarter of the year revealed the following:

Sales in units	**10,000**
Loss	**₹10,000**
Fixed cost (for the year ₹1,20,000)	**₹30,000**

Variable cost per unit ₹8.00

The Finance Manager who feels perturbed suggests that the company should at least break even in the second quarter with a drive for increased sales. Towards this, the company should introduce better packing which will increase the cost by ₹0.50 per unit.
The Sales Manager has an alternative proposal. For the second quarter additional sales promotion expenses a can be increased to the extent of ₹5,000 and a profit of ₹5,000 can be aimed at during the period with increased sales.
The Production Manager feels otherwise. To improve the demand, the selling price per unit has to be reduced by 3%. As a result the sales volume can be increased to attain a profit level of ₹4,000 for the quarter.
The Manager Director asks you as a Cost Accountant to evaluate the three proposals and calculate the additional sales volume that would be required in each case, in order to help him to take a decision.

Solution:

Calculation of selling Price

		₹
Variable cost	(8 x 10,000)	80,000.00
Add: Fixed cost		30,000.00
Total cost		1,10,000.00
Profit		(10,000.00)
Sales		1,00,000.00
Selling price	(100000/10000)	₹10

Statement showing evaluation of alternatives and the number of units required to attain the targets of respective managers.

	Finance Manager	Sales Manager	Production Manager
i) Selling price (₹)	10.00	10.00	9.70
ii) Variable cost (₹)	8.50	8.00	8.00
iii) Contribution per unit (₹)	1.50	2.00	1.70
iv) Fixed cost (₹)	30,000.00	35,000.00	30,000.00
v) Target (₹)	B.E.P	Profit or ₹5000	Profit of ₹4000
	(30000/1.5)	(40000/2)	(34000/1.7)
	20,000.00	20,000.00	20,000.00
Additional units required	10,000.00	10,000.00	10,000.00

Q 26. - Hudco Ltd. Requires its various operating divisions to meet the company's target return of 15% on investment, as specified by the board. Besides the ROI of 15% the board also requires an annual positive cash flow. The Steady Division has achieved the 15% target for many years. Steady's assets are mainly plant and equipment (its property rented), plus net current assets. The

average age of its assets has increased by 10 months per year over the last four years. A recent benchmarking exercise has shown that Steady's productivity is below that of its competitors, although its financial performance appears very good. The divisional operations director has recently presented a proposal for a major investment in new plant and machinery. He argued that without substantial investment Steady would not be able to compete on either quantity or delivery time. The divisional sales director agreed that these factors had become the two most important features in winning new orders. The budgeted financial figures for 2004 are shown here:

	Steady Division- 2004 (₹ Cr)	
Sales		**168.60**
Operation profit before depreciation	**22.20**	
Depreciation		**3.00**
Operating profit		**19.20**
Interest payable		**1.80**
Divisional net profit before tax	**17.40**	
Plant and equipment	**60.00**	
Net current assets	**36.00**	
Total divisional assets	**96.00**	

The proposal for new investment would lead to a net increase in plant and equipment of ₹36 crore and a reduction in net current assets of ₹ 12 crore. Steady expects that the new assets would lead to an increase in operating profit before depreciation of Rs 8.4 crore and a net increase in depreciation of ₹ 4.8 crore. Hudco charges 12% on all funds used by divisions.

You are required to-

- **(a) Calculate the return on investment for Steady Divisions for 2004, with and without the new investment proposal. Briefly comment on the expected performance of Steady Division for each option.**
- **(b) Calculate the Residual Income (RI) for Steady Division for 2004, with or without the new investment proposal. Briefly comment on whether using RI would improve the measurement of Steady's performance.**
- **(c) Outline the major features of Economic Value Added (EVA) and briefly discuss whether its use could improve divisional performance measurement for Hudco.**

Answer:

(a) **Hudco Ltd.-Steady Division [Return on Investment (ROI)]**

	Without investment ₹Cr.		with investment ₹Cr.
PBIT	19.20	(+8.4 - 4.8)	22.80
Total Assets	96.00	(36.00 – 12.00)	120.00
ROI	20%		19%

Comments :-

Steady's return is more than the company's target. However, the information of poor productivity and aged assets makes a discerning accountant wonder if the apparent better result were the products of low asset values rather than production efficiency.

With new additional investment the ROI is reduced. This might discourage the steady manjagement to undertake the proposed investment, though this will mean steady remains a weakling in respect of productivity, quality of goods and service in its market.

This measure, ROI, obstructs a clear vision of the merit of a project at times.

(b)

Residual Income (RI)

	Without investment ₹Cr.		with investment ₹Cr.
PBIT	19.20		22.80
Imputed interest charge			
@ 12% (on 96.00)	(11.52)	(on 120.00)	(14.40)
RI	7.68		8.40

Comments :-

As in ROI, RI also shows better results as the imputed interest on older assets gets smaller.

However, the RI measure here will encourage new investment. As against the current return, a target return is decided with a view to long term objective of the corporate management. Sometimes the target rate of return is used as the imputed interest charge; a positive RI in this case will indicate a project that earns in excess of the target ROI. Performance measures must be designed to reward decisions that are optimum for the company as a whole.

(c) Economic Value Added (EVA)

EVA, as a measure, follows the same principle as RI. Value addition by a project is measured by EVA. However, this measure looks at the impact on economic value of the business by the project. This requires a procedure which may deviate from the conventional accounting principles. For example, fully written off goodwill, research and development may be reinstated at their economic values with corresponding adjustments to the reported profit. The use of all the assets to generate economic benefits is thus highlighted. The emphasis on measuring value creating in the EVA should encourage managers to make decisions that are compatible with the objectives of the business as a whole.

Indeed, assets are often measured on a current cost basis within the EVA, which will eliminate the misleading benefit that appears to be gained from holding assets for

longer than their economic value warrants. Divisional bonus schemes may be based on EVA for motivation of managers, which will attain corporate goal congruence at the same time.

Q 27. (a) A Co. manufactures three products. The budgeted quantity, selling prices and unit cost are as under

Particulars	**A**	**B**	**C**
Raw Materials @ ₹20 per Kg	**80**	**40**	**20**
Direct Wages@ ₹5 per hour	**5**	**15**	**10**
Variable Overheads	**10**	**30**	**20**
Fixed Overhead	**9**	**22**	**18**
Budgeted Production In units	**6400**	**3200**	**2400**
Selling Price per unit	**140**	**120**	**90**

(i) Present a statement of budgeted profit

(ii) Set optimal product Mix and determine the profit ,if the supply of Raw material is restricted to 18,400 kgs

(b) What is matrix organization structure? What are its advantages and dis-advantages?

Answer 27. (a)

(a) Calculation of Contribution per unit and Total Fixed Cist

		Products		
		A	B	C
		6400	3200	2400
Selling Price p.u	(a)	140	120	90
Variable Cost p.u:				
Raw Material		80	40	20
Direct Wages		5	15	10
Variable Overheads		10	30	20
Total Variable Cost p.u	(b)	95	85	50
Contribution p.u	(a)-(b)	45	35	40
Raw material p.u		4	2	1
Contribution per kg of raw material		11.25	17.50	40
Ranking		III	II	I
Fixed Overheads p.u		9	22	18
Total Fixed Overhead		57,600	70,400	43,200
Total Fixed Overhead = ₹		1,71,200		

Statement of Budgeted Profit

Particulars	Products			
	A	B	C	Total
No of Units	6,400	3,200	2,400	
Contribution p u (₹)	45	35	40	
Total Contribution	2,88,000	1,12,000	96,000	4,96,000
Less: Fixed Cost				1,71,200
Profit				3,24,800

Statement of Optimum Product Mix and Profitability

Particulars	Units	Raw Material Kgs	Contribution ₹	Total Contribution
Product C	2400	2400	40	96,000
Product B	3200	2400	35	1,12,000
Product A	2400	9600	45	1,08,000
Total Contribution				3,16,000
Less: Fixed Cost				1,71,200
Profit				1,44,800

Answer 27. (b)

Matrix Organisation Structure combines the coordination and control of the decentralized structure with the technical excellence economies of scale of the functional structures to reap the benefits of both. While managing complex programs as in large high-technology programs, complex products and services and multinational business, organization face several coordination problems. A matrix avoids such problems as the total responsibility for achieving the goals and objective of the program lies with Program Manager but must share resources from the various functional heads. The functional managers assigned to the projects are administratively reporting to the Project Manager but functionally to the Function Head.

The distinguishing feature of the matrix structure is thus the dual dimensions of management embodied in it. The outputs produced by the organization may be identified in the rows of the matrix while functional inputs utilized by each project may be identified in the columns of the matrix. The total outputs of the functions are found in the last column of the matrix. Though the Project Manager assumes full responsibility for delivery of a product which meets performance specifications he does not have direct authority over the functional organization that actually performs the work. The functional personnel thus operate under the knowledge-based authority of the function and the resource-based authority of the Project Manager. This may create a friction

in the course of the work but it is up to the Project Manager to use it as a creative friction to further the goals of the program.

The matrix organization structure is suitable for projects which are not large enough to warrant a fully decentralized set-up, with all functional managers under each project. Decentralization may result in loss of scale economics, by way of duplication of functional services for several projects. The matrix structure is suitable for projects of short duration.

Advantages

(a) Ensures better coordination and control of the decentralized structure along with achieving technical excellence and economies of scale of the functional organization,

(b) Fosters creativity and multiple sources of diversity,

(c) Broader middle-management exposure to strategic issues of the business,

(d) Acts as a good training ground for future leaders.

Disadvantages

(a) Dual accountability as explained above, which may create confusion,

(b) Necessitates tremendous horizontal and vertical coordination,

(c) Difference in orientation between Program and Functional personnel. The functional person may aim for high technical performance not warranted by project requirement,

(d) Diffuse responsibility - as responsibility is distributed between program and functional personnel becomes difficult to administer system of accountability, leading to potential conflict,

(e) Program personnel may have a sense of insecurity as soon as a project is completed and this may lower their morale,

(f) The design of the reward structure for program and functional personnel is a ticklish issue which should be worked out in a fair and transparent manner to satisfy all.

Q28. What do you mean by Backflushing in JIT System? Explain briefly the problems with Backflushing, which must be corrected/addressed for the effective functioning of the system.

Answer 28.

Backflush Costing : An alternative approach to Sequential Tracking is Backflush Costing. Traditional normal and standard costing systems use the Sequential Tracking method for accounting costs. This involves recording journal entries in the same order as transactions occur, i.e. purchase, issue of materials, production, OH absorption, etc. It is a costing system that omits recording some or all of the journal entries relating to the cycle from purchase of Direct Materials to the sale of Finished Goods. The Journal Entries for the subsequent stages use normal or standard costs to work backward to flush out the costs in the cycle for which the Journal Entries were omitted earlier.

Suitability in JIT : Given the large transaction volumes associated in JIT, Backflush Costing is ideal when compared to sequential Tracking method. However, the following issues must be corrected before effective implementation of Backflush Costing –

(a) **Accurate Production Reports:** The total production figure entered into the system must be absolutely correct, or else the wrong component types and quantities will be subtracted from stock. Errors in Production Reporting can be reduced by proper staff training and reducing staff turnover.

(b) **Proper Scrap Reports:** All abnormal scrap must be diligently tracked and recorded. Otherwise, these materials will fall outside the Backflushing System and will not be charged to inventory. Since Scrap can occur anywhere in a production process, lack of attention by any of the Production Staff can result in an inaccurate inventory.

(c) **Lot Tracing:** Lot Tracing is impossible under Backflushing System. It is required when a Manufacturer needs to keep records of which production lots were used to create a product in case all the items in a lot must be recalled. Only a Picking System can adequately record this information. Some computer systems allow picking and Backflushing System to co-exist.

(d) **Inventory Accuracy:** The inventory balance may be too high at all times because the Backflushing Transaction that relieves inventory usually does so only once a day, during which time other inventory is sent to the production process. This makes it difficult to maintain an accurate set of inventory records in the warehouse.

The Success of a Backflushing System is directly related to the Company's willingness to invest in a well-paid, well experienced, well-educated production staff that undergoes little turnover.

Q29. (a) A company has two divisions A and B sells two products B1 and B2 made of 3 materials A1, A2, and A3 produced by division A. Division A has no outside market for these 3 materials. The following details are relevant :

	A1	A2	A3
Variable cost per unit (₹)	1.00	0.50	0.75
Quantity used (units) per unit of			
B1	2	0.5	1
B2	2	2	3
Processing capacity	4,000	3,000	4,800

The price and variable processing cost for products B1 and B2 are :

	B1	B2
Price	₹ 8	₹ 14
Processing cost in division B	2	1.75

The overall profitability of the company has to be maximized and with this end in view, formulate the optimization as a linear programming model.

(b) Write the dual of the following LP problem

Minimize $Zx = 3x_1 - 2x_2 + 4x_3$

Subject to constraints

$3x_1 + 5x_2 + 4x_3 \geq 7$

$6x_1 + x_2 + 3x_3 \geq 4$

$7x_1 - 2x_2 - x_3 \geq 10$

$X_1 - 2x_2 + 5x_3 \geq 3$

$4x_1 + 7x_2 - 2x_3 \geq 2$

And $x_1, x_2 x_3 \geq 0$

Answer 29. (a)

(a) Let Y_1 and Y_2 be the amounts of B_1 and 2 respectively

Let X_1, X_2, X_3, be the amounts of A_1, A_2, A_3 produced.

The capacity constraints :

X_1 - 4,000 X_2 - 3,000 X_3 - 4,800

The demand for each of the 3 of the Division A Products in terms of the amounts of the 2 of the Division B Products to be produced is given by.

$$2Y_1 + 2Y_2 - X_1 \geq 0$$

$$0.5Y_1 + 2Y_2 - X_2 \geq 0$$

$$Y_1 + 3Y_2 - X_3 \geq 0$$

The model to be formulated

Maximize (8-2) Y_1 + (14–1.75) $Y_2 - 1X_1 - 0.5X_2 - 0.75X_3$

Subject to	$2Y_1 + 2Y_2 - X_1$	$\geq$	0
	$0.5Y_1 + 2Y_2 - X_2$	$\geq$	0
	$Y_1 + 3Y_2 - X_3$	$\geq$	0
	X_1	$\geq$	4,000
	X_2	$\geq$	3,000
	X_3	$\geq$	4,800
Where	Y_1, Y_2, X_1, X_2, X_3	$\geq$	0

Answer 29. (b)

Since the objective function of the given LP problems is of minimization, the direction of each inequality of ≤ type has to be changed. The standard primal LP problem so obtain is :

Minimize $Zx = 3x_1 - 2x_2 + 4x_3$

Subject to constraints

$3x_1 + 5x_2 + 4x_3 \geq 7$

$6x_1 + x_2 + 3x_3 \geq 4$

$-7x_1 + 2x_2 + x_3 \geq -10$

$X_1 - 2x_2 \; 5x_3 \geq 3$

$4x_1\ 7x_2 - 2x_3 \geq 2$

If y_1, y_2, y_3, y_4 and y5 are dual variables corresponding to the five primal constraints in given order, then the dual of the primal LP problem is:

Maximize $Zy = 7y_1 + 4y_2 - 10y_3 + 3y_4 + 2y_5$

Subject to constraints

$3y_1 + 6y_2 - 7y_3 + y_4 + 4y_5 \geq 3$

$5y_1 + y_2 + 2y_3 - 2y_4 + 7y_5 \geq -2$

$4y_1 + 3y_2 + y_3 + 5y_4 - 2y_5 \geq 4$ and $y_1, y_2, y_3, y_4, y_4, y_5 \geq 0$

Q30. Write Short Notes on

a. **Distribution Requirement Planning**
b. **KAIZEN Costing**
c. **Five S Concept**
d. **Six Sigma**
e. **PDCA**

Answer 30. (a)

Systematic process for determining which goods, in what quantity, at which location, and when are required in meeting anticipated demand. This inventory related information is then entered into a manufacturing requirements planning (MRP-I) system as gross requirements for estimating input flows and production schedules.

A supply channel is composed of three structures. At one end of the channel is the manufacturer. The manufacturer focuses on the development and production of products and originates the distribution process. The terminal point in the channel is the retailer who sells goods and services directly to the customer for their personal, non-business use. In between the two lies a process called distribution.

Distribution involves a number of activities centered around a physical flow of goods and information. At one time the term distribution applied only to the outbound side of supply chain management, but it now includes both inbound and outbound. Management of the inbound flow involves these elements:

- Material planning and control
- Purchasing
- Receiving
- Physical management of materials via warehousing and storage
- Materials handling

Management of the outbound flow involves these elements:

- Order processing
- Warehousing and storage
- Finished goods management

- Material handling and packaging
- Shipping
- Transportation

Distribution channels are formed to solve three critical distribution problems: functional performance, reduced complexity, and specialization.

Answer 30. (b)

Kaizen Costing:

Kaizen costing is a modification of standard costing which is essential to realize the planned cost reductions in continuous time. Kaizen costing is a Japanese contribution to cost accounting. Kaizen costing is continuous improvement applied to cost reduction in the manufacturing stage of a product's life. Like that of standard costing programme, the aim of Kaizen costing is to remove inefficiencies from production processes.

Kaizen costing tracks the cost reduction plans on a monthly basis. The Kaizen costing targets are expressed in the physical resources terms. If the head of a group fails to achieve the Kaizen costing target by 1 percent, review by senior will start. Resource consumption is so tightly controlled in many Japanese firms. Thus the planned cost reductions are planned and monitored through Kaizen cost targets in terms of physical resources.

While implementing the concept of Kaizen, following few rules are to be remembered :

- List down your own problems.
- Grade your problems as to minor, difficult and major.
- Select the smallest minor problem and start with it. After tackling this, move on to next graded problem and so on.
- Know and always remember, improvement is a part of daily routine.
- Never accept status quo.
- Never reject any idea before trying it.
- Share the experiments with colleagues.
- Eliminate already tried but failed experiments, while sharing the problems with your colleagues.
- Never hide problems, always highlight them.

Answer 30. (c)

Five S Concept- Five 'S' are derived from the first letters of the words

SEIRI means Organization or sorting

SEITON means straighten or prepare correctly

SEISO means Cleanup or Cleanliness

SEIKETSU means Standardization

SHITSUKE means Discipline

Advantages of 5S

By thoroughly enforcing 5S in each work area.

1. Operations can be performed without error, proceeding in a well-regulated fashion, resulting in fewer defective items thereby increasing the overall quality of product.
2. Operations can be performed safely and comfortably, reducing the chances of accidents.
3. Machinery and equipment can be carefully maintained, reducing the number of breakdowns.
4. Operations can be performed efficiently, eliminating waste thereby incrasing the efficiency and productivity.

Answer 30. (d)

Six Sigma- Six Sigma is a rigorous and a systematic methodology that utilizes information (management by facts) and statistical analysis to measure and improve a company's operational performance, practices and systems by identifying and preventing 'defects' in manufacturing and service-related processes in order to anticipate and exceed expectations of all stakeholders to accomplish effectiveness.

Six Sigma is a business management strategy originally developed by Motorola, USA in 1981. As of 2010, it enjoys widespread application in many sectors of industry, although its application is not without controversy.

Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability in manufacturing and business processes. It uses a set of quality management methods, including statistical methods, and creates a special infrastructure of people within the organization ("Black Belts", "Green Belts", etc.) who are experts in these methods. Each Six Sigma project carried out within an organization follows a defined sequence of steps and has quantified targets. These targets can be financial (cost reduction or profit increase) or whatever is critical to the customer of that process (cycle time, safety, delivery, etc.).

The term six sigma originated from terminology associated with manufacturing, specifically terms associated with statistical modelling of manufacturing processes. The maturity of a manufacturing process can be described by a sigma rating indicating its yield, or the percentage of defect-free products it creates. A six-sigma process is one in which 99.99966% of the products manufactured are free of defects, compared to a one-sigma process in which only 31% are free of defects. Motorola set a goal of "six sigmas" for all of its manufacturing operations and this goal became a byword for the management and engineering practices used to achieve it.

Answer 30. (e)

PDCA-PDCA ("Plan-Do-Check-Act") is an iterative four-step problem-solving process typically used in quality control. PDCA was made popular by Dr. W. Edwards Father of modern quality control; however it was always referred to by him as the "Shewhart cycle." Later in Deming's career, he modified PDCA to "Plan, Do, Study, Act" (PDSA) so as to better describe his recommendations.

The concept of PDCA comes out of the Scientific Method. The scientific method can be written as "hypothesis" - "experiment" - "evaluation" or Plan, Do, and Check. Shewhart described manufacture under "control" - under statistical control - as a three step process of specification, production, and inspection. The also specifically related this to the Scientific Method of hypothesis, experiment and evaluation. Shewhart, says that the statistician "must help to change

the demand [for goods] by showing... how to close up the tolerance range and to improve the quality of goods." Clearly, Shewhart intended the analyst to take action based on the conclusions of the evaluation. PDCA has an inherent circular paradigm, it assumes that everything starts with Planning. Plan has a limited range of meaning. Shewart intended that experiments and quality control should be planned to deliver results in accordance with the specifications, which is good advice. However, Planning was not intended to cover aspects such as creativity, innovation, invention. In these aspects particularly when based upon imagination, it is often impossible or counterproductive to plan. Hence, PDCA is inapplicable in these situations.