

Branch Name:	Environment Engineering
Program Code:	ET212
Subject Title:	Hydrology and Mitigation of Groundwater Contamination
Subject Code:	2ET2120402T
Pre-requisite Subject:	Basics of Groundwater Flow and Characteristics

Course Objective:

- Student should acquire knowledge related to ground water system and characteristics of water.
- Student will get knowledge about contaminant transport mechanism.
- Student will get idea about the concept of salt water intrusion and its control.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	3	1	-	4	24	60	16	40	-	-	-	-	100

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
1	Groundwater Hydrology: Occurrence of groundwater. Vertical distribution of groundwater, zone of aeration, zone of saturation, types of aquifers, storage coefficient. Groundwater movement: Darcy's law, permeability, hydraulic conductivity, anisotropic aquifers, groundwater flow direction	8	20	
2	Ground water Contamination: Ground water Contamination and Transport, Ground Water remediation, Sources and Types of Ground water contamination, Landfills, surface impoundment's, Waste disposal Injection wells Septic systems, Agricultural wastes, land applications, Radioactive contamination, other sources of contaminates.	10	25	
3	Contaminant transport Mechanisms: Introduction, advection processes, diffusion and dispersion processes, Mass- transport equations, one dimensional model, Governing flow and transport equation in two dimensions, semi-analytical methods, test for dispersivity, Natural gradient field test for dispersion.	8	20	
4	Sorption & other chemical reactions: factors affecting sorption, Sorption isotherms, Sorption effect on fate & transport of pollutants, Estimation of sorption Biodegradation reactions & kinetics: biological transformations, microbial dynamics, kinetics of biodegradation.	6	15	
5	Salt water intrusion: Concept; interface and its location; control of intrusion. Pollutant transport: Plume Transport, source identification, tracer methods and control measures.	6	15	
6	Application of GIS on Ground water. Basics of Groundwater Software.	4	5	

Reference Books:

1. Rifai & Newell “Ground Water Contamination, Transport and Remediation by Bedient”, PTR Prentice Hall
 2. Phlip.B.Bedient, Hanadi.S. Rifai, Charles.J.Newell, “Ground water contamination (Transport and remediation)”, Prentice Hall.
 3. Randall J. Charbeneau, “Ground Water Hydraulics and Pollutant Transport ”, 2000.
 4. Allen Freeze, R. and John A. Cherry, "Ground Water ". Prentice Hall.Inc.1979.
 5. Thonana “Water Quality Modelling”
 6. K. Karanth ,” Ground Water Assessment, Development and Management” , McGraw Hill Companies.
 7. David Keith Todd and Larry W. Mays, “Groundwater Hydrology” John Wiley and Sons.
 8. K.R. Rushton, “Groundwater Hydrology”, John Wiley & Sons, Ltd.
 9. D.K. Todd, “Groundwater Hydrology”, John Wiley & Sons
 10. Radd M. Wafur, “Application Of GIS And Remote Sensing Techniques On Groundwater” Scholar’s Press.
- List of Open Source Software/learning website:**

1. <https://nptel.ac.in/>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom’s Taxonomy Level
CLO1	Student will able to understand ground water system and characteristics of water	L-2
CLO2	Student will able to apply the concept of contaminant transport mechanism	L-3
CLO3	Student will able to understand the concept of salt water intrusion and apply the knowledge for its control	L-2 and L-3

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO1	M	M	M				M						M	M	
CLO2	M	M	M			M	M						M	M	
CLO3	M	M	M			M	M						M	M	

H: High, M: Medium, L: Low