

Total No. of Questions : 12]

SEAT No. :

**P3859**

**[5561]-505**

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**B.E.(Civil)**

**SYSTEMS APPROACH IN CIVIL ENGINEERING**

**(2015 Course) (Semester - I) (Elective - I) (401004B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1) a)** Differentiate between Linear Programming and Non Linear Programming. **[3]**

- b) Formulate LPP: A person wants to decide the constituents of a diet which will fulfil his daily requirement of protein, fats & carbohydrates at minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given in table: **[3]**

Food Type	Yield Per Unit			Cost Per Unit
	Protein	Fats	Carbohydrates	
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Min.requirement	800	200	700	

OR

**Q2) a)** Solve graphically **[3]**

$$\text{Max } Z = 2X_1 + X_2,$$

subject to,

$$X_1 + 2X_2 \leq 10,$$

$$X_1 + X_2 \leq 6,$$

$$X_1 - X_2 \leq 2,$$

$$X_1 - 2X_2 \leq 1,$$

$$X_1, X_2 \geq 0$$

- b) What type of Civil Engineering problems may be optimized using system approach models? **[3]**

**P.T.O.**

**Q3) a)** If average arrival time (rate) is 3 per hour, average service rate is 4 per hour. Calculate queue length and system length. [2]

**b)** Time jobs are to be processed on 2 machines  $M_1$  &  $M_2$  in order  $M_1$ - $M_2$ . processing time is in hours. Find the sequence of total elapsed & idle time for both machines. [6]

Job	Time required (hour)	
	A	B
1	5	2
2	1	6
3	9	7
4	3	8
5	10	4

OR

**Q4) a)** What are assumptions for queuing model? [2]

**b)** Find the optimum sequence to get minimum time and sequence of operation A-B-C [6]

Job	Time required (hour)		
	A	B	C
1	13	9	14
2	12	8	9
3	11	7	12
4	15	10	13
5	16	11	15

Find the total elapsed time & Idle time for A,B & C.

**Q5)** Solve the following transportation problem using Least Cost Method. [6]

	A	B	C	D	
I	1	2	1	4	30
II	3	3	2	1	50
III	4	2	9	9	20
	20	40	30	10	

OR

**Q6)** Solve by Row Minima & Column Minima

[6]

	1	2	3	4	
1	2	3	11	7	15
2	1	2	5	6	25
3	5	8	15	9	20
	20	20	5	15	

**Q7) a)** Solve using simplex method

[8]

$$\text{Max, } Z = 3X_1 + 4X_2$$

$$\text{Subject to, } X_1 + X_2 \leq 450$$

$$2X_1 + X_2 \leq 600$$

$$X_1, X_2 \geq 0$$

b) Explain the rules for forming the dual.

[8]

Construct dual of the problem :

$$\text{Mini. } Z = 3X_1 - 2X_2 + 4X_3$$

$$\text{Subject to, } 3X_1 + 5X_2 + 4X_3 \geq 7$$

$$6X_1 + X_2 + 3X_3 \geq 4$$

$$7X_1 - 2X_2 - X_3 \leq 10$$

$$X_1 - 2X_2 + 5X_3 \geq 3$$

$$4X_1 + 7X_2 - 2X_3 \geq 2$$

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

OR

**Q8) a)** Use method of Big-M to solve the problem :

[8]

$$\text{Mini. } Z = 600X_1 + 500X_2$$

$$\text{Subject to, } 2X_1 + X_2 \geq 80$$

$$X_1 + 2X_2 \geq 60$$

$$X_1, X_2 \geq 0$$

b) Use two phase method to solve the problem :

[8]

$$\text{Max. } Z = 4X_1 + 5X_2$$

$$\text{Subject to, } 2X_1 + 3X_2 \leq 6$$

$$3X_1 + X_2 \geq 3$$

$$X_1, X_2 \geq 0$$

**Q9) a)** Use Fibonacci Method to Max.  $Fx = X^3 (12 - X)$  in the interval (0,12) within 10% accuracy. [9]

b) Use Golden section Method to Max.  $Fx = X^3 (12 - X)$  in the interval (0,12) within 10% accuracy. [9]

OR

**Q10)a)** What is uni-modal and multimodal function with diagram? Explain procedure for Lagrangian Multiplier technique. [9]

b) Lagrangian Multiplier technique to solve [9]

$$\text{Minimize, } Z = 3X_1^2 + 2X_2 + 3X_3^2 + 10X_1 + 9X_2 + 16X_3 - 50$$

$$\text{Subject to, } 2X_1 + X_2 + 2X_3 = 40$$

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

**Q11)a)** It is proposed to develop hydropower project on reservoir across 3 possible river sites. The total financial resource available is 400 cores rupees. The return fuctions for each of the possible investment are given below. The available resources is to be allocated optimally to these developments using dynamic programming the maximum return and give the allocation to various sites. [8]

Resources Allocated	Returns from site		
	A	B	C
0	0	0	0
100	120	140	300
200	750	550	500
300	910	700	700
400	980	800	750

b) What are applications of Dynamic programming in Civil Engineering? State advantages and disadvantages of dynamic programming. [8]

OR

**Q12)a)** The maintenance cost and resale value per year of a machine whose purchase price is Rs. 7000 is given below : [8]

Year	1	2	3	4	5	6	7	8
Maintenance cost	900	1200	1600	2100	2800	3700	4700	5900
Resale value	4000	2000	1200	600	500	400	400	400

When should the machine be replaced?

b) Explain the types of Games. What are characteristics of two person zero sum game? [8]

