Bengal Engineering and Science University, Shibpur

M.E. (Civil) 2nd Semester Examination, 2013

Sub: Irrigation and Water Use Management (CE-1036)

Time: Three Hours | Full Marks: 70

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

---

1. a) Design an unlined irrigation canal to carry a discharge of 20 m^3/s. Provide a bed slope of 1 in 5000 and side slopes of 1H : 2V. Assume critical velocity ratio m as 1.1 and Manning's n as 0.025. (9)

   b) A minor irrigation canal has to carry a discharge of 5 m^3/s. Design the section and the required bed slope, assuming Manning's n as 0.0225, critical velocity ratio m as 1 and B/D ratio as 3.25. (8)

2. a) Using Lacey's method, design an irrigation canal in alluvial soil with silt factor f = 0.95 to carry a discharge of 12 m^3/s. Assume side slopes as 1H: 2V. (10)

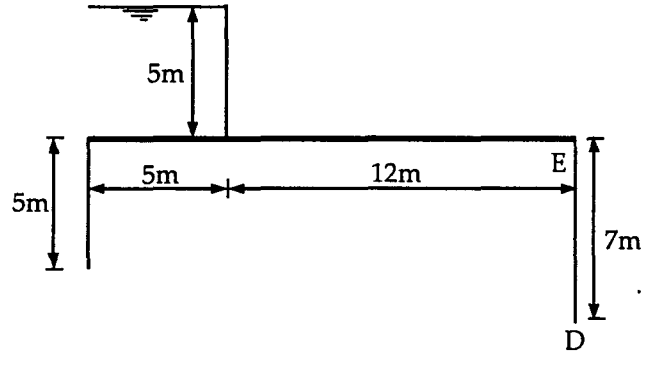
   b) The bed slope of a canal in alluvium is 1 in 4500. If Lacey's silt factor f is 0.95 and the side slope of the canal section is 1H : 2V, determine the canal section and the maximum possible discharge through it. (7)

3. An unlined canal in alluvial soil has annual seepage loss of 2 m^3 /s per 10^6 m^2 of wetted perimeter. The canal has a wetted perimeter of 25m and has annual maintenance cost of Rs. 0.3/m^2 of wetted perimeter. There is a huge scarcity of water in the area and as such the canal is to be lined with 12mm thick cement concrete lining, so as 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. 25/m^2. If the average annual revenue per m^3/s of water is Rs. 6 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 7% per anum. (17)

4. a) Draw a neat sketch of a trapezoidal, lined canal section as per IS: 10430-1982. (5)

   b) i) Design a trapezoidal shaped concrete lined canal to carry a discharge of 200 m^3/s at a slope of 0.30m/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. ii) If the B/D ratio is to be limited to 6.0 only, re-design the section and find the limiting velocity. (12)

5. The following figure shows the section of a weir on permeable foundation. Determine the residual pressure at point E using a) Bligh's Creep Theory and b) Khosla's method of independent variables (correction for mutual interference of piles only). Also find the value of exit gradient as per Khosla's method. (17)



6. a) Calculate the frequency of irrigation water to be applied to ensure healthy growth of crops if i) Field capacity = 29%, ii) Permanent wilting point = 11%, iii) Density of soil = 1300 kg/m^3, iv) Effective depth of root zone = 700 mm, and v) Daily consumptive use for the crop = 12 mm. For healthy growth, moisture content must not fall below 25% of the water holding capacity between the field capacity and permanent wilting point. (9)

   b) Define *duty* and *delta*. Derive the relationship between duty, delta and base period of a crop.

   c) The CCA of a canal is 1000 hectares. Intensity of irrigation for wheat is 45% and for rice is 30%. Wheat has a *kor* period of 25 days and rice has a *kor* period of 20 days. Determine the outlet discharge. Outlet factors for wheat and rice may be assumed as 1600 ha/cumec and 800 ha/cumec. Also calculate *delta* for each crop.