

**FACULTY OF ENGINEERING**  
**B.E. III - Semester (AICTE) (CME) Examination, October 2021**

**Subject: Operation Research**

**Time: 2 Hours**

**Max. Marks: 70**

**Note: Missing data, if any, may be suitably assumed.**

**PART – A**

**Answer any five questions.**

**(5x2 = 10 Marks)**

1. What is unbounded solution in linear programming?
2. What is use of slack, surplus variable in LPP?
3. Define dual LLP. What are the advantages of duality?
4. Distinguish between Primal and Dual LPP
5. What is unbalanced transportation problem? How to solve it?
6. Define travelling salesman problem
7. What is preventive replacement?
8. What is the meaning of two-person zero sum game?
9. Classify the sequencing problem.
10. Explain Kendall's notation

**PART – B**

**Answers any Three questions.**

**(3x18=54 Marks)**

11. Use Big M method to Maximize  $Maximize Z = 2x_1 + x_2 + 3x_3$ ,  
 Subject to constraints  $x_1 + x_2 + 2x_3 \leq 5$ ,  $2x_1 + 3x_2 + 4x_3 = 12$  and  $x_1, x_2, x_3 \geq 0$ .
12. Use dual simplex method to solve the LPP  $Min (Z) = x_1 + 2x_2 + 3x_3$   
 Subjected to  $x_1 - x_2 + x_3 \geq 4$ ,  $x_1 + x_2 + 2x_3 \leq 8$ ,  $x_2 - 2x_3 \geq 2$  and  $x_1, x_2, x_3 \geq 0$ .
13. Find the initial basic feasible solution for the following TP by Vogel's method

|        |                | Destination |     |     |     | Supply |
|--------|----------------|-------------|-----|-----|-----|--------|
|        |                | D1          | D2  | D3  | D4  |        |
| Origin | O <sub>1</sub> | 11          | 13  | 17  | 14  | 250    |
|        | O <sub>2</sub> | 16          | 18  | 14  | 10  | 300    |
|        | O <sub>3</sub> | 21          | 24  | 13  | 10  | 400    |
|        | Demand         | 200         | 225 | 275 | 250 |        |

14. Solve the following Assignment problem

|      |    | Machines |    |    |    |
|------|----|----------|----|----|----|
|      |    | M1       | M2 | M3 | M4 |
| Jobs | J1 | 18       | 26 | 17 | 11 |
|      | J2 | 13       | 28 | 14 | 26 |
|      | J3 | 38       | 19 | 18 | 15 |
|      | J4 | 19       | 26 | 24 | 10 |

15. Find the sequence for the following eight jobs that will minimize the total elapsed time for the completion of all jobs in the order ABC. Also determine the idle time of machines.

| for<br>machines | Job (hrs) |    |     |    |    |    |     |      |
|-----------------|-----------|----|-----|----|----|----|-----|------|
|                 | I         | II | III | IV | V  | VI | VII | VIII |
| A               | 4         | 6  | 7   | 4  | 5  | 6  | 6   | 2    |
| B               | 8         | 10 | 7   | 8  | 11 | 8  | 9   | 13   |
| C               | 5         | 6  | 2   | 3  | 4  | 9  | 15  | 11   |

16. A machine costs Rs 10,000. Its operating cost and resale values are given below. Determine at what time it could be replaced

| Year           | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
|----------------|------|------|------|------|------|------|------|------|
| Operating cost | 1000 | 1200 | 1400 | 1700 | 2000 | 2500 | 3000 | 3500 |
| Resale value   | 6000 | 4000 | 3200 | 2600 | 2500 | 2400 | 2000 | 1600 |

17. a) A mobile repair man takes average time for repair as 30min, mobiles arrive at an average of 10 per day of 8hr. Find idle time of repair man and average number of units in the system  
 b) People arrive at a theatre ticket centre in a Poisson distributed arrival rate of 25 per hour. Service time is constant at two minutes. Calculate, (i) Mean number in the waiting line (ii) Mean waiting time (iii) utilization factor.

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**PART – A**

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**PART – B**

**Answers any three questions.**

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