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 is more suitable for permeable soil for large stream discharge?
(a) Check flooding (b) Free flooding
(c) Check basin (d) Furrow irrigation.

(ii) The total area of land that is commanded by a particular irrigation project is known as
(a) CCA (b) GCA
(c) Culturable Cultivated Area (d) Culturable Uncultivated Area

(iii) If wheat requires about 7.5 cm of water after every 28 days, and the base period for wheat is 140 days, find out the value of delta for wheat.
(a) 22.5 cm (b) 27.5 cm (c) 37.5 cm (d) 47.5 cm

(iv) Time period between first watering at the time of sowing to the last watering upto harvest is called
(a) crop period (b) base period
(c) sow period (d) kor period.

(v) For the lined channels a trapezoidal section is adopted when a discharge
(a) greater than 100 cumecs (b) greater than 85 cumecs
(c) less than 85 cumecs (d) less than 100 cumecs

(vi) 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

(vii) If a stream is carrying a discharge of 5 cumec/m width having silt factor of 3.0, then Lacey's scour
(a) 1.72 m (b) 2.72 m (c) 20.54 m (d) 31.23 m

(viii) The discharge of a channel, if the bed slope is 1 in 5800 and the average particle size is 0.323 mm is

(a) 43 cumecs (b) 27.67 cumecs
(c) 25 cumecs (d) 17.67 cumecs.

(ix) The structure that is provided when the canal bed level is higher than the HFL of the drainage is

(a) Aqueduct (b) Syphon Aqueduct
(c) Canal Syphon (d) Super passage

(x) According to Lacey, "silt factor" (*f*) is related to mean diameter of the bed material, *m* as

(a) $f = 1.76\sqrt{m}$ (b) $f = 1.56\sqrt{m}$
(c) $f = 1.26\sqrt{m}$ (d) $f = 1.16\sqrt{m}$.

Fill in the blanks with the correct word

(xi) A _____ canal is constructed to protect the areas most prone to famines.

(xii) Lacey gave wetted regime perimeter equation as, *P* = _____.

(xiii) _____ is the ratio of areas under different crops to be irrigated during a year.

(xiv) When a canal runs for 7 days out of 14 days of watering period, the time factor is _____ .

(xv) The canal which is aligned along a watershed (or ridge) is called a _____ canal.

Group - B

2. (a) What are the different types of tanks used in tank irrigation? Differentiate between them. *[(CO4)(Remember/LOCQ)]*

(b) Differentiate between flow and lift irrigation. *[(CO4)(Remember/LOCQ)]*

(c) Short note on Furrow irrigation with advantages and disadvantages. *[(CO4)(Remember/IOCQ)]*

3 + 5 + 4 = 12

3. (a) Explain the suitability and limitations of surface irrigation methods. *[(CO2)(Remember/LOCQ)]*

(b) Differentiate between surface and sub-surface irrigation methods. *[(CO2)(Remember/LOCQ)]*

6 + 6 = 12

Group - C

4. (a) The intensity of irrigation for Kharif season is 50 % for an irrigation project with CCA of 50,000 ha and duty is 1000 ha/cumecs. Determine the required discharge at the head of the canal if transmission loss is 10%. *[(CO3)(Analyse/HOCQ)]*

(b) The transplantation of rice requires 10 days and total depth of water required during transplantation is 48 cm. During transplantation, there is an effective rainfall (useful for irrigation) of 8 cm. Calculate the duty of irrigation water (in hectares/cumec). *[(CO2)(Apply/IOCQ)]*

(c) Define crop ratio and evapotranspiration. *[(CO4)(Remember/LOCQ)]*

6 + 3 + 3 = 12

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

Crop	Base period (days)	Area (hectares)	Duty of water at the head of thecanal
Sugarcane	320	900	580
Overlap for sugercane in hot weather	90	150	580
Wheat (Rabi)	120	750	1600
Bajra (Kharif)	120	600	2000
Vegetables (hot weather)	120	320	600

[(CO3)(Analyse/HOCQ)]

(b) The CCA for a distributary is 16000hactares. The intensity of irrigation for wheat is 45% and for rice is 25%. If the total water requirements of the two crops are 37cm and 122cm and their periods of growth are 160 days and 135 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 14cm and 19cm. And their kor periods are 4weeks and 2 weeks respectively. *[(CO3)(Analyse/HOCQ)]*

6 + 6 = 12

Group - D

6. (a) Determine the most economical section of rectangular channel carrying water at the rate of 0.6 cumecs. The bed slope is 1 in 2000. Assume Chezy's constant $C = 50$. *[(CO4)(Apply/IOCQ)]*

(b) The bed width of a trapezoidal 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

7. (a) A V – shaped open channel of included angle 90° conveys a discharge of 0.05 m^3/s when the depth of flow at the center is 0.225 m. Assuming that $C = 50$ in the Chezy's equation, calculate the slope of the channel. *[(CO4)(Analyse/HOCQ)]*

(b) A rectangular flume of width 600 mm and depth 300 mm is carrying a uniform discharge of 100 lt/s. Find the bottom slope if Chezy's constant $C = 56$. Also calculate conveyance, K of the flume. *[(CO4)(Apply/IOCQ)]*

6 + 6 = 12

Group - E

8. (a) Design a channel section with following data: Q = 30 cumecs; f=1; Side slope S=1/2:1. Also find the longitudinal slope. Use Lacey's theory. *[(CO6)(Analyse/HOCQ)]*

(b) How canals are classified based on alignment? Define them. *[(CO5)(Remember/LOCQ)]*

8 + 4 = 12

9. (a) Design an irrigation channel on Kennedy's theory to carry a discharge of 50 cumecs. Take Maning's N =0.02 and m = 2, Bed slope = 1 in 3000.

[(CO6)(Analyse/HOCQ)]

(b) How canals are classified based on canal surface? Define them.

[(CO5)(Remember/LOCQ)]

8 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	32.28	19.8	47.91