

(Civil Department)

(Water Resources and Hydroinformatics)

SECOND SEMESTER M.TECH. DEGREE EXAMINATION APRIL 2018

07-CE-6402 WATER RESOURCES SYSTEMS ENGINEERING

Time:3 hours

Max. Marks: 60

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

**Module 1**

- 1a What are the functions of water resources systems? Elaborate with examples 4

**Answer b or c**

- 1b Explain the various techniques used in water resources system analysis 5
- 1c What is meant by a system? Explain the different types of systems 5

**Module 2**

- 2a Write short note on (i) mathematical modelling (ii) Objective function and constraints. Explain them on the basis of a typical water resources decision making problem. 4

**Answer b or c**

- 2b What is meant by simulation? Explain how the combination of simulation-optimization can be used for water resources modelling 5
- 2c A farmer has 100 acre farm in which he cultivates tomatoes, potatoes and carrots. The expected selling price per kg of tomatoes, potatoes and carrots are Rs.10, Rs.12 and Rs.15 and the average yield/acre is 2tons, 5tons and 4 tons respectively. The cost of fertiliser is Rs.8/per kg and the quantity required per acre for tomatoes, potatoes and carrots are 45kg, 60kg and 50kg respectively. The fertiliser available in a year is 1ton. Labour required/acre for sowing, cultivating and harvesting is 5mandays for tomatoes and 6mandays for potatoes and carrots. Females work for less hours in a day and hence 1.2 female days is equivalent to 1man-day. A total of 10 male labourers and 8 female workers are available and total working days in a year is 90. The wages/day is Rs.600 for men and 500 for women. Formulate the problem as LPP which maximises the total profit of the farmer. 5

**Module 3**

- 3a Define concave and convex function and write the method of identification 4

**Answer b or c**

- 3b A tank of volume  $200\text{m}^3$  is to be made from steel. It has a cylindrical body with flat ends. If the material for the sides costs twice that for the body, find the dimensions of the tank which minimises the cost. Assume the cost of material for body as Rs.250/ $\text{m}^2$ . 5
- 3c Locate the stationery points and identify the value and nature of extreme points 5
- (i)  $f(x) = \frac{2x^3}{3} - 2x^2 - 5x + 2x^2 + 4x + 5$
- (ii)  $f(x) = x^5 - 5x^3 - 20x + 5$

**Module 4**

- 4a Solve the following LPP graphically 4

$$\text{Max } z = 5x_1 + 8x_2$$

$$\text{sub. to } 3x_1 + 2x_2 \leq 36, \quad x_1 + 2x_2 \leq 20, \quad 3x_1 + 4x_2 \leq 42, \quad x_2 \geq 1, \quad x_1, x_2 \geq 0$$

**Answer b or c**

- 4b** Solve  $Min Z = 3x_1 + 8x_2$  **5**

subject to  $x_1 + x_2 = 200, \quad x_1 \leq 80, \quad x_2 \geq 60, \quad x_1 \geq 0, x_2 \geq 0,$

- 4c** What are the possible problems which may come across while solving an LPP using Simplex method? Explain with examples. Also write the dual of the given LPP **5**

$Min Z = 5x_1 + 6x_2 - 3x_3$

subject to  $2x_1 + 3x_2 + 2x_3 \geq 5, \quad 5x_1 - x_2 + 6x_3 \leq 4,$

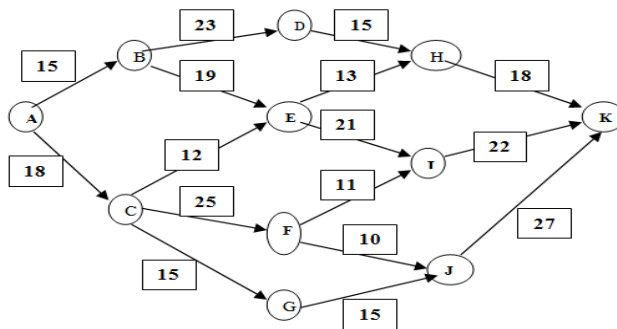
$4x_1 - x_2 + 8x_3 = 22, \quad x_1 \geq 0, x_3 \geq 0, x_2 \text{ is unrestricted in sign}$

**Module 5**

- 5a** Write short note on (i) dynamic programming (ii) Curse of dimensionality **5**

**Answer b or c**

- 5b** The network of roads connecting the locations A and K are shown. The numerical values indicate the time of travel in minutes. Find out the minimum time required for a passenger at A to reach the destination K using Dynamic Programming Technique **7**



- 5c** Solve by Fibonacci method using 5 iterations and with  $\epsilon = 0.1$  within the range 8 to 18 for the function  $Max Z = -\frac{x^3}{3} + 10x^2 - 75x + 65$  **7**

**Module 6**

- 6a** Write short note on (i) Sinking Fund (ii) salvage value (iii) Depreciation **5**

**Answer b or c**

- 6b** Using the present worth method, compare the following projects and identify the better alternative. The interest rate is 12% per year. **7**

Particulars	project 1	project 2
Land value (Rs.)	50,00,000/-	50,00,000/-
Annual operating cost for the first five years (Rs.)	25,000/-	20,000/-
Annual operating cost for the remaining useful life (Rs.)		22,500/-
Expected salvage value	20,000/-	25,000/-
Annual Revenue	50,000/-	60,000/-
Useful life	5 years	10 years

- 6c** Prove that the capital Recovery factor is the sum of interest rate and sinking fund factor. **7**

Find the amount credited towards loan repayment in the 15<sup>th</sup> year if a person borrows 30 lakh at 10% interest rate for 20 years. What is the percentage of repayment done towards capital by the end of 15th year?