

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-VII • EXAMINATION – WINTER 2013****Subject Code: X71903****Date: 7/12/2013****Subject Name: Operations Research****Time: 10:30 am to 1:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Use the graphical method to solve the following LP problem **07**Maximise $Z = 80 X_1 + 120 X_2$

Subject to the constraints:

$$X_1 + X_2 \leq 9$$

$$X_1 \geq 2$$

$$X_2 \geq 3$$

$$20X_1 + 50X_2 \leq 360$$

$$X_1, X_2 \geq 0$$

(b) Write the dual of the following LP problem: **07**Maximise $Z = 3X_1 + 4X_2 + 7X_3$

Subject to the constraints:

$$X_1 + X_2 + X_3 \leq 10$$

$$4X_1 - X_2 - X_3 \geq 15$$

$$X_1 + X_2 + X_3 = 7$$

$$X_1, X_2 \geq 0 \quad X_3 \text{ unrestricted in sign}$$

Q.2 (a) Find the initial basic feasible solution to the following transportation problem by using (a) NWCM (b) LCM (c) VAM **07**

FROM	TO				SUPPLY
	5	1	3	3	
	3	3	5	4	
	6	4	4	3	
	4	1	4	2	
DEMAND	21	25	17	17	

(b) Determine the initial basic feasible solution to the following transportation problem using VAM and obtain the optimal solution. Also find transportation cost. **07**

FROM	TO			SUPPLY
	11	9	6	
	12	14	11	
	10	8	10	
DEMAND	55	45	30	

OR**(b)** What is degeneracy in transportation problems? Explain how to resolve degeneracy in a transportation problem. **07****Q.3 (a)** Four lecturers, each capable of teaching any one of the four subjects. Class preparation **07**

time in hours for different subject varies from teacher to teacher and is given in the table below. Each lecturer is assigned only one subject. Determine an assignment schedule so as to minimize the total subject preparation time for all subjects. Also determine total preparation time for all subjects.

Lecturer	THERMO DYNAMICS	MACHINE DESIGN	PRODUCTION ENGG	OPERATIONS RESEARCH
A	2	10	9	7
B	15	4	14	8
C	13	14	16	11
D	4	15	13	9

- (b) A truck owner finds from his past experience that the maintenance costs of a truck, whose purchase price is Rs 3,00,00, during the first 8 years of its life and the resale price at the end of each year is as follows: 07

YEAR	1	2	3	4	5	6	7	8
MAINTENANCE COST(Rs)	36000	48000	60000	72000	84000	96000	108000	120000
RESALE PRICE (Rs)	200000	150000	100000	80000	70000	60000	50000	40000

Find the optimum period and year of replacement.

OR

- Q.3 (a) A transport corporation has three vehicles in three cities. Each of vehicles can be assigned to any of the four other cities. The distance differs from one city to the other as under: You are required to assign a vehicle to a city in such a way that total distance travelled is minimized. 07

	CITY-1	CITY-2	CITY-3	CITY-4
VEHICLE- A	33	40	43	32
VEHICLE-B	42	30	31	24
VEHICLE-C	40	31	37	31

- (b) A truck owner finds from his past experience that the maintenance costs Rs 200 for the first year and then increases by Rs 2000 every year. The cost of the truck type A is Rs 9000. Determine the best age at which to replace the truck. Truck B type costs Rs 10000. Annual maintenance costs are Rs 400 and increases by Rs 800 every year. The truck owner now has truck A, which is one year old. Should it be replaced by type B and if so, when? 07

- Q.4 (a) Using the dominance rule, obtain the optimal strategies for both the players and determine the value of the game. The payoff matrix for player A is given below: 07

PLAYER-A	PLAYER -B					
		1	2	3	4	5
	P	2	4	3	8	4
	Q	5	6	3	7	8
	R	6	7	9	8	7
	S	4	2	8	4	3

- (b) Explain the various elements of queuing system in detail. 07

OR

- Q.4 (a) Assume that at a bank teller window the customers arrive in their cars at the average rate 07

of 20 per hour according to a Poisson distribution. Assume also that the bank teller spends an average of 2 minutes per customer to complete service and the service time is exponentially distributed. Customers, who arrive from an infinite population, are served on FIFO basis, and there is no limit to possible queue length.

- 1) What is the expected waiting time in the system per customer?
- 2) What is the mean number of customer waiting in the system?
- 3) What is the probability of zero customers in the system?
- 4) What is the utilization factor value?

- (b) Explain clearly with suitable examples the different costs that are involved in the inventory problems. 07

- Q.5 (a) Information on the activities required for a project is as follows: 07

Name	A	B	C	D	E	F	G	H	I	J	K
Activities (Node)	1 - 2	1 - 3	1 - 4	2 - 5	3 - 5	3 - 6	3 - 7	4 - 6	5 - 7	6 - 8	7 - 8
Duration (days)	2	7	8	3	6	10	4	6	2	5	6

Draw the network and find critical path.

- (b) The PERT time estimates for the activities of a project are given below: 07

Activity	Optimistic time	Most likely time	Pessimistic time
1-2	4	6	8
2-3	5	7	15
2-4	4	8	12
3-6	15	20	25
3-5	10	18	26
4-6	8	9	16
5-7	4	8	12
6-7	1	2	3
7-8	6	7	8

1. Draw the project network.
2. Determine the expected project length

OR

- Q.5 (a) plain Bellmans principle of optimality. 07

- (b) What are the advantages and limitations of simulation models. 07
