

**DEPARTMENT OF CIVIL ENGINEERING  
NATIONAL INSTITUTE OF TECHNOLOGY  
TIRUCHIRAPALLI- 620 015, TAMIL NADU, INDIA**

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**CEPC29 IRRIGATION AND HYDRAULIC STRUCTURES**

**Course Learning Objectives**

1. To build on the student's background in irrigation and understanding of water resources systems.
2. To develop the skills in designing the irrigation canals and headwork structures.
3. To develop skills in the modelling of irrigation water requirement by Cropwat software.
4. To provide the knowledge of the canal diversion works, canal falls like notch fall and the design principles of head regulators / cross regulators.

**Course content**

Definition, Need, Benefit, Historical Development, Scope in the country and the state - Sources for irrigation, wells, springs, rivers, streams, tanks, reservoirs - Flow and Lift irrigation-Devices and equipments for lift irrigation- Quality Standard of Irrigation Water Methods of flow irrigation

Soil-plant-water relationship, Evapo-transpiration, Assessment of crop water requirements- Consumptive use of water(CUW), methods of determinations of CUW, Effective rainfall - Net irrigation requirements for principal crops, Kor period - base period- Duty-delta and base period relationship, Determination of irrigation water requirement of a crop- Depth of application and Frequency of irrigation efficiency- Introduction to Cropwat software.

Typical layout of a canal head works- Diversion and storage structures - Design of vertical drop weir- Typical sections of weir and barrage, vertical wall, floor and apron- Canals, Fish ladder, Canal head regulator, Main canal, branch distributary Forces on particle- in bed, on sides- Bed scour, Uplift on floor Exit gradient weirs on permeable foundation, creep length, Bling's theory.

Canal alignments -contour ridge, Branch canals, minors, water course and notches - Control structures - drops, escapes, shutters and operating devices, division boxes - Design of Earthen Canal- Concept of Regime- Khosla's theory- Lacey's and Kennedy's theory on design of earthen canal

Head regulators, canal drops, canal siphons and aqueducts, under tunnels-Cross masonry structures - Sediment control in irrigation structures, Sediment excluder, Sediment ejector-Settling basin Water logging.

**Text Books:**

1. Sharma R.K, "Irrigation Engineering and Hydraulic Structures", Oxford and IBII Publishing Company, New Delhi, 2002.
2. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1997.

**References:**

1. Michael A.M, "Irrigation - Theory and practice", Vikas Publishing House, 2000.
2. Hand Book on irrigation system operation Practices, Water Management and training Project Technical ReportNo.33. CWC, 1990.
3. Hand Book for improving Irrigation System Maintenance Practices, Water Management and Training ReportNo.19A, CWC, Delhi, 1989.

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**Course outcomes**

By the end of this course the students

1. Incorporate the analytical abilities in the planning and design of water resource systems.
2. Acquire the knowledge on design of irrigation canals and cross regulator structures.
3. Acquire fundamentals of distribution systems for canal irrigation.
4. Understand the basics of the requirements of irrigation and various irrigation techniques, requirements of the crops.

<b>COURSE PLAN</b>			
Course Title	<b>IRRIGATION AND HYDRAULIC STRUCTURES</b>		
Course Code	<b>CEPC29</b>	No. of Credits	<b>3</b>
Department	<b>CIVIL ENGINEERING</b>	Faculty	<b>Dr. S. Saravanan</b>
Pre-requisites Course Code	<b>CEPC17</b>		
Course Coordinator(s)	<b>NIL</b>		
Other Course Teacher(s)E-mail	<b>ssaravanan@nitt.edu</b>	Telephone No.	<b>04312503175</b>
Course Type	Core course <input checked="" type="checkbox"/> Elective course <input type="checkbox"/>		
<b>COURSE OVERVIEW</b>			
This course introduces the fundamental concepts, duty-delta-base period and soil-plant-water relationship, Assessment of crop water requirement, principles in design of Conveyance and Distribution Structures, Irrigation Canal, and Headwork Structures, and sediment control in irrigation structures.			
<b>COURSE OBJECTIVE</b>			
<ol style="list-style-type: none"> <li>1. To build on the student's background in irrigation and understanding of water resources systems.</li> <li>2. To develop the skills in designing the irrigation canals and headwork structures.</li> <li>3. To develop skills in the modelling of irrigation water requirement by Cropwat software.</li> <li>4. To provide the knowledge of the canal diversion works, canal falls like notch fall and the design principles of head regulators / cross regulators.</li> </ol>			
<b>COURSE OUTCOMES (CO)</b>			
<b>Course Outcomes</b>			<b>Aligned Programme Outcomes (PO)</b>
<b>Course outcomes</b> <ol style="list-style-type: none"> <li>1. Incorporate the analytical abilities in the planning and design of water resource systems.</li> <li>2. Acquire the knowledge on design of irrigation canals and cross regulator structures.</li> <li>3. Acquire fundamentals of distribution systems for canal irrigation.</li> <li>4. Understand the basics of the requirements of irrigation and various irrigation techniques, requirements of the crops.</li> </ol>			

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**COURSE TEACHING AND LEARNING ACTIVITIES**

S.No	Week	Topic	Mode of Delivery
1	Week 1	<b>Introduction:</b> <ul style="list-style-type: none"> <li>• Importance of Irrigation Engineering</li> <li>• Advantages and Disadvantages of Irrigation</li> <li>• Need of Irrigation in India</li> <li>• Planning of irrigation projects</li> </ul>	PPT & Black board
2	Week 2	<b>Irrigation Methods</b> <ul style="list-style-type: none"> <li>• Sources for irrigation, wells, springs, rivers, streams, tanks, reservoirs</li> <li>• Flow and Lift irrigation</li> <li>• Devices and equipment for lift irrigation</li> <li>• Quality Standard of Irrigation Water</li> <li>• Methods of flow irrigation</li> </ul>	PPT & Black board
3	Week 3	<b>Soil-plant-water relationship</b> <ul style="list-style-type: none"> <li>• Physical and chemical properties of soil</li> <li>• Root zone soil water, Hygroscopic water, capillary water, gravitational water</li> <li>• Superfluous water, available water, unavailable water.</li> <li>• Limiting soil moisture conditions</li> <li>• Evapotranspiration, Consumptive use of water(CUW)</li> <li>• Factors affecting consumptive use</li> <li>• Methods of determinations of CUW-by direct measurement or by use of equations</li> <li>• Assessment of crop water requirements</li> <li>• Effective rainfall, Kor period and base period</li> <li>• Net irrigation requirements for principal crops</li> <li>• Problems</li> </ul>	PPT & Black board
<b>Assignment 1</b>			
4	Week 4	<b>Duty-delta and Irrigation efficiencies</b> <ul style="list-style-type: none"> <li>• Duty and delta, factors affecting duty</li> <li>• Determination of irrigation water requirement of a crop-Depth of application and Frequency of irrigation efficiency Types of irrigation efficiencies: water conveyance efficiency, water application efficiency, water use efficiency, water surface efficiency, water distribution efficiency, consumptive use efficiency.</li> <li>• Introduction to Cropwat software.</li> <li>• Problems</li> </ul>	PPT & Black board
5	Week 5	<b>Assessment- I</b>	
6	Week 6	<b>Diversion of head works and types of headworks:</b> <ul style="list-style-type: none"> <li>• Typical layout of a canal head works</li> <li>• Diversion and storage structures</li> <li>• Types of weirs, vertical drop weir, rock fill weir, concrete sloping weir, Design of vertical drop weir</li> <li>• Typical sections of weir and barrage</li> </ul>	PPT & Black board

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		<ul style="list-style-type: none"> <li>• Difference between weirs and barrages, vertical wall, floor and apron ,Fish ladder</li> <li>• Problems</li> </ul>	
7	Week 7	<b>Canals</b> <ul style="list-style-type: none"> <li>• Canal head regulator, Main canal, branch distributary.</li> <li>• Forces on particle- in bed, on sides</li> <li>• Bed scour, Uplift on floor</li> <li>• Exit gradient</li> <li>• Weirs on permeable foundation.</li> <li>• Problems</li> </ul>	PPT & Black board
<b>Assignment -2</b>			
8	Week 8	<b>Canal alignments</b> <ul style="list-style-type: none"> <li>• contour ridge</li> <li>• Branch canals, minors</li> <li>• water course and notches</li> <li>• Control structures - drops, escapes, shutters and operating devices, division boxes</li> </ul>	PPT & Black board
9	Week 9	<b>Design of Irrigation canals</b> <ul style="list-style-type: none"> <li>• Design of Earthen Canal- Khosla's theory-</li> <li>• Design of Earthen Canal- Lacey's and Kennedy's theory</li> <li>• Concept of Regime</li> <li>• Balancing depth: definition, explanation with figure.</li> <li>• Canal lining: definition, necessity, advantages, types of lining.</li> <li>• Problems</li> </ul>	PPT & Black board
10	Week 10	<b>Assessment -II</b>	
11	Week 11	<b>Cross drainage works: Types and selection of site</b> <ul style="list-style-type: none"> <li>• Head regulators- Design of vent way, fixing crest level, length of floor, thickness of floor for different distances, cut off wall, uplift pressure, protection works- length &amp; thickness and problems</li> <li>• canal drops</li> </ul>	PPT & Black board
<b>Assignment-3</b>			
12	Week 12	<b>Cross drainage works: Types and selection of site</b> <ul style="list-style-type: none"> <li>• canal siphons and aqueducts- Finding maximum flood discharge, waterway requirements, afflux calculations, fluming the canal, transitions, wings returns</li> <li>• under tunnels- Finding maximum flood discharge, waterway requirements, afflux calculations, fluming the canal, transitions, wings returns</li> <li>• Cross masonry structures</li> <li>• Problems</li> </ul>	
13	Week 13	<b>Sediment control in irrigation structures</b> <ul style="list-style-type: none"> <li>• Sediment excluder, Sediment ejector</li> <li>• Settling basin</li> <li>• Water logging.</li> </ul>	PPT & Black board
14	Week 14	<b>Final Assessment</b>	

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**COURSE ASSESSMENT METHODS**

S.No	Mode of Assessment	Week	Duration	% Weightage
1	Assessment-I	4 <sup>th</sup> Week	1 hr	20 marks
2	Assessment-II	8 <sup>th</sup> Week	1 hr	20 marks
3	Assignment-1	3 <sup>rd</sup> Week	1 week time	10 marks
4	Assignment-2	7 <sup>th</sup> Week	1 week time	
5	Assignment-3	11 <sup>th</sup> week	1 week time	
6	Final Assessment	14 <sup>th</sup>	3 hour	50 marks
7	<b>Total</b>			<b>100 marks</b>

**ESSENTIAL READINGS: Textbooks, reference books and journals.**

**Text Books:**

1. Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001.
2. Sharma R.K, "Irrigation Engineering and Hydraulic Structures", Oxford and IBII Publishing Company, New Delhi, 2002.
3. Subramanya, Engineering Hydrology, Tata-McGraw Hill, 2004.
4. Chow, V. T. (ed.): Hand book of Applied Hydrology, Tata- McGraw Hill Book Company, 2005.

**Reference Books:**

1. Hand Book on irrigation system operation Practices, Water Management and training Project Technical Report No.33. CWC, 1990.
2. Hand Book for improving Irrigation System Maintenance Practices, Water Management and Training Report No.19A, CWC, Delhi, 1989

**COURSE EXIT SURVEY**

1. Class committee meetings.
2. Online - Feedback forms submission through MIS.

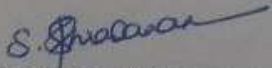
**COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)**


Minimum 75% attendance is compulsory for attending the final examination.

**ADDITIONAL COURSE INFORMATION**

The Course Faculty Details: No.:101 (Civil- Annexure Building);  
Timings: 10 am - 5 pm  
Email ID: ssaravanan@nitt.edu  
Telephone No.: 0431-250-3175

**FOR SENATE'S CONSIDERATION**

  
Course Faculty **Dr. S. Saravanan**

CC-Chairperson 

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