

GUJARAT TECHNOLOGICAL UNIVERSITY**M.C.A -IVth SEMESTER-EXAMINATION – MAY- 2012****Subject code: 640003****Date: 17/05/2012****Subject Name: Operations Research****Time: 10:30 am – 01:00 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) (i) What is Operation Research? Explain its features. 04**
 (ii) What is Replacement? Describe some important 03
 Replacement situations.
- (b) A Company has two grades of Inspectors 1 and 2, the 07**
 members of which are to be assigned for a quality control
 inspection. It is required that atleast 2000 pieces to be
 inspected per 8-hour day. Grade 1 Inspectors can check pieces
 at the rate of 40 per hour, with an accuracy of 97%. Grade 2
 Inspectors can check at the rate of 30 pieces per hour with an
 accuracy of 95%.
 The wage rate of grade 1 Inspector is Rs 5 per hour while that
 of a grade 2 Inspector is Rs 4 per hour. An error made by an
 Inspector costs Rs 3 to a company. There are only 9 grade 1
 Inspectors and 11 grade 2 Inspectors available with the
 company. The Company wishes to assign work to the
 available inspectors to minimize the total cost of the
 Inspection. Formulate this problem as an LP model to
 minimize the daily inspection cost. (Do not solve)
- Q.2 (a) Solve the following LP problem Graphically. 07**
 $\text{Max } z = 60x_1 + 40x_2$
 Subject to the constraints
 (i) $x_1 \leq 25$, (ii) $x_2 \leq 35$, (iii) $2x_1 + x_2 = 60$
 and $x_1, x_2 \geq 0$
- (b) Solve the following LP problem using Simplex Method. 07**
 $\text{Max } z = 3x_1 + 2x_2 + 5x_3$
 Subject to the constraints
 (i) $x_1 + 2x_2 + x_3 \leq 430$, (ii) $3x_1 + 2x_3 \leq 460$,
 (iii) $x_1 + 4x_2 \leq 420$
 and $x_1, x_2, x_3 \geq 0$.
- OR**
- (b) Solve the following LP problem using Big-M Method. 07**
 $\text{Max } z = x_1 + 2x_2 + 3x_3 - x_4$
 Subject to the constraints
 (i) $x_1 + 2x_2 + 3x_3 = 15$, (ii) $2x_1 + x_2 + 5x_3 = 20$
 (iii) $x_1 + 2x_2 + x_3 + x_4 = 10$
 and $x_1, x_2, x_3, x_4 \geq 0$
- Q.3 (a) Obtain dual of the following Primal LP problem. 07**
 Minimize $Z = x_1 - 3x_2 - 2x_3$
 Subject to the constraints
 (i) $3x_1 - x_2 + 2x_3 \leq 7$ (ii) $2x_1 - 4x_2 \geq 12$,

(iii) $-4x_1 + 3x_2 + 8x_3 = 10$
 and $x_1, x_2 \geq 0$; x_3 unrestricted in sign.

(b) Determine an Initial Basic Feasible Solution to the following **07**
 Transportation Problem by using:

(i) NWCM (ii) VAM

	D1	D2	D3	D4	Supply
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

OR

Q.3 (a) What is Simulation? What are the advantages and **07**
 disadvantages of Simulation?

(b) A book binder has one printing press, one binding machine **07**
 and manuscripts of a number of books. The time required for
 performing the printing and binding operations on each book
 are shown below. The binder wishes to determine the order in
 which the book should be processed, so that the total time
 required to process all books is minimized.

Book	1	2	3	4	5	6
Printing time (Hours)	30	120	50	20	90	110
Binding time (Hours)	80	100	90	60	30	10

Q.4 (a) In a railway marshalling yard, goods trains arrive at a rate of **07**
 30 trains per day. Assuming that the inter-arrival time follows
 an exponential distribution and the service time (the time
 taken to hump a train) distribution is also exponential with an
 average of 36 minutes. Calculate the following:

- (i) The average number of trains in a queue.
- (ii) The probability that the queue size exceeds 10.
- (iii) Expected waiting time in a queue.

(b) Define the following: **07**

- (i) Saddle Point
- (ii) Payoff Matrix
- (iii) Optimal Strategies

OR

- Q.4 (a)** Describe the characteristics of Calling Population (input source) of a Queuing System. What do you understand by Queue Discipline? **07**
- Q.4 (b)** A small assembly plant assembles PCs through 9 interlink stages according to the following precedence / process. **07**

Stage From	Stage to	Duration (Hours)	Stage From	Stage to	Duration (Hours)
1	2	4	4	6	10
1	3	12	5	7	10
1	4	10	6	7	0
2	4	8	6	8	8
2	5	6	7	8	10
3	6	8	8	9	6

- (i) Draw an Arrow Diagram (Network) representing the above assembly work.
- (ii) Tabulate earliest start, earliest finish, latest start and latest finish time for all the stages.
- (iii) Find the critical path and the assembly duration.
- (iv) Tabulate the Total Float, Free Float and Independent Float.

- Q.5 (a)** What are Inventory Models? Clearly explain with suitable examples the different costs that are involved in the inventory problem. **07**
- (b)** A Construction Company has requested bids for sub contracts on five different projects. Five companies have responded. Their bids are represented below: **07**

		Bid Amount (‘000s Rs)				
		I	II	III	IV	V
Bidders	A	41	72	39	52	25
	B	22	29	49	65	81
	C	27	39	60	51	40
	D	45	50	48	52	37
	E	29	40	45	26	30

Determine the minimum cost assignment of sub contracts to bidders assuming that each bidder can receive only one contract.

OR

- Q.5 (a)** A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Rs 0.60 per unit per year. The set up cost per run is Rs 80.00. Find the Optimum run size and the minimum average yearly cost. **07**
- (b)** Explain the difference between PERT and CPM. **07**
