Total No. of Questions : 10]

SEAT No. :

P2114

[Total No. of Pages : 4

[5254]-505

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

SYSTEMS APPROACH IN CIVIL ENGINEERING

(2012 Pattern) (Elective - I)

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.7or Q.8, Q.9 or Q10.***
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) State application of optimization in Civil Engineering? **[4]**

b) State whether following functions are Convex or Concave **[6]**

i) $f(x) = x^4 + x^2 + 10\,x$

ii) $f(x) = x^3 + x^2 - 15x$

OR

Q2) a) What are the advantages of Newton's method over steepest gradient technique. **[4]**

b) Minimize $Z = 3x_1^2 + 4x_2 - 5x_1x_2 - 8\,x_2$,

Subject to $x_1 + x_2 = 4$ by Lagrange's multiplier method. **[6]**

Q3) a) Find the sequence that minimize the total elapsed time to complete the job in the order of AB **[6]**

Machine	Jobs Processing Time in Minutes				
	1	2	3	4	5
A	3	10	6	4	9
B	7	12	8	5	2

b) Explain Kendal's Notation. **[4]**

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OR

Q4) a) Explain the process of sequencing of n jobs on three machines. **[4]**

b) Ships arrive at a port at an average rate of 8 ships per week and their arrival pattern follows Poisson distribution. On an average 12 ships are loaded and unloaded with exponential distribution per week. Determine **[6]**

i) The average queue length and the number of ships in the system.

ii) The average time spent by the ships waiting in the queue and in the system.

Q5) a) Write short note on characteristics of Dynamic Programming. **[4]**

b) Find shortest path for a network with following data **[12]**

Node	Distance in kms	Node	Distance in kms
A-B	14	A-C	15
A-D	18	B-E	19
B-F	21	C-E	25
C-F	30	D-E	24
D-F	20	E-G	14
E-H	18	E-I	15
F-G	16	F-H	17
F-I	22	G-J	22
H-J	24	I-J	23

OR

Q6) a) Discuss Dynamic Programming applications to business. **[4]**

b) Maximize the sales by allocating salesman to different zones as per amount of sales contribution as given below **[12]**

No of salesman	Zone 1	Zone 2	Zone 3
	Profitability in thousands of Rs.		
0	12	13	14
1	14	15	18
2	15	18	23
3	17	20	27
4	19	23	31
5	20	27	35
6	25	30	40

Q7) a) Minimize $Z = x_1 - 3x_2 + 2x_3$ **[12]**

Subject to $3x_1 - x_2 + 2x_3 \geq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1, x_2, x_3 \geq 0$

Use Simplex method to solvc the problem.

b) What do surplus variable and slack variables represent in Simplex method? Also, explain when these are used. **[4]**

OR

Q8) a) What is the difference between simplex solution procedure for a maximization and minimization problem? **[4]**

b) Maximize $Z = 3x_1 + 2x_2 + 5x_3$ **[12]**

Subject to $x_1 + x_2 + x_3 \leq 9$

$2x_1 + 3x_2 + 5x_3 \leq 30$

$2x_1 - x_2 - x_3 \leq 8$

$x_1, x_2, x_3 \geq 0$

Use Simplex method to solve the problem.

Q9) a) What do you understand by a balanced and unbalanced transportation problem? How are the unbalanced problems solved? **[8]**

b) Solve following assignment problem to minimize time (in minutes) required by 5 operators on 5 machines **[10]**

Machines

Operators	I	II	III	IV	V
A	10	17	27	18	28
B	11	24	16	19	33
C	25	26	12	20	29
D	32	23	15	13	34
E	31	22	14	21	30

OR

Q10)a) Give the mathematical formulation of an assignment problem with the help of an example. **[6]**

b) Calculate transportation cost for following problem using Column minima, row minima and least cost method. **[12]**

Destinations

Origins	D_1	D_2	D_3	D_4	Supply
O_1	20	18	16	20	75
O_2	14	12	18	15	75
O_3	17	13	11	17	50
O_4	16	14	12	18	100
Demand	100	50	100	50	