

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]  
(2125)

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B. Tech 7th Semester Examination

Operation Research (OS)

ME-7004

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

**Note :** Attempt five questions in all, selecting one question each from Sections A, B, C & D of the paper and all sub-parts of question no. 9 of Section E.

**SECTION - A**

- (a) What is OR? Explain the main characteristics of OR with suitable examples. (10)
- (b) What is the role of decision making in OR? Define scientific decision - making and explain how it affects OR decisions. (10)
2. Explain the different type of models used in OR. Explain briefly the general methods for solving these OR models. (20)

**SECTION - B**

3. A company produces two parts  $P_1$  and  $P_2$  used in television sets. A unit of  $P_1$  costs the company Rs. 5 in wages and Rs.6 in material, while a unit of  $P_2$  costs the company Rs. 20 in wages and Rs. 10 in material. The company sells both parts on one-period credit terms, but the company's labour and material expenses must be paid in cash. The selling price of  $P_1$  is Rs. 25/unit and  $P_2$  is Rs. 60/unit. The company's

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production capacity is limited by two considerations. First, at the beginning of period 1, the company has an initial balance of Rs. 35,000 (cash + bank credit + collections from past credit sales). Second, the company has available in each period 1,600 hours of machine time and 1,400 hours of assembly time. The production of each  $P_1$  requires 2 hours of machine time and 1.5 hours of assembly time, while production of each  $P_2$  require 2 hours of machine time and 3 hours of assembly time. Formulate the problem as L.P. model to maximize the total profit to the company. (20)

4. (a) Define the following terms:
  - (i) Infeasibility
  - (ii) Degeneracy (5)
- (b) Find the minimum value of:  
 $Z = -X_1 + 2X_2$ ,  
Subjected to  $-X_1 + 3X_2 \leq 10$ ,  
 $X_1 + X_2 \leq 6$ ,  
 $X_1 - X_2 \leq 2$ ,  
 $X_1, X_2 \geq 0$ . (15)

**SECTION - C**

5. Find the optimal solution to the following transportation problem in which the cells contain the transportation cost in rupees. (20)

	1	2	3	4	5	Available
A	7	6	4	5	9	40
B	8	5	6	7	8	30
C	6	8	9	6	5	20
D	5	7	7	8	6	10
Required	30	30	15	20	5	100 Total

6. (a) Explain Hungarian method for solution of the assignment problem. (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.
- Equipment utilization.
  - The percent time that an arriving letter has to wait.
  - Average system time.
  - Average cost due to wait on the part of typewriter per day. (10)

#### SECTION - D

7. (a) Discuss the similarities and differences of CPM and PERT. (10)
- (b) The details of a project are as follows:

Activity	A	B	C	D	E	F	G	H	I	J	K
Immediate predecessor	-	-	-	A,B,C	A,B,C	D	D,E	D,E	F	G	H
Duration	4	3	2	5	6	7	6	9	4	6	8

Draw the network diagram and find the critical path. (10)

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8. The time estimates (weeks) for the activities of a PERT network are given below.

Activity	To (optimistic time)	Tm (most-likely time)	Tp (pessimistic time)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- Draw the project network and identify all the paths through it.
- Determine the expected project length.
- Calculate the variance of the project length. (20)

#### SECTION - E

9. (a) Give definitions of a deterministic model.
- (b) Write two objectives of OR.
- (c) Define a scientific model.
- (d) Explain the meaning of linear programming.
- (e) Define trans-shipment model.
- (f) What do you mean by loops in transportation problems?
- (g) What is an infeasible assignment?
- (h) What is an assignment problem?
- (i) Mention two importance of critical path,
- (j) What do you mean by PERT? (2×10=20)