VII SEMESTER B.TECH. (INDUSTRIAL & PRODUCTION ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: OPERATIONS RESEARCH [MME 453]

REVISED CREDIT SYSTEM (30/11/2016)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer ANY FIVE FULL questions.
- ✤ Missing data may be suitable assumed.
- **1A.** A Model building is the central element in O.R. Briefly explain the steps in building L.P. models.
- **1B.** A dairy purchases and mixes quantities of three types of grains each containing different units of three nutritional elements. The management has developed nutritional requirements for the feed mix.

The table gives the relevant data:

Nutritional	Units of N	Minimum		
elements		kg of	-	units
	Grain 1	Grain 2	Grain 3	specified
1	4	6	8	2500
2	2	3	1	750
3	4	1	1	900
Cost per kg(Rs)	90	80	70	
Maximum available (kg)	1000	Unlimited	Unlimited	

Formulate the L.P.P. with an appropriate objective. Draw the first simplex tableau. Do not solve. Show the incoming and outgoing variable.

1C. Find the optimal strategy and value of the game shown below.

	Cor	Company B						
Company		Ι	II	III	IV			
А	Ι	3	5	4	2			
	Π	5	6	2	4			
	III	2	1	4	0			
	IV	3	3	5	2			

- 2A. Write short note on sensitivity analysis in LPP
- **2B.** Solve the following LPP using Simplex Algorithm. $Min Z = 120x_1 + 80x_2$

Subject to,

 $2x_1 + 4x_2 \ge 16$

 $5x_1 + 2x_2 \ge 20$

 $x_1, x_2 \ge 0$

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2C. Given below the final simplex table for a maximization LP problem involving four products using two resources.

			Cj	6	8	10	6	0	0
Unit profit	Basis	Qty		X1	X2	Х3	X4	S1	S2
6	X1	80				2	1	2/3	-1/3
8	X2	40				0	0	-1/3	2/3

- i. Complete the tableau and compute Cj Zj numbers
- ii. Suppose the profit coefficient of x1 decreases to 2 will the product mix change? If yes find the new solution.
- **3A.** What is degeneracy in Transportation problem? Explain how to resolve degeneracy.

Explain how to identify alternate optimal solution in transportation problem.

3B. Given below is the transportation cost matrix for supplying water from three reservoirs to three cities daily. Cost is in Rs.00's per million litres. The demand and supply capacity is in million litres per day.

	City A	City B	City C	Supply
Reservoir 1	2	4	5	15
Reservoir 2	3	5	2	20
Reservoir 3	4	2	3	25
Demand	18	12	25	

The surplus water can be supplied to the other states at a profit of Rs.200 and Rs.300 per million litres from reservoir 2 and 3 respectively. Using the transportation algorithm, determine the optimum transportation schedule.

- **4A.** What are the differences between Travelling salesman problem and Assignment problem? State their applications.
- **4B.** A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The main cost involved is setup cost. The setup cost per change depends on the item presently on the machine and the setup to be made, according to the following table. If he processes each type of item once and only once each week, how should he sequence the items on his machine? Use an appropriate Operation Research tool technique to solve.

		To item				
		Α	В	С	D	Ε
From item	А	-	4	7	3	4
	В	4		6	3	4
	С	7	6		7	5
	D	3	3	7		7
	Ε	4	4	5	7	

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- 5A. A truck loading dock is being studied to decide the optimum crew size. With space for only one truck, this is a single server system. But the loading time can be reduced by increasing the size of the crew. The trucks arrive at the rate of two per hour. The waiting cost is \$20 per hour per truck. The mean service rate is one truck per hour per one loader. Each crew member is paid \$5 per hour. Find the total cost of the system if
 - a) Number of loaders = 3
 - b) Number of loaders = 4

Assume Poisson arrivals and Exponential service times.

5B. A Machine shop is concerned over the down time of its machines. Given below is the frequency distribution of time between breakdowns and repair times based on 100 random observations.

	Distribution of breakdown			downs
Time between the breakdowns (hours)	1	2	3	4
Frequency	15	25	40	20

	Repair Time distribution			
Repair time (hours)	0.5	1	1.5	
Frequency	50	30	20	

Using the following random numbers, simulate the system for 10 breakdowns and determine

- a) Average waiting time
- b) expected busy time of the repairman
- c) Total time spent in the system.

Random no. for breakdowns	84	46	77	61	08	39	74	00	99	24
Random no. for repair	48	72	03	26	31	78	92	34	91	43

- **6A.** Explain the following with respect to Game theory models: a) Saddle point b) Pure strategy and mixed strategy game
 - c) Value of the game. d) Rule of dominance.
- **6B.** The table below gives the normal cost/duration and other relevant information for a project:

	Time (w	eeks)	Normal	Cost (dollars)
Activity	Normal	Crash	cost (\$)	per day
			τοςι (φ)	accelerated
1 – 2	3	1	140	110
2 – 3	2	1	200	175
2 – 4	3	1	160	125
2 – 5	2	1	300	200
3 – 6	2	1	250	175
4 – 6	6	1	400	70
5 – 6	5	1	230	70
6 – 7	5	1	230	90

There is a bonus of \$ 100 per day for everyday saved below the contract period of 15 days and a penalty of \$ 200 for each day after the 15 days.

- i. Calculate the normal duration and normal cost of the project.
- ii. Calculate the minimum cost of completing the project in 15 days.
- iii. What is the optimal plan for the company to attempt?

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