GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170609

Subject Name: Irrigation Engineering
Semester – VII

Type of course: Professional Elective Course

Rationale:
India is an agricultural dominated country. Agricultural production has a substantial contribution in the gross domestic product (GDP). Agricultural production entirely depends upon availability of water for the crops. Mainly water is available naturally in the form of rains or artificially by irrigation to the fields. Non-uniform distribution and inadequate rains in our country give rise to apply water artificially in the form of irrigation. The deliverance of water through surface irrigation system requires understanding of storage works, design of conveyance systems, knowledge of canal regulation devices and canal outlet works. The knowledge of various cross-drainage works falling across the alignment of canal is also required to an irrigation engineer. Information and knowledge about Soil-water relationships, water requirements by various crop is essential for efficient use of irrigation water.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Module 1: Irrigation** Introduction- Definition, Necessity, Scope, Benefits and ill effects of irrigation, Types of irrigation schemes, Social and environmental considerations, Irrigation development and water resources potentials in India. **Water Requirement of Crops-** Methods of irrigation, Various modes of application of irrigation water Crop seasons in India**,** Principal Indian crops Soil-water-plant relation- field capacity, wilting point, available water, Consumptive use and its empirical methods, Irrigation requirements – Net irrigation requirement, Field irrigation requirement, Gross Irrigation requirement, Soil moisture extraction pattern, Frequency of irrigation, Gross command area, Culturable command area, Intensity of irrigation, Duty and delta relation, Irrigation efficiency, assessment of irrigation water	**10**
2	**Module 2: Diversion Works:** Diversion head works, Weir and barrages, Various parts of diversion head works and their functions, Types of weir, Causes of failures of weir on permeable foundations, Principles of weir design on permeable formations -Bligh's creep theory, Lanes weighted creep theory and Khosla's theory, critical gradient**,** Exit gradient, Khosla's method of independent variables, location of hydraulic jump, basic factors for design of weir floor	**15**

	Storage works: **Embankment dam**: Classification of dams, site assessment and selection of type of dam, Environmental impacts of dam, Types of earthen dams, Methods of construction, causes of failures, Seepage in earth dams: Location of phreatic line in earthen dam, Rock-fill dams Gravity dams, Forces acting on a gravity dam, Modes of failure, load combinations for design of gravity dam, and stability analysis and design of gravity dam	
3	**Module 3: Distribution works:** Modes of conveying irrigation water- Types of irrigation canals- contour canal, ridge canal, side sloping canals, canal alignment Method of design of unlined section of irrigation canal, Kennedy's and Lacey's Silt theories, Silting and scouring of canals Canal sections-filling, cutting, partial cutting and partial filling, Balanced depth, Canal FSL, Capacity factor and Time factor, Longitudinal section, Schedule of area statistics and channel dimension, canal losses Lined canals, Design of lined canal, Link canals	**8**
4	**Module: 4** **Regulating and Cross Drainage Works:** Canal falls, development of various types of falls, Classification of falls and its selection, Cross drainage works, Types of cross drainage works and its selection, Design consideration of cross drainage work, Design discharge of drainage and waterway, uplift pressure Canal escapes, Head regulator and Cross regulator, Meter flume, Irrigation outlets and types of outlets.	**8**
5	**Module: 5** Water logging: causes and prevention, ill effects of waterlogging, Land Reclamation, management of irrigation water, Characteristics of irrigation water, Types of Drainage system	**4**

Distribution of Theory Marks (Percentage)					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**20**	**20**	**10**	**10**

Suggested Specification table with Marks (For BE only):
Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers.
The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Irrigation & Water Power Engineering - Dr. B.C.Punmia & B.B.Pande, Laxmi Publications, (P) Ltd, New Delhi
2. Irrigation, Water Resources & Water Power Engineering - Dr. P.N.Modi, Standard Book House, Delhi
3. Irrigation, Water Power & Water Resources Engineering - Dr. K.R.Arora Standard Publishers Distributors, Delhi

4. Irrigation Engineering and Hydraulic Structures - S.K.Garg, Khanna Publishers, Delhi
5. Irrigation Engineering, S.K. Mazumder, Galgotia Publications Pvt Ltd., New Delhi
6. Irrigation Engineering, G.L.Asawa, New Age publications, New delhi
7. Hydraulic Structures, P. Novak, A.I.B. Moffat, C. Nalluri and R. Narayanan, Taylor and Francis Group

Course Outcomes: At the end of the course, Student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	***Assess*** consumptive Irrigation requirement based on values of Duty and Delta of different crops and ***plan*** an irrigation system	20
CO-2	***Design*** lined and unlined canals	15
CO-3	***Plan*** diversion head works and ***design*** it based on piping and uplift theories	15
CO-4	***Plan*** various irrigation canal structures in the canal network as per the site situation and requirement	20
CO-5	***Analyze*** gravity and earth dams and ***identify*** type of spillway and energy dissipation work	20
CO-6	***Select*** suitable drainage system to reclaim water logged soil.	10

the bold words in the course outcome refer to the verbs of blooms taxonomy

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of Tutorials

1. A detailed note on Irrigation development and water resources potentials in India.
2. Design a storage capacity of reservoirs based on the crop sown in the area
3. Compute field irrigation requirement of crop using soil water plant relationship
4. Design weir floor using Khosla's theory
5. Carry out stability analysis of gravity dam
6. Design unlined canal using silt theories
7. Design a lined canal section.
8. Compute balanced depth of cutting and filling for a deigned channel section
9. Compute design discharge and water way in case of cross-drainage work
10. Describe a suitable cross drainage system to reclaim water logged soil

List of Open Source Software/learning website: nptel.ac.in