



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

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; May/June - 2018

Operations Research

Time: 3 hrs

Max. Marks: 100

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

UNIT - I

- 1 a. Define Operations Research. List and briefly explain the phases of Operations Research. 9
- b. A publisher of textbooks is in the process of presenting a new book to the market. The book may be bound by either cloth or hard paper. Each cloth bound book sold contributes Rs. 30 and each paper bound book contributes Rs. 25 towards profit. It takes 8 minutes to a bind a cloth cover and 6 minutes to bind paperback. The total time available for binding is 800 hours. 11
After market survey, it is predicted that the cloth cover sales will be at least 2000 copies, but the paperback will be at the most 5000 copies. Formulate the above problem as LPP and find the optimal solution by graphical method.
- 2 a. Solve the LPP by Simplex method: 10
Maximize $Z = 7x_1 + 5x_2$
Subject to
 $-x_1 - 2x_2 \geq -6$
 $4x_1 + 3x_2 \leq 12$ and $x_1, x_2 \geq 0$
- b. Solve the following LPP by Big-M method: 10
Maximize $Z = 3x_1 + 9x_2$
Subject to
 $x_1 + 4x_2 \leq 8$
 $x_1 + 2x_2 \leq 4$ and $x_1, x_2 \geq 0$

UNIT - II

- 3 a. Explain key relationships between primal and dual problems. 8
- b. Solve the following problem using dual simplex method: 12
Minimize $Z = 2x_1 + 3x_2 + 4x_3$
Subject to
 $2x_1 + 3x_2 + 5x_3 \geq 2$
 $3x_1 + x_2 + 7x_3 \leq 3$
 $x_1 + 4x_2 + 6x_3 \leq 5$ and $x_1, x_2, x_3 \geq 0$
- 4 a. Solve the following transportation problem to minimize the total transportation cost. 12

	D ₁	D ₂	D ₃	D ₄	Supply
O ₁	6	1	9	3	70
O ₂	11	5	2	8	55
O ₃	10	12	4	7	70
Demand	85	35	50	45	

b. Five Men are available to do five different jobs. From past records, timing in hours, each man takes to do the job is known and is given in the following table.

	I	II	III	IV	V
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

8

Solve this problem by Hungarian method to minimize the time.

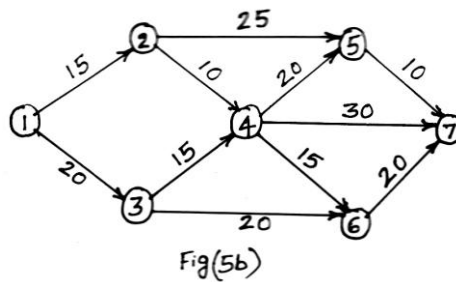
UNIT - III

5a. Define the following with reference to networks :

- i) Path
- ii) Node
- iii) Arc
- iv) Connected network
- v) Spanning tree

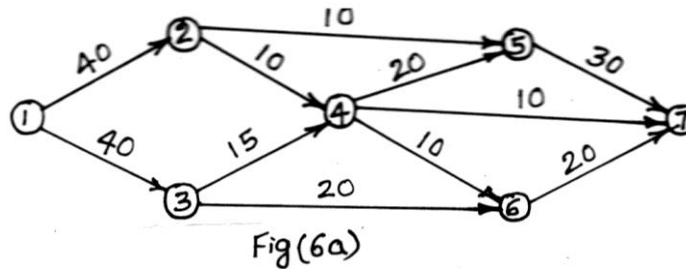
10

b. Find the shortest route/path between source 1 and destination 7 for the network shown in Fig. (5b).



10

6a. Compute the maximum flow for the network shown in Fig. (6a).



10

b. The following table gives data on normal time, cost and crash time and cost for a project

Activity	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (days)	Cost (Rs.)
1 - 2	6	60	4	100
1 - 3	4	60	2	200
2 - 4	5	50	3	150
2 - 5	3	45	1	65
3 - 4	6	90	4	200
4 - 6	8	80	4	300
5 - 6	4	40	2	100
6 - 7	3	45	2	80

10

The indirect cost per day is Rs. 10.

- i) Draw the network for the project
- ii) Find the critical path
- iii) Determine minimum total time and corresponding cost

UNIT - IV

- 7a. Explain briefly the structure and operating characteristics of a queuing system. 10
- b. A self-service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time. Find;
- i) Average number of customers in the system 10
 - ii) Average number of customers in the queue or average queue length
 - iii) Average time a customer spends in the system
 - iv) Average time a customer waits before being served.
- 8a. Explain briefly the applications of queuing theory. 10
- b. A branch of Punjab National Bank has only one typist. Since the typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8-hour work day. If the typewriter is valued at Rs. 1.50 per hour. Determine;
- i) Equipment utilization
 - ii) The percent time an arriving letter has to wait
 - iii) Average system time
 - iv) Average cost due to waiting on the part of typewriter i.e. it remaining idle 10

UNIT - V

- 9 a. Discuss the salient features of Dynamic Programming. 10
- b. Solve the following LPP by the method of dynamic programming:
- Maximize $Z = 2x_1 + 5x_2$,
 Subject to
- $2x_1 + x_2 \leq 430$
 - $2x_2 \leq 460$
 - $x_1, x_2 \geq 0$
- 10

- 10 a. Solve the following game by principle of dominance;

Player A	Player B			
	I	II	III	IV
1	20	15	12	35
2	25	14	8	10
3	40	2	19	5
4	5	4	11	0

10

- b. Solve the following game using graphical method:

Player A	Player B		
	B ₁	B ₂	B ₃
A ₁	6	4	3
A ₂	2	4	8

10