NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

CEPC34 GROUNDWATER HYDROLOGY

Course Learning Objectives

1. To provide the knowledge of in aquifer and occurrences and movement of groundwater systems.
2. To develop the skills in Identify different fundamental equations and concepts as applied in the Groundwater studies
3. To develop skills in solve groundwater mathematical equations and analyze pumping tests and optimal pumping in steady and unsteady flow cases.
4. To provide the knowledge of groundwater vulnerability, contamination, and seawater intrusion.
5. To build the skill in identifying the potential groundwater zones, artificial recharge, sustainable management of aquifer using Remote sensing and Geophysical techniques

Course content

Introduction to groundwater hydrology and Aquifer: Describe elements of hydrologic cycle, focusing on role of groundwater, available and occurrence of groundwater, Porosity, Specific yield, Specific Retention, Hydraulic Conductivity, Storativity, and Transmissivity. **Aquifer:** Types, rock type and its geology, Unconfined, Confined, Semi-Confined & Perched; Springs; Hydrothermal phenomena.

Ground Water Mechanics: Darcy's law and its Application; Determination of Permeability in laboratory and in field; Steady State, Dupuit assumptions, Storage coefficient - Unsteady State and Radial Flow equations, Governing equation for flow through porous medium.

Well hydraulics: Groundwater flow to wells, Types of wells, Steady unidirectional flow - well in a uniform flow - steady flow with uniform recharge - unsteady radial flow to a well - well flow near aquifer boundaries - Multiple well systems - partially penetrating wells - characteristic well losses- Thesis solution, Jocob model.

Ground Water Chemistry: Quality of Ground Water, Physical and Chemical properties; Quality criteria for domestic, irrigation and industrial uses, safe yield, seepage from surface water, stream-aquifer interaction, artificial recharge. Introduction to Contaminant transport, Seawater intrusion. Occurrence of sea water intrusion - Ghypon-Heizberg relation between fresh and saline waters - shape length and structure of the fresh salt water interface

Surface/ Sub-Surface Investigation of Ground Water: Subsurface investigation - test drilling - resistivity logging- potential logging -temperature and caliper logging. geophysical exploration - electrical resistivity - Seismic refraction - Gravity and magnetic – Application of GRACE data in groundwater hydrology. artificial ground water recharge.

References:

1. Raghunath H.M., Ground Water Hydrology, New-Age International, 2ndEdition, 1990.
2. D.K. Todd and L. F. Mays,"Groundwater Hydrology", John Wiley and sons.
3. K. R.Karanth,"Hydrogeology", TataMcGraw Hill Publishing Company.
4. Agarwal, V. C.,"Groundwater Hydrology", PHI Learning, India.

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DEPARTMENT OF CIVIL ENGINNERING

COURSE PLAN – PART I			
Name of the programme and specialization	**BTech Civil Engineering**		
Course Title	**Groundwater Hydrology**		
Course Code	**CEPE34**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**January 2023**	**Section (if, applicable)**	**A & B**
Name of Faculty	**Dr. S. Saravanan**	**Department**	**CIVIL ENGINEERING**
Official Email	**ssaravanan@nitt.edu**	**Telephone No.**	**04312503175**
Name of Course Coordinator(s)	**Dr. Jeevan**		
Official E-mail	**Jeevan@nitt.edu**	**Telephone No.**	
Course Type (please tick appropriately)	**Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

COURSE OBJECTIVES

. 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.

MAPPING OF COs with POs

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. Comprehend the basic concepts and techniques used in groundwater hydrology.	
2. Acquire Knowledge of various geological strata for occurrences, groundwater movement and availability	
3. Acquire the knowledge on design of Single well, group well and optimal pumping strategy	
4. Incorporate the analytical abilities in the planning and design of groundwater resource systems.	
5. Acquire Knowledge analyzing the groundwater quality and occurrence using Remote Sensing techniques.	

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COURSE PLAN – PART II			
COURSE OVERVIEW			
This course focuses on ground water availability/ flow/ storage/ intermixing/ investigation while simultaneously bringing out the advanced/ relevant theories/ practices/ techniques of practical importance. The topics to be covered include introduction, occurrence and movement of ground water, advanced well hydraulics, pollution and quality analysis of ground water, surface/ sub-surface investigation of ground water, artificial ground water recharge, saline water intrusion in aquifers, modeling and management of ground water.			
COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)			
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	**Week 1**	**Introduction:** • Describe elements of hydrologic cycle, focusing on role of groundwater, available and occurrence of groundwater • Porosity, Specific yield, Specific Retention, Hydraulic Conductivity, Storativity, and Transmissivity.	PPT & Black board
2	**Week 2**	**Introduction:** • Origin & age • of ground water, rock properties affecting groundwater, groundwater • column, zones of aeration & saturation, aquifers and theircharacteristics/classification,	PPT & Black board
	Week 3	**Aquifer:** • Types, rock type and its geology, • Unconfined, Confined, • Semi-Confined & Perched; • Springs; Hydrothermal phenomena.	PPT & Black board
	Week 4	**Assessment-I**	
	Week 5	**Ground Water Mechanics:** • Darcy's Law, permeability & its determination, Dupuit assumptions, heterogeneity&anisotropy, • Ground water flow rates & flow directions, • general flow equations through porous media.	PPT & Black board
	Week 6	**Ground Water Mechanics** • Steady State, Dupuit assumptions, Storage coefficient • Unsteady State and Radial Flow equations • Governing equation for flow through porous medium.	PPT & Black board
	Week 7	**Well hydraulics:** • Groundwater flow to wells, Types of wells, Steady unidirectional flow • well in a uniform flow - steady flow with uniform recharge	PPT & Black board
	Week 8	**Assessment -2**	

	Week 9	**Well hydraulics:** • unsteady radial flow to a well - well flow near aquifer boundaries • Multiple well systems - partially penetrating wells - characteristic well losses- Thesis solution, Jocob model. • Problems	PPT & Black board
	Week 10	**Ground Water Chemistry:** • Quality of Ground Water, Physical and Chemical properties • Quality criteria for domestic, irrigation and industrial uses, safe yield, seepage from surface water, • stream-aquifer interaction • artificial recharge.	PPT & Black board
	Week 11	**Seawater Intrusion:** • Introduction to Contaminant transport, Seawater intrusion. Occurrence of sea water intrusion • Ghypon-Heizberg relation between fresh and saline waters - shape length and structure of the fresh salt water interface • Problems	PPT & Black board
	Week 12	**Re-Assessment**	
	Week 13	**Surface/ Sub-Surface Investigation of Ground Water:** • Subsurface investigation - test drilling - resistivity logging- potential logging -temperature and caliper logging. • geophysical exploration - electrical resistivity - Seismic refraction - Gravity and magnetic – Application of GRACE data in groundwater hydrology. • Artificial ground water recharge and vulnerability assessment.	PPT & Black board
	Week 14	**Final Assessment**	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment-I	4thWeek	1 hr	20 marks
2	Assessment-II	8th Week	1 hr	20 marks
3	Compensation Assessment*	11th Week	1 week time	20 marks
4	Assignment-1	3rd Week	1 week time	5 marks
5	Assignment-2	11th Week	1 week time	5 marks
6	Final Assessment *	14th	3 hour	50 marks

***mandatory; refer to guidelines on page 4**

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COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Class Committee Meetings.
2. Online feedback forms submission through MIS

COURSE POLICY (including compensation assessment to be specified)

1. The number of assessments for any theory course shall range from 4 to 6.
2. Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
3. One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- Students with less than 75% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

The Course Faculty Details: No.:201 (Civil – Annexure Building);
Timing: 10 am to 5 pm
Email ID: ssaravanan@nitt.edu
Telephone No: 0431-250-3175

FOR APPROVAL

Course Faculty 17/2/23 **CC- Chairperson** 17/02/23 **HOD**

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Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				**P.G.**
2018	**2017**	**2016**	**2015**	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.