Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 170602 **Date: 31/12/2012**

Subject Name: Irrigation Engineering

Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define 'Irrigation'. State the advantages and ill-effects of irrigation. **04**

(b) Explain 'Duty' and 'Delta'. Obtain the relationship between them. **05**

(c) Explain: Frequency of irrigation. **05**

Calculate the frequency of irrigation for a crop, to ensure the optimum growth, for the following data:

Field Capacity = 33% , Permanent wilting point = 13%

Relative density of soil = 1.2, Root zone depth of crop = 95 cm

Daily consumptive use of water = 10 mm

Assume the optimum soil moisture as 80% of the available moisture.

Q.2 **(a)** Enlist different methods of irrigation. Explain, with neat sketch, 'Furrow method'. What are the factors which decide the spacing between the furrows? **07**

(b) Distinguish, clearly, between Application efficiency and Storage efficiency. State the measures to improve the water application efficiency. **07**

Determine the water distribution efficiency in a 180m long border strip when the soil sampling after irrigation at 30m interval along the water run showed the effective depths of water penetration (in cm) as 120, 120, 112, 108, 107 and 105.

OR

(b) Explain: Kor watering, Time factor. **07**

An irrigation canal has a gross command area of 50000 ha, 10% of it being unculturable. Calculate the design discharge of the canal for the following data:

Sr. No.	Crop	Intensity of irrigation	Duty at outlet (ha/cumec)	Crop season
1	Paddy	40%	850	Kharif
2	Bajra	20%	1800	Kharif
3	Wheat	50%	1200	Rabi
4	Vegetables	40%	750	HW
5	Sugarcane	20%	700	Perennial

Take time factor = 0.8, capacity factor = 0.75 and canal losses = 20%.

Q.3 **(a)** Discuss, in brief, Kennedy's silt theory for the design of unlined channel. Explain 'regime channel' and state different regime conditions. Given the Lacey's regime equations, obtain the relation between wetted perimeter (P) and discharge (Q). **07**

(b) What are the advantages and disadvantages of canal lining? **07**

Design a trapezoidal concrete lined channel to carry a discharge of 200 cumecs for the longitudinal slope 1/5000 and side slopes 1.25:1. Assume the limiting velocity of flow = 2 m/s and Manning's coefficient N = 0.014.

OR

Q.3 **(a)** Explain water-logging. What are the causes of water-logging? Discuss, in detail, the precautionary measures for water-logging. **07**

(b) Sketch the typical cross section of an irrigation channel flowing fully in filling and show on it different component parts of the channel. **07**
Design a regime channel to carry a discharge of 40 cumecs, if side slopes are at 0.5:1 and Lacey's silt factor f = 0.95.

Q.4 **(a)** What is Diversion headwork? Sketch typical layout of a diversion headwork scheme and explain the importance of the scouring sluices. **05**

(b) The profile of a concrete slope weir is as shown in Fig.(1). Using Khosla's theory, check the safety of the weir against piping. Also, calculate the uplift pressure heads at the key points and check the safety of the weir against uplift at the toe of the downstream glacis. The thickness of the concrete floor at upstream sheet pile is 1m, at the intermediate sheet pile is 2m and at the downstream sheet pile is 1m. Consider the case of no flow at pond level, safe exit gradient G_E = 1/7, relative density of concrete S = 2.4 and slope correction factor for 3:1 slope = 4.5. **09**

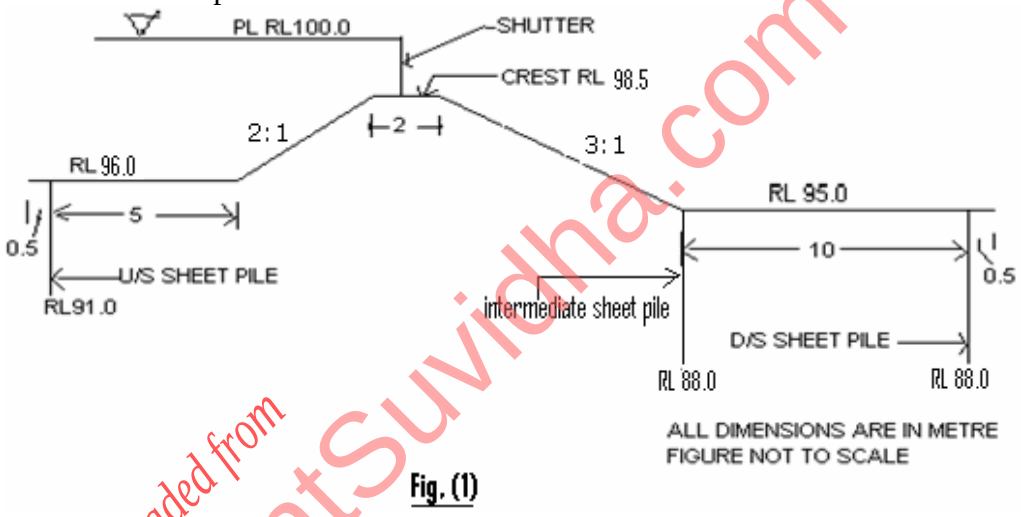

Fig. (1)

OR

Q.4 **(a)** Explain clearly, the following terms in context of diversion headwork: **08**
Creep length, Barrage, Percolation coefficient, Bed retrogession.

Q.4 **(b)** Distinguish between 'exit gradient' and 'safe exit gradient'. **06**
The depth of the downstream sheet pile of a concrete slope weir is 8 m. If the safe exit gradient is 1/6, what should be the minimum length (b) of the impervious concrete floor required for the seepage head of 6 m?

Q.5 **(a)** Explain different types of Aqueduct and discuss the factors affecting the selection of a suitable type of aqueduct. **05**

(b) Sketch the section (along the drain) of a siphon aqueduct. What are the different forces likely to act on the bottom of the canal trough? **05**

(c) Discuss: Surplus water escape is the safety valve in a canal system. **04**

OR

Q.5 **(a)** Explain the importance of channel transition in a Cross drainage work. Also, design a contraction transition for a 24m wide canal with 50% fluming. Use Mitra's method for the design of the transition. **04**

(b) Explain the necessity of canal fall in a canal system. Why is the 'Cistern' provided below the canal fall? **04**

(c) Explain the importance of the following in the canal regulation works: **06**
Cross regulator, King's vanes, Bed bars

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