



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2017

Operations Research

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

UNIT - I

- 1 a. Explain scope of operations research. 10
- b. Explain the main characteristics of OR. 10
- 2 a. A small business makes 3-speed and 10-speed bicycles at two different factories. Factory A produces 16 3-speed and 20 10-speed bikes in one day while factory B produces 12 3-speed and 20 10-speed bikes daily. It costs Rs. 1000/day to operate factory A and Rs. 800/day to operate factory B. An order for 96 3-speed bikes and 140 10-speed bikes has just arrived. How many days should each factory is operated in order to fill this order at a minimum cost? What is the minimum cost? 14
- b. Define the following : 6
- i) Objective function ii) Variables iii) Constraints.

UNIT - II

3. Solve the following problem using Simplex method : 20
- Max. $Z = 5x_1 - 2x_2 + 3x_3$
- Subject to, $2x_1 + 2x_2 - x_3 \geq 2$
- $3x_1 - 4x_2 \leq 3$
- $x_2 + 3x_3 \leq 5$ and
- $x_1, x_2, x_3 \geq 0.$
- 4 a. Define the following : 6
- i) Slack variables ii) Surplus variables iii) Artificial variable.
- b. Write down the duality of the following LP problem and solve it : 14
- Max. $Z = 4x_1 + 2x_2$
- Subject to the constraints,
- $-x_1 - x_2 \leq -3$
- $-x_1 + x_2 \leq -5$ and
- $x_1, x_2 \geq 0.$
- 5 a. Write the mathematical formulation for the transportation problem. 5

b. Priyanshu Enterprises has three factories at locations A, B and C which supplies three warehouses located at D, E and F. Monthly factory capacities are 10, 80 and 15 units respectively. Monthly warehouse requirements are 75, 20 and 50 units respectively. Unit shipping costs are given in the following table :

The penalty costs for not satisfying demand at the warehouses D, E and F are Rs. 5, 3 and Rs. 2 per unit respectively. Determine the optimum distribution for Priyanshu, using transportation problem.

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Warehouse▶	D	E	F
Factory▼			
A	5	1	7
B	6	4	6
C	3	2	5

6 a. Write the procedural steps involved in minimization transportation problem.

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b. A leading firm has three auditors. Each auditor can work upto 160 hour during the next month, during which time three projects must be completed. Project I will take 130 hours, Project II will take 140 hours, the project III will take 160 hours. The amount per hour that can be billed for assigning each auditor to each project is given in the table.

Auditor	Project		
	1(Rs.)	2(Rs.)	3(Rs.)
1	1200	1500	1900
2	1400	1300	1200
3	1600	1400	1500

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Formulate this as a transportation problem and find the optimal solution. Also find maximum total billing during the next month.

UNIT - IV

7 a. The owner of a small machine shop has four machinists available to assign to jobs for the day. Five jobs are offered with expected profit for each machinist on each job as follows :

	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

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Find the optimum solution using assignment method and also find which job should be declined.

- b. Explain the procedural steps involved in Hungarian Assignment Method. 10
- 8 a. Differentiate between Assignment problem and Transportation problem. 8
- b. Solve the Travelling sales man problem given by the following data,
 $C_{12} = 20, C_{13} = 4, C_{14} = 10, C_{23} = 5, C_{34} = 6, C_{25} = 10, C_{35} = 6, C_{45} = 20$ and there is no route
 between cities i and j , if the value for C_{ij} is not shown. 12

UNIT - V

- 9 a. A bank has one drive-in-counter. It is estimated that cars arrive according to Poisson distribution at the rate of 2 every 5 minutes and that there is enough space to accommodate a line of 10 cars. Other arriving cars can wait outside this space, if necessary. It takes 1.5 minutes on as average to serve a customer, but the service time actually varies according to an exponential distribution. You are required to find :
 - i) The proportion of time the facility remains idle 10
 - ii) The expected number of customer waiting but currently not being served at a particular point of line
 - iii) Expected time a customer spends in the system
 - iv) Probability that the waiting line will exceed the capacity of the space leading to the drive- in-customer.
- b. Define the following terms :
 - i) Pure strategy ii) Mixed strategy 10
 - iii) Competitive game iv) Payoff Matrix v) Saddle point.
- 10 a. List the rules for determining the saddle point. 6
- b. Given the payoff matrix for player A, obtain the optimum strategies for both the players and determine the value of the game.

	Player B	
Player A	$\begin{pmatrix} 6 & -3 & 7 \\ -3 & 0 & 4 \end{pmatrix}$	

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