15105/M

Roll No. | | | | | | | | | | |

B.E /B.Tech (FULL TIME) END SEMESTER EXAMINATION APRIL/MAY 2019
B.E AGRICULTURAL AND IRRIGATION ENGINEERING
SEMESTER - VIII
AI 8011 – SYSTEM ANALYSIS IN IRRIGATION ENGINEERING
(Regulation 2012)

Time: 3 Hours | Answer ALL Questions (11^{th} question is compulsory) | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What are the components of a system?
2. What are closed systems and open systems? Give example for each system.
3. Show that Dual of a Dual is a Primal from the L.P. model given below:

   Minimize $Z = 50x_1 + 80x_2$

   Subjected to

   $$2x_1 + 4x_{2x} \geq 10$$
   $$2x_1 + 5x_2 \geq 8$$
   $$3x_1 \geq 6$$
   $$x_1, x_2 \geq 0$$

4. What are the significance of slack variables and surplus variables used in Linear Programming models?
5. Why is Dynamic programming known as multistage programming?
6. What is the salient difference between backward and forward recursion? Which is more efficient?
7. List various applications of Dynamic programming as an OR tool in Water Resources Management.
8. Generate a series of five numbers using Mixed Congruential Method for the expression given below.

   $X_1 = a X_0 + b$ (modulo m)

   $X_0 = 13$, $a = 9$, $b = 7$, $m = 29$
9. What are the applications of Sequent Peak Analysis to water resources planning?
10. What is Goal Programming (GP)?

Part – B (5 x 16 = 80 marks)

11. Sketch Boulding hierarchy of system. Explain how, integrated water resources system can find a place in it?

12.a) A farmer has 100 ha farm. He grows tomatoes, brinjal and beans in his farm. The price obtained is Rs. 10 per kg of tomatoes, Rs. 7.50 per kg of brinjal and Rs. 12 per kg of beans. The average yield per ha is 5 tonnes of tomatoes, 7.5 tonnes of brinjal and 2 tonnes of beans. The fertilizer is available to him at the cost of Rs. 5 per kg and the quantity is 10 tonnes. Each ha of tomato requires 150 kg, brinjal requires 200 kg and bean requires 200 kg of fertilizer. The labour requirement is 50 man days for tomatoes, 60 days for brinjal and 70 days for beans for every ha of crop. Total man days available to the farmer are 800 and cost of labour is Rs. 100 per man day. Formulate the problem as a linear programming model to maximize the farmer's profit.

(OR)

(P.T.O)

12.b) Using simplex method solve

Maximize $Z = 2x_1 + x_2$

Subjected to

$$3x_1 + x_2 \leq 300$$
$$4x_1 + 2x_2 \leq 500$$
$$x_1, x_2 \leq 0$$

Discuss the result of the optimization model.

13.a) A total of 6 units of water is to be allocated optimally to three users. The allocation is made in discrete steps of one unit ranging from 0 to 6. With the three users denoted as User 1, User 2 and User 3 respectively, the returns obtained from the users for a given allocation are given in the following table.

Amount of water Allocated	Return from		
	User 1	User 2	User 3
x	$R_1(x)$	$R_2(x)$	$R_3(x)$
0	0	0	0
1	5	5	7
2	8	6	12
3	9	3	15
4	8	-4	16
5	5	-15	15
6	0	-30	12

Find optimal allocation.

(OR)

13.b) A farm manager is considering crop planning for the forth coming irrigation season. She has computed the total resources available with her for all the season as 5 crore rupees. She has a choice of 3 crops meant for export, to be raised in her farm. The quantum of resource required by each crop is given in the table below:

Crops	Resources required crores	Export potential crores
Orchids	2	6.5
Roses	3	8.0
Geranium	1	3.0

Construct the D.P.model for the above situation. Indicate state, stage and operating policy. Solve the D.P.model using backward recursive equation. Find optimum allocation of resources to each crop so as to obtain maximum profit.

(P.T.O)

14.a) Compute the storage of a reservoir at the end of a monsoon season. The initial storage is 58.8 TMC. The monthly flow pattern is expected to follow the following expression during the monsoon season:

$$X_1 = 7^* x_0 + 17 \text{ (modulo 31)}$$

The initial inflow x_0 is 50 TMC.

Find the storage in the reservoir at the end of 6 months. Evaporation losses and seepage losses are found to be negligible. There were no other releases from the reservoir during monsoon season.

(OR)

14.b) Using Monte Carlo technique find the change in soil moisture regime. The rainfall for 10 days has the following probability.

Rainfall	Probability	Rainfall	Probability
1 mm	0.02	6 mm	0.20
2 mm	0.03	7 mm	0.14
3 mm	0.07	8 mm	0.14
4 mm	0.09	9 mm	0.12
5 mm	0.15	10 mm	0.04

The evaporation for 10 days has the following probability

Evaporation in mm	3	4	5	6	7	8	9	10
Probability	0.10	0.15	0.20	0.12	0.14	0.11	0.10	0.08

The initial soil moisture is 10 mm on day one. Graphically represent the change in soil moisture regime.

15.a) i) Explain how Discrete Differential Dynamic Programming is differed from state Increment Dynamic Programming?

ii) Explain the procedure of Discrete Differential Dynamic Programming.

iii) Explain how Discrete Differential Dynamic Programming is particularly useful in water resources systems studies.

iv) List the limitations of Discrete Differential Dynamic Programming method

(OR)

15.b) i) Justify the need for stochastic simulation in water resources systems studies.

ii) Give the steps of simulation in the form of a flow chart.

iii) List various applications of simulation models in reservoir operations.