PAPER – 5 : ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Public Utility Service

1. A public company responsible for the supply of domestic gas has been approached by several prospective customers in a rural area adjacent to a high-pressure main. As a condition of its license to operate as a utility, the company is obliged to respond positively to current needs provided the financial viability of the company is not put at risk. New customers are charged ₹ 250 each for connection to the system.

   Once a meter is installed, a standing charge of ₹ 10 per quarter is billed. Charges for gas are levied at ₹ 400 per 1,000 metered units.

   A postal survey of the area containing, according to the rating authority, 5,000 domestic units, elicited a 40% response rate. 95% of those who responded confirmed that they wished to become gas users and expressed their willingness to pay the connection charge.

   Although it is recognized that a small percentage of those willing to pay for connection may not actually choose to use gas, it is expected that the average household will burn 50 metered units per month. There will be some seasonal differences.

   The company's marginal cost of capital is 17% pa and supplies of bulk gas cost the company ₹ 0.065 per metered unit. Wastage of 15% has to be allowed to determine what the maximum capital project cost can be to allow the company to provide the service required.

Labour Related Decision

2. If DBC Ltd. is producing a component called 'DBC'. Estimated costs are:

	Fixed Cost per year (₹ '000)	Variable Cost per 'DBC' (₹)
Production	32,000	3,600
Distribution	2,000	200

   Direct labour costs are 40% of the variable production costs. In the production department machining and assembling of 'DBC', 90 men work 8 hours per day for 300 days in a year. Each worker can machine and assemble 1 'DBC' per uninterrupted 180 minutes time frame. In each 8 hours working day, 20 minutes are allowed for coffee-break, 30 minutes on an average for training and 22 minutes for supervisory instructions. Besides 10% of each day is booked as idle time to cover checking in and checking out changing operations, getting materials and other miscellaneous matters.

   DBC Ltd. has been facing industrial relations problem as the workers of company have a very strong union. Company is faced with the possibility of a strike by direct production workers engaged on the assembly of 'DBC'. The trade union is demanding an increase of

15%, back-dated from the beginning of financial year, but the company expects that if a strike does take place, it will last 25 Days after which the union will settle for an increase of 10% similarly back-dated. The only product of the company is being sold at ₹6,000.

If the strike takes place, Sales of 1,300 'DBC' would be lost. The balance that would ordinarily have been produced during the strike period could, however be sold, but these 'DBC' would have to be made up in overtime working which would be at an efficiency rate of 90% of normal. This would entail additional fixed cost of ₹1,00,000 and wage payments at time and one-half.

Required

Give necessary advice to the management to allow the strike to go ahead or to accept the union's demand.

Just in Time

3. Revolution Ltd. has entered into a contract to supply a component to a company which manufactures electronic equipments.

    Expected demand for the component will be 70,000 units totally for all the periods. Expected sales and production cost will be

Period	1	2	3	4
Sales (units)	9,500	17,000	18,500	25,000
Variable cost per unit	30	30	32.50	35

    Total fixed overheads are expected to be ₹14 lakhs for all the periods.

    The production manager has to decide about the production plan.

    The choices are:

    Plan 1: Produce at a constant rate of 17,500 units per period. Inventory holding costs will be ₹ 6.50 per unit of average inventory per period.

    Plan 2: Use a just-in-Time (JIT) system

    Maximum capacity per period normally   18,000 units

    It can produce further up to 10,000 units per period in overtime.

    Each unit produced in overtime would incur additional cost equal to 30% of the expected variable cost per unit of that period.

    Assume zero opening inventory.

    ### *Required*

    (i)   CALCULATE the incremental production cost and the savings in inventory holding cost by JIT production system.

    (ii) ADVISE the company on the choice of a plan.

CVP Analysis

4. The profit for the year of Garena Ltd. works out to 12.5% of the capital employed and the relevant figures are as under:

Sales.. ₹5,00,000

Direct Materials.. ₹2,50,000

Direct Labour.. ₹1,00,000

Variable Overheads...₹40,000

Capital Employed.. ₹4,00,000

The new Sales Manager who has joined the company recently estimates for next year a profit of about 23% on capital employed, provided the volume of sales is increased by 10% and simultaneously there is an increase in Selling Price of 4% and an overall cost reduction in all the elements of cost by 2%.

Required

Find out by computing in detail the cost and profit for next year, whether the proposal of Sales Manager can be adopted.

Profit Maximisation Model

5. APV Ltd. has developed a new product which is about to be launched into the market. The variable cost of selling the product is ₹ 17 per unit. The marketing department has estimated that at a sale price of ₹ 25, annual demand would be 10,000 units. However, if the sale price is set above ₹ 25, sales demand would fall by 500 units for each ₹ 0.50 increase above ₹ 25. Similarly, if the price is below ₹ 25, demand would increase by 500 units for each ₹ 0.50 stepped reduction in price below ₹ 25.

Required

Determine the price which would maximise APV Ltd.'s profit in the next year.

Return on Investment Pricing

6. The cost of production and sales of 80,000 units per annum of product 'l' are:

Material..........................	₹ 4,80,000	Labour..................	₹ 1,60,000
Variable Overhead............	₹ 3,20,000	Fixed overhead.......	₹ 5,00,000

The fixed portion of capital employed is ₹12 lacs and the varying portion is 50% of sales turnover.
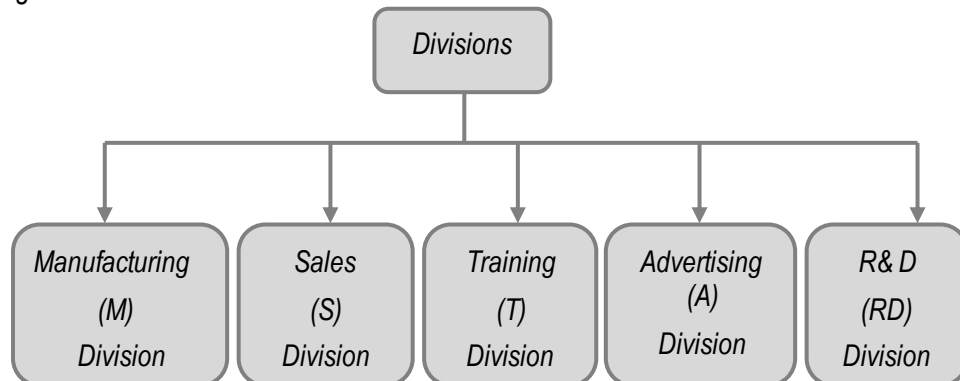
Required

Determine the selling price per unit to earn a return of 12% net on capital employed (net of Tax @ 40%).

Pricing Strategy

7. State the appropriate pricing policy in each of the following independent situations:

    (i)   'W' 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) 'X' 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) 'Y' 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) 'Z' is a perishable item, with more than 80% of its shelf life over.

Budget – Zero Based Budgeting

8. Air Communication Limited is a state-owned large public company in the telecommunications sector. One of its main planning and control tools is the preparation and use of traditional annual budgets. Its divisional structure is as under:

Division T, A and RD incur substantial amount on discretionary expenses.

Required

Identify the possibilities of introducing a Zero Based Budgeting system for Division T, A and RD.

Budget – Missing Figure

9. Following information are extracted from monthly budgets of JIT Ltd.

	November	December
Beginning WIP Inventory	36,000	???
Beginning Finished Goods Inventory	44,000	???

Variable Cost of Goods Sold	1,23,000	???
Direct Material Usage	50,000	56,000
Direct Labour	53,100	69,000
Variable Overhead	25,000	29,000
Variable Cost of Goods Manufactured	1,07,500	1,15,900
Ending WIP Inventory	???	???
Ending Finished Goods Inventory	???	45,000

Required

Find out missing figures.

Standard Costing – Profit Reconciliation

10. HKT Ltd. has provided the following summarized results for two years:

	Year ended (₹ In lacs)	
	31-03-2018	31-3-2019
Sales	3,000	3,277.50
Material	2,000	2,357.50
Variable overheads	500	525.00
Fixed overheads	300	367.50
Profit	200	27.50

During the year ended 31-3-2019 sale price has increased by 15% whereas material and overhead prices have increased by 15% and 5% respectively.

Required

(i) Analyse the variances of revenue and each element of cost over the year in order to bring out the reasons for the change in profit.

(ii) Present a profit reconciliation statement starting from profits in 2017-18 showing the factors responsible for the change in profits in 2018-19.

Note – Consider 'Contribution Variances' for solving this question.

Transfer Pricing

11. Great Southern Company Ltd. has two Divisions namely Casnub Bogie Division (CBD) and Wagon Division (WD). CBD manufactures Casnub Bogies and WD manufactures BOBN type of Wagons. To manufacture a Wagon WD needs four Casnub Bogies. CBD is the only manufacturer of the Casnub Bogies and supplies both WD and outside customers. Details of CBD and WD for the coming financial year 2019-20 are as follows:

	CBD	WD
Fixed Costs (₹)	9,20,20,000	16,45,36,000
Variable Cost per unit (₹)	2,20,000	4,80,000*
Capacity per month (units)	320	12

excluding transfer costs

Market research has indicated that the demands in the market for Great Southern Company Ltd.'s products at different quotations are as follows-

For Casnub Bogies: Quotation price of ₹3,20,000 no tender will be awarded, but demand will increase by 30 Casnub Bogies with every ₹10,000 reduction in the unit quotation price below ₹3,20,000.

For Wagons: Quotation price of ₹17,10,000 no tender will be awarded, but the demand for Wagons will be increased by two Wagons with every ₹50,000 reduction in the unit quotation price below ₹17,10,000.

Required

(i)   Calculate the unit quotation price of the Wagon that will maximise Great Southern Company Ltd.'s profit for the financial year 2019-20.

(ii) Calculate the unit quotation price of the Wagon that is likely to emerge if the divisional managers of CBD and WD both set quotation prices calculated to maximise divisional profit from sales to outside customers and the transfer price is set at market selling (quotation) price.

[Note: If P = a – bQ then MR = a – 2bQ]

Linear Programming

12. Find the dual problem for the following:

   Minimize

   $$Z = 2x_1 - 3x_2 + 4x_3$$

   Subject to the constraints

   $$3x_1 + 2x_2 + 4x_3 \geq 9$$
   $$2x_1 + 3x_2 + 2x_3 \geq 5$$
   $$7x_1 - 2x_2 - 4x_3 \leq 10$$
   $$6x_1 - 3x_2 + 4x_3 \geq 4$$
   $$2x_1 + 5x_2 - 3x_3 = 3$$
   $$x_1, x_2, x_3 \geq 0$$

Assignment Problem – Minimisation

13. A factory is going to modify of a plant layout to install four new machines X_1, X_2, X_3 and X_4. There are 5 vacant places P, Q, R, S and T available. Because of limited space machine X_2 cannot be placed at R and X_3 cannot be placed at P. The cost of locating machine to place in Rupees is shown below:

(₹)

	P	Q	R	S	T
X_1	9	11	15	10	11
X_2	12	9	--	10	9
X_3	--	11	14	11	7
X_4	14	8	12	7	8

Required

Determine the optimal assignment schedule in such a manner that the total costs are kept at a minimum.

Missing Figures & Network

14. The number of days of total float (TF), earliest start times (EST) and duration in days are given for some of the following activities.

Activity	TF	EST	Duration
1–2	0	0	???
1–3	2	???	???
1–4	5	???	???
2–4	0	4	???
2–5	1	???	5
3–6	2	12	???
4–6	0	12	???
5–7	1	???	???
6–7	???	23	???
6–8	2	???	???
7–8	0	23	???
8–9	???	30	6

Required

(i) Find the??? Figures.

(ii) Draw the network.

(iii) List the paths with their corresponding durations and state when the project can be completed.

15. Finance Controller of Dunk Limited has drawn the following projections with probability distribution:

Raw Material		Wages & Other Variable Overheads		Sales	
₹ in '000	Probability	₹ in 000	Probability	₹ in 000	Probability
08 – 10	0.2	11 – 13	0.3	34 – 38	0.1
10 – 12	0.3	13 – 15	0.5	38 – 42	0.3
12 – 14	0.3	15 – 17	0.2	42 – 46	0.4
14 – 16	0.2			46 – 50	0.2

Opening cash balance is ₹ 40,000 and fixed cost is estimated at ₹ 15,000 per month.

Required

Simulate cash flow projection and expected cash balance at the end of the sixth month. Use the following single digit random numbers.

Raw Material	4 3 1 0 4 6
Wages & Other Variable Overheads	2 7 9 1 8 9
Sales	0 6 6 0 2 8

16. West Wood Appliances Ltd. (WWAL) manufactures consumer durable products in a very highly competitive market. WWAL is considering launching a new product 'W-9' into the market and gathered the following data:

Expected Market Price- ₹ 5,000 per unit

Direct Material Cost- ₹ 1,850 per unit

Direct Labour Cost- ₹ 80 per hour

Variable Overhead Cost- ₹ 1,000 per unit

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

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

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

Required

(i)   Calculate the expected total labour hours over the life time of the product 'W-9'.

(ii) Profitability of product 'W-9' that WWAL will earn over the life time of the product.

(iii) Average target labour cost per unit over the life time of the product if WWAL requires average profit of ₹ 800 per unit, to achieve its long term objectives.

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

Miscellaneous

17. Indicate 6 activity drivers in respect of each of the following activity cost pools:

(i)   Human Resources Cost

(ii) Accounting Costs

SUGGESTED ANSWERS/HINTS

1. **Working Notes**

    1. No. of Customer   =   1,900 (5,000 × 40% × 95%)

    2. Consumption of Gas   =   11,40,000 Metered units
                                          (1,900 × 50 mt.× 12 months)

         Gas Supply   =   13,41,176 Metered units

                                          {11,40,000 × (100 ÷ 85)}

    3. Cash Inflow

	(₹)
Rent (1,900 × 4 Quarters × ₹ 10)	76,000
Add: Consumption Charge (11,40,000 × ₹ 0.4)	4,56,000
Less: Cost of Company (13,41,176 × ₹ 0.065)	87,176
Cash Inflow p.a.	4,44,824

    One Time Connection Charge   =   ₹ 4,75,000 (₹ 250 × 1,900 customers)

    Maximum Capital Project Cost Can be to Allow the Company to Provide the

Service Required

By Following the Concept of Perpetuity

(Investment − ₹ 4,75,000) × 17% = ₹ 4,44,824

∴   Investment   =   ₹ 30,91,612

2. **Alternative-1 with No Strike:** (Refer W.N.-2, 3)

Cost of Settlement is 15% Increase i.e. ₹216 per unit

Annual Cost of Settlement

=   54,000 units × ₹216

=   ₹1,16,64,000

Alternative 2 i.e. if Strike Goes Ahead: (Refer W.N.-1, 2, 3)

Extra Cost	(₹)
Annual Incremental Labour Cost (Ex. Strike Days Production) [{54,000 units – (25 Days × 180 units per Day)} × ₹144.00]	71,28,000
Loss of Contribution *due to loss of sales* [1,300 units × ₹ 2,200]	28,60,000
Incremental Labour Cost for Balance 3,200 units [(25 Days × 180 units per Day) – 1,300 units} × ₹144.00]	4,60,800
Overtime Premium [3,200 units × 1,584 × 0.5]	25,34,400
Payment for Efficiency [3,200 units × 1/9 × 1,584 × 1.5]	8,44,800
Additional Fixed Cost	1,00,000
	1,39,28,000

If there is no strike, it will yield a financial benefit of ₹ 22,64,000 (₹1,39,28,000 – ₹ 1,16,64,000). Management should accept union's demand.

Working Note

(1) **Statement Showing Contribution *per unit* of 'DBC'**

	(₹)
Selling Price	6,000
Less: Variable Costs:	
Labour Cost	1,440
Production Ex. Wages (₹3,600 – ₹1,440)	2,160
Distribution	200
Contribution	2,200

(2) Calculation of Labour Cost

Direct Labour (40% of production costs of ₹3,600)	=	₹1,440 *per unit*
With 15% Increase, Revised Labour Cost (₹1,440 + ₹216)	=	₹1,656
With 10% Increase, Revised Labour Cost (₹1,440 + ₹144)	=	₹1,584

(3) Statement Showing Budgeted Production

Total Time in a Day: (8hrs. × 60 minutes)	=	480 minutes
Less: Idle Time	=	48 minutes
Coffee Break	=	20 minutes
Instructions	=	22 minutes
Training	=	30 minutes
Productive Time *per day*	=	360 minutes

Therefore, 'DBC' to be produced per man per day: (360/180 × 1)

= 2 units

Since 'DBC' are produced at the rate of 2 'DBC' per man day, so total yearly production will be 54,000 units (2 units × 90 men × 300 days) of 'DBC'

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> This problem has been solved by <u>comparing</u> **'Existing Situation'** with both **'Alternatives (Strike or Non-Strike)'** *independently*. However this problem can also be solved by <u>comparing</u> **'Alternatives (Strike or Non-Strike)'** *only* and final answer would be the same. Students may also solve this problem by taking **'Total Approach'** instead of **'Incremental Approach'**.

3. (i) Workings

Statement Showing 'Inventory Holding Cost' under Plan 1

Particulars		Pd. 1	Pd. 2	Pd. 3	Pd.4
Opening Inventory	(A)	---	8,000	8,500	7,500
Add: Production		17,500	17,500	17,500	17,500
Less: Demand/ Sales		9,500	17,000	18,500	25,000
Closing Inventory	(B)	8,000	8,500	7,500	---
Average Inventory $\left(\frac{A+B}{2}\right)$		4,000	8,250	8,000	3,750
Inventory Holding Cost @ ₹6.50		26,000	53,625	52,000	24,375

Inventory Holding Cost *for the four periods* = ₹1,56,000

(₹26,000+₹53,625+₹52,000+₹24,375)

Statement Showing 'Additional Cost-Overtime' under Plan 2 (JIT System)

Particulars		Pd. 1	Pd. 2	Pd. 3	Pd.4
Demand/ Sales		9,500	17,000	18,500	25,000
Production in Normal Time		9,500	17,000	18,000	18,000
Production in Over Time	(A)	---	---	500	7,000
Variable Cost *per unit*		30.00	30.00	32.50	35.00
Additional Cost – Overtime *per unit* (@ 30% of Variable Cost)	(B)	9.00	9.00	9.75	10.50
Additional Cost – Overtime	(A) × (B)	---	---	4,875	73,500

Total Additional Payment (Overtime)   =   ₹78,375

(₹4,875 + ₹73,500)

Statement Showing 'Additional Variable Cost*' under Plan 2 (JIT System)

Particulars	Pd. 1	Pd. 2	Pd. 3	Pd.4	Total
Production (Plan 1)	17,500	17,500	17,500	17,500	70,000
Variable Cost ...(A)	5,25,000	5,25,000	5,68,750	6,12,500	22,31,250
Production (Plan 2, JIT)	9,500	17,000	18,500	25,000	70,000
Variable Cost (B)	2,85,000	5,10,000	6,01,250	8,75,000	22,71,250
Total				(B) – (A)	40,000

* excluding overtime cost

Incremental Production Cost in JIT System = ₹78,375 + ₹40,000

= ₹1,18,375

Therefore, Saving in JIT System (Net)   = ₹1,56,000 – ₹1,18,375

= ₹37,625

(ii) Advice

Though Revolution Ltd is saving ₹37,625 by changing its production system to Just-in-time but it has to consider *other factors* as well before taking any final call which are as follows:-

— Revolution Ltd has to ensure that it receives materials from its suppliers on the exact date and at the exact time when they are needed. Credentials and reliability of supplier must be thoroughly checked.

  — To remove any quality issues, the engineering staff must visit supplier's sites and examine their processes, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.

  — Revolution Ltd should also aim to improve quality at its process and design levels with the purpose of achieving "Zero Defects" in the production process.

  — Revolution Ltd should also keep in mind the efficiency of its work force. Revolution Ltd must ensure that labour's learning curve has reached at steady rate so that they are capable of performing a variety of operations at effective and efficient manner. The workforce must be completely retrained and focused on a wide range of activities.

4.   **Statement Showing "Cost and Profit for the Next Year"**

Particulars	Existing Volume, etc.	Volume, Costs, etc. after 10% Increase	Estimated Sale, Cost, Profit, etc.*
	(₹)	(₹)	(₹)
Sale	5,00,000	5,50,000	5,72,000
Less: Direct Materials	2,50,000	2,75,000	2,69,500
Direct Labour	1,00,000	1,10,000	1,07,800
Variable Overheads	40,000	44,000	43,120
Contribution	1,10,000	1,21,000	1,51,580
Less: Fixed Cost#	60,000	60,000	58,800
Profit	50,000	61,000	92,780

(*) for the next year after increase in selling price @ 4% and overall cost reduction by 2%.

(#) Fixed Cost	=	Existing Sales – Existing Marginal Cost – 12.5% on ₹4,00,000
	=	₹5,00,000 – ₹3,90,000 – ₹50,000
	=	₹60,000

Percentage Profit on Capital Employed equals to 23.19% $\left(\dfrac{₹92,780}{₹4,00,000} \times 100 \right)$

Since the Profit of ₹92,780 is more than 23% of capital employed, the proposal of the Sales Manager can be adopted.

5.   **Statement of Total Contribution**

Sales Price p.u. (₹)	Variable Cost p.u. (₹)	Contribution p.u. (₹)	Sales Volume (units) (₹)	Total Contribution (₹)
(1)	(2)	(3) = (1) – (2)	(4)	(5) = (3) × (4)
25.00	17.00	8.00	10,000	80,000
24.50	17.00	7.50	10,500	78,750
24.00	17.00	7.00	11,000	77,000
25.50	17.00	8.50	9,500	80,750
26.00	**17.00**	**9.00**	**9,000**	**81,000**
26.50	17.00	9.50	8,500	80,750
27.00	17.00	10.00	8,000	80,000
27.50	17.00	10.50	7,500	78,750

From the above statement it is quite apparent that the contribution would be maximum at a sale price of ₹26 per unit and sales demand of 9,000 units.

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| This problem can also be solve by using **'Profit Maximisation'** model formula. |

6. Return of 12% Net (after tax of 40%) on Capital Employed is equivalent to 20% (Gross) [12% ÷ (1 – 0.4)] on Capital Employed.

Let Selling Price per unit to be 'K'

Since Total Sales   =   Total Cost + Profit

                80,000 K   =   14,60,000 + 20% (12,00,000 + 0.5 × 80,000K)

Or,   80,000 K   =   14,60,000 + 2,40,000 + 8,000K

Or,   72,000 K   =   17,00,000

Or,   'K'   = $\dfrac{17,00,000}{72,000}$

                        =   ₹23.61

Hence Selling Price per unit will be ₹23.61.

7.

	Situation	Appropriate Pricing Policy
(i)	'W' 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)	'X' is a new product for the company, but not for the market. X's success is crucial for the company's survival in the long term.	Market Price or Price Just Below Market Price
(iii)	'Y' 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)	'Z' is a perishable item, with more than 80% of its shelf life over.	Any Cash Realizable Value*

(*) this amount decreases every passing day.

8. Discretionary costs are those that are incurred, typically each year, in an amount that is approved as part of the normal budget process. However, there is no clear relationship between the volume of services and the amount of cost that must be incurred. Manager must decide and justify the level that is deemed to be appropriate. This justification is to be made a fresh without making reference to previous level of spending in his/her department.

Zero based budgeting is undoubtedly most effective in terms of discretionary costs. The bottom line of a zero based budgeting is that it is important to understand what types of objectives are being accomplished by discretionary cost centers and what resources being devoted to accomplishing various objectives. This will allows a prioritization, so that organization can evaluate the likely impact of substantial increase or decrease in the resources allocated to the discretionary center.

Accordingly, ZBB has extensive potential application to the division T, A and RD.

9. Analysis of WIP Account

	November	December
Opening WIP	36,000	**56,600**
Add: Direct Materials Usage	50,000	56,000
Add: Direct Labor	53,100	69,000
Add: Variable Overhead	25,000	29,000

Total Inflow into WIP	1,64,100	2,10,600
Less: Variable Cost of Goods Manufactured	1,07,500	1,15,900
Ending WIP	**56,600**	**94,700**

Analysis of Finished Goods Inventory Account

	November	December
Opening Finished Goods	44,000	**28,500**
Add: Cost of Goods Manufactured	1,07,500	1,15,900
Cost of Goods Available for Sale	1,51,500	1,44,400
Less: Cost of Goods Sold	1,23,000	**99,400**
Ending Finished Goods Inventory	**28,500**	45,000

10. **Statement Showing Reconciliation Between Budgeted [F.Y. 2017-18] & Actual Profit [F.Y. 2018-19]**

Particulars	(₹ in lacs)	(₹ in lacs)
Budgeted Profit		200.00
Sales Contribution Variances:		
Price	427.50 (F)	
Volume	25 (A)	402.50 (F)
Direct Material Variances:		
Price	307.50 (A)	
Usage	150.00 (A)	457.50 (A)
Variable Overheads Variances:		
Expenditure	25.00 (A)	
Efficiency	25.00 (A)	50.00 (A)
Fixed Overheads Variances:		
Expenditure	67.50 (A)	
Volume	N.A.	67.50 (A)
Actual Profit		27.50

Computation of Variances (₹ In Lacs)

Sales Variances (W.N.1)

Price Variance   = Actual Sales – Standard Sales

                 = ₹ 3,277.50 – ₹ 2,850.00

	=	₹ 427.50 (F)
Volume Variance	=	Standard Sales – Budgeted Sales
	=	₹ 2,850.00 – ₹ 3,000.00
	=	₹ 150 (A)

Sales Contribution Variances

Sales Contribution Price Variance

= Sales Price Variance

= ₹ 427.50 (F)

Sales Contribution Volume Variance

= Sales Volume Variance × Budgeted PV Ratio

$$= ₹\ 150\ (A) \times \left(\frac{₹\ 200 + ₹\ 300}{₹\ 3,000} \right)$$

= ₹ 25 (A)

Material Variances (W.N.2)

Material Price Variance

= Standard Cost of Actual Quantity – Actual Cost

= ₹ 2,050.00 – ₹ 2,357.50

= ₹ 307.50 (A)

Material Usage Variance

= Standard Cost of Standard Quantity for Actual Output – Standard Cost of Actual Quantity

= ₹ 1,900 – ₹ 2,050

= ₹ 150 (A)

Variable Overhead Variances (W.N.3)

Expenditure Variance

= Budgeted Variable Overheads for Actual Hours – Actual Variable Overheads

Or

= Std. Rate *per unit* × Expected Output for Actual Hours Worked – Actual Variable Overheads

= ₹ 500 – ₹ 525

= ₹ 25 (A)

Efficiency Variances = Standard Variable Overheads for Production – Budgeted Variable Overheads for Actual Hours

Or

= Std. Rate *per unit* × Actual Output – Std. Rate *per unit* × Expected Output for Actual Hours Worked

= ₹ 475 – ₹ 500

= ₹ 25 (A)

Fixed Overhead Variances (W.N.4)

Expenditure Variance

= Budgeted Fixed Overheads – Actual Fixed Overheads.

= ₹ 300.00 – ₹ 367.50

= ₹ 67.50 (A)

Working Notes (₹ in lacs)

Note-1:

Sales in F.Y. 2018-2019	3,277.50
Less: Increase due to *price rise* [₹ 3,277.50 lacs x 15/115]	427.50
Sales in F.Y. 2018-2019 at F.Y. 2017-2018 Prices **[Standard Sales]**	2,850.00
Sales in F.Y. 2017-2018	3,000.00
Fall in Sales in F.Y. 2018-2019 [₹ 3,000 lacs - ₹ 2,850 lacs]	150.00
Percentage fall	5%

Note-2:

Material Cost in F.Y. 2017-2018	2,000.00
Less: 5% for Decrease in Volume	100.00
'Standard Material Usage' at F.Y. 2017-18 Prices **(Standard Cost of Standard Quantity for Actual output)**	1,900.00
Actual Material Cost F.Y. 2018-2019	2,357.50
Less: 15% Increase in Prices [₹ 2,357.50 lakhs x 15/115]	307.50
Actual Materials Used, at F.Y. 2017-2018 Prices **(Standard Cost of Actual Quantity)**	2,050.00

Note-3:

Variable Overheads Cost in F.Y. 2017-18	500.00
Less: 5% due to fall in Volume of Sales in F.Y. 2018-19	25.00
"Standard Overheads for Production" in F.Y. 2018-19	475.00
Actual Variable Overheads Incurred in F.Y. 2018-19	525.00
Less: 5% for Increase in Price [₹ 525 lacs x 5 / 105]	25.00
Amount Spent in F.Y. 2018-19 at F.Y. 2017-18 Prices **(Budgeted Variable Overheads for Actual Hours)**	500.00

11. (i) Assumed Quotation Price 'P', Quantity 'Q'

The Marginal Cost of a 'Wagon' is ₹13,60,000

(₹2,20,000 × 4 Casnub Bogies + ₹4,80,000)

Demand Function for a 'Wagon'

P	=	₹17,10,000 – (₹50,000 / 2) × Q
Revenue (R)	=	Q × [17,10,000 – 25,000 × Q]
	=	$17,10,000\,Q - 25,000\,Q^2$
Marginal Revenue (MR)	=	17,10,000 – 50,000 Q
Marginal Cost (MC)	=	13,60,000

Profit is Maximum where Marginal Revenue (MR) equals to Marginal Cost (MC)

17,10,000 – 50,000 Q	=	13,60,000
Q	=	7.00 units

By putting the value of 'Q' in *Demand Function*, value of 'P' is obtained.

P	=	17,10,000 – (50,000/ 2) × Q
	=	17,10,000 – 25,000 × 7.00
	=	₹15,35,000

At ₹15,35,000 unit Quotation Price of a Wagon the Great Southern Company Ltd.'s Profit will be Maximum.

(ii) At CBD the Divisional Manager would ensure that Divisional Marginal Revenue should be **equal to** Division's Marginal Cost so that Profit can be Maximum.

MR of a Casnub Bogies	=	MC of Manufacturing a Casnub Bogies
3,20,000 – 2(10,000/ 30) × Q	=	2,20,000
Q	=	150 units

Selling Price of a Casnub Bogie 'P' is

P	=	3,20,000 – (10,000/ 30) × 150
	=	₹2,70,000

CBD will earn Maximum Profit when it will Quote ₹2,70,000 to the Outside Market. Since, Outside Market Quotation is *Transfer Price* as well, so Transfer Price to WD will be ₹2,70,000 and it forms part of WD's Marginal Cost.

At WD, Division Manager would ensure that Divisional Marginal Revenue should be **equal to** Division's Marginal Cost so that Profit can be Maximum.

MR of a Wagon	=	MC of Manufacturing a Wagon
$17,10,000 - 50,000 \times Q$	=	(₹2,70,000 × 4 Casnub Bogies) + ₹4,80,000
Q	=	3.00 units

Quotation Price of a Wagon 'P' should be:

P	=	₹17,10,000 – 25,000 × 3.00
	=	₹16,35,000

The unit Quotation Price of Wagon that emerges as a result of Market Based Transfer Pricing is ₹16,35,000.

12. Primal

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

Subject to the constraints

$$3x_1 + 2x_2 + 4x_3 \geq 9$$
$$2x_1 + 3x_2 + 2x_3 \geq 5$$
$$-7x_1 + 2x_2 + 4x_3 \geq -10$$
$$6x_1 - 3x_2 + 4x_3 \geq 4$$
$$2x_1 + 5x_2 - 3x_3 \geq 3$$
$$-2x_1 - 5x_2 + 3x_3 \geq -3$$
$$x_1, x_2, x_3 \geq 0$$

Dual

Maximize $Z = 9y_1 + 5y_2 - 10y_3 + 4y_4 + 3y_5 - 3y_6$

Subject to constraints

$$3y_1 + 2y_2 - 7y_3 + 6y_4 + 2y_5 - 2y_6 \leq 2$$

$$2y_1 + 3y_2 + 2y_3 - 3y_4 + 5y_5 - 5y_6 \leq -3$$

$$4y_1 + 2y_2 + 4y_3 + 4y_4 - 3y_5 + 3y_6 \leq 4$$

$$y_1, y_2, y_3, y_4, y_5, y_6 \geq 0$$

By substituting $y_5 - y_6 = y_7$ the dual can alternatively be expressed as:

Maximize $Z = 9y_1 + 5y_2 - 10y_3 + 4y_4 + 3y_7$

Subject to constraints

$$3y_1 + 2y_2 - 7y_3 + 6y_4 + 2y_7 \leq 2$$

$$-2y_1 - 3y_2 - 2y_3 + 3y_4 - 5y_7 \geq 3$$

$$4y_1 + 2y_2 + 4y_3 + 4y_4 - 3y_7 \leq 4$$

$$y_1, y_2, y_3, y_4 \geq 0, y_7 \text{ unrestricted in sign.}$$

13. Dummy machine (X_5) is inserted to make it a balanced cost matrix and assume its installation cost to be zero. Cost of install at cell X_3 (P) and X_2 (R) is very high marked as M.

	P	Q	R	S	T
X_1	9	11	15	10	11
X_2	12	9	M	10	9
X_3	M	11	14	11	7
X_4	14	8	12	7	8
X_5 (Dummy)	0	0	0	0	0

Step 1

Subtract the minimum element of each row from each element of that row-

	P	Q	R	S	T
X_1	0	2	6	1	2
X_2	3	0	M	1	0
X_3	M	4	7	4	0
X_4	7	1	5	0	1
X_5 (Dummy)	0	0	0	0	0

Step 2

Subtract the minimum element of each column from each element of that column-

	P	Q	R	S	T
X_1	0	2	6	1	2
X_2	3	0	M	1	0
X_3	M	4	7	4	0
X_4	7	1	5	0	1
X_5 (Dummy)	0	0	0	0	0

Step 3

Draw lines to connect the zeros as under-

	P	Q	R	S	T
X_1	[0]	2	6	1	2
X_2	3	[0]	M	1	0
X_3	M	4	7	4	[0]
X_4	7	1	5	[0]	1
X_5 (Dummy)	0	0	[0]	0	0

There are five lines which are equal to the order of the matrix. Hence the solution is optimal. We may proceed to make the assignment as under-

	P	Q	R	S	T
X_1	[0]	2	6	1	2
X_2	3	[0]	M	1	⨯
X_3	M	4	7	4	[0]
X_4	7	1	5	[0]	1
X_5 (Dummy)	⨯	⨯	[0]	⨯	⨯

The following is the assignment which keeps the total cost at minimum-

Machines	Location	Costs (₹)
X_1	P	9
X_2	Q	9
X_3	T	7

X₄	S	7
X₅ (Dummy)	R	0
	Total	32

14. **(i)** Calculation of **Missing Figures**:

Activity	Duration	EST	EFT	LST	LFT	Total Float
	D_{ij}	E_i	$E_i + D_{ij}$	$L_j - D_{ij}$	L_j	LST− EST
1–2	4	0	4	0	4	0
1–3	12	0	12	2	14	2
1–4	7	0	7	5	12	5
2–4	8	4	12	4	12	0
2–5	5	4	9	5	10	1
3–6	9	12	21	14	23	2
4–6	11	12	23	12	23	0
5–7	13	9	22	10	23	1
6–7	0	23	23	23	23	0
6–8	5	23	28	25	30	2
7–8	7	23	30	23	30	0
8–9	6	30	36	30	36	0

(ii) The **Network** for the given problem:

Critical Path : 1—2—4—6—7—8—9
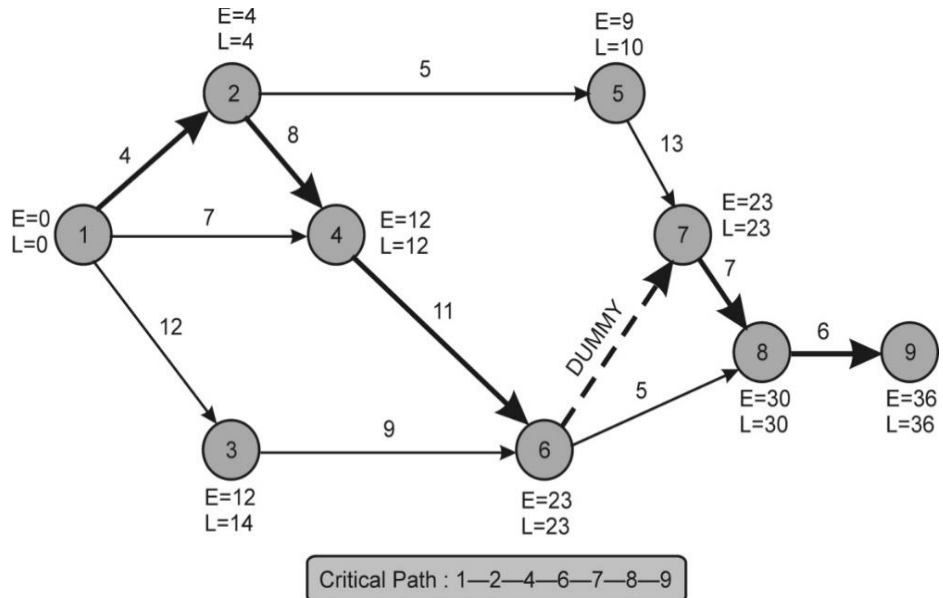
    (iii) The **Various Paths** in the Network are:

        1–2–4–6–7–8–9 with Duration 36 Days

        1–2–5–7–8–9 with Duration 35 Days

        1–3–6–7–8–9 with Duration 34 Days

        1–2–4–6–8–9 with Duration 34 Days

        1–3–6–8–9 with Duration 32 Days

        1–4–6–7–8–9 with Duration 31 Days

        1–4–6–8–9 with Duration 29 Days

    (iv) The **Critical Path** is 1–2–4–6–7–8–9 with Duration 36 Days.

15. **Allocation of Random Numbers**

Raw Material			Wages & Other Variable Overheads			Sales		
Mid Point	**Cum. Prob.**	**Random Nos.**	**Mid Point**	**Cum. Prob.**	**Random Nos.**	**Mid Point**	**Cum. Prob.**	**Random Nos.**
9	0.2	0 – 1	12	0.3	0 – 2	36	0.1	0
11	0.5	2 – 4	14	0.8	3 – 7	40	0.4	1 – 3
13	0.8	5 – 7	16	1.0	8 – 9	44	0.8	4 – 7
15	1.0	8 – 9				48	1.0	8 – 9

Simulation Table   (₹ in 000)

Month	Raw Material	Wages & Other V.O	Sales	Fixed Cost	Net Cash Flow	Cash Balancing (Opening ₹ 40 thousand)
1	11	12	36	15	-2	38
2	11	14	44	15	+4	42
3	9	16	44	15	+4	46
4	9	12	36	15	0	46
5	11	16	40	15	-2	44
6	13	16	48	15	+4	**48**

16. **Calculation of Total Labour Hours Over the Life Time of The Product 'W-9'**

The average time per unit for 250 units

$$Y_x = ax^b$$

Or, $Y_{250} = 30 \times 250^{-0.3219}$

Or, $Y_{250} = 30 \times 0.1691$

Or, $Y_{250} = 5.073$ hours

Total time for 250 units $= 5.073 \times 250$ units

$= 1{,}268.25$ hours

The average time per unit for 249 units

$$Y_{249} = 30 \times 249^{-0.3219}$$

Or, $Y_{249} = 30 \times 0.1693$

Or, $Y_{249} = 5.079$ hours

Total time for 249 units $= 5.079 \times 249$ units

$= 1{,}264.67$ hours

Time for 250th unit $= 1{,}268.25$ hours $- 1{,}264.67$ hours

$= 3.58$ hours

Total Time for 1,000 units $= (750 \times 3.58 \text{ hours}) + 1{,}268.25$ hours

$= 3{,}953.25$ hours

Profitability of the Product 'W-9'

Sales 1,000 Units

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

Average Target Labour Cost *per unit*

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

17. (i)

Human Resource Cost	1. Number of employee
	2. Number of training Hours
	3. Number of benefit changes
	4. Number of insurance claims
	5. Number of pension changes
	6. Number of recruiting contacts

(ii)

Accounting Cost	1. Number of billings
	2. Number of cash receipts
	3. Number of check payments
	4. Number of general ledger entries
	5. Number of reports issued
	6. Number of responsibility centre