Roll No. ....

JAN 2021

Total No. of Questions – **7**

Total No. of Printed Pages – **16**

Time Allowed – **3 Hours**

Maximum Marks – **100**

DRH

Answers to questions are to be given only in English except in the case of candidates who have opted for Hindi Medium. If a candidate has not opted for Hindi Medium, his/her answers in Hindi will not be valued.

Question No. **1** is compulsory

Answer any **five** questions from the remaining **six** questions.

Working notes should form part of the respective answers.

No Statistical or other table will be provided with the question paper.

Marks

1. (a) A Company has continuous manufacturing process involving an output   **5**
    of 10 tonnes per hour valued at ₹ 80 per tonne. Process wages cost
    ₹ 40 per hour and raw material ₹ 60 per tonne of product. Regular
    maintenance works out to ₹ 1,15,750 per month.

    The company is experiencing breakdown due to mechanical reason
    averaging 100 hours a month, costing ₹ 75,000 to repair. It is estimated
    that these breakdown can be reduced or eliminated if additional
    maintenance on the following scale were undertaken :

Breakdown per month (hours)	0	20	40	60	80
Maintenance Cost (₹)	2,23,000	1,53,000	1,46,500	1,26,000	1,22,500
Repair Cost (₹)	0	25,000	30,000	50,000	65,000

    Process labour during stoppages can be used elsewhere up to 40 hours
    per month.

DRH

P.T.O.

Required :

(i)   Present, in tabular form, the optimum amount of maintenance to be undertaken each month.

(ii) What is the additional revenue that will be resulting from the optimum level, compared with the present situation ?

(b) Micro Industries manufactures 2 types of microwaves, "Best & Super". The following information is available on each microwave :   **5**

Particulars	Best	Super
Units manufactured and sold	8,000 units	7,000 units
Selling Price per unit	₹ 6,000	₹ 4,000
Variable Costs per unit	₹ 3,600	₹ 3,000
Hours spent on design	1,200 hours	500 hours
Testing and inspection hour per unit	3	1
Percentage of units reworked in plant	5%	10%
Re-work costs per unit	₹ 1,000	₹ 600
Percentage of units repaired at customer site	5%	7%
Repair costs per unit	₹ 1,250	₹ 750
Estimated lost sales from poor quality	–	200 units

The Labour Rates per hour for design activities are ₹ 600 per hour. Testing and inspection charges are ₹ 20 per hour.

Required : Calculate the total costs of quality for each of the two models after classifying them into Prevention, Appraisal, Internal Failure, and External Failure Categories.

(c) Given below is an iteration in a simplex table for a maximization   5
objective linear programming product mix problem for products X_1
and X_2. Each of these product is processed on three machines A, B and
C. Each machine has limited available hours.

C_B	Basic Variable (B)	Value of Basic Variables b(=X_B)	**40** X_1	**60** X_2	**0** S_1	**0** S_2	**0** S_3
		C_j					
0	S_1	6	2	0	1	0	$-\dfrac{1}{2}$
0	S_2	40	$\dfrac{13}{3}$	0	0	1	$-\dfrac{1}{3}$
60	X_2	10	$\dfrac{1}{3}$	1	0	0	$\dfrac{1}{6}$
Z		600	20	60	0	0	10
$C_j - Z_j$			20	0	0	0	−10

(S_1, S_2 and S_3 are slack variables for machine A, B and C respectively)

Answer the following questions, giving reasons in brief :

(i)   Is the above solution optimal ? If not, then find the optimal
solution.

(ii) Is the optimal solution arrived at (i) 'Degenerate' ?

(iii) Which of the machine is not being used to full capacity when
producing according to optimal solution ?

(d) ESS Ltd uses a standard costing system in manufacturing of its single product 'ZED'. During the month of October 2020, 18000 units of 'ZED' were produced and the same was found to be at 75% capacity of the budget. Following relevant information is available :   **5**

Actual hours worked	37,500 hours
Actual Fixed overheads	₹ 5,12,500
Fixed overhead expenditure variance	₹ 32,500 (Adverse)
Standard total overhead rate	
(2 hours @ ₹ 16 per hour)	₹ 32 per unit

Required :

Compute the following variances clearly indicating Adverse (A) or Favourable (F) :

(i) Variable overhead efficiency variance

(ii) Fixed overhead capacity variance

(iii) Fixed overhead efficiency variance

2. (a) Kay Ltd manufactures many products. To compute manufacturing costs, it uses a costing System with one direct cost category (Direct Materials) and three Indirect cost categories as under: **8**

- Batch related - Set up, production order, and materials handling costs- all of which vary with number of batches.

- Manufacturing Operation costs that vary with machine hours.

- Costs of engineering changes that vary with the number of engineering changes made.

DRH

In response to competitive pressure at the end of year 2019, product designer at the company employed value engineering technique to reduce manufacturing costs. Actual Information for year 2019 to year 2020 are as follows :

Particulars	Actual Result for year 2019	Actual Result for year 2020
Total setup, Production order and Material handling costs	₹ 84,00,000	₹ 96,00,000
Total number of batches	1,200	1,500
Total manufacturing operation costs	₹ 1,35,00,000	₹ 1,37,20,000
Total number of machine hours worked	2,50,000	2,80,000
Total cost of engineering changes	₹ 16,00,000	₹ 11,37,500
Total number of engineering changes made	200	175

The company wants to evaluate whether value engineering has succeeded in reducing the target manufacturing cost per unit of one of its main product CAT-36 by 10%. Actual results for year 2019 and year 2020 for CAT-36 are :

Particulars	Actual Result for year 2019	Actual Result for year 2020
Units of CAT-36 produced	3,000	4,000
Direct materials costs per unit of CAT-36	₹ 1,500	₹1,400
Total no. of batches required to produce CAT-36	55	65
Total machine hours required to produce CAT-36	19,500	21,000
Number of engineering changes made	10	6

Required :

(i) Calculate the manufacturing cost per unit of CAT-36 for year 2019 and year 2020.

(ii) Did the company achieve the target manufacturing cost per unit for CAT-36 in 2020 ?

(iii) Explain briefly how the components of target costing system help in achieving cost reduction.

(b) DJ Ltd. manufactures product 'Rust' in addition to other products by using the same machines in Department X and Department Y. The cost data are as under :   **8**

Direct Material	FM 4kg	@ ₹12/kg used in Dept. X
	ST 8kg	@ ₹ 5/kg used in Dept. Y
Direct Labour	2 hours	@ ₹ 8 per hour in Dept. X
	3 hours	@ ₹ 6 per hour in Dept. Y

Overheads :

	Dept. X Per rupee of direct Material ₹	Dept. Y Per direct labour hour ₹
Variable	0.80	2.00
Fixed	2.20	3.00
Depreciation component in Fixed overhead rate	0.80	0.10

Other relevant data :

Net plant and equipment value	60,00,000	1,40,000
Total depreciation per month	60,000	1,000

Total working capital requirement of product 'Rust' based on a target volume of output of 1,200 units per month is estimated at ₹ 19,800 per month.

Required :

(i) Indicate the selling price of product 'Rust' assuming that price is adequate to ensure contribution equivalent to 25% on total asset employed for 'Rust'.

(ii) Calculate the selling price in a situation where product is well established in the market so as to yield return of 16% on total asset employed for 'Rust'.

3. (a) Managing Director of TEE Ltd thinks that Standard Costing has little to offer in the reporting of material variances due to frequently change in price of materials.   8

TEE Ltd. can utilize one of two equally suitable raw materials and tries to purchase the raw materials which will lead to most economical total production cost. However TEE Ltd. is frequently trapped by price changes and the material actually used often provides, after the event, to have been more expensive than the alternative which was originally not considered.

During last accounting period, to produce a unit of single product 'RT' the company could use either 5 kg of 'SP' or 5 kg of 'NP'. The company planned to use 'SP' as it appeared to be cheaper of the two and plans were based on a cost of 'SP' of ₹ 12 per kg. Due to market fluctuations the actual prices changed and if the company had purchased efficiently the cost would have been :

'SP' ₹ 14 per kg

'NP' ₹ 12.5 per kg.

Production of 'RT' was 9,000 units and usage of 'SP; amounted to 47,600 kg at a total cost of ₹ 7,02,100.

Required :

(a) Analyse the material variance for 'RT' by :

    (i) Traditional variance Analysis and

    (ii) An approach which distinguish between Planning and Operational variances.

(b) Briefly explain the approach to variance analysis which distinguish between Planning and Operational variance and indicate the usefulness of the approach to company in general.

(b) A project consists of eight activities. At the end of activity 6-7, the project is to be launched based on the normal duration of activities as given below. Activities have been subcontracted by the project manager to contractor A, B, C, D, E, F, G and H. Each subcontractor offers a discount on his contract price for each day given to him in addition to the normal days. The relevant information for all the activities for this project are given below :

8

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6	6-7
Duration (Days)	7	2	14	6	9	6	5	8
Contractor	A	B	C	D	E	F	G	H
Discount ₹/Day	600	400	2,400	1,000	800	2,000	1,200	1,000

Required :

(i) Draw a network diagram for the project.

(ii) Find the critical path after estimating the earliest and latest event times for all nodes.

(iii) Calculate the free float and independent float for each activity.

(iv) What will be the maximum discount that the project manager may earn for the company without delaying the launch of the project ?

4. (a) Maple Ltd (ML) has a chain of retail outlets of uniform sizes across   10
the country. Mainly three products are sold through these retail outlets
namely 'Mango', 'Tango' and 'Icy Cool'. ML maintains stocks for all
retail outlets in a centralized warehouse. Goods are released from the
warehouse to the retail outlets as per requisition raised by the outlets.
Two types of van i.e. normal and refrigerated, transport these goods to
the outlets. These vans are taken on hire by ML.

Costs per month of ML are as follows :

Warehouse cost :	₹
Labour and staff cost	1,28,000
Refrigeration cost	4,08,000
Material handling cost	1,32,000
Total	**6,68,000**
Head office cost :	
Salary to H.O. staff	2,50,000
Office administrative cost	2,94,000
Total	**5,44,000**
Retail outlet cost :	
Labour related cost	1,52,000
Refrigeration cost	4,56,000
Other cost	2,08,000
Total	**8,16,000**

Average transportation cost of ML per trip to any retail outlet is as
follows :

Refrigerated van	₹ 21,600
Normal van	₹ 15,600

DRH   **Marks**

The Chief Financial Manager has asked his Finance managers to calculate profitability based on three products sold through these retail outlets rather than traditional method of calculating profitability. The following information regarding retail outlets are gathered :

	Mango	Tango	Icy Cool
No. of cartons per cubic metre (m³)	50	30	44
No. of items per carton (units)	300	150	100
Sales per month (units)	52,000	15,216	4,504
Time in warehouse (in months)	1	1.5	0.5
Time in Retail Outlets (in months)	1.5	2	0.75
Selling price per unit (₹)	190	96	70
Purchase price per unit (₹)	170	78	60

Mango and Icy Cool are required to be kept under refrigerated conditions.

Additional information :

Total volume of all goods sold per month	1,00,000 m³
Total volume of refrigerated goods sold per month	60,000 m³
Carrying volume of each van	120 m³

Required :

Calculate the profit per unit using Direct Product Profitability (DPP) method.

(Make calculations up to three decimal points)

DRH

(b) A company manufactures 27 items per day. Daily sale of items and the   6
corresponding probabilities are given below :

Daily sale (units)	25	27	29	24	26	28
Probability	0.20	0.28	0.15	0.10	0.22	0.05

The production and sale price of each unit is ₹ 50 and ₹ 60
respectively. Any unsold product at the end of the day is to be
disposed off at a loss of ₹ 15 per unit. There is a penalty of ₹ 5 per unit
if the demand is not met.

Using the following random numbers estimate daily profit/loss for the
company for the next 8 days :

80, 15, 99, 35, 52, 89, 65, 18

5. (a) BGL Company has two manufacturing divisions operating on profit   8
centre basis. Division Q makes product A which requires a particular
component which can be sourced only from Division P. Each unit of
product A requires two unit of that particular component.

The demand for product A is not steady and order for increased
quantities can be obtained by reduction in the price. The Manager of
Division Q has given the following forecast :

Sales per day (units)	Average Price per unit of A (₹)
3,000	500
6,000	450
9,000	400
12,000	340
15,000	290
18,000	240

The manufacturing cost (excluding cost of component from Division P) of A in Division Q is ₹10,80,000 on first 3,000 units and @ ₹ 90 per unit in excess of 3,000 units for up to 9,000 units and thereafter @ ₹ 75 per unit for units in excess of 9,000 units. Division P incurs a total cost of ₹ 4,92,500 per day for an output up to 6,000 units of component and then total cost will increase by ₹ 2,27,500 per day for every additional 6,000 components manufactured. The manager of Division P has set the transfer price for component at ₹ 60 per unit to optimize the performance of his Division.

You are required to :

(a) Prepare a divisional profitability statement at each level of output for Division P and Q separately.

(b) Find out the profitability to the company as a whole at the output level where

    (i) Division P's net profit is maximum.

    (ii) Division Q's net profit is maximum.

(c) Find out at what level of output the company will earn maximum profit, if the company is not organized on profit centre basis.

(b) The following table shows all the necessary information on the available supply from each plant, the requirement of each market and unit transportation cost from each plant to each market :   **8**

Plant	Market				Supply
	I	II	III	IV	
P_1	12	6	10	8	27
P_2	10	–	4	14	18
P_3	10	14	16	12	10
Requirement	12	18	17	8	55

Note : Units cannot be transported from P_2 to II due to unavoidable reasons.

DRH

From the past experience, the shipping clerk has worked out the following schedule :

18 units from P_1 to II, 1 units from P_1 to III, 8 units from P_1 to IV, 16 units from P_2 to III, 2 units from P_2 to I and 10 units from P_3 to I.

Required :

(i)   Check and see if the clerk has the optimal schedule.

(ii) Find the optimal schedule and minimum transportation cost.

(iii) In case all the 10 units produced at P3 are shipped through the route (P3, II), what should be the transportation cost per unit from P3 to II to maintain the same transportation cost for optimal schedule calculated at point no. (ii).

6.   (a)   The following information is extracted from the budgets of Damson   **8**
            Limited :

Sales and Stock Budget (units)

Particulars	Period I	Period II	Period III	Period IV	Period V
Opening stock of finished goods	6,000	3,750	4,950	3,750	4,500
Sales	22,500	30,000	24,750	31,500	27,000

Cost Budget

	Period I	Period II	Period III
	₹	₹	₹
Direct material	8,10,000	12,48,000	9,42,000
Direct labour	20,25,000	33,30,000	23,55,000
Production Overhead (excluding depreciation)	7,56,250	10,30,000	8,38,750
Depreciation	2,00,000	2,00,000	2,00,000
Administrative Overhead	5,27,500	6,37,000	5,60,500
Selling Overhead	3,37,500	3,75,000	3,48,750

Additional Information :

- If in any period production exceeds 27,000 units, a bonus is paid to the workers in addition to normal wage rate for the additional units produced.

- Any variable costs contained in selling overheads are assumed to vary with units sold.

- All other variable costs are assumed to vary with units produced.

Required :

(i)   Prepare the production budget (units) for the period I to IV.

(ii)   Prepare a suitable cost budget for period IV.

(b)   Apex Ltd manufactures a product AXE using three components named   **8**
P, Q and R. Number of units of each component required to manufacture product AXE are as under :

Component P : One

Component Q : Two

Component R : Four

These components can be either manufactured by the company or sub-contracted and following are the relevant data :

Particulars	Component P	Component Q	Component R
Direct material cost per component (₹)	2,000	1,000	1,100
Direct labour hours per component	50	25	5
Sub-contract price per component (₹)	4,000	1,750	1,325

Sale of product AXE is currently 10,000 units per month at a selling price of ₹ 15,000 per unit. A capacity constraint of 3,00,000 direct labour hours per month obligates the company to sub-contract the components. The variable overheads vary with direct labour hours worked and are incurred at rate of ₹ 4 per hour. Fixed costs are ₹ 15,00,000 per month and labour cost is ₹ 11 per hour.

Required :

(a) Indicate which of the component(s) should be purchased and in what quantities so as to achieve the maximum possible profit. Also calculate the expected monthly profit from your suggestion.

(b) What is the maximum monthly profit that could be earned if demand of product AXE is 15000 units per month ?

7. Answer any **four** out of the following **five** questions :

(a) State whether and why the following are valid or not for learning curve theory.   4

   (i) Learning curve theory applies to a division of a company which is fully automated.

   (ii) Learning curve theory helps in setting standards.

   (iii) Learning curve helps in pricing decisions.

   (iv) Experienced workmen are prone to learning effect.

(b) What is product life cycle costing ? What are the costs that you would include in product life cycle cost ?   4

(c) What do you mean by back flushing in JIT system ? What are the problems that must be corrected before it will work properly ?   4

(d) Answer the following independent situation relating to an assignment problem with a minimization objective : **4**

    (i) Under the usual notation, where A_{12} means the element at the intersection of the 1st row and 2nd column, we have, in a 4×4 assignment problem, A_{12} and A_{33} figuring in the optimal solution. What can you conclude about the remaining assignment ? Why ?

    (ii) Just after the row and column minimization operations, we find that a particular row has two zeros. Does this implies the two corresponding numbers in original matrix before any operation were equal ? Why ?

(e) What are the cost and non-cost factors to be considered in shut down decisions ? **4**