Total No. of Questions : 12]

SEAT No. :

P720

[Total No. of Pages : 6

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B.E. (Civil)

SYSTEMS APPROACH IN CIVIL ENGINEERING

(Semester - I) (2008 Pattern) (Elective - I (b))

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer any 3 questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) A block making firm manufactures 2 products A & B. The profits are Rs. 3 and Rs. 4 per piece respectively. The firm has two machines and below is the required processing time in minutes for each machine for each product. **[4]**

	A	B
X	4	3
Y	2	2

Machine X & Y have 200 and 300 machine minutes per day respectively. The firm must manufacture 150 A's and 250 B's but no more than 200 A's. Set up a Linear Programming Problem to maximize profit.

b) Solve the above problem using graphical method. **[8]**

c) What is Linear Programming? Discuss the applications of LP to managerial decision making. **[6]**

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OR

Q2) a) Solve following problem : **[10]**

Maximise $Z = 4X_1 + 10X_2$

Subject to

$X_1 + X_2 + \leq 2$

$5X_1 + 2X_2 \leq 10$

$-2X_1 - 8X_2 \geq -12$

$X_1, X_2 \geq 0$

b) How will you solve a LPP graphically? What are its limitations? Explain with example an LP Problem which has **[8]**

i) Infinite solution

ii) No feasible solution

Q3) a) There are three RMC plants which supplies concrete to 4 sites. The capacities of the sources and the demands are as given below. **[8]**

R1 = 150 cu.m.; R2 = 200 cu.m.; R3 = 120 cu.m.

S1 = 160 cu.m.; S2 = 80 cu.m.; S3 = 110 cu.m.; S4 = 120 cu.m.

The cost of transporting concrete per cu.m. from plants to sites is as given below :

	S1	S2	S3	S4
R1	320	280	360	550
R2	210	550	450	750
R3	230	600	350	650

Find out the optimal solution by U-V method for transporting the product at minimum cost. Use VAM method.

b) A corporation has floated four tenders of repair of road. The repairs must be done at lowest cost and quickest time. Also, corporation has decided to award one road to only one contractor. Five contractors have sent their bids as follows. **[8]**

Cost of repairs on roads (Rs. in lakhs)

Contractors	R1	R2	R3	R4
C1	10	12	13	16
C2	8	10	10	15
C3	9	10	9	12
C4	11	13	15	18
C5	10	11	11	13

Decide the best way of assigning the repairs to the contractors and the costs. Which contractor does not get the work?

OR

Q4) a) Solve the following maximization assignment problem. The estimated sales per month in four different cities by 5 different managers are as follows : **[8]**

	A	B	C	D
P	13	15	12	14
Q	12	14	10	12
R	16	18	14	14
S	15	15	13	13
T	14	15	14	12

Find out the assignment of managers to cities in order to maximize sales.

b) Solve following transportation problem & optimize the transportation cost using least cost method. **[8]**

	E	F	G	H	J	Supply
A	15	10	8	14	13	50
B	9	13	10	20	19	75
C	13	20	12	6	7	125
D	12	19	17	10	6	100
demand	50	75	75	100	50	

Q5) a) What is definition of Dynamic Programming? What are the main characteristics of DP? **[8]**

b) Solve following DP problem : **[8]**

A firm has divided its marketing area into 3 zones A, B & C. The amount of sales depends upon the number of salesman in each zone. The firm has been collecting the data regarding sales and salesman in each area over a number of past years. The information is summarized as follows:

Areas → No. of Salesman ↓	A	B	C
0	32	36	45
1	47	48	50
2	65	72	65
3	75	72	70
4	82	80	74
5	95	90	86
6	98	95	92
7	100	105	108
8	100	108	110
9	90	110	115

Allocate the salesman to the zones so that the total sales are maximum.

OR

Q6) a) Explain the following in the context of DP : **[6]**

i) Principle of optimality

ii) State

iii) Stage

b) Find the shortest path from 1 to 14 with the durations given as **[10]**

act	1-2	1-3	1-4	2-6	3-6	4-7	2-5	5-9	6-9	7-9	5-8	7-10	10-13	13-14	8-11	11-14	9-12	12-14
du	5	4	6	3	9	8	2	4	5	3	6	5	5	4	8	4	7	7

SECTION - II

Q7) a) Define Global and Local optima maxima & minima, concave & convex functions. Show with the help of neat sketches. **[4]**

b) Give definitions of following : **[4]**

i) unconstrained optimization

ii) constrained optimization

b) Find maximum and minimum of the function : **[8]**

$$F(X) = 2X_1^2 + X_2^2 + 4X_3^2 - X_1 - 6X_2 - 8X_3$$

OR

Q8) a) Use the method of Lagrangian Multiplier to solve the following : **[8]**

Minimize $Z = 2X_1^2 + X_2 + 3X_3^2 + 10X_1 + 8X_2 + 6X_3 - 100$

Subject to

$$X_1 + X_2 + 3X_3 = 0$$

$$5X_1 + 2X_2 + X_3 = 5$$

$$X_1, X_2, X_3 \geq 0$$

b) Give the steps to solve problems using one Dimensional Search technique : Dichotomous search, Fibonacci method & Golden Section rule. **[8]**

Q9) a) What are the types of problems that can be solved using queuing models (waiting line problem)? **[6]**

b) Give various elements of queuing systems. **[4]**

c) A new project is launched by a builder. One marketing manager is employed on site office to answer the queries. Five customers arrive in an average every 20 minutes while the manager can attend 5 customers every 15 minutes. Assume poisons distribution for arrival rate and exponential distribution for service time, find : **[8]**

i) average number of customers in the system.

ii) average number of customers in the queue.

iii) average time a customer spends in system.

iv) average time a customer waits before being attended.

OR

Q10) a) What is simulation? Describe its advantages in solving the problems. Give its main limitations with suitable examples. **[6]**

b) Explain the importance of sequencing problems. What are various methods of solving sequencing problems? **[4]**

b) Solve the following sequencing problem if the order of processing is C-A-B. Find the idle time of the machines & jobs. **[8]**

Jobs		1	2	3	4	5	6	7	8
machines	A	4	6	7	4	5	3	6	3
	B	5	10	7	8	11	8	13	13
	C	5	6	3	4	4	9	15	11

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Q11) a) A company has machine whose cost is Rs. 50,000/- its maintenance cost at the end of different years is given below : **[8]**

Year	1	2	3	4	5	6	7
Maintenance cost	5000	5200	5500	6000	6700	7400	8800
Resale value	48000	47000	45500	44000	42000	39500	36500

What is the economic life of the machine & what is the minimum average cost?

b) Explain in brief the types of environment under which the decisions are made? Also write a short note on application of Game theory. **[8]**

OR

Q12) a) Explain how the theory of replacement is used in replacement of items whose maintenance cost varies with time. Explain with suitable example considering constant scrap value and ignoring time value of money. **[6]**

b) Following is the payoff matrix for player A **[10]**

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

Using dominance property, obtain the optimum strategy for both the players & determine value of game.