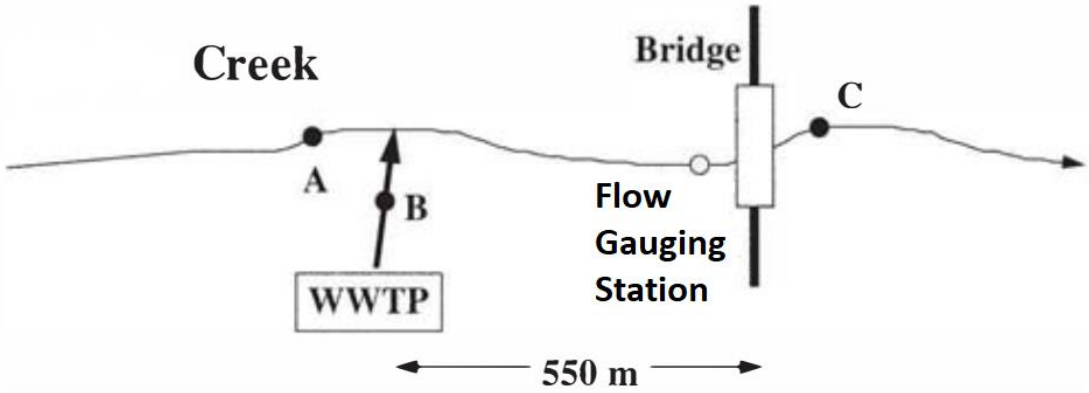
BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2022-2023
MID-SEMESTER 2022-23 (OPEN BOOK/NOTES)

COURSE NO.: CE G525 TIME: 90 Min.
COURSE TITLE: Water Resources Planning and Management DATE: 05/11/2022
MAX. MARKS: 25%

Note: (i) Attempt all questions.
(ii) Make necessary assumptions, if required.

Q.1 A treated sewage effluent discharged to a creek just above a flow gauging station. Test sampling results shows that conductivity value at A, B, and C are 170, 820, and 639 micro-mho per cm respectively. If the flow at the gauging station is 0.494 m^3/s, estimate the flows for the treatment plant and creek. (6.0 M)



Q.2 Assume water can be allocated to three users. The allocation, x_j, to each use j provides the following returns: $R(x_1) = (12x_1 - x_1^2)$, $R(x_2) = (8x_2 - x_2^2)$, and $R(x_3) = (18x_3 - 3x_3^2)$. Assume that the objective is to maximize the total return, $F(\boldsymbol{X})$, from all three allocations and that the sum of all allocations cannot exceed 10. How much would each user like to have? Also, calculate the value of the Lagrange multiplier. (5.0 M)

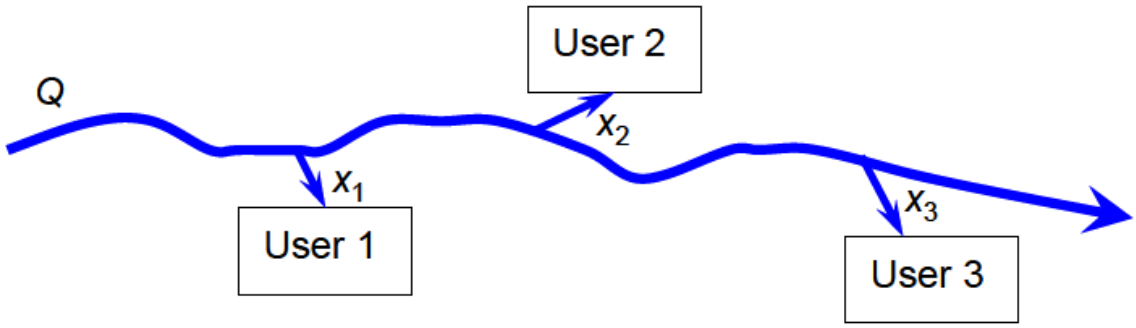


Fig.Q.2

Q.3 A treated sewage effluent discharged to a river with a mean flow velocity of 0.1 m/s raises the BoD immediately below the mixing zone from 2.6 to 4.5 mg/L. The upstream DO concentration is 9.5 mg/L at a water temperature of 12 ^{o}C. If the deoxygenation rate constant for treated wastewater is 0.15 d^{-1}, and the reaeration rate constant for an average velocity river is 0.5 d^{-1}, calculate the time when the minimum DO concentration occur. Also, determine the distance downstream where this minimum DO occur and finally the value of the minimum DO concentration. Take the saturation concentration of oxygen is 10.8 mg/L at T = 12°C. (8.0 M)

Q.4 Answer the Following:

(a) Explain what kinds of water resources planning are done at the local and state level and in what regards that would differ if multistate or central government involvement was involved. Name some specific examples of projects most likely seen at the local/state level and why they would not need other state or central government involvement. (2.0 M)

(b) Describe the differences between point and nonpoint sources of pollution. Give examples of each. (2.0 M)

(c) A community is planning for future water supply and wastewater disposal. Explain how systems modeling might be used to assist the planning effort. (2.0 M)

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