IRRIGATION ENGINEERING
(CIVL 4145)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Which type of irrigation system involves diversion headworks?
(a) Direct irrigation (b) Flow irrigation
(c) Innundation irrigation (d) Storage irrigation

(ii) Flow irrigation is most suitable in
(a) Undulating terrain (b) Flat and alluvial plains
(c) Steep slopes (d) Rocky lands

(iii) If rice requires about 10 cm depth of water at an average interval of about 10 days, and the crop period for rice is 120 days, find out the delta for rice.
(a) 130 cm (b) 120 cm (c) 150 cm (d) 100 cm

(iv) When a canal runs for 7 days out of 14 days of watering period, the time factor is
(a)14/7 (b)1/3 (c)7/14 (d)1/14

(v) For most crops, the Kor period varies between
(a) 1 and 4 weeks (b) 2 and 4 weeks
(c) 1 and 3 weeks (d) 2 and 6 weeks

(vi) The base period of wheat crop is 120 days, and duty at field is 1800 hectares/cumec. What is the delta?
(a) 0.576 m (b) 0.864 m (c) 1.2 m (d) 1.44 m

(vii) For a discharge of 100 cumec and flow depth of 5 m in a rectangular channel, the width as per Lacey's theory would be
(a) 47.5 m (b) 37.5 m (c) 20 m (d)10 m

(viii) The hydraulic radius of an economical rectangular open channel section having depth 20 m is
(a) 10 m (b) 5 m (c) 6.5 m (d) 15 m

(ix) According to Lacey's theory, the relation between mean velocity and hydraulic radius

(a) $V = \sqrt{\frac{2}{5}fR}$ (b) $V = \sqrt{\frac{1}{5}fR}$

(c) $V = \sqrt{\frac{5}{2}fR}$ (d) $V = \sqrt{\frac{1}{3}fR}$

(x) Kennedy selects _____ formula for designing irrigation channel.

(a) Manning's formula (b) Chezy's formula

(c) Kutter's formula (d) Bazin's formula

Fill in the blanks with the correct word

(xi) Area irrigated per unit discharge of water is known as _____.

(xii) Hydraulic slope is defined as the ratio of vertical drop of channel to the _____.

(xiii) The velocity of flow is maximum when hydraulic radius is _____.

(xiv) The side slope of canal in alluvial soil is assumed as _____ when the canal has run for some time.

(xv) A _____ canal is constructed to feed water to another canal.

Group - B

2. (a) Short note on (*i*) Surface irrigation; (*ii*) Border irrigation. *[(CO2)(Remember/LOCQ)]*

(b) What is meant by sub-surface irrigation? What are the different types of sub-surface irrigation? *[(CO1)(Remember/LOCQ)]*

8 + 4 = 12

3. (a) Short note on irrigation scheduling. *[(CO2)(Remember/LOCQ)]*

(b) Define Sprinkler irrigation. Explain the suitability and limitation of Sprinkler irrigation method. *[(CO3)(Remember/LOCQ)]*

(c) Differentiate between inundation and perennial irrigation? *[(CO2)(Remember/LOCQ)]*

3 + 6 + 3 = 12

Group - C

4. (a) Calculate conveyance efficiency of a well if the quantity of water pumped into a field is 2 cumecs. 1.6 cumecs is turned out to another field at a distance of 1 km from the well. *[(CO3)(Analyse/HOCQ)]*

(b) Explain the various factors affecting the duty of water? *[(CO4)(Remember/LOCQ)]*

(c) An irrigation canal has a GCA of 80000 ha out of which 85% is culturable area. The intensity of irrigation for Kharif season is 30% and for Rabi season 60%. Find the discharge required at the head of the canal if the Duty at its head is 800 ha/cumec for Kharif season and 1700 ha/cumec for Rabi season. *[(CO2)(Apply/IOCQ)]*

3 + 5 + 4 = 12

5. (a) The CCA for a distributary is 18000hactares. The intensity of irrigation for for wheat is 25% and for rice is 65%. If the total water requirements of the two crops are 45cm and 125cm and their periods of growth are 140 days and 105 days respectively. (i) Determine the outlet discharge from the average demand considerations (ii) Also determine the peak demand discharge, assuming that the kor water depths for crops are 10cm and 20cm. And their kor periods are 5 weeks and 3 weeks respectively. *[(CO3)(Analyse/HOCQ)]*

(b) A watercourse has a culturable command area of 1600 ha, out of which the intensities of irrigation for perennial sugarcane and rice crops are 30% and 50%, respectively. The Duty for these crops at the head of the watercourse is 550 ha/cumec and 1500 ha/cumec, respectively. Find the discharge required at the head of watercourse if the peak demand is 10% higher than the average requirement. *[(CO2)(Apply/IOCQ)]*

7 + 5 = 12

Group - D

6. (a) A power canal of trapezoidal section has to be excavated through hard clay at the least cost. Determine the dimensions of the channel given, discharge equal to 14 m^3/s, bed slope 1/2500, Manning's n = 0.02. *[(CO4)(Analyse/HOCQ)]*

(b) What are the advantages and disadvantages of canal irrigation? *[(CO3)(Remember/LOCQ)]*

8 + 4 = 12

7. (a) A channel is designed to carry a discharge of 20 m3/s with Manning's n = 0.015 and bed slope of 1 in 1000 (for trapezoidal channel side slope m = 1√3). Find the channel dimensions of the most efficient section if the channel is trapezoidal. *[(CO4)(Analyse/HOCQ)]*

(b) The bed width of a right-angled triangular channel section is 40 m and the side slope is 2 horizontal to 1 vertical. The discharge in the canal is 60 cumecs. The Manning's n is 0.015 and the bed slope is 1 in 5000. Determine the normal depth? *[(CO4)(Analyse/HOCQ)]*

6 + 6 = 12

Group - E

8. (a) Design an irrigation channel on Kennedy's theory to carry a discharge of 45 cumecs. Take Maning's n =0.0225 and m = 1.05, Bed slope = 1 in 5000. *[(CO6)(Analyse/HOCQ)]*

(b) How canals are classified based on size? Define them. *[(CO6)(Remember/LOCQ)]*

8 + 4 = 12

9. (a) Differentiate between Kennedy's theory and Lacey's theory. *[(CO5)(Remember/LOCQ)]*

(b) Short note on: Design of alluvial and non-alluvial channels. *[(CO5)(Remember/LOCQ)]*

(c) How canals are classified based on size and financial returns? *[(CO5)(Apply/IOCQ)]*

5 + 5 + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	51.04	9.38	39.58