

**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) The maximum recommended furrow slope to avoid soil erosion is  
(a) 0.01% (b) 0.04%  
(c) 0.1% (d) 0.5%.
- (ii) What is the relation between CIR, NIR, FIR and GIR?  
(a) CIR>FIR>GIR>NIR (b) CIR>GIR>FIR>NIR  
(c) GIR>FIR>CIR>NIR (d) GIR>FIR>NIR>CIR.
- (iii) Water is released at the rate of 12 cumec at the head of a canal. If duty at the field is 1250 hectares/cumec and loss of water in transit is 25%, find the area of the land that can be irrigated.  
(a) 11250 ha (b) 112500 ha  
(c) 1.125 ha (d) 11.25 ha.
- (iv) A crop needs 3 cumecs of water for irrigating 5100 ha of land up to 10 cm depth. Total 12 watering at an interval of 10 days are needed. Determine duty and delta.  
(a) 15000 ha/cumec, 10 cm (b) 17000 ha/cumec, 110 cm  
(c) 1700 ha/cumec, 120 cm (d) 1500 ha/cumec, 100 cm.
- (v) Diversion techniques come under which type of irrigation system?  
(a) Direct irrigation (b) Flow irrigation  
(c) Innundation irrigation (d) Storage irrigation.
- (vi) Water application efficiency is defined as  
(a)  $\frac{W_f}{W_r} \times 100$  (b)  $\frac{W_s}{W_n} \times 100$   
(c)  $\frac{W_u}{W_f} \times 100$  (d)  $\frac{W_s}{W_r} \times 100$
- (vii) Time duration between first watering during sowing and last watering during harvest is known as  
(a) Base period (b) Sow period  
(c) Kor period (d) Yield period.

- (viii) In an irrigation project, in a certain year, 60% and 46% of CCA of Kharif and Rabi respectively remained without water and remaining area got water. Determine the intensity of irrigation in that year of the project?  
 (a) 54% (b) 106% (c) 94% (d) 40%.
- (ix) The area of a land that has the potential for cultivation but is not being utilized for crop production is known as  
 (a) CCA (b) GCA  
 (c) Culturable Cultivated Area (d) Culturable Uncultivated Area.
- (x) Trickle irrigation is also known as  
 (a) Basin irrigation (b) Uncontrolled irrigation  
 (c) Drip irrigation (d) Controlled irrigation.

*Fill in the blanks with the correct word*

- (xi) Area irrigated per unit discharge of water is known as \_\_\_\_\_.
- (xii) The ratio of area irrigated in Rabi season to area irrigated in Kharif season is known as \_\_\_\_\_.
- (xiii) Hydraulic slope is defined as the ratio of vertical drop of channel to the \_\_\_\_\_.
- (xiv) The velocity of flow is maximum when hydraulic radius is \_\_\_\_\_.
- (xv) For filling canals, the side slope varies between \_\_\_\_\_.

### **Group - B**

2. (a) Discuss the benefits and ill-effects of irrigation. [[CO1](Remember/LOCQ)]  
 (b) Short note on Furrow irrigation and Basin irrigation. [[CO3](Remember/LOCQ)]  
**6 + 6 = 12**
3. (a) Discuss about the Canal irrigation and Drip irrigation methods explaining their merits and demerits. [[CO3](Remember/LOCQ)]  
 (b) Discuss about the various types of flow irrigation. [[CO1](Remember/LOCQ)]  
**8 + 4 = 12**

### **Group - C**

4. (a) A water course commands an irrigated area of 1000 hectares. The intensity of irrigation of rice in this area is 70%. The transplantation of rice crop takes 15 days and during the transplantation period the total depth of water required by the crop on this field is 500 mm. During the transplantation period, the useful rain falling on the field is 120 mm. Find the duty of irrigation water for the crop on the field during transplantaion, at the head of the field and at the head of the water course assuming losses of water to be 20% in the water course. Also calculate the discharge required at the water course. [[CO4](Analyse/HOCQ)]  
 (b) The culturable commanded area for a distributary is  $3 \times 10^8$  m<sup>2</sup>. The intensity of irrigation for a crop is 42%. If kor water depth and Kor period for the crop are 12 cm and weeks, respectively. Determine the peak demand discharge. [[CO2](Analyse/HOCQ)]

- (c) For a culturable command area of 1000 hectares with the intensity of irrigation of 50%, the duty on the field for a certain crop is 2000 hectares/cumec. What is the discharge required at the head of the watercourse with 25% losses of water?  
 [[CO2](Analyse/HOCQ)]  
**5 + 3 + 4 = 12**
5. (a) The CCA for a distributary is 16000 hectares. The intensity of irrigation for wheat is 45% and for rice is 25%. If the total water requirements of the two crops are 37 cm and 122 cm 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 14 cm and 19 cm. And their kor periods are 4 weeks and 2 weeks respectively.  
 [[CO4](Apply/IOCQ)]
- (b) For a culturable command area of 1000 hectares with the intensity of irrigation of 50%, the duty on the field for a certain crop is 2000 hectares/cumec. What is the discharge required at the head of the watercourse with 25% losses of water?  
 [[CO2](Analyse/HOCQ)]
- (c) Define consumptive and net irrigation requirement. What do you mean by water conveyance and application efficiency?  
 [[CO1](Analyse/HOCQ)]  
**6 + 2 + 4 = 12**

### Group - D

6. (a) Discuss about the various components in the distribution network of the canal irrigation system.  
 [[CO6](Remember/LOCQ)]
- (b) Explain in brief the advantages and disadvantages of canal irrigation system.  
 [[CO6](Remember/LOCQ)]  
**6 + 6 = 12**
7. (a) Calculate the dimensions of the rectangular cross-section of an open channel which requires minimum area to convey 10 m<sup>3</sup>/s. The slope being 1 in 1500. Take the Manning's n as 0.013.  
 [[CO3](Analyse/HOCQ)]
- (b) What are the different types of channel losses? Discuss in detail.  
 [[CO5](Remember/LOCQ)]  
**5 + 7 = 12**

### Group - E

8. (a) Design an irrigation channel on Kennedy's theory to carry a discharge of 45 cumecs. Take N = 0.0225 and m = 1.05, Bed slope = 1 in 5000.  
 [[CO6](Apply/IOCQ)]
- (b) Short note on Lacey's theory.  
 [[CO5](Remember/LOCQ)]  
**8 + 4 = 12**
9. (a) Discuss about various drawbacks of Kennedy's theory and Lacey's theory.  
 [[CO6](Remember/LOCQ)]
- (b) Discuss about various components parts of a canal with figure.  
 [[CO5](Remember/LOCQ)]  
**8 + 4 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	61.46	14.58	23.96

**Course Outcome (CO):**

After the completion of the course students will be able to

1. Develop the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth.
2. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service-oriented approach.
4. Know the basic requirements of irrigation and various irrigation techniques, requirements of the Crops
5. Understand the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.
6. Explain the distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design.

*\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*