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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2023

CIVIL ENGINEERING
VII Semester
CE 5701 – Irrigation Engineering
(Regulation 2019)

Time: 3 hrs

Max. Marks: 100

CO 1	Describe the National Water Policy structure and soil plant water characteristics.
CO 2	Describe the basics of requirements and estimation of crop water.
CO 3	Design the various types of hydraulic structure including dams, spillways and dissipaters.
CO 4	Design the components of irrigation canal including canal drops and cross drainage works.
CO 5	Apply the concepts of Irrigation water management, Water Users' Association for participatory irrigation management.

BL – Bloom's Taxonomy Levels

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL																
1	Find out the water holding capacity of the soil in cm in a 45 cm soil profile. <table border="1" style="margin-left: 20px;"> <tr> <td>Soil Depth (cm)</td> <td>FC (%)</td> <td>PWP (%)</td> <td>Bulk Density (g/cm³)</td> </tr> <tr> <td>0 – 15</td> <td>25.2</td> <td>12.0</td> <td>1.53</td> </tr> <tr> <td>15 – 30</td> <td>24.8</td> <td>11.5</td> <td>1.55</td> </tr> <tr> <td>30 – 45</td> <td>23.4</td> <td>11.3</td> <td>1.56</td> </tr> </table>	Soil Depth (cm)	FC (%)	PWP (%)	Bulk Density (g/cm ³)	0 – 15	25.2	12.0	1.53	15 – 30	24.8	11.5	1.55	30 – 45	23.4	11.3	1.56	2	CO1	2
Soil Depth (cm)	FC (%)	PWP (%)	Bulk Density (g/cm ³)																	
0 – 15	25.2	12.0	1.53																	
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2	Fit ' <i>furrow irrigation</i> ' in the classification tree, as you classify the irrigation projects based on the way of water application.	2	CO1	1																
3	Write a short note on crop rotation.	2	CO2	2																
4	If $C_u = 13$ cm ; $P_{eff} = 4.5$ cm ; $\eta_a = 0.8$; $\eta_c = 0.8$, calculate CIR, NiR, FIR and GIR.	2	CO2	2																
5	State the advantage of buttress dam over an arch dam.	2	CO3	2																
6	State the purpose of drainage gallery in a dam.	2	CO3	1																
7	How a ridge canal is aligned and state its important advantage.	2	CO4	1																
8	Write a short note on silt factor.	2	CO4	1																
9	List any two advantages of SRI method of cultivation over the conventional flooding method.	2	CO5	1																
10	Differentiate between modernization and rehabilitation of irrigation systems.	2	CO5	2																

PART- B (5 x 13 = 65 Marks)

Q. No.	Questions	Marks	CO	BL
11 (a) (i)	Compare and contrast the following methods of soil moisture measurement with neat schematic sketches: (i) Tensiometric method and (ii) Neutron probe method.	7	CO1	3
(ii)	Analyse the Indian Water Policies 1987, 2002 and 2012. Give any two major gaps identified.	6	CO1	3

OR																															
11 (b) (i)	Bring out the importance of soil water constants in irrigation water application.	7	CO1	3																											
(ii)	Discuss on merits of irrigation.	6	CO1	3																											
12 (a) (i)	Discuss on how the duty can be improved?	7	CO2	4																											
(ii)	The chemical analysis of water sample obtained for a medium depth borewell at a distance of 1.5 km from the seashore is given below: pH = 9.0 Calculate SAR, % Na and RSC. Indicate the classification of irrigation water.	6	CO2	4																											
<table border="1"> <thead> <tr> <th>Constituents</th> <th>Ca</th> <th>Mg</th> <th>Na</th> <th>HCO₃</th> <th>CO₃</th> <th>SO₄</th> <th>Cl</th> <th>K</th> </tr> </thead> <tbody> <tr> <td>Equivalent Weight</td> <td>20.04</td> <td>12.16</td> <td>23</td> <td>61.02</td> <td>30</td> <td>48.03</td> <td>35.46</td> <td>39.1</td> </tr> <tr> <td>Values (mg/l)</td> <td>58</td> <td>15</td> <td>87</td> <td>250</td> <td>26</td> <td>40</td> <td>80</td> <td>0</td> </tr> </tbody> </table>					Constituents	Ca	Mg	Na	HCO ₃	CO ₃	SO ₄	Cl	K	Equivalent Weight	20.04	12.16	23	61.02	30	48.03	35.46	39.1	Values (mg/l)	58	15	87	250	26	40	80	0
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12 (b) (i)	A stream of 150 liters per second was diverted from a canal and 130 liters per second was delivered to the field. An area of 2.1 hectares was irrigated in 8 hours. The effective depth of root zone was 1.4 m. The runoff loss in the field was 375 m ³ . The depth of water penetration varied linearly from 1.9 m at the head end of the field to 1.1 m at the tail end. Available moisture holding capacity of the soil is 21 cm per meter depth of soil. It is required to determine the (i) water conveyance efficiency, (ii) water application efficiency, (iii) water storage efficiency and (iv) water distribution efficiency. Irrigation was started at a moisture extraction level of 50% of the available moisture.	7	CO2	4																											
(ii)	Elaborate on any two direct methods of measurement of consumptive use of water,	6	CO2	4																											
13 (a) (i)	Write notes with neat sketches on: (i) Under sluices (ii) River training works	7	CO3	3																											
(ii)	Explain the failures in Earthen dams with neat sketches.	6	CO3	3																											
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13 (b) (i)	Examine a gravity dam for its stability under the condition, "when the reservoir is empty". Discuss on the forces that influence such a condition.	7	CO3	3																											
(ii)	Explain any two types of spillways with neat sketches.	6	CO3	3																											
14 (a) (i)	Design a canal for the following data. Discharge in the canal 40 cumecs. Side slope is ½ H : 1 V. Assume the silt factor as unity. Calculate the longitudinal slope too.	7	CO4	4																											
(ii)	Explain the types of canal falls with neat sketches bringing out the advantage of each.	6	CO4	3																											
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14 (b) (i)	Draw the schematic diagrams of drip and sprinkler irrigation systems. Bring out the advantages and limitations of each method.	7	CO4	4																											
(ii)	Discuss any two types of surface irrigation methods with neat sketches, bringing out their merits and limitations.	6	CO4	3																											
15 (a)	Discuss on the types of water delivery systems and elaborate any one such with a case study.	13	CO5	4																											



OR

15 (b)	Discuss on the modernization techniques used for improving the irrigation water management.	13	CO5	4
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PART- C (1 x 15 = 15 Marks)
(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL																																			
16.	<p>The base period, area and delta of various crops under a canal irrigation system are given in the table below:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th style="width: 10%;">Sl. No.</th> <th style="width: 15%;">Crop</th> <th style="width: 15%;">Base period (days)</th> <th style="width: 15%;">Area (hectares)</th> <th style="width: 15%;">Duty (ha/cumecs)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Paddy</td> <td style="text-align: center;">130</td> <td style="text-align: center;">3,000</td> <td style="text-align: center;">1,100</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Vegetables</td> <td style="text-align: center;">100</td> <td style="text-align: center;">1,500</td> <td style="text-align: center;">700</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Pulses</td> <td style="text-align: center;">150</td> <td style="text-align: center;">1,000</td> <td style="text-align: center;">2,200</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Sugarcane</td> <td style="text-align: center;">330</td> <td style="text-align: center;">6,000</td> <td style="text-align: center;">800</td> </tr> <tr> <td style="text-align: center;">5</td> <td>Fruits</td> <td style="text-align: center;">100</td> <td style="text-align: center;">1,500</td> <td style="text-align: center;">900</td> </tr> <tr> <td style="text-align: center;">6</td> <td>Cotton</td> <td style="text-align: center;">210</td> <td style="text-align: center;">3,000</td> <td style="text-align: center;">1,200</td> </tr> </tbody> </table>	Sl. No.	Crop	Base period (days)	Area (hectares)	Duty (ha/cumecs)	1	Paddy	130	3,000	1,100	2	Vegetables	100	1,500	700	3	Pulses	150	1,000	2,200	4	Sugarcane	330	6,000	800	5	Fruits	100	1,500	900	6	Cotton	210	3,000	1,200			
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	(i) If reservoir losses are 10% and conveyance losses in the canal system is 35%, find out the reservoir capacity.	8	2	5																																			
	(ii) Suggest the best suited irrigation method from water saving perspective, for each crop and a crop rotation to sustain soil health.	7	2&4	5																																			

