BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

FIRST SEMESTER 2016-2017

MID-SEMESTER TEST (CLOSE BOOK)

COURSE NO.: CE G525 TIME: 90 Min.

COURSE TITLE: Water Resources Planning and Management DATE: 06/10/2016

MAX. MARKS: 25%

Note: (i) Attempt all questions.

(ii) Make necessary assumptions, if required.

Q1. A water engineer investigates the self- purifying capacity of a river and observes that there are several factors which affect the process of self-purification of the stream. Discuss four such factors occurring within the stream which the engineer might have observed. Explain with the help of an example of an Indian river that how the approach of 'Integrated River Basin Planning and Management (IRBPM)' can be the possible solution to revive the self-purifying capacity of the river. Describe in brief four steps that can be taken in this regard.

[2.0 + 1.5 + 2.0]

Q2. A sewage treatment plant discharges secondary effluent to a surface stream. The worst conditions are known to occur during the summer when the stream flow is low and water temperature is high. Under these conditions, measurements are made in the laboratory and in the field to determine the characteristics of the wastewater and stream flows. The wastewater is found to have a maximum flow rate of 15,000 m^3/day, a BOD_5 of 40 mg/l, a dissolved oxygen concentration of 2 mg/l, and a temperature of 25^0C. The stream (upstream from point of wastewater discharge) is found to have a minimum flow rate of 0.5 m^3/s, a BOD_5 of 3 mg/l, a dissolved oxygen concentration of 8 mg/l, and a temperature of 22^0C. Complete mixing of the wastewater and stream is almost instantaneous, and the velocity of the mixture is 0.2 m/s. From the flow regime, the reaeration constant is estimated to be 0.4 day^{-1} and deoxygenation constant is 0.23 day^{-1} for 20^0C conditions. Sketch the dissolved oxygen profile a 100-km reach of the stream below the discharge using a graph paper. To draw the profile, you may calculate deficit at 20, 75 and 100 km from the point of discharge and at the location at which critical deficit occurs. Equilibrium concentration of dissolved oxygen for the fresh water is as follows:

Temp, ^{0}C	18	20	22	23	24	25	26
C_s (mg/l)	9.54	9.17	8.99	8.83	8.53	8.38	8.22

[8]

Q3. Explain in step-wise manner the 'Standard Operating Policy' of a reservoir with the help of the plot between Release and Water Available. Write all the equations and corresponding conditions when the evaporation loss is included. A reservoir with a capacity K = 370 units and an initial storage of 220 units. Inflow, demand and evaporation are known values (given in Table below) for a year. Compute the release, storage and spill for all 12 months. [2.5+3]

Table: Properties of the reservoir

Qt, Inflow	Dt, Demand	Et, Evaporation
71	52	10
412	128	8
349	128	8
142	65	8
104	27	6
45	204	6
19	204	5
14	180	5
11	90	6
9	0	8
10	0	8
18	0	10

Q4. Three crops are to be grown in an available land area of 250 hectare (ha) in a particular season. Gross benefits from each of the crops per hectare are Rs. 2000, Rs 2500, Rs 1000 respectively. Total available water from surface and ground water sources is 4 ha-m. Crops water requirements for each crop per hectare are 3 cm, 2 cm and 1 cm respectively. Cost of seeds and fertilizer per hectare is Rs. 400, Rs. 500 and Rs. 200 respectively. Water charges per hectare are Rs. 200, Rs. 120 and Rs. 140 respectively. Land preparation and other charges per hectare are Rs 100, Rs 150 and Rs 125. Based on demography considerations, lower and upper limits for each of the crops are fixed as 40 and 90 ha; 40 and 100 ha; 45 and 60 ha respectively. Formulate the problem in linear programming framework for maximization of net benefits. [6]

**************************ALL THE BEST***************************