



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

(An Autonomous Institution affiliated to VTU, Belagavi)  
 Seventh Semester, B.E. - Mechanical Engineering  
 Semester End Examination; February - 2022  
**Operations Research**

Time: 3 hrs

Max. Marks: 100

## Course Outcomes

The Students will be able to:

CO1: Define operation research Develop operation research models from the verbal description of real life.

CO2: Analyze the problem using mathematical tools and simple queue system.

CO3: Solve transportation and assignment problem using different methods.

CO4: Describe the model project and Solve different model techniques.

CO5: Explain the Inventory and different models with their characteristics and solve problems

**Note:** I) PART - A is compulsory. Two marks for each question.

II) PART - B: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.

Q. No.	Questions	Marks	BLs	COs	POs
<b>I : PART - A</b>		<b>10</b>			
I a.	Define Operations Research (OR).	2	L1	CO1	PO1
b.	What is unbounded solution with respect to LPP?	2	L1	CO2	PO1
c.	Mention the different methods to find basic feasible solution in transportation problems.	2	L1	CO3	PO1
d.	What is project controlling?	2	L1	CO4	PO1
e.	Which are the problems faced in inventory control?	2	L1	CO5	PO1
<b>II : PART - B</b>		<b>90</b>			
<b>UNIT - I</b>		<b>18</b>			

1 a. A firm produces an alloy having the following specifications:

i) Specific gravity  $\leq 0.98$                       ii) Chromium  $\geq 8\%$

iii) Melting point  $\geq 450^\circ\text{C}$

Raw materials A, B and C having the properties shown in the table can be used to make the alloy.

Property	Properties of raw material		
	A	B	C
Specific gravity	0.92	0.97	1.04
Chromium	7%	13%	16%
Melting point	440°C	490°C	480°C

10    L2    CO1    PO2

Costs of various raw materials per ton are: Rs. 90-A, Rs. 280-B, Rs. 40-C. Formulate the LP model to find proportions in which A, B and C be used to obtain alloy of desired properties while the raw material cost is minimum.

b. Solve the LPP by graphical method. Find the minimum value of,

$$Z = -x_1 + 2x_2$$

Subjected to

$$-x + 3x_2 \leq 10,$$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

10 L3 CO1 PO2

c. Explain scope of OR.

8 L2 CO1 PO2

**UNIT - II**

**18**

2 a. Solve by simplex method the following LPP.

Minimize  $Z = x_1 - 3x_2 - 3x_3$

Subjected to  $3x_1 - x_2 + 2x_3 \leq 7$

$$2x_1 + 4x_2 \geq -12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

12 L3 CO2 PO2

b. Solve the following LPP using two-phase simpler method.

Minimize  $Z = 5x_1 - 4x_2 - 3x_3$

Subjected to  $2x_1 + x_2 - 6x_3 = 20$

$$6x_1 + 5x_2 + 10x_3 \leq 76$$

$$8x_1 - 3x_2 + 6x_3 \leq 50$$

$$x_1, x_2, x_3 \geq 0$$

12 L3 CO2 PO2

c. State the comparison between Big-m method and two phase method.

6 L2 CO2 PO2

**UNIT - III**

**18**

3 a. Find the optimum solution to the following transportation problem in which the cell contains the transportation cost in rupees:

	W1	W2	W3	W4	W5	Available
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Required	30	30	15	20	5	

10 L3 CO3 PO2

b. A salesman wants to visit cities 1, 2, 3 and 4. He does not want to visit any city twice before completing the tour of all cities and wishes to return starting station. Cost of going from one city to another in rupees is gives in the table. Find the least cost route.

		To City			
		1	2	3	4
From City	1	0	30	80	50
	2	40	0	140	30
	3	40	50	0	20
	4	70	80	130	0

8 L3 CO3 PO2

c. Mention the assumptions used to solve problems in transportation problems and assignment problems.

8 L1 CO3 PO2

**UNIT - IV**

**18**

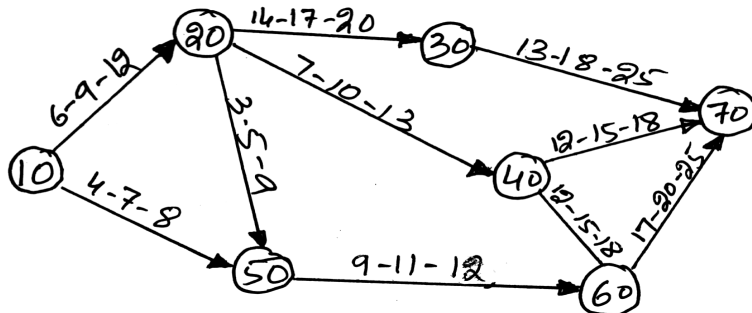
4 a. A project schedule has the following characteristics,

Activity	Time (Weeks)	Activity	Time (Weeks)
1 - 2	4	5 - 6	4
1 - 3	1	5 - 7	8
2 - 4	1	6 - 8	1
3 - 4	1	7 - 8	2
3 - 5	6	8 - 10	5
4 - 9	5	9 - 10	7

12 L4 CO4 PO2

- i) Construct the network
- ii) Compute E and L for each event
- iii) Find the critical path

b. Consider the network shown in below figure. For each activity the three time estimates  $t_o$ ,  $t_m$  and  $t_p$  are given along the arrows in the  $t_o-t_m-t_p$  order. Determine variance and expected time for each activity.



12 L4 CO4 PO2

c. Mentioning the steps that involved in project planning.

6 L2 CO4 PO2

**UNIT - V**

**18**

5 a. An automobile manufacturers purchases 2,400 costing over a period of 360 days. This requirement is fixed and known. These costing are subject to quantity discounts. Ordering cost is Rs. 70,000/- order and storage cost per day is 0.12% of the unit cost. Determine the optional purchase quantity if the supplies has offered the following unit prices for the costing:

8 L3 CO5 PO2

Unit Price = Rs.1000 for  $q < 1000$ ,  
 = Rs. 950 for  $q \geq 1000$

- b. Mention the limitations and assumptions used in EOQ formula.
- c. Discuss the EOQ model where demand rate is Non-uniform and production rate or replenishment rate in infinite and shortage is not allowed.

8 L1 CO5 PO2

10 L2 CO5 PO2