Code No: **R42243** **R10** **Set No. 1**

IV B.Tech II Semester Regular Examinations, April/May - 2014

OPERATIONS RESEARCH

(Automobile Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any Five Questions

All Questions carry equal marks

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1 a) Explain the role of Slack Variables. [3]

b) Solve the following problem using the two-phase simplex method: [12]
Maximize z=5x+8y
subject to the constraints,
$3x+2y\geq3$;
$x+4y\geq4$;
$x+y\leq5$;
$x\geq0$; $y\geq0$;

2 a) Distinguish between transportation model and assignment model. [3]

b) A company has factories at A, B, C which supply warehouses at D, E, F and G. Monthly factory capacities are 160, 150 and 190 buts respectively. Monthly warehouse requirements are 80, 90, 110 and 160 units respectively. Unit shipping costs are given below. Determine the optimum distribution for this company to minimize shipping cost.

From/To	D	E	F	G
A	42	48	38	37
B	40	49	52	51
C	39	38	40	43

[12]

3 a) When the individual replacement policy is considered? [3]

b) A truck is priced at Rs.60,000 and running costs are estimated at Rs.6000 for each of the first four years, increasing by Rs.2000 per year in the fifth and subsequent years. If the money is worth 10% per year, when the truck should be replaced? Assume that the truck will eventually be sold for scrap at a negligible price. [12]

4 a) Explain the graphical method of solving 2xn and mx2 games. [6]

b) A and B play a game in which each has three coins Rs.2, Rs.5 and Rs.10. Each selects a coin without the knowledge of the other choice. If the sum of the coins is an odd amount, A wins B's coin. If the sus is enen, B wins A's coin. Find the best strategy for each player and the value of the game. [9]

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5 a) Write short notes on
  (i) Service discipline
  (ii) Service mechanism
  (iii) Minimum cost service rate [6]

b) Patients arrive at clinic according to a Poisson distribution at a rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with a mean rate 20 per hour.
  (i) Find the effective arrival rate at the clinic
  (ii) What is the probability that an arriving patient will not wait?
  (iii) What is the expected waiting time until a patient is discharged from the clinic? [9]

6 a) With the help of a neat diagram explain the following terms:
  (i) Order quantity
  (ii) Lead time
  (iii) Safety stock
  (iv) Reorder point [6]

b) The cost of parameters and other factors for a production inventory system of automobile pistons are given below. Find (i) optimal lot size (ii) number of shortages and (iii) manufacturing time and time between setups.
Demand per year = 6000 units
Unit cost = Rs.40
Setup cost = Rs.500
Production rate per year = 36000 units [9]

7 a) State the principle of optimality in dynamic programming and give a mathematical formulation of DP. [6]

b) How does dynamic programming differ conceptually from linear programming? [4]

c) State the essential characteristics of dynamic programming problem. [5]

8 a) What are the elements of simulation models [4]

b) Explain the steps involved in Monte Carlo simulation. [5]

c) Explain how simulation can be used in solving the queuing problems. [6]

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Set No. 2

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OPERATIONS RESEARCH

(Automobile Engineering)

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*****

1 a) Define surplus variable, slack variable and artificial variable [3]

b) Solve the following problem using duel simplex method:
Maximize z=-2x-3y
subject to the constraints,
$x+y\geq 2$;
$10x+y\leq 10$;
$x+y\leq 8$;
$x\geq 0$; $y\geq 0$; [12]

2 a) Explain the different methods in obtaining the basic feasible solution for a given transportation problem. [6]

b) Five operators have to be assigned to five machines. The assignment costs are given below. Operator A cannot operate machine III and operator C cannot operate machine IV. Find the optimal assignment.

Operator/Machine	I	II	III	IV	V
A	5	5	-	2	6
B	7	4	2	3	4
C	9	3	5	-	3
D	7	2	6	7	2
E	6	5	7	9	1

[9]

3 a) What are the various replacement models? [3]

b) The following mortality rates have been observed fro a certain type of light bulbs:

Week	1	2	3	4	5
% failing at the end of week	10	25	50	80	100

There are 100 bulbs in use and it costs Rs.4 to replace an individual bulb, which has burnt out. If all bulbs were replaced simultaneously it would cost Re.1 per bulb. It is proposed to replace all the bulbs at fixed intervals, whether or not they have burnt out and continues to replace the bulbs as and when they fail. At what intervals all the bulbs should be replaced? [12]

Code No: **R42243** **R10** **Set No. 2**

4 a) Two players A and B match coins. If the coins match, then A wins two units of value. If the coins do not match, then B wins two units of value. Determine the optimum strategies for the players and the value of the game. [7]

b) The payoff matrix for the player A and B is given below. Solve the problem by graphical method.

		Player B			
		1	2	3	4
Player A	1	9	3	8	0
	2	6	5	6	7
	3	2	4	3	8
	4	5	6	2	1

[8]

5 a) Define queue and state the characteristics of waiting lines. [5]

b) The repair of a lathe requires four steps to be completed one after another in a certain order. The time taken to perform each step follows exponential distribution with a mean of 5 minutes and is independent of other steps. Machine breakdown follows poisson process with mean rate of 2 break downs per hour.

(i) What is the expected idle time of the machine, assuming there is only one repairman available in the workshop

(ii) What is the average waiting time of a break down machine in the queue?

(iii) What is the expected number of broken down machines in the queue? [10]

6 a) What is safety stock? Explain with the help of suitable example. [7]

b) Find the optimal order quantity for a product for which the price breaks are as follows: [8]

Quantity (units)	Price per unit (Rs.)
$0 \le Q_1 < 500$	10.00
$500 \le Q_2 < 750$	9.25
$750 \le Q_3$	8.75

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7 a) State the bellman's principle of optimality. [4]

b) Explain with an example how bellman principle can be used to solve shortest path problem. [7]

c) State the applications of dynamic programming. [4]

8 a) State the advantages and limitations of simulation. [5]

b) The following table gives the arrival pattern at a coffee house for one minute intervals. The service is taken as 2 persons in one minute in one counter.

No. of persons arriving:	0	1	2	3	4	5	6	7
Probability percentage:	5	10	15	30	20	10	5	5

Using Monte carlo simulation technique and the following random numbers, generate the patterns of arrivals and the quieu formed when the following 20 random numbers are given.

5, 25, 16, 80, 35, 48, 67, 79, 90, 92, 9, 14, 1, 55, 20, 71, 30, 42, 60, 85. [10]

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1 a) Explain duality in the linear programming problem. [5]

b) Solve the following problem using Big-M method:
Minimize $z=2x_1+9x_2+x_3$
subject to the constraints,
$x_1+4x_2+2x_3 \geq 5$;
$3x_1+x_2+2x_3 \geq 4$;
$x_1 \geq 0$; $x_2 \geq 0$; $x_3 \geq 0$; [10]

2 a) Find the optimal solution to an assignment problem with the following cost matrix.

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

[7]

b) Find the sequence that minimizes the total elapsed time for ten jobs through two machines M_1 and M_2 as shown below. Also find the total elapsed time.

Job	A	B	C	D	E	F	G	H	I	J
Time of M_1	7	3	10	8	13	9	5	11	7	10
Time of M_2	6	5	15	7	12	12	2	8	5	11

[8]

3 a) Explain under what circumstances the replacement problems arise. [5]

b) The cost of a new machine is Rs.5000. The maintenance cost of nth year is given by $R_n=500(n-1)$ where n=1, 2, 3, 4,……… The discount rate per year is 0.5. After how many years it will be economically to replace the machine? [10]

4 a) How do you solve a game when (i) saddle point exists and (ii) saddle point does not exist? [6]

b) Solve the following game problem:

		Player B			
		1	2	3	4
Player A	1	3	2	4	0
	2	3	4	2	4
	3	4	2	4	0
	4	0	4	0	8

[9]

Code No: **R42243** **R10** **Set No. 3**

5 a) What is queuing theory? [3]

b) What information can be obtained by analyzing a queuing system? [4]

c) The repair of certain type of machine consists of three basic steps which must be performed sequentially. The time taken to perform each of the three steps is found to have an exponential distribution with a mean of 12 minutes and independent of other steps. If these machines breakdown in poisson fashion at an average 1.2 per hour and there is only one repairman, determine,
(i) Average number units in the system
(ii) Average waiting time and
(iii) Average length of waiting line. [8]

6 a) Describe the costs associated with the inventories. [6]

b) An item is produced at the rate of 128 units per day. The annual demand is 6400 units, the setup cost for each production run is Rs.24 and inventory carrying cost is Rs.3 per unit per year. There are 250 working days for production each year. Develop an inventory policy for this item. [9]

7 a) What is dynamic programming? [3]

b) Explain the two advantages and two disadvantages of dynamic programming. [4]

c) Use dynamic programming to solve the following problem. Minimize z = $y_1^2+ y_2^2+y_3^2$ subject to constraints $y_1 +y_2+y_3 \geq 15$, and y_1 , y_2 , $y_3 \geq 0$. [8]

8 a) What is simulation? [3]

b) State the applications of simulation models. [4]

c) Explain how simulation can be used in the case of inventory problems where the demand is probabilistic and lead time is random. [8]

Code No: **R42243** **R10** **Set No. 4**

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1 a) What are the important applications of liner programming problem? [5]

b) Formulate and solve the following linear programming problem by graphical method:
A manufacturer makes straight chairs, and rotating chairs. For each type of chair, he uses there major production areas of cutting, dipping and assembly. Capacities of three areas during the next week are:
Cutting: 200 straight or 300 rotating or any other combination
Dipping: 400 straight or 400 rotating or any other combination
Assembly: 250 straight or 200 rotating or any other combination
The manufacturer gets Rs.5 profit from a straight chair and Rs.10 profit from a rotating chair. Determine the number of straight chairs and number of rotating chairs to be manufactured so as to have maximum profit. [10]

2 a) What are the assumptions made in the sequencing problem? [3]

b) A company has three mines A, B and C and five factories I, II, III, IV and V. The mines can supply 80, 100 and 140 tons of ore daily and the requirement of the factories is 40, 50, 60, 70 and 80 respectively. The unit transportation cost of ore is given below.

Mines	Factories				
	I	II	III	IV	V
A	4	2	3	2	6
B	5	4	5	2	1
C	6	5	4	7	3

[12]

3 a) Explain the importance of group replacement policy. [5]

b) A machine owner finds from his past record that the costs per year of maintaining a machine whose purchase price is Rs.6000 are given in the following table:

Year	1	2	3	4	5	6	7	8
Resale price	3000	1500	750	375	200	200	200	200
Maintenance cost (Rs)	1000	1200	1400	1800	2300	2800	3400	4000

Determine at which age replacement is due. [10]

Code No: **R42243** **R10** **Set No. 4**

4 a) Explain the theory of dominance in the solution of rectangular games. Illustrate with examples. [7]

b) Consider the game with the following payoff table:

	Player B		
Player A		B1	B2
	A1	2	6
	A2	-2	γ

i) Show that the game is strictly determinable, whatever γ may be.
ii) Determine the value of the game. [8]

5 a) Give a brief description of the types of queue disciplines. [5]

b) A foreign bank is considering opening in window for customer service. Management estimates that customers will arrive for service at the rate of 12 per hour. The teller whom it is considering to staff the window can serve customers at the rate of one every three minutes assuming poisson arrivals and exponential service, find,
(i) Utilization factor of teller
(ii) Average number in the system
(iii) Average waiting time in the line
(iv) Average waiting time in the system [10]

6 a) Obtain an expression for the EOQ for any one inventory model, stating the assumptions made. [7]

b) A company requires 2000 units per month of raw material for its production. The cost of placing an order is Rs.100 per order. The inventory carrying cost is 10% per year per unit of average inventory. The company maintains a safety stock of 20 days requirements. If purchase price of raw material is Rs.25 per unit, determine,
(i) EOQ
(ii) Minimum total cost per year
(iii) Maximum and minimum inventories [8]

7 a) What is dynamic recursive relation? [3]

b) Define the following dynamic programming terms:
(i) State variable
(ii) Decision variable
(iii) Return function [3]

c) Use dynamic programming to solve the following problem. Maximize $z=y_1.y_2.y_3$ subject to constraints $y_1 + y_2 + y_3 = 5$, and $y_1, y_2, y_3 \geq 0$. [9]

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8 a) Explain why is simulation is used. [5]

b) A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is given below:

Production per day:	196	197	198	199	200	201	202	203	204
Probability:	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in a specially designed three storeyed lorry that can accommodate only 200 mopeds. Using the given 15 random numbers. 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10.

Simulate the process to find out:

(i) The average number of mopeds waiting in the factory and

(ii) The average number of empty spaces on the lorry [10]