[4959] - 1005
B.E. (Civil) (Semester - I)
SYSTEMS APPROACH IN CIVIL ENGINEERING
(2012 Course)

Time : 2½ Hours]   *[Max. Marks :70*

Instructions to the candidates:
    1)   Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q. 7 or Q.8, Q.9 or Q.10.
    2)   Neat diagrams must be drawn wherever necessary.
    3)   Figures to the right side indicate full marks.
    4)   Assume suitable data if necessary.

Q1) a)   Explain the applications of Systems Approach in following areas.   **[5]**

       i)   Production

       ii)   Procurement

       iii)   Marketing

       iv)   Finance

       v)   Personnel

   b)   State whether following functions are convex or concave.   **[5]**

       i) $F(x) = x^3 - x^2 - x + 5$

       ii) $F(x) = x^2 \log(x)$

<div align="center">OR</div>

Q2) a)   Explain Hessian Matrix and state the conditions for concave and convex function for bivariable problems.   **[5]**

   b)   State the points of differences between Dichotomous Search, Fibonacci and Golden section methods.   **[5]**

Q3) a)   Explain following notations which represent queuing models.   **[5]**

       i) $(M/M/1) : (SIRO/\infty/\infty)$

       ii) $(M/E/c) : (FCFS/N/\infty)$

   b)   Explain the steps in Lagrangian Multiplier technique of optimisation. **[5]**

<div align="right">***P.T.O.***</div>

OR

Q4) a) Find the sequence that minimizes the total elapsed time to complete the following jobs in the order BA. **[5]**

Jobs (Processing times in minutes)

		1	2	3	4	5	6	7
machines	A	12	6	5	11	5	7	6
	B	7	8	9	4	7	8	3

Find total elapsed time.

b) What is simulation? How can you use Monte Carlo simulation to solve industrial problems? **[5]**

Q5) a) What is Dynamic Programming? Write step by step procedure to solve the general problem by DP approach. **[8]**

b) In an investment project, 10 units of money are available for allocation in three investment programmes. The returns are as follows. What is the optimal investment policy? **[8]**

		Returns										
		0	1	2	3	4	5	6	7	8	9	10
Investment policy	A	0	5	15	40	62	80	88	90	98	110	115
	B	0	6	18	45	70	83	92	95	100	120	125
	C	0	4	13	42	60	78	85	88	95	100	105

OR

Q6) a) What is the need of Dynamic Programming? How is it different from LP? Write some applications of DP. **[8]**

b) Find the shortest path from node 1 to node 11 through the network as given below. **[8]**

Node	Distance	Node	Distance	Node	Distance
1-2	5	3-6	5	5-10	5
1-3	2	3-7	2	6-9	8
1-4	7	3-8	1	6-10	4
2-5	8	4-6	6	7-9	4
2-6	9	4-7	8	7-10	3
2-7	6	4-8	7	9-11	2
3-5	4	5-9	9	10-11	3

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Q7) a) Explain the meaning of duality in L.P. What are the advantages of solving a minimization problem by converting it into maximization problem? **[6]**

b) Solve the following by Simplex method. **[6]**

Maximize $Z = x_1 + x_2/2$

Subject to $3x_1 + 2x_2 \leq 8$

$\qquad 5x_1 \leq 10$

$\qquad x_1 + x_2 \leq 8$

$\qquad -x_1 + x_2 \geq 4$

$\qquad x_1, x_2 \geq 0$

c) Solve the following by graphical method **[6]**

Minimize $Z = 60x + 40y$

Subject to

$\qquad 3x + 10y \geq 240$

$\qquad 10x + 10y \geq 160$

$\qquad 20x + 60y \geq 480$

$\qquad x, y \geq 0$

OR

Q8) a) Solve by using big M method. **[8]**

Maximize $Z = 4x_1 + 3x_2 + 5x_3$

Subject to

$\qquad x_1 + 3x_2 + 2x_3 \leq 10$

$\qquad 2x_1 + 2x_2 + x_3 \geq 6$

$\qquad x_1 + 2x_2 + 3x_3 = 14$

$\qquad x_1, x_2, x_3 \geq 0$

b) A pharmaceutical company produces two drugs A and B which are sold at a rate of Rs. 9.6 and Rs. 7.8 respectively. The main ingredients are x, y and z and they are required in the following proportions. **[10]**

Drugs	x%	y%	z%
A	50	30	20
B	30	30	40

The total available quantities of different ingredients are 1600 in x, 1400 in y and 1200 in z the cost in Rs. of x, y and z per gm are Rs. 8, Rs.6 and Rs.4 respectively. Estimate the most profitable quantities of A and B to produce, using Simplex method.

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Q9) a) Determine optimum solution by using VAM method for following transportation problem. Optimise using u-v method. **[10]**

Destinations

	1	2	3	4	5	Supply
A	2	11	10	3	7	6
Origins B	1	4	7	2	1	10
C	3	9	4	8	12	9
Demand	4	4	4	7	6	

b) Assign the jobs to employees to minimize cost. **[6]**

Employees

	A	B	C	D
1	7	9	3	3
2	2	6	1	6
Jobs 3	6	5	3	4
4	9	10	7	1
5	5	2	2	4

OR

Q10) a) National Oil company has 3 refineries and 4 depots. Transportation cost per ton, capacities and requirements are as given below. Determine optimum allocation of output. **[8]**

	D_1	D_2	D_3	D_4	Capacity (tons)
R_1	5	7	3	10	700
R_2	8	6	14	13	400
R_3	12	10	9	11	800
Required	200	600	700	400	

b) Assign tasks to employees to minimize cost. **[8]**

Tasks

		1	2	3	4	5
	A	25	30	70	40	60
	B	10	10	45	40	50
Employees	C	55	40	25	55	40
	D	60	70	10	35	30
	E	30	55	60	20	35

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