

M.E. (Water Resources & Hydraulic Engineering), Examination 2025

(1st Semester)

IRRIGATION AND AGRONOMY

(Program Elective 3)

Time : Three Hours

Full Marks : 100

Part – I carries 70 marks and Part – II carries 30 marks.

Part - IAnswer any *five* questions from Part - I.

1. a) What are the benefits, disadvantages and ill effects of irrigation?
 b) Why is the need for irrigation unavoidable?
 c) What are the agricultural aspects of irrigation?
 d) What are the basic and supportive requirements of agricultural production?

6+3+2+3 = 14

2. a) Differentiate between storage irrigation and indirect irrigation.
 b) Using which methods lifting of irrigation water are done?
 c) Define irrigation efficiency.
 d) What do you mean by suitability of water for irrigation of soil.
 e) Differentiate between capillary and hygroscopic water.
 f) Is there any relation between percolation and surface runoff.

2+2+2+3+4+1 = 14

3. a) How will you classify irrigation projects based on i) type of flow, ii) scope and purpose of the project, iii) the function served, and iv) financial returns?
 b) In preparation of a sound and economical irrigation project, which points are to be addressed in the appendix?
 c) Define GCA, CCA and intensity of irrigation.
 d) Name two kharif, two rabi and two overlapping crops.

6+2+3+3 = 14

4. a) Why are excessive K, Mg, Ca harmful to the crops?
 b) How will you estimate Cu?
 c) Define PWP and field capacity.
 d) Prove that the depth of water stored in the root zone in filling the soil upto field capacity is given by $Ad\gamma_s F_c / \gamma_w$ (in meters). Assume that the area of the soil is A m², depth of the root zone is d meters, unit weight of soil = γ_s kg/m³, and field capacity of the soil is F_c .

2+4+3+5 = 14

[Turn over

5. a) The base period, intensity of irrigation and duty of water of various crops under a canal system are given in the table below. Find the reservoir capacity if the canal losses are 18% and reservoir losses are 15%. The total gross command area is 24,000 hectares.

Crop	Base Period (Days)	Intensity of Irrigation (%)	Duty at the field (ha/cum)	Area under the crop (ha)
Wheat	130	25	1950	5000
Sugar Cane	360	30	720	6000
Cotton	180	14	1630	3000
Rice	120	20	750	4000
Vegetables	110	11	710	2000

- b) Compare the duties of the following two irrigation systems and state which one is more economical. It is given that CCA is 80% of the GCA.

Data	1 st System	2 nd System
GCA	3000 ha	800 ha
Intensity of irrigation	50%	70%
Base Period	130 days	120 days
Mean Discharge (Q)	4 cumec	2 cumec

9+5 = 14

6. a) What are the advantages and disadvantages of the float method? State the precautions to be taken during the measurement.
 b) What are the advantages and disadvantages of Parshall flume in flow measurement?
 c) A soil core was drawn with a core sampler having an inside dimension of 4.9 cm diameter and 15.1 cm length from a field two days after irrigation when the soil water was near field capacity. The weight of the core sampler with fresh soil sample was 1.951 kg and the weight of the same on oven drying was 1.842 kg. The empty core sampler weighed 1.403 kg. Calculate the (i) bulk density of soil, (b) water holding capacity of soil in percent on a volume basis and (c) depth of water held per meter depth of soil.

4+5+5 = 14

7. a) Differentiate between duty, full supply coefficient and nominal duty.
 b) What are the causes of salt efflorescence?
 c) Explain the remedial measures for prevention of water logging.
 d) What is meant by Leaching Requirement (L.R.) of a soil?

4+2+4+4 = 14

8. a) What do you mean by soil separates?
 b) Explain columnar, platy and prismatic soil structures with neat sketches.
 c) What is true density?
 d) Calculate the (i) bulk density, (ii) mass wetness and (iii) volume wetness of soil when a soil core of 4.356 cm diameter and 6.534 cm length weighs 1354.634 gm immediately after sampling and 965.346 gm after oven drying at 105.0 °C.

2+6+1+5 = 14

Part – II

Answer any **three** questions from Part - II.

9. a) Define the term Agronomy.
b) What are the broad classifications of crops?
c) Name two of each positively and negatively charged ions that are either attracted to the soil colloids or remain in the soil solution.
3+5+2 = 10
10. a) What are the factors for choosing drip and sprinkler irrigation systems?
b) What is the water requirement of a crop?
c) What are the factors that are considered for determining the water requirement of crops?
4+2+4 = 10
11. a) What role does soil type play in determining the appropriate drainage system?
b) Write a short note on the following
 i) Causes of Water logging, ii) Tensiometer
c) Give two examples of each cereal and oil seed crop.
3+3+4 = 10
12. a) Define soil structure and soil texture.
b) Which are the forms by which water is held in soil?
c) What are the key factors to consider before applying fertilizers through a drip irrigation system?
3+3+4 = 10
13. a) How does soil texture affect moisture retention?
b) What is the Soil-Plant-Atmosphere Continuum (SPAC)?
4+6 = 10