USN ⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚ **10ME74**

Seventh Semester B.E. Degree Examination, June/July 2014
Operations Research

Time: 3 hrs.   Max. Marks: 100

Note: *1. Answer FIVE full questions, selecting*
at least TWO questions from each part.
2. Use of statistical tables permitted.

PART – A

1 a. List and explain the various phases of OR problems. **(06 Marks)**
   b. What are the limitations of OR? **(04 Marks)**
   c. A manufacturer of a line of patent medicines is preparing a production plan on medicines A and B. There are sufficient ingredients available to make 20,000 bottles of 'A' and 40,000 bottles of 'B'. But three are only 45,000 bottles into which either of the medicines can be put. Furthermore, it takes 3 hours to prepare enough material to fill 1,000 bottles of 'A', it takes 1 hour to prepare enough material to fill 1,000 bottles of 'B' and there are 66 hours available for this operation. The profit is ₹8 per bottle for 'A' and ₹7 per bottle for 'B'. Formulate the problem as a LPP and solve by graphical method. **(10 Marks)**

2 a. Define slack, surplus, and artificial variables. **(06 Marks)**
   b. Obtain the dual of the following primal LP problem:
   Minimize $Z = x_1 + x_2 + x_3$
   Subject to $x_1 - 3x_2 + 4x_3 = 5$; $2x_1 - 2x_2 \le 3$
   $2x_2 - x_3 \ge 5$; $x_1, x_2 \ge 0$, x_3 unrestricted. **(04 Marks)**
   c. Use Big-M method to solve the following LPP.
   Minimize $Z = 4x_1 + 2x_2$
   Subject to $3x_1 + x_2 \ge 27$; $-x_1 - 2x_2 \le -21$
   $x_1 + 2x_2 \ge 30$; $x_1, x_2 \ge 0$ **(10 Marks)**

3 a. A company has plants A, B and C which have capacity to produce 300, 200 and 500 kg respectively of a particular chemical/day. The production cost per kg in these plants are ₹0.70, ₹0.60 and ₹0.66 respectively. Four bulk consumers have placed orders for the products on the following books;

Consumers	Kg required/day	Price offered ₹/kg
I	400	1.00
II	250	1.00
III	350	1.02
IV	150	1.03

   Shipping costs in paise/kg from plants to consumers are given below:

   To consumers

	I	II	III	IV
A	3	5	4	6
B	8	11	9	12
C	4	6	2	8

   From Plants

   Workout the optimum schedule for the above situation considering all the data given. **(12 Marks)**

b. A company has a team of four salesman and there are four districts where the company wants to start its business. The company estimates that the profit/day is given below. Find the assignment of salesman to districts which gives maximum profit.

		Districts			
		I	II	III	IV
	A	16	10	14	11
Salesman	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

(08 Marks)

4 a. Explain the branch and bound method in integer programming. (06 Marks)

   b. Use Gomary's fractional cutting plane method to solve the following IPP.
   Maximize $Z = x_1 + 4x_2$
   Subject to $2x_1 + 4x_2 \le 7$
   $5x_1 + 3x_2 \le 15$
   $x_1, x_2 \ge 0$ and are integers. (14 Marks)

PART – B

5 a. List the differences between PERT and CPM. (05 Marks)

   b. A small project consists of EIGHT activities has the following characteristics.

Activity	Preceeding activity	Time estimates (weeks)		
		t_0	t_m	t_p
A	-	2	4	12
B	-	10	12	26
C	A	8	9	10
D	A	10	15	20
E	A	7	7.5	11
F	B, C	9	9	9
G	D	3	3.5	7
H	E, F, G	5	5	5

   (i) Draw the PERT network for the project.
   (ii) Determine the critical path and prepare the activity schedule for the project.
   (iii) If a 30 week deadline is imposed, what is the probability that the project will be completed within the time limit? (15 Marks)

6 a. Briefly explain the queuing system and their characteristics. (06 Marks)

   b. A postal clerk can service a customer in 3 minutes. The service time is being exponentially distributed. The inter arrival time of customers is also exponentially distributed with an average of 12 minutes during early morning slack period and an average of 5 minutes during the afternoon peak period. Assess the average queue length and the expected waiting time in the queue during the two periods. (14 Marks)

7 a. Explain the following:
   (i) Pay off matrix   (ii) Saddle point   (iii) Fair game. **(05 Marks)**

   b. Explain the rule of dominance. **(03 Marks)**

   c. Use of property of dominance to solve the following game.

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B

		I	II	III	IV	V	VI
	I	0	0	0	0	0	0
	II	4	2	0	2	1	1
A	III	4	3	1	3	2	2
	IV	4	3	7	-5	1	2
	V	4	3	4	-1	2	2
	VI	4	3	3	-2	2	2

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(12 Marks)

8 a. State the assumptions made while dealing with sequencing problems. **(04 Marks)**

   b. Find the sequence for the following six jobs that will minimize the total elapsed time for the three operations: **(06 Marks)**

Job	1	2	3	4	5	6
Turning (A)	3	12	5	2	9	11
Threading (B)	8	6	4	6	3	1
Knurling (C) (Time in minutes)	13	14	9	12	8	13

   c. Use graphical method to minimize the time required to process the following jobs on the machines. Calculate the total elapsed time to complete the jobs. For each machine specify the job that should be done first. **(10 Marks)**

	Machines					
Job 1	Sequence :	A	B	C	D	E
	Time (hr) :	6	8	4	12	4
Job 2	Sequence :	B	C	A	D	E
	Time (hr) :	10	8	6	4	12

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