Total No. of Questions : 10]

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SEAT No. :

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B.E. (Civil) (Semester - I)

SYSTEMS APPROACH IN CIVIL ENGINEERING

(2012 Pattern) (Elective)

Time : 2.30 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data jf necessary.***

Q1) a) What are the applications of systems approach in Civil Engineering? Describe with the help of suitable examples **[5]**

b) A machine operator has to perform turning and threading on a number of different jobs. The time required for the operations for various jobs are as under. **[5]**

Job	Time for turning (minutes)	Time for threading (minutes)
1	3	2
2	5	4
3	8	8
4	2	5
5	9	3

Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs. Also, find the total processing time and idle time for both operations.

OR

Q2) a) What are the conditions for Convex function and concave function? **[5]**

b) A plant manufactures washing machines and dryer in three departments as stamping, motor & transmission, washer assembly and dryer assembly. The monthly capacities are as follows: **[5]**

Stamping deptt: 950 washers or 950 dryers

Motor & transmission dept: 1500 washers or 5000 dyers

Washer assembly: 8000 washers only

Dryers assembly: 5000 dryers only

Profits per piece of washers and dryers are Rs. 2500 and Rs 3000 respectively.

Formulate the L.P. model

P.T.O.

Q3) a) For the following functions, determine whether they are concave or convex **[5]**

i) $F(x)=x_1^2\ x_2$

ii) $F(x)= x_1 + 5x_2$

b) Define Local optima and global optima with the help of neat sketch. **[5]**

OR

Q4) a) Following is the arrival time and service time at a coffee shop. **[6]**

Interarrival time (minutes)	:	0	0.5	1	1.5	2	2.5	3
Frequency (%)	:	5	35	25	15	10	7	3
Service time (minutes)	:	1	2	3	4	5		
Frequency (%)	:	5	25	35	20	5		

Simulate the system for 10 arrivals and find the idle time for customer and waiter.

Use following rendom numbers:

For arrival : 21, 11, 71, 65, 41, 35, 17, 91, 07, 34

For service : 20, 72, 34, 54, 30, 22, 48, 74, 76, 02

b) What are the assumptions for queuing model? **[4]**

Q5) a) In an investment project, only 8 units of money are available for allocation in unit amounts to three investment programmes. The return function for each programme is given below. It gives the return from investing x units of money in ith investment programme. Find the optimum investment policy. **[10]**

x	0	1	2	3	4	5	6	7	8
I	0	5	15	40	80	90	95	98	100
II	0	5	15	40	60	70	73	74	75
III	0	4	26	40	45	50	51	52	53

b) Write short note on characteristics of Dynamic Programming. **[6]**

OR

Q6) a) A distance network consists of eleven nodes which are distributed as shown below. **[8]**

Arc	Distance	Arc	Distance
1-2	8	5-8	12
1-3	7	5-9	7
1-4	1	6-9	9
2-5	5	7-9	6
3-5	9	7-10	13
3-6	2	8-11	4
3-7	8	9-11	2
4-7	10	10-11	15

Find the shortest path from node 1 to 11 and the corresponding distance.

b) Define Dynamic programming problem. List and explain the terminologies of dynamic programming problem. What are the application areas of dynamic programming. **[8]**

Q7) a) Solve by using graphical method **[6]**

Maximize $Z = 2x_1 + x_2$

Subject to :

$x_1 + 2\,x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - 2\,x_2 \leq 1$

$x_1, x_2 \geq 0$

b) Solve the example in Que 7 (a) by Simplex method. **[6]**

c) What is meant by duality in LP? What are its applications? **[4]**

OR

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

Maximize $Z = 4\,x_1 + 5\,x_2 — 3x_3$

Subject to

$x_1 + x_2 + x_3 = 10$

$x_1 - x_2 \geq 1$

$2x_1 + 3\,x_2 + x_3 \leq 40$

$x_1, x_2, x_3 \geq 0$

b) Solve the following with two phase method **[8]**

Minimize $Z = -x_1 - x_2$

Subject to $x_1 - x_2 - x_3 = 1$

$-x_1 + x_2 + 2\,x_3 - x_4 = 1$

$x_j \geq 0;\ j = 1,2,3,4$

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

Destination

		1	2	3	4	5	supply
	A	2	3	4	1	4	4
origin	B	11	7	7	3	8	8
	C	10	1	2	9	12	9
	demand	3	3	4	5	6	

b) A project comprises of four jobs for which four contractors have submitted the tenders. Assign the project to the contractor for minimizing the total cost. **[8]**

		1	2	3	4
	A	12	32	42	19
contractor	B	11	37	47	23
	C	10	31	52	19
	D	13	30	49	25

OR

Q10)a) Solve the following cost minimizing transportation problem using **[10]**

i) North West Corner method

ii) Column Minima method

iii) Row minima method

iv) Least cost method

	D1	D2	D3	D4	D5	D6	available
O1	2	1	3	3	2	5	50
O2	3	2	2	4	3	4	40
O3	3	5	4	2	4	1	60
O4	4	2	2	1	2	2	30
Required	30	50	20	40	30	10	180

b) A company is faced with the problem of assigning six different machines to five different jobs. The costs estimated in hundreds of rupees are given in the table below. **[8]**

		Jobs				
		1	2	3	4	5
Machines	1	2.5	5	1	6	2
	2	2	5	1.5	7	3
	3	3	6.5	2	8	3
	4	3.5	7	2	9	4.5
	5	4	7	3	9	6
	6	6	9	5	10	6

Solve the problem to minimize the total cost.