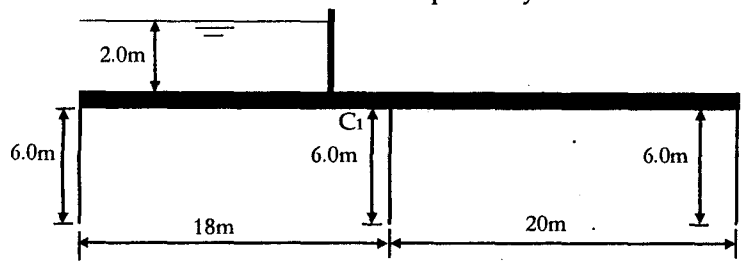
Indian Institute of Engineering Science and Technology, Shibpur
M.E. (Civil) Second Semester Examination, May, 2014
Sub: Irrigation and Water Management (CE-1036)

Time: Three hours **Full Marks: 70**

Answer any four from the following. Figures in the margin indicate full marks. Two marks are reserved for neatness.

1. An unlined canal in alluvium has annual seepage loss of 2.5 m^3 /s per 10^6 m^2 of wetted perimeter. The canal has a wetted perimeter of 30m and has annual maintenance cost of Rs. 0.4/m^2 of wetted perimeter. Due to scarcity of water the canal is to be lined with 12mm thick cement concrete lining that is expected to reduce the annual seepage loss to 0.025 m^3 /s per 10^6 m^2 of wetted perimeter. The lined canal will have a wetted perimeter of 20m. The extra cost of lining works out to be Rs. 30/m^2. If the average annual revenue per m^3/s of water is Rs. 7 lakhs, and the percentage reduction in annual maintenance cost is 40%, decide whether it is economically feasible to provide canal lining. Assume the life of canal lining as 50 years and the interest rate is 8.5% per anum. (17)

2. Using Khosla's method obtain the residual seepage pressure at point C_1 for the weir profile shown below. Apply correction for mutual interference of piles only. Also determine the exit gradient. (17)



3. Determine the HGL diagram for the weir profile shown in Question 2. using Bligh's Creep theory. Also determine the required thicknesses i) at a section immediately downstream of the gate, and ii) at a section immediately downstream of the intermediate pile. Assume specific Gravity of the floor material $G = 2.24$. (17)

4. a) The Gross Command Area (GCA) for an irrigation canal is 25000 hectares out of which 70% is Culturable Command Area (CCA). The intensity of irrigation is 40% for Rabi and 10% for Kharif. If kor period is 4 weeks for Rabi and 2.5 weeks for Kharif, determine the outlet discharge. Outlet factors for Rabi and Kharif may be assumed as 2000 hectares/cumec and 800 hectares/cumec. Also calculate delta for each case. (8)

b) The table below indicates necessary data about the crop, duty of water and the area under each crop commanded by a canal taking off from a storage reservoir. Assuming a time factor for the canal as (12/20), calculate the discharge required at the head of the canal. If the capacity factor is 0.8, determine the design discharge. (9)

Crop	Base Period (days)	Area (ha)	Duty at the head of the canal (ha/cumec)
Sugarcane	320	800	590
Overlap for sugar cane	90	200	590
Wheat (Rabi)	120	800	1500
Bajra (Kharif)	120	750	2000
Vegetables (hot weather)	120	350	500

5. a) Design an irrigation canal carrying a discharge of 25 m^3 /s with critical velocity ratio m and Manning's n equal to 1.1 and 0.0225 respectively. Assume bed slope as 1 in 4500 and side slopes as 1H : 2V. (9)

b) Design an irrigation canal to carry a discharge of 20 m^3 /s. Assume Manning's $n = 0.0225$, critical velocity ratio $m = 1.1$ and $B/D = 6.0$. (8)

6. a) Using Lacey's method, design an irrigation canal in alluvial soil with silt factor $f = 0.9$, to carry a discharge of 20 m^3 /s. Assume side slopes as 1H : 2V. (9)

b) Design a trapezoidal shaped concrete lined canal to carry a discharge of 180 m^3/s at a slope of 30 cm/km. The side slopes of the channel are 1.5(H):1(V) and. Assume Manning's n as 0.017 and limiting velocity as 2 m/s. (8)