Techno India NJR Institute of Technology

Course File

Water Resources Engineering (5CE4-05)

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(Assistant Professor)
Department of CE

RAJASTHAN TECHNICAL UNIVERSITY, KOTA
Syllabus
3rd Year - V Semester: B.Tech. (Civil Engineering)

5CE4-05: WATER RESOURCE ENGINEERING

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**

2L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	**Introduction**: Definitions, functions and advantages of irrigation, present status of irrigation in India, classification for agriculture, soil moisture and crop water relations, Irrigation water quality. Consumptive use of water, principal Indian crop seasons and water requirements.	5
3	**Canal Irrigation:** Types of canals, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory) **Diversion Head works:** Design for surface and subsurface flows, Bligh's and Khosla's methods.	6
4	**Embankment Dams:** Suitable sites, causes of failures, stability and seepage analysis, flow net, principles of design of earth dams. **Gravity Dams:** Force acting on a gravity dam, stability requirements.	5
5	**Well Irrigation:** Open wells and tube wells, types of tube wells, duty of tube well water. **Cross-Drainage Structure**: Necessity of Cross-drainage structures, their types and selection, comparative merits and demerits.	5
6	**Hydrology:** Definition, Hydrologic cycle, measurement of rainfall, Flood hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination.	6
		28

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

Course Overview:

Water resources engineering is the quantitative study of the hydrologic cycle -- the distribution and circulation of water linking the earth's atmosphere, land and oceans. Surface runoff is measured as the difference between precipitation and abstractions, such as infiltration (which replenishes groundwater flow), surface storage and evaporation. Applications include the management of the urban water supply, the design of urban storm-sewer systems, and flood forecasting. Hydraulic engineering consists of the application of fluid mechanics to water flowing in an isolated environment (pipe, pump) or in an open channel (river, lake, and ocean). Civil engineers are primarily concerned with open channel flow, which is governed by the interdependent interaction between the water and the channel.
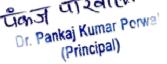
After studying Water Engineering, graduates can work as a Water Resource Engineer, Environmental Engineer, Hydrologist/ Hydrological Engineer, Sustainability Engineer/ Sustainable Energy Technologist, Environmental Protection Specialist, etc and can earn around INR 4 LPA to INR 6 LPA. Their salary will increase gradually as per the experience they gather throughout the duration of B.Tech Water Resource Engineering course.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Comprehension	Students will be able to Understand the basics of Hydrograph, rainfall analysis and its distribution.
2	Analysis	Student will learn to analyse the rainfall patterns and can evaluate the same with probabilistic methods.
3	Synthesis	Students be able to design the channels on the basis of Kennedy's theory and Lacey's theory.
4	Synthesis	Students will be able to generate designs and layout of canal according to the use.
5	Synthesis	Students be able to differentiate between types of canals and canal headworks.

Prerequisites:
- Students with basic knowledge of mathematical geometry can understand the topics clearly.
- Students with understanding of basic physics principles can grasp the topics of this course.
- Students with a basic calculation methodologies can perform surveying calculations.

Course Outcome Mapping with Program Outcome:

Course Outcome	WATER RESOURCE ENGINEERING														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO355.1	3	3	3	3	2	2	2	1	1	1	2	3	2	1	1
CO355.2	3	2	2	3	2	1	2	1	1	1	1	1	2	1	1
CO355.3	3	2	2	2	2	1	1	1	2	1	1	2	2	2	1
CO355.4	3	2	2	3	2	1	2	1	1	1	1	1	2	1	1
CO355.5	3	2	2	2	2	1	1	1	2	1	1	2	2	1	1
CO355 (AVG)	3	2.2	2.2	2.6	2	1.2	1.6	1	1.4	1	1.2	1.8	2	1.2	1

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	**INTRODUCTION:** Objective, scope and outcome of the course
2	2	**INTRODUCTION: DEFINITIONS**, functions and advantages of irrigation, Present status of irrigation in India
3	2	Classification for agriculture, soil moisture and crop water relations
4	2	Irrigation water quality. Consumptive use of water
5	2	Principal Indian crop seasons and water requirements
6	3	**CANAL IRRIGATION:** Types of canals, design of channels
7	3	Regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory)
8	3	Diversion Head works: Design for surface and subsurface flows
9	3	Bligh's and Khosla's methods
10	4	**EMBANKMENT DAMS:** Suitable sites
11	4	Causes of failures, stability and seepage analysis
12	4	Flow net, principles of design of earth dams
13	4	Gravity Dams: Force acting on a gravity dam, stability requirements
14	5	WELL IRRIGATION: Open wells and tube wells
15	5	Types of tube wells, duty of tube well water
16	5	Cross-Drainage Structure: Necessity of Cross drainage structures, their types and
17	5	Comparative merits and demerits
18	6	HYDROLOGY: Definition, Hydrologic cycle

19	6	Measurement of rainfall, Flood hydrograph
20	6	Flood hydrograph
21	6	Rainfall analysis, Infiltration
22	6	Run off
22	6	Unit hydrograph and its determination
23	6	Unit hydrograph and its determination
24		Revision to coursework
25		Revision to coursework
26		Revision to coursework
27		Revision to coursework
28		Revision to coursework

TEXT/REFERENCE BOOKS

1. Irrigation Water Power and Water Resource Engineering by KR Arora, Standard Publishers and Distributers, Delhi.
2. Water Resource Engineering by Modi, Standard Publishers.
3. Irrigation and Water Power Engineering by BC Punmia & B B Lal, Laxmi Publication (P) Ltd.
4. Irrigation Engineering by G.L. Asawa, New Age International Publishers, New Delhi.

Course Level Problems (Test Items):

CO.NO.	Problem description
1	A. Explain the types of canal system used in irrigation. B. Discuss the importance of hydrological cycle. C. Explain the use of rain gauges.
2	A. Write and explain principles of infiltration and runoff B. Explain the methods of irrigation.
3	A. Explain the types of irrigation systems used in India B. State the types of canal headworks.

Assessment Methodology:

1. Practical exam in lab where they have to analyze the problem statement. (Once in a week)
2. Assignments one from each unit.
3. Midterm subjective paper based on topics as mentioned in the modules. (Twice during the semester)
4. Final paper at the end of the semester subjective.

TEACHING AND LEARNING RESOURCES UNIT-WISE

All the Water resources engineering notes/study material can be found on below link:

https://engineeringonline.ucr.edu/blog/what-is-water-resources-engineering/

https://nptel.ac.in/courses/105/104/105104103/

https://www.youtube.com/watch?v=GjwrU4hYpCE&list=PLbMVogVj5nJRIPjxn3dPWPwOeK C927qZf

Techno India NJR Institute of Technology
Academic Administration of Techno NJR Institute
Syllabus Deployment

Name of Faculty : Mr. Jitendra Choubisa	Subject Code: 5CE4-05
Subject : Water Resources Engineering	
Department : Civil Engineering	Sem: V
Total No. of Lectures Planned: 28	

COURSE OUTCOMES HERE (3 OUTCOMES)

At the end of this course students will be able to:

CO1. Calculate the components of hydrological cycle.

CO2. Apply the basis knowledge in design dam.

CO3. Do flood frequency analysis and flood routine.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** Objective, scope and outcome of the course
2	**2**	**INTRODUCTION: DEFINITIONS**, functions and advantages of irrigation, Present status of irrigation in India
3	2	Classification for agriculture, soil moisture and crop water relations
4	2	Irrigation water quality. Consumptive use of water
5	2	Principal Indian crop seasons and water requirements
6	**3**	**CANAL IRRIGATION:** Types of canals, design of channels
7	3	Regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory)
8	3	Diversion Head works: Design for surface and subsurface flows
9	3	Bligh's and Khosla's methods
10	**4**	**EMBANKMENT DAMS:** Suitable sites
11	4	Causes of failures, stability and seepage analysis
12	4	Flow net, principles of design of earth dams

13	4	Gravity Dams: Force acting on a gravity dam, stability requirements
14	**5**	**WELL IRRIGATION:** Open wells and tube wells
15	5	Types of tube wells, duty of tube well water
16	5	Cross-Drainage Structure: Necessity of Cross drainage structures, their types and selection
17	5	Comparative merits and demerits
18	**6**	**HYDROLOGY:** Definition, Hydrologic cycle
19	6	Measurement of rainfall, Flood hydrograph
20	6	Flood hydrograph
21	6	Rainfall analysis, Infiltration
22	6	Run off
22	6	Unit hydrograph and its determination
23	6	Unit hydrograph and its determination
24		Revision to coursework
25		Revision to coursework
26		Revision to coursework
27		Revision to coursework
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5E1345

5E1345

B. Tech. V - Sem. (Main / Back) Exam., Feb.-March - 2021

PCC/PEC Civil Engineering

5CE4 - 05 Water Resource Engineering

Time: 2 Hours   [To be converted as per scheme]

Max. Marks: 65

Min. Marks: 23

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and one questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL _____   2. NIL _____

PART – A

(Answer should be given up to 25 words only)   [5×2=10]

All questions are compulsory

Q.1 Define Hydrological cycle.   [2]

Q.2 Define consumptive use of water.   [2]

Q.3 Enumerate various factors affecting duty.   [2]

Q.4 Write the necessity of cross drainage structures.   [2]

Q.5 Describe the Phreatic line.   [2]

PART - B

[10]

Q.1 Write the drawbacks in Kennedy's theory.   [10]

Q.2 Draw a neat diagram for a diversion Headwork.   [10]

Q.3 Describe Khosla's theory.   [10]

Q.4 Discuss various modes of failure of a gravity dam.   [10]

Q.5 Discuss various types of tube wells.   [10]

Q.6 Write the various uses of Unit Hydrograph.

PART - C

Q.1 What are Lacey's basic regime equations? Starting from the equations derive following
equations -   [15]

(a)   Wetted Perimeter

(b)   Hydraulic Radius

(c)   Bed Slope

Q.2 A canal has a culturable commanded area of 1,00,000 ha. The intensities of irrigation
for Kharif (Rice), Rabi (Wheat) and Sugarcane are respectively 20%, 30% and 10%.
The consumptive use of water for the three crops is as under -   [15]

(a)   Rice: July = 21cm, August = 24 cm, September = 12 cm, October = 12 cm.

(b)   Wheat: December = 9cm, January = 9cm, February = 9cm, March = 9cm.

(c)   Sugarcane: November = 6cm, December to April = 9cm every month, May= 12cm.

Q.3 Design an irrigation channel by Kennedy's theory to carry a discharge of 5 cumecs.
Take m = 1.0, N = 0.0225 and B/D ratio = 4.40.   [15]

Roll No. 15IECTE024

7E7061

7E7061

B. Tech. VII Sem. (Main / Back) Exam., Nov. – Dec. - 2018
Civil Engineering
7CE1A Water Resources Engineering - I

Total No of Pages: 4

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 26

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL   2. NIL

UNIT- I

Q.1 (a) Write short notes on the following- [8]

    (i)   Comparison of sprinkler and drip irrigation

    (ii)   Quality standard for irrigation water

  (b)   A watercourse has a culturable command area of 1100 hectares. The intensity of irrigation for crop A is 40% and for crop B is 30%, both crops being Rabi crops. Crop A has a Kor period of 20 days and crop B has a Kor period of 15 days. Calculate the outlet discharge of the water course if the Kor depth for crop A is 10 cm and for crop B is 16 cm. [8]

UNIT-III

Q.3 (a) What are the basic principles of regulation of a canal system? Describe the methods of regulation of a canal system. [8]

(b) Define flexibility, setting, sensitivity, efficiency, proportionality, modular limits of a canal outlet. [8]

OR

Q.3 (a) What do you understand by river training works? Draw neat sketches of Guide banks and Spurs. Also explain their functions. [8]

(b) What do you understand by critical tractive force? Explain initial and final regime condition of channels. Also discuss the mechanics involved in sediment transport. *[8]*

UNIT-IV

Q.4 (a) What are saline, saline-alkali and alkali soils and explain how you will reclaim each one of these soils? [8]

(b) Differentiate between an open well and a tube well. What are the advantages of tube wells over open wells? [8]

OR

Q.4 (a) Explain the advantages and disadvantages of canal lining. [8]

(b) Design a trapezoidal shaped concrete lined channel to carry a discharge of 120 cumecs at a slope of 20 cm/km. The side slopes of the channel are 1.5:1. The value of N may be taken as 0.014. Assume limiting velocity as 1.5m/s. [8]

[7E7061] Page 3 of 4 [7900]

UNIT- V

Q.5 (a) What is Hydrological cycle? Give brief description of different components of hydrological cycle.

[8]

(b) Describe run-off. Differentiate between direct run-off and base flow. What are various components of run-off?

[8]

OR

Q.5 (a) Draw a neat diagram of Symon's rain gauge, clearly showing all its dimensions. How will you select a site for rain gauge station?

[8]

(b) What is a unit hydrograph? What are the basic propositions and limitations of the unit hydrograph theory?

[8]

Roll No. 15IECTE024

7E7061

Total No of Pages: 4

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OR

Q.1 (a) What is subsurface irrigation? Differentiate between the natural subsurface irrigation and the artificial subsurface irrigation.

(b) Define the following terms- [8]

(i) Frequency of irrigation [8]

(ii) Crop rotation

(iii) Irrigation efficiencies

(iv) Consumptive use of water

UNIT- II

Q.2 (a) Discuss the factors governing the selection of alignment of main canal and its distributaries.

[8]

(b) What are Lacey's basic regime equations? Starting from these equations, derive the equations for-

[8]

(i) Wetted perimeter

(ii) Hydraulic radius

(iii) Bed slope

OR

Q.2 (a) Write short notes on the following- [8]

(i) Role of command area development

(ii) Estimation of channel losses

(iii) Rotational delivery

(iv) Silt control in canals

(b) Compare the Kennedy's and Lacey's theories for the design of alluvial channels. What are the drawbacks of both theories? [8]

[7E7061]

[7900]

UNIT- III

Q.3 (a) What are the basic principles of regulation of a canal system? Describe the methods of regulation of a canal system. [8]

(b) Define flexibility, setting, sensitivity, efficiency, proportionality, modular limits of a canal outlet. [8]

OR

Q.3 (a) What do you understand by river training works? Draw neat sketches of Guide banks and Spurs. Also explain their functions. [8]

(b) What do you understand by critical tractive force? Explain initial and final regime condition of channels. Also discuss the mechanics involved in sediment transport. [8]

UNIT- IV

Q.4 (a) What are saline, saline-alkali and alkali soils and explain how you will reclaim each one of these soils? [8]

(b) Differentiate between an open well and a tube well. What are the advantages of tube wells over open wells? [8]

OR

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