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PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING

Question No.1 is compulsory.

*Answer any **five** out of the remaining **six** questions.*

Working notes should form part of the answer.

No statistical or other table will be distributed along with this question paper.

In theory questions where situations are given, candidates are not expected to copy the situations into the answer books.

Question-1

(a) *A company has to decide whether to accept a special order or not for a certain product M in respect of which the following information is given:*

Material A required	*5,000 kg*	*Available in stock. It was purchased 5 years ago at ₹35 per kg. If not used for M, it can be sold as scrap @ ₹15 per kg.*
Material B required	*8,000 kg*	*This has to be purchased at ₹25 per kg from the market.*
Other hardware items	*₹10,000*	*To be incurred*
Dept X - Labour oriented	*5 men for 1 month @ ₹7,000 per month per man*	*Labour to be freshly hired. No spare capacity available.*
Dept Y - Machine oriented	*3,000 machine hours @ ₹5 per machine hour*	*Existing spare capacity may be used.*
Patten and Specification	*₹15,000*	*To be incurred for M, but after the order, it can be sold for ₹2,000*

Considering relevant costs, find out the minimum value above which the company may accept the order. *(5 Marks)*

(b) *Answer the following independent situations relating to an assignment problem with a minimization objective:*

(i) *Just after row and column minimum operations, we find that a particular row has 2 zeroes. Does this imply that the 2 corresponding numbers in the original matrix before any operation were equal? Why?*

(ii) *Under the usual notation, where a_{32} means the element at the intersection of the 3rd row and 2nd column, we have, in a 4 × 4 assignment problem, a_{24} and a_{32} figuring in the optimal solution. What can you conclude about the remaining assignments? Why?* *(5 Marks)*

(c) *The PLN Co. presents the following static budgets for 4,000 units and 6,000 units activity levels for October 2013:*

	4,000 units activity level	*6,000 units activity level*
Overhead A ₹12/hr. x 2 hr. /unit	*96,000*	*1,44,000*
Overhead B	*1,40,000*	*1,90,000*

Overhead C was omitted to be listed out. It is a fixed plant overhead, estimated at ₹12.5/hr. at 4,000 units activity level. This has to also feature in the flexible budget. The actual production was 5,000 units and 9,600 hours were needed for production.

You are required to present the flexible budget amount of each overhead to enable appropriate comparison with the actual figures. *(5 Marks)*

(d) *A company can produce any of its 4 products, A, B, C and D. Only one product can be produced in a production period and this has to be determined at the beginning of the production run. The production capacity is 1,000 hours. Whatever is produced has to be sold and there is no inventory build-up to be considered beyond the production period. The following information is given:*

	A	*B*	*C*	*D*
Selling Price (₹/unit)	*40*	*50*	*60*	*70*
Variable Cost (₹/unit)	*30*	*20*	*20*	*30*
No. of units that can be sold	*1,000*	*600*	*900*	*600*
No. of production hours required per unit of product.	*1 hour*	*1 hour and 15 minutes*	*1 hour and 15 minutes*	*2 hours*

What are the opportunity costs of A, B, C and D? *(5 Marks)*

Answer

(a) Determination of Minimum Value of Special Order (considering relevant cost)

Cost Element	Relevant / Irrelevant	Calculation	Amount (₹)
Material – A	Realisable value is relevant.	5,000 Kg. × ₹15	75,000
Material – B	Relevant as it has to be purchased.	8,000 Kg. × ₹25	2,00,000
Other hardware items	Relevant as it is to be incurred.	----	10,000
Dept X – Labour oriented	Relevant as fresh labours are to be hired.	5 men × 1 month × ₹7,000	35,000

Dept Y – Machine oriented	Irrelevant, as spare capacity is available.	----	----
Pattern and Specification	Relevant, Net cost after considering its resale value.	₹ 15,000 – ₹ 2,000	13,000
Minimum Value of Special Order			3,33,000

(b) (i) Under the Hungarian Assignment Method, the prerequisite to assign any job is that each row and column must have a zero value in its corresponding cells. If any row or column does not have any zero value then to obtain zero value, each cell values in the row or column is subtracted by the corresponding minimum cell value of respective rows or columns by performing row or column operation. This means *if any row or column have two or more cells having same minimum value then these row or column will have more than one zero.* However, having two zeros does not necessarily imply two equal values in the original assignment matrix just before row and column operations. *Two zeroes in a same row can also be possible by two different operations i.e. one zero from row operation and one zero from column operation*.

(ii) The order of matrix in the assignment problem is 4 × 4. The total assignment (allocations) will be four. In the assignment problem when any allocation is made in any cell then the corresponding row and column become unavailable for further allocation. Hence, these corresponding row and column are crossed mark to show unavailability. In the given assignment matrix two allocations have been made in a_{24} (2^{nd} row and 4^{th} column) and a_{32} (3^{rd} row and 2^{nd} column). This implies that 2^{nd} and 3^{rd} row and 4^{th} and 2^{nd} column are unavailable for further allocation.

Therefore, the other allocations are at either at a_{11} and a_{43} or at a_{13} and a_{41}.

(c) Statement Showing Flexible Budget for 5,000 units Activity Level

Particulars	Amount (₹)
Overhead A (₹12.00 *per hour* × 2 hrs. *per unit* × 5,000 units)	1,20,000
Overhead B* (₹ 40,000 + ₹25 × 5,000 units)	1,65,000
Overhead C (₹12.50 *per hour* × 2 hrs. *per unit* × 4,000 units)	1,00,000
Total	3,85,000

Working Note (*)

Overhead B

$$\text{Variable Cost (per unit)} = \frac{\text{Change in Overhead Cost}}{\text{Change in Production Units}}$$

$$= \frac{₹\ 1,90,000 - ₹\ 1,40,000}{6,000\ \text{units} - 4,000\ \text{units}}$$

$$= \frac{₹\ 50,000}{2,000\text{units}}$$

$$= ₹\ 25$$

Fixed Cost = ₹ 1,40,000 – 4,000 units x ₹ 25

= ₹ 40,000

(d) Statement Showing Calculation of Opportunity Cost

Product	A	B	C	D
Selling Price (₹ per unit)	40	50	60	70
Variable Cost (₹ per unit)	30	20	20	30
Contribution (₹ per unit) ...[A]	10	30	40	40
Demand (units)	1,000	600	900	600
No. of Units can be Produced (within 1,000 hours of production capacity)	1,000 $\left(\frac{1,000\text{hrs.}}{1\text{hr.}}\right)$	800 $\left(\frac{1,000\text{hrs.}}{1.25\text{hr.}}\right)$	800 $\left(\frac{1,000\text{hrs.}}{1.25\text{hr.}}\right)$	500 $\left(\frac{1,000\text{hrs.}}{2\text{hr.}}\right)$
No. of Units can be Sold (lower of demand and production) [B]	1,000	600	800	500
Possible contribution of product (₹) ...[A] × [B]	10,000	18,000	32,000	20,000
Opportunity Cost*	32,000	32,000	20,000	32,000

(*) Opportunity cost is the maximum possible contribution foregone by not producing alternative products i.e. if product A is produced then opportunity cost will be maximum of possible contribution from product B,C and D i.e. ₹ 32,000. Same is for Product B and D. In case of product C opportunity cost will be the maximum of possible contribution from product A, B and D i.e. ₹ 20,000.

Question-2

(a) State the appropriate pricing policy in each of the following independent situations:

(i) 'A' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.

(ii) 'B' is a new product for the company, but not for the market. B's success is crucial for the company's survival in the long term.

(iii) *'C' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the usual sources of capital have uncertainties blocking them.*

(iv) *'D' is a perishable item, with more than 80% of its shelf life over.* *(4 Marks)*

(b) *A bakery sells a popular brand of bread. Cost price per bread is ₹ 16 and selling price per bread is ₹ 20. Shelf life of the bread is 2 days and if it is not sold within two days, then it has no sale value at the end of second day. Daily demand based on past experience is as under:*

Daily Demand	*0*	*20*	*25*	*35*	*40*	*45*
Probability	*.01*	*.15*	*.30*	*.40*	*.10*	*.04*

Consider the following sequence of random numbers:

58, 80, 51, 09, 47, 26, 64, 43, 86, 35

Using the sequence, simulate the demand for the next 10 days and find out the total profit or loss for 10 days assuming 35 breads are purchased every day in the morning and there is an opening stock of 5 breads (purchased the previous day) on the 1st day morning. Assume LIFO basis (Last In First Out basis - where the fresh bread is sold first).

(8 Marks)

(c) *The following independent situations are given in JIT systems of production. You are required to state if each recommendation is valid or invalid and give a brief reason.*

Sl. No.	*Situation*	*Recommendation by the Cost Accountant*
(i)	*A company produces LCD TVs. Presently total inventory turnover is measured annually.*	*Compute inventory turnover every month. Break it down into raw material, WIP, expensive inventory and finished goods.*
(ii)	*Textile company.*	*Accept employees' claim for piece rate incentive for exceeding a certain production volume.*
(iii)	*Sports goods manufacturing company.*	*Closely monitor direct labour variances including idle time variances to convince employees to work faster.*
(iv)	*Multiproduct production*	*Monitor the average set up time per machine in a period which is given by* $\frac{\text{Aggregate set up time of all machines}}{\text{Total number of machines.}}$

(4 Marks)

Answer

(a)

Situation		Appropriate Pricing Policy
(i)	'A' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.	Penetration Pricing
(ii)	'B' is a new product for the company, but not for the market. B's success is crucial for the company's survival in the long term.	Market Price or Price Just Below Market Price
(iii)	'C' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the unusual sources of capital have uncertainties blocking them.	Skimming Pricing
(iv)	'D' is a perishable item, with more than 80% of its shelf life over.	Any Cash Realizable Value*

(*) this amount decreases every passing day.

(b) The demand patterns yield the following probability distribution. The numbers 00–99 are allocated in proportion to the probabilities associated with each event.

Random No. Coding for Demand

Demand	Prob.	Cum Prob.	Random Numbers
0	0.01	0.01	00 – 00
20	0.15	0.16	01 – 15
25	0.30	0.46	16 – 45
35	0.40	0.86	46 – 85
40	0.10	0.96	86 – 95
45	0.04	1.00	96 – 99

Let us simulate the supply and demand for the next ten days using the given random numbers / information in order to find the profit if

- the cost of the bread is ₹16,
- the selling price is ₹20 and
- unsold bread after the end of the 2nd Day have no saleable value.

Simulation Sheet for Finding Profit

Day	Random No	Op. Stock (In No.)	Demand (In No.)	Supply (In No.)	Waste (In No.)	Cl. Stock (In No.)	Loss on Waste (In ₹)	Profit on Sale (In ₹)	Net Profit (In ₹)
1	58	5	35	35	5	0	80 (5b×₹16)	140 (35b×₹4)	60
2	80	0	35	35	0	0	0	140 (35b×₹4)	140
3	51	0	35	35	0	0	0	140 (35b×₹4)	140
4	09	0	20	35	0	15	0	80 (20b×₹4)	80
5	47	15	35	35	15	0	240 (15b×₹16)	140 (35b×₹4)	–100
6	26	0	25	35	0	10	0	100 (25b×₹4)	100
7	64	10	35	35	10	0	160 (10b×₹16)	140 (35b×₹4)	–20
8	43	0	25	35	0	10	0	100 (25b×₹4)	100
9	86	10	40	35	5	0	80 (5b×₹16)	160 (40b×₹4)	80
10	35	0	25	35	0	10	0	100 (25b×₹4)	100

**b refers to no. of breads*

Profit on Sale of one Bread ₹4 (₹20 – ₹16).

Total Profit for 10 Days is ₹680.

(₹60 + ₹140 + ₹140 + ₹80 – ₹100 + ₹100 – ₹20 + ₹100 + ₹80 + ₹100)

Cost of Bread in Stock at the end of the 10th Day is ₹160 (10 Breads × ₹16).

(c)

Situation		Valid / Invalid
(i)	A company produces LCD TVs. Presently total inventory turnover is measured	Valid - JIT system emphasize extraordinary high inventory turnover. When a company is producing LCD TVs, total turnover of inventory will be high,

	annually.	when the recommendation of computing of inventory turnover and breaking it into raw material, W-I-P and finished goods is given JIT system is very much valid.
(ii)	Textile company.	Invalid - In textile industry, employees are paid extra if they exceed certain production volume targets. JIT focuses on producing only what is needed not to accumulate inventory on account of high incentives. So any piece rate system must be eliminated and replaced with measures that focus instead on the quality of output or the number of employee suggestions for improving the system, which are much more important outcomes in a JIT system.
(iii)	Sports goods manufacturing company.	Invalid - Monitoring Direct labour efficiency is highly inappropriate in JIT system. As JIT system unlike traditional system does not focus on fast workings of employees. Instead JIT focuses on quality of product manufactured. JIT system strives to avoid all unnecessary activities and hence eliminate non-value-added activities like monitoring direct labour variance including idle variance.
(iv)	Multiproduct production.	Invalid - The average setup time per machine is of great importance as it can be measured periodically and plotted on a trend line. The shortest possible setup intervals are crucial for the success of short production runs, so this is a major JIT measurement. It is best to measure it by machine, rather than in the aggregate, since an aggregate measure does not reveal enough information about which equipments requires more setup time reduction work.

☞ Conceptual correct brief reason along with the validity of recommendation (valid or invalid) is sufficient.

Question-3

(a) *Flyway Ltd. has hired an aircraft to specially operate between cities A and B. All the seats are economy class.*

The following information is available:

Seating capacity of the aircraft	:	*260 passengers*
Average number of passengers per flight	:	*240 passengers*
Average one-way fare from A to B	:	*₹5,000 per passenger*

Fuel costs per flight from A to B	:	*₹ 90,000*
Food cost (A to B sector)	:	*₹ 300 per passenger*
(no charge to passenger)		
Commission to travel agents	:	*10% of the fare*
(All tickets are through agents)		
Annual lease costs allocated to each flight	:	*₹ 2,00,000*
Ground services, baggage handling/checking in service costs per flight A to B	:	*₹ 40,000*
Flight crew salaries per flight A to B	:	*₹ 48,000*

There is an offer from another airlines operator, Haltgo Ltd. for a stop-over at destination D, which is on the way from A to B. Due to this, the flight will operate from A to D, then from D to B.

The following terms are considered for the stop-over:

50 seats from D to B will be booked by Haltgo at ₹ 2,700 per ticket, whether or not Haltgo is able to sell them to its customers. No agents' commission is payable on these tickets. However, Snacks must be provided to these passengers also by Flyway Ltd. at no further charge to Haltgo or the passengers.

A maximum of 60 tickets can be sold by Flyway's travel agents for the A to D sector at a fare of ₹ 3,000 per passenger.

Since the stop-over wastes more time, 25 of Flyway's original passengers in the A to B sector will voluntarily drop out in favour of other airlines offering direct flights between A and B.

Due to the stop-over, fuel costs will increase from ₹ 90,000 to ₹ 1,35,000. Additional airport landing/baggage handling charges of ₹ 19,000 per stop- over will have to be incurred by Flyway Ltd.

Flyway Ltd. will have to serve snacks to all the passengers in the D to B sector at no charge to passengers. Each snack will cost Flyway ₹ 200. This will be in addition to the original food at ₹ 300 served in the A to D sector.

You may assume that fuel costs are not affected by the actual number of passengers in the flight, ignore non-financial considerations, additional wear and tear to aircraft due to extra landing/take-off.

Without considering Haltgo's offer,

(i) What is the profit earned by Flyway Ltd. per flight from A to B?

(ii) What is the Break-even number of passengers for each flight from A to B? Considering the effects of Haltgo's offer,

(iii) Evaluate whether Flyway should accept the offer.

(A detailed profitability statement is not essential. Only figures relevant for the cost-revenue analysis are required.) *(12 Marks)*

(b) What are the limitations of Uniform Costing? *(4 Marks)*

Answer

(a) Statement Showing Allocation of Seats in the Aircraft

Existing Situation	
For Destination A to B	
Seating Capacity of the Aircraft	260 passengers
Average Number of Passengers *per flight*	240 passengers
Proposed Situation	
For Destination D to B	
Seats Booked by Haltgo Ltd.	50 Seats
For Destination A to B	
Seats Available {260 (capacity) – 50 (booked by Haltgo Ltd. for destination D to B)}	210 Seats
Requirement of Regular Passengers {240 (original no. of passengers) – 25 (no. of passengers drop out due to wastage of time)}	215 Seats
Possible Allocation of Seats to Regular Passengers	210 Seats
For Destination A to D	
Seats Available {260 (capacity) – 210 (seats allocated to regular passengers of destination A to B)}	50 Seats
Requirement of Agents (tickets can be sold by Flyway's travel agents)	60 Seats
Possible Allocation to Agents of Flyway Ltd.	50 Seats

Existing Situation

Profit per Flight

	₹	₹
Revenue *per passenger* (Gross Fare)		5,000
Less: Total Variable Cost *per passenger:*		
10% Commission on Fare	500	
Food	300	800

Contribution *per passenger*		4,200
Contribution *per flight* (Contribution for 240 Passengers)		10,08,000
Less: Fixed Costs *per flight*		
Fuel Cost	90,000	
Annual Lease Cost	2,00,000	
Ground Service, Baggage Handling / Checking in	40,000	
Flight Crew Salaries	48,000	3,78,000
Profit *per flight*		6,30,000

Break-even Point

Break-even Number of Passengers@ $\left(\frac{₹\ 3,78,000}{₹\ 4,200}\right)$	90 Passengers

(@) Break-even Number of Passengers = $\frac{\text{Total Fixed Cost per Flight}}{\text{Contribution per Passenger}}$

Proposed Situation

Contribution per Passenger (A to D)

	₹	₹
Revenue *per passenger* (Gross Fare)		3,000
Less: Total Variable Cost *per passenger:*		
10% Commission on Fare	300	
Food#	300	600
Contribution *per passenger*		2,400

Statement Showing Additional Revenue / Expenditure from Haltogo Ltd.'s Offer

	Additional	
	Cost (₹)	Revenue (₹)
Revenue from Destination D to B (50 Seats × ₹2,700)		1,35,000
Contribution from Destination A to D (50 Seats × ₹2,400)		1,20,000
Contribution Lost for Destination A to B (30 Seats* × ₹4,200)	1,26,000	
Snacks (260 Passengers × ₹ 200)	52,000	
Fuel Cost	45,000	

Airport Landing / Baggage Handling Charges	19,000	
Total	2,42,000	2,55,000

(*) 240 Seats (existing) Less 210 Seats (proposed)

(#) All the passengers booked for destination A to D are also served food free of cost.

Flyway Ltd. will gain ₹13,000 (₹2,55,000 – ₹2,42,000) per flight if it accepts Haltgo's offer.

Decision: Accept Haltgo's offer.

(b) Limitations of Uniform Costing

(i) Sometimes it is not possible to adopt uniform standards, methods and procedures of costing in different firms due to differing circumstances in which they operate. Hence, the adoption of uniform costing becomes difficult in such firms.

(ii) Disclosure of cost information and other data is an essential requirement of a uniform costing system. Many firms do not wish to share such information with their competitors in the same industry.

(iii) Small firms in an industry believe that uniform costing system is only meant for big and medium size firms, because they cannot afford it.

(iv) It induces monopolistic trend in the business, due to which prices may be increased artificially and supplies withheld.

Question-4

(a) B Ltd. makes three products X, Y and Z in Divisions X, Y and Z respectively. The following information is given:

	X	*Y*	*Z*
Direct Material (₹/ Unit) (excluding material X for Divisions Y and Z)	*8*	*22*	*40*
Direct Labour (₹/ Unit)	*4*	*6*	*8*
Variable Overhead (₹/ Unit)	*2*	*2*	*2*
Selling price to outside customers (₹/ Unit)	*25*	*65*	*90*
Existing capacity (no. of units)	*6,000*	*3,000*	*3,000*
Maximum external Market demand (no of units)	*5,000*	*5,500*	*5,000*
Additional fixed cost that would be incurred to install additional capacity (₹)	*45,000*	*9,000*	*23,100*
Maximum additional units that can be produced by additional capacity	*6,000*	*2,000*	*2,250*

Y and Z need material X as their input. Material X is available in the market at ₹ 23 per unit. Defectives can be returned to suppliers at their cost. Division X supplies the material free from defects and hence is able to sell at ₹ 25 per unit. Each unit of Y and Z require one unit of X as input with slight modification.

If Y purchases from outside at ₹ 23 per unit, it has to incur ₹ 3 per unit as modification and inspection cost. If Y purchases from Division X, it has to incur, in addition to the transfer price, ₹ 2 per unit to modify it.

If Z gets the material from Division X, it can use it after incurring a modification cost, of ₹ 1 per unit. If Z buys material X from outside, it has to either inspect and modify it at its own shop floor at ₹ 5 per unit or use idle labour from Division X at ₹ 3 per unit. Division X will lend its idle labour as per Z's requirement even if Z purchases the material from outside.

The transfer prices are at the discretion of the Divisional Managers and will remain confidential. Assume no restriction on quantities of inter-division transfers or purchases.

Discuss with relevant figures the best strategy for each division and for the company as a whole. *(12 Marks)*

(b) State whether the learning curve theory can be applied to .the following independent situations briefly justifying your decision:

(i) A labour intensive sculpted product is carved from the metal provided to the staff. The metal is sourced from different suppliers since it is scarce. The alloy composition of the input metal is quite different among the suppliers.

(ii) Pieces of hand-made furniture are assembled by the company in a far off location. The labourers do not know anything about the final product which utilizes their work. As a matter of further precaution, rotation of labour is done frequently.

(ill) Skilled workers have been employed for a long time. The company has adequate market for the craft pieces done by these experts.

(iv) A company funds that it always has an adverse usage of indirect material. It wants to apply learning curve theory to improve the way standards have been set. *(4 Marks)*

Answer

(a) Statement Showing Contribution *per unit* (₹)

Particulars	Division X			Division Y		Division Z
	Sale to	Internal Transfer to		Purchase from	Transfer from	Transfer from
	Outside	Y	Z	Outside	X	X
Selling Price	25.00	---	---	65.00	65.00	90.00

Transfer Price	---	24.00*	25.00#	---	---	---
Direct Material (Excluding Material 'X')	8.00	8.00	8.00	22.00	22.00	40.00
Direct Labour	4.00	4.00	4.00	6.00	6.00	8.00
Variable Overhead	2.00	2.00	2.00	2.00	2.00	2.00
Purchase Price 'X'	---	---	---	23.00	---	---
Transfer Price 'X'	---	---	---	---	24.00	25.00
Modification Cost	---	---	---	3.00	2.00	1.00
Contribution	11.00	10.00	11.00	9.00	9.00	14.00

(*) Division 'Y' will not pay Division 'X' anything more than ₹ 24, because at 24, it will incur additional cost of ₹ 2 per unit to modify it, ₹ 23 + ₹ 3 = ₹ 26, the outside cost.

(#) To purchase material X from outside is costly for Division 'Z' as after modification at own shop floor, cost of the same comes to Division 'Z' is ₹ 28 (₹ 23 + ₹ 5).

If Division 'X' goes to utilize its full capacity in that case labour would not be available for modification to Department 'Z'.

Accordingly Division 'Z' may purchase material X at ₹ 25 from Division 'X' i.e. market price to outsiders.

Statement Showing Internal Transfer Decision (units)

Particulars	X	Y	Z
Existing Capacity ...(A)	6,000 units	3,000 units	3,000 units
Maximum Capacity *that can be added* ...(B)	6,000 units	2,000 units	2,250 units
Total Maximum *that can be produced* ...(C)=(A)+(B)	12,000 units	5,000 units	5,250 units
Maximum External Demand ...(D)	5,000 units	5,000 units	5,000 units
Balance ...(C) – (D)	7,000 units	---	250 units
Internal Transfer to Other Divisions	5,000 units to Z* 2,000 units to Y	N.A.	N.A.
Internal Transfer from Other Divisions	N.A.	2,000 units transfer from X (material X)	5,000 units transfer from X (material X)

(*) Division 'X' will supply its production to Division 'Z' first (after meeting its external requirement) as contribution from product Z is high.

Statement Showing Decision Whether to Expand or Not

Particulars	X	Y	Z
Additional Fixed Cost on Expansion	₹45,000	₹9,000	₹ 23,100
Contribution that can be earned by expansion	₹ 64,000 (4,000 units × ₹ 11 + 2,000 units × ₹ 10)	₹ 18,000 (2,000 units × ₹ 9)	₹ 28,000 (2,000* units × ₹ 14)
Net Benefit from Expansion	₹ 19,000	₹ 9,000	₹ 4,900
Decision	Expansion	Expansion	Expansion

(*) As maximum demand of product Z is 5,000 units which Division 'Z' first complete with existing capacity of 3,000 units. Balance 2,000 units from expansion.

Statement Showing Net Revenue Addition (₹)

Particulars	X	Y	Z	Total
Contribution – External Sales	55,000 (5,000 units × ₹11)	45,000 (5,000 units × ₹ 9)	70,000 (5,000 units x ₹14)	1,70,000
Contribution – Internal Transfer	75,000 (2,000 units × ₹10 + 5,000 units × ₹11)	---	---	75,000
Additional Fixed Cost	45,000	9,000	23,100	77,100
Net Revenue Addition				1,67,900

Strategy for Company & Divisions

(i) Division 'X' will transfer maximum possible material to Division 'Z' as Division 'Z' is offering maximum transfer price to Division 'X'. At the same time Division 'Z' is fetching maximum contribution for the organisation so it is beneficial for both the Divisions as well as organisation as a whole.

(ii) As shown above all the three Divisions are getting net benefit when they are taking decision to expand and hence, all the three Divisions should expand there activity by incurring additional fixed cost on expansion.

(b) (i) 'Learning Curve Theory' will not be applicable as *alloy combination of the input metal is quite different* among the suppliers hence learning experience with one type of metal may not be beneficial for the workers to deal with other metal with separate alloy composition.

(ii) 'Learning Curve Theory' will not be applicable as in this situation *rotation of labour is done frequently*, labours will not be able to get the benefit of learning and apply their learning. Hence, learning curve theory can not be applied.

(iii) 'Learning Curve Theory' will not be applicable as in this situation as *workers are skilled and employed for a long time*, they have already achieved maximum level of expertise by taking advantage of learning. Hence, at this point of time learning curve theory can not be applied.

(iv) 'Learning Curve Theory' will not be applicable as indirect materials are the materials which are not used directly in the production (not directly proportionate with volume of output) and usually used machines (e.g. lubricants, spares parts etc.) with less human interactions. Adverse usage of indirect materials can be controlled through proper monitoring and appropriate standard settings and not from applying learning curve theory.

Question-5

(a) The following information relates to the labour element of X Ltd.

Type of labour	*Skilled*	*Semi-skilled*	*Unskilled*	*Total*
No. of workers in the standard gang	*4*	*3*	*2*	*9*
Standard rate per hour (₹)	*6*	*3*	*1*	
Number of workers in actual gang				*9*
Actual rate per hour (₹)	*7*	*2*	*2*	

In a 40 hour week, the gang produced 270 standard hours. The actual number of semi-skilled workers is two times the actual number of unskilled workers.

The rate variance of semi-skilled workers is ₹160 (F).

Find the following:

(i) The number of workers in each category

(ii) Total gang variance

(iii) Total sub-efficiency variance

(iv) Total labour rate variance

Indicate if the variances are Favourable (F) or Adverse (A or U). *(8 Marks)*

(b) Given below is an iteration in a simplex table for a maximization objective linear programming product mix problem for products X_1, X_2 and X_3.

C_j→			6	4	10	0	0	0
	Basic Variable	Quantity	X_1	X_2	X_3	S_1	S_2	S_3
0	S_1	400	0	4/3	0	1	-1/3	0
6	X_1	400	1	2/3	2	0	1/3	0

0	*S_3*	*400*	*0*	*5/3*	*0*	*0*	*-2/3*	*1*
Z_j		*2,400*	*6*	*4*	*12*	*0*	*2*	*0*
$C_j - Z_j$			*0*	*0*	*-2*	*0*	*-2*	*0*

Answer the following questions:

(i) Is the above solution feasible?

(ii) Perform one more iteration with X_2 entering the solution to get a solution with the same value for the objective function.

(iii) Indicate the shadow prices.

(iv) If customer is prepared to pay higher price for product X_3 then by how much should the price be increased so that the company's profit remains unchanged?

(v) From the given table, derive any one original constraint inequality with the coefficients of variables in their simplest whole number forms. *(8 Marks)*

Answer

(a) *Working Note*

Computation of Standard Hours Category Wise

Category	No. of Workers	Standard Hours
Skilled	4	120 $\left(270\,\text{hrs.} \times \frac{4\ \text{workers}}{9\ \text{workers}}\right)$
Semi-Skilled	3	90 $\left(270\,\text{hrs.} \times \frac{3\ \text{workers}}{9\ \text{workers}}\right)$
Un-Skilled	2	60 $\left(270\,\text{hrs.} \times \frac{2\ \text{workers}}{9\ \text{workers}}\right)$
Total	9	270

Computation of Actual Hours Category Wise

Semi-Skilled Workers

Labour Rate Variance = Standard Cost of Actual Time – Actual Cost

Or = Standard Rate × Actual Hours – Actual Rate × Actual Hours

Or = Actual Hours × (Standard Rate – Actual Rate)

⇒ ₹ 160 (F) = Actual Hours × (₹ 3 – ₹ 2)

⇒ Actual Hours = 160 Hours

(i)

Computation of Total No. of Workers in Each Category

Category	No. of Workers	Actual Hours
Skilled	3 $\left(\frac{120\text{ hrs.}}{40\text{ hrs.}}\right)$	120 (Balancing Figure)
Semi-Skilled	4 $\left(\frac{160\text{ hrs.}}{40\text{ hrs.}}\right)$	160 (Working Note)
Un-Skilled	2 $\left(\frac{80\text{ hrs.}}{40\text{ hrs.}}\right)$	80 $\left(\frac{160\text{ hrs.}}{2}\right)$
Total	9	360*

(*) Total No. of Actual Hours is 360 hrs. (40 hrs. x 9 workers)

(ii), (iii), & (iv)

Computation of Variances

Statement Showing Standard & Actual Cost

Category	Standard Cost			Actual Cost			Revised Actual Hrs. (In Std. Proportion)
	Hrs.	Rate	Amt.	Hrs.	Rate	Amt.	
Skilled	120	6	720	120	7	840	160 $\left(360\text{hrs.x}\frac{120\text{hrs.}}{270\text{hrs.}}\right)$
Semi-Skilled	90	3	270	160	2	320	120 $\left(360\text{hrs.x}\frac{90\text{hrs.}}{270\text{hrs.}}\right)$
Un-Skilled	60	1	60	80	2	160	80 $\left(360\text{hrs.x}\frac{60\text{hrs.}}{270\text{hrs.}}\right)$
Total	270		1,050	360		1,320	360

Total Gang Variance

= Total Actual Time *Worked* (hours) × {*Average* Standard Rate *per hour* of Standard Gang

Less *Average* Standard Rate *per hour* of Actual Gang@}

@on the basis of hours worked

$$= 360 \text{ hrs.} \times \left(\frac{₹1,050}{270 \text{ hrs.}} - \frac{₹\ 6x120 \text{ hrs.} + ₹\ 3x160 \text{ hrs.} + ₹\ 1x80 \text{ hrs.}}{360 \text{ hrs.}} \right)$$

= ₹120 (F)

Alternate Formula

Gang Variance = Standard Cost of Actual Time *Worked* in Standard Proportion – Standard Cost of Actual Time Worked

Or = Revised Actual Hours × Standard Rate – Actual Hours × Standard Rate

Or = Standard Rate × (Revised Actual Hours - Actual Hours)

Skilled Workers = ₹6 × (160 hrs. – 120 hrs)

= ₹240 (F)

Semi-Skilled Workers = ₹3 × (120 hrs. – 160 hrs)

= ₹120 (A)

Skilled Workers = ₹1 × (80 hrs. – 80 hrs)

= ₹ 0

Total = ₹ 240 (F) + ₹ 120 (A) + ₹ 0

= ₹ 120 (F)

Total Sub- Efficiency Variance

= *Average* Standard Rate *per hour* of Standard Gang × {Total Standard Time (hours) Less Total Actual Time *Worked* (hours)}

$$= \left(\frac{₹1,050}{270 \text{ hrs.}} \right) x (270 \text{ hrs.} - 360 \text{ hrs.})$$

= ₹350 (A)

Alternate Formula

Sub- Efficiency Variance

	=	Standard Cost of Standard Time for Actual Production – Standard Cost of Actual Time *Worked* in Standard Proportion
Or	=	Standard Hours x Standard Rate – Revised Actual Hours × Standard Rate
Or	=	Standard Rate × (Standard Hours – Revised Actual Hours)
Skilled Workers	=	₹6 × (120 hrs. – 160 hrs.)
	=	₹240 (A)
Semi-Skilled Workers	=	₹3 × (90hrs. – 120 hrs.)
	=	₹90 (A)
Skilled Workers	=	₹1 × (60 hrs. – 80 hrs.)
	=	₹20 (A)
Total	=	₹240 (A) + ₹90 (A) + ₹20 (A)
	=	₹350 (A)

Labour Rate Variance

	=	Standard Cost of Actual Time – Actual Cost
Or	=	Standard Rate × Actual Hours – Actual Rate × Actual Hours
Or	=	Actual Hours × (Standard Rate – Actual Rate)
Skilled Workers	=	120 hrs. × (₹6 – ₹7)
	=	₹120 (A)
Semi- Skilled Workers	=	160 hrs. × (₹3 – ₹2)
	=	₹160 (F)
Skilled Workers	=	80 hrs. × (₹1 – ₹2)
	=	₹80 (A)
Total	=	₹120 (A) + ₹160 (F) + ₹80 (A)
	=	₹40 (A)

(b)

$C_j \rightarrow$			6	4	10	0	0	0	Min. Ratio
C_B	Basic Variable	Quantity	X_1	X_2	X_3	S_1	S_2	S_3	
0	S_1	400	0	4/3	0	1	–1/3	0	300
6	X_1	400	1	2/3	2	0	1/3	0	600
0	S_3	400	0	5/3	0	0	–2/3	1	←240
		$Z_j = \sum C_{Bi}X_j$	6	4	12	0	2	0	
		$C_j - Z_j$	0	0↑	–2	0	–2	0	

(i) Yes, because the given solution has no artificial variables in the basic column.

(ii) Perform one more iteration with X_2:

$C_j \rightarrow$			6	4	10	0	0	0
C_B	Basic Variable	Quantity	X_1	X_2	X_3	S_1	S_2	S_3
0	S_1	80	0	0	0	1	1/5	–4/5
6	X_1	240	1	0	2	0	3/5	–2/5
4	X_2	240	0	1	0	0	–2/5	3/5
		$Z_j = \sum C_{Bi}X_j$	6	4	12	0	2	0
		$C_j - Z_j$	0	0	–2	0	–2	0

(iii) Shadow Price is ₹0, ₹2 and ₹0 (or any other given monetary unit) for Constraint 1, Constraint 2 and Constraint 3 respectively and same has been obtained from row $C_j - Z_j$.

(iv) $C_j - Z_j$ for X_3 being –2, production of each unit of X_3 would cause a reduction of ₹2 (or any other given monetary unit). Thus, the price for X_3 should be increased by at least two rupee *per unit* to ensure no reduction of profits.

(v) Original Constraint Inequality *with the coefficient of variables:*

Let us consider the given iteration is the 2nd one. The first iteration (I_1) must have had S_2 instead of X_1. Row X_1 of I_2 has been computed by dividing the S_2 row of I_1 by 3. S_2 of I_1 (in Identity Matrix) would have been 1. Now it is 1/3. Working backwards, we multiply row X_1 of I_2 by 3 to get Row S_2 of I_1.

Original Row S_2 [X_1 of I_2 × 3]:

$$(1X_1 + 2/3X_2 + 2X_3) \times 3 \leq 400 \times 3$$

Or

$$3X_1 + 2X_2 + 6X_3 \leq 1,200$$

Similarly Original Row S_1 [S_1 of I_2 + X_1 of I_2]:

$$(0X_1 + 4/3X_2 + 0X_3) + (1X_1 + 2/3X_2 + 2X_3) \leq 400 + 400$$

Or

$$X_1 + 2X_2 + 2X_3 \leq 800$$

Similarly Original Row S_3 [S_3 of I_2 + 2 × X_1 of I_2]:

$$0X_1 + 5/3X_2 + 0X_3 + (1X_1 + 2/3X_2 + 2X_3) \times 2 \leq 400 + 400 \times 2$$

Or

$$2X_1 + 3X_2 + 4X_3 \leq 1,200$$

☞ Original Constraint Inequality (with the coefficient of variables) can also be traced through algebraic method by solving through *system of equations*.

Question-6

(a) *MK Ltd. manufactures four products, namely A, B, C and D using the same plant and process. The following information relates to a production period:*

Product	*A*	*B*	*C*	*D*
Output in Units	*720*	*600*	*480*	*504*

The four products are similar and are usually produced in production runs of 24 units and sold in batches of 12 units. The total overheads incurred by the company for the period are as follows:

	₹
Machine operation and maintenance cost	*63,000*
Setup costs	*20,000*
Store receiving	*15,000*
Inspection	*10,000*
Material handling and dispatch	*2,592*

During the period the following cost drivers are to be used for the overhead cost:

Cost	*Cost driver*
Setup cost	*No. of production runs*
Store receiving	*Requisitions raised*
Inspection	*No. of production runs*
Material handling and dispatch	*Orders executed*

It is also determined that:

- *Machine operation and maintenance cost should be apportioned between setup cost, store receiving and inspection activity in the ratio 4: 3: 2.*
- *Number of requisition raised on store is 50 for each product and the no. of orders executed is 192, each order being for a batch of 12 units of a product.*

Calculate the total overhead cost per unit of each product using activity based costing after finding activity wise overheads allocated to each product. *(8 Marks)*

(b) A project consists of seven activities whose time estimates (optimistic - t_o, pessimistic - t_p and most likely - t_m) in days are given below:

Activity	t_o	t_p	t_m
1-2	*1*	*5*	*3*
1-3	*1*	*7*	*4*
1-4	*2*	*10*	*6*
2-5	*2*	*8*	*2*
3-5	*3*	*15*	*6*
4-6	*2*	*8*	*5*
5-6	*2*	*14*	*5*

Required:

(i) Draw the network and find out the expected time and variance for each activity. What is the expected duration for completion of the project?

(ii) IT the target time is 22 days, what is the probability of not meeting the target?

(iii) Within how many days can the project be expected to be completed with 99 percent chance?

Given $Z_{2.33} = 0.9901$ and $Z_{1.67} = 0.9525$ *(8 Marks)*

Answer

(a) Statement Showing Overhead Cost *per unit*

Particulars	A (₹)	B (₹)	C (₹)	D (₹)
Setup	15,000 $\left[\frac{720\text{units}}{24\text{units}} \times ₹500\right]$	12,500 $\left[\frac{600\text{units}}{24\text{units}} \times ₹500\right]$	10,000 $\left[\frac{480\text{units}}{24\text{units}} \times ₹500\right]$	10,500 $\left[\frac{504\text{units}}{24\text{units}} \times ₹500\right]$
Store Receiving	9,000 [50Req.x₹180]	9,000 [50Req.x₹180]	9,000 [50Req.x₹180]	9,000 [50Req.x₹180]
Inspection	7,500 $\left[\frac{720\text{units}}{24\text{units}} \times ₹250\right]$	6,250 $\left[\frac{600\text{units}}{24\text{units}} \times ₹250\right]$	5,000 $\left[\frac{480\text{units}}{24\text{units}} \times ₹250\right]$	5,250 $\left[\frac{504\text{units}}{24\text{units}} \times ₹250\right]$
Material Handling and Dispatch	810 $\left[\frac{720\text{units}}{12\text{units}} \times ₹13.5\right]$	675 $\left[\frac{600\text{units}}{12\text{units}} \times ₹13.5\right]$	540 $\left[\frac{480\text{units}}{12\text{units}} \times ₹13.5\right]$	567 $\left[\frac{504\text{units}}{12\text{units}} \times ₹13.5\right]$
Total Overhead Cost	32,310	28,425	24,540	25,317
Overhead Cost *per unit*	44.875	47.375	51.125	50.232

Workings

Allocation of Machine Operation and Maintenance Cost

Particulars	Setup	Store Receiving	Inspection
Machine operation and maintenance cost of ₹63,000 to be distributed in the ratio of 4: 3: 2	28,000	21,000	14,000

Activities, Drivers and Cost

Activity	Cost (₹)	Drivers	Nos.	Cost *per unit* of Driver (₹)
Setup (₹20,000 + ₹28,000)	48,000	Production Runs	96	500.00
Store Receiving (₹15,000 + ₹21,000)	36,000	Requisitions Raised	200	180.00
Inspection (₹10,000 + ₹14,000)	24,000	Production Runs	96	250.00
Material Handling and Disp.	2,592	Orders	192	13.50

Note:

Production Run for

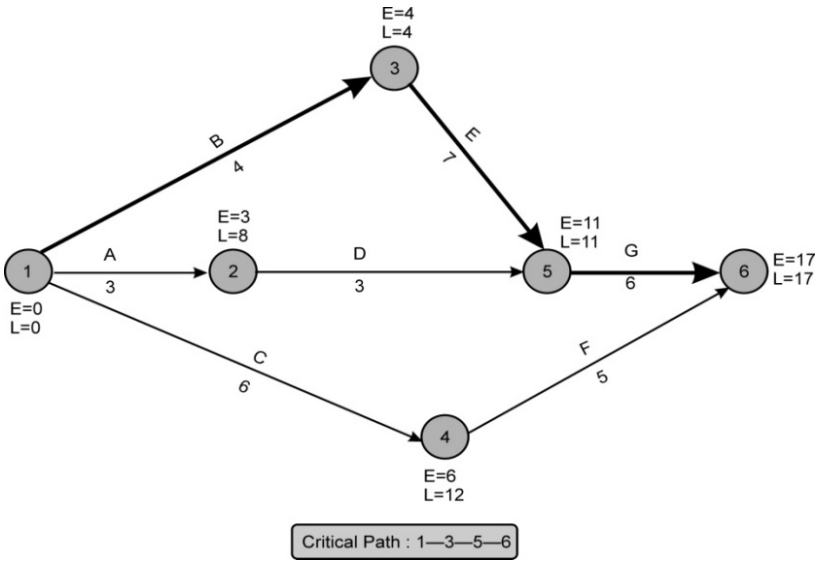
A (720/24) = 30

B (600/24) = 25

C (480/24) = 20

D (504/24) = 21

(b) (i) The network for the given problem



The Expected Time and Variance for each of the activities (in Days)

Activity	Time Estimates (Days)			Expected Time	Variance
	Optimistic (t_o)	Pessimistic (t_p)	Most Likely (t_m)	$t_e = \frac{t_o + 4t_m + t_p}{6}$	$S_t^2 = \left(\frac{t_p - t_o}{6}\right)^2$
A (1–2)	1	5	3	3	$\frac{4}{9}$
B (1–3)	1	7	4	4	1
C (1–4)	2	10	6	6	$\frac{16}{9}$

D (2–5)	2	8	2	3	1
E (3–5)	3	15	6	7	4
F (4–6)	2	8	5	5	1
G (5–6)	2	14	5	6	4

Probability of Completing the Project by Schedule Time T_s is given by $Z = \frac{T_s - T_e}{\sigma_e}$

Expected Project Length (T_e) = 17 Days

Variance of the Critical Path 1–3–5–6 (σ_e^2) [1+4+4] = 9

Standard Deviation of the Critical Path (σ_e) $\left[\sqrt{9}\right]$ = 3

(ii) Probability of not meeting the target time of 22 days

Probability of Completing the Project by Schedule Time T_s is given by $Z = \frac{T_s - T_e}{\sigma_e}$

Accordingly probability of meeting the target time of 22 days is given by Z

$= \frac{22 - 17}{3}$

= 1.67*

Probability (Z = 1.67) = 0.9525

Probability of not meeting the target time of 22 days [1– 0.9525] = 0.0475

Or = 4.75%

(iii) Expected Time if the project to be completed with 99% chance

Probability of Completing the Project by Schedule Time T_s is given by $Z = \frac{T_s - T_e}{\sigma_e}$

Accordingly,

$Z = \frac{T_s - 17}{3}$

At 99% Chance Z equals to 2.33

Accordingly,

$$2.33 = \frac{T_s - 17}{3}$$

Or $T_s = 23.99$

Hence, expected time of completing the project with 99% of chances is 23.99 or 24 Days.

Question-7

Answer any four of the following questions:

(a) Discuss briefly two methods of costing in the service sector and give examples. (4 Marks)

(b) In Value Chain analysis, business activities are classified into primary activities and support activities. Classify the following under the more appropriate activity.

(i) Order processing and distribution

(ii) Installation, repair and parts replacement

(ill) Purchase of raw material and other consumable stores

(iv) Transforming inputs into final products

(v) Selection, promotion, appraisal and employee relations

(vi) Material handling and warehousing

(vii) General management, planning, finance, accounting

(viii) Communication, pricing and channel management (4 Marks)

(c) Define the following terms in relation to a transportation problem:

(i) Degeneracy

(ii) Prohibited routes (4 Marks)

(d) State the type of cost in the following cases:

(i) Cost associated with the acquisition and conversion of material into finished product.

(ii) Cost arising from a prior decision which cannot be changed in the short run.

(iii) Increase in cost resulting from selection of one alternative instead of another.

(iv) Rent paid for a factory building which is temporarily closed. (4 Marks)

(e) In each of the following independent situations, state with a brief reason whether 'Zero Base Budgeting' (ZBB) or 'Traditional Budgeting' (TB) would be more appropriate for year II.

(i) A company producing a certain product has done extensive ZBB exercise in year I. The activity level is expected to marginally increase in year II.

(ii) The sales manager of a company selling three products has the intuitive feeling that in year II, sales will increase for one product and decrease for the other two. His expectation cannot be substantiated with figures.

(iii) The top management would like to delegate responsibility to the functional managers for their results during year II.

(iv) Resources are heavily constrained and allocation for budget requirements is very strict.

(4 Marks)

Answer

(a) Methods of Costing in the service sector are as follows:

(i) Job costing method: In job costing method the cost of a particular service is obtained by assigning costs to a distinct identifiable service. In service sector like Accounting firm, Advertising campaigns etc. job costing method is used. For assigning indirect costs (overheads) models such as Activity Based Costing may be used.

(ii) Process costing method: In process costing system the cost of a service is obtained by assigning costs to masses of similar unit and then computing unit cost on an average basis. Retail banking, Postal delivery, Credit card etc. uses process costing method.

(iii) Hybrid costing method: Many companies uses a method of costing which is neither job costing nor process costing method. They in fact uses a hybrid costing method which combines elements of both job costing and process costing methods.

(b)

Activity		Primary Activity/Support Activity
(i)	Order processing and distribution	Primary Activity
(ii)	Installation, repair and parts replacement	Primary Activity
(iii)	Purchase of raw material and other consumable stores	Support Activity
(iv)	Transforming inputs into final products	Primary Activity
(v)	Selection, promotion, appraisal and employee relations	Support Activity
(vi)	Material handling and warehousing	Primary Activity
(vii)	General management, planning, finance, accounting	Support Activity
(viii)	Communication, pricing and channel management	Primary Activity

(c) (i) Degeneracy: A transportation problem's solution has m+n–1 basic variables, (where m,n are the number of rows and columns) which means that the number of occupied cells in such a solution is one less than the number of rows and number of columns.

When the number of occupied cells in a solution is less than m+n–1, the solution is called a degenerate solution.

Such a situation is handled by introducing an infinitesimally small allocation 'e' in the least cost and independent cell.

(ii) Prohibited Routes: Sometimes in a given transportation problem, some routes may not be available. There could be several reasons for this such as bad road conditions or strike etc. In such situations, there is a restriction on the route available for transportation. To handle such type of a situation, a very large cost (or a negative profit for the maximization problem) represented by ∞ or 'M' is assigned to each of such routes which are not available. Due to assignment of very large cost, such routes would automatically be eliminated in the final solution. The problem is the solved in its usual way.

(d)

Cases		Type of Cost
(i)	Cost associated with the acquisition and conversion of material into finished product.	Product Cost
(ii)	Cost arising from a prior decision which cannot be changed in the short run.	Committed Cost
(iii)	Increase in cost resulting from selection of one alternative instead of another.	Differential/Incremental Cost
(iv)	Rent paid for a factory building which is temporarily closed.	Shut Down Cost

(e) (i) The company has done extensive exercise in year-I that can be used as a basis for budgeting in year-II by incorporating increase in costs / revenue at expected activity level. Hence, Traditional Budgeting would be more appropriate for the company in year-II.

(ii) In Traditional Budgeting system budgets are prepared on the basis of previous year's budget figures with expected change in activity level and corresponding adjustment in the cost and prices. But under Zero Base Budgeting (ZBB) the estimations or projections are converted into figures. Since, sales manager is unable to substantiate his expectations into figures so Traditional Budgeting would be preferred against Zero Base Budgeting.

(iii) Zero Base Budgeting would be appropriate as ZBB allows top-level strategic goals to be implemented into the budgeting process by tying them to specific functional

areas of the organization, where costs can be first grouped, then measured against previous results and current expectations.

(iv) Zero Base Budgeting allocates resources based on order of priority up to the spending cut-off level (maximum level upto which spending can be made). In an organisation where resources are constrained and budget is allocated on requirement basis, Zero Base Budgeting is more appropriate method of budgeting.