

Course title: Groundwater Hydrology and Management				
Course code: NRE 163		No. of credits: 3	L-T-P: 31-14-0	Learning hours: 45
Pre-requisite course code and title (if any): NRE 111 Applied Mathematics, NRE 162 Hydrology				
Department: Energy and Environment				
Course coordinator:			Course instructor: Ms Ranjana R. Chaudhuri	
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Course type: Elective			Course offered in: Semester 3	
Course Description This course will provide an insight into the field of groundwater hydrology. The students will equip themselves with the knowledge of interpretation of groundwater data, conducting the surface and subsurface investigations for the groundwater using the latest methods and tools. The students will be able to learn basic fundamentals of groundwater flow, storage and yield. They will also learn various methods of well development. The concepts of groundwater basin management, conjunctive use, competing demands, recharge and mining will add in equipping students to take better decisions in groundwater management.				
Course objectives				
<ol style="list-style-type: none"> 1. To learn basic fundamentals of groundwater flow 2. To learn the hydraulics of different kinds of wells 3. Conjunctive use of ground water along with other fresh water sources 				
Course content				
Module	Topic	L	T	P
1.	Ground Water Introduction of ground water resources: Global and Indian perspectives Occurrence of ground water Geological factors governing the occurrence of ground water Hydraulics of ground water Aquifers and their types and important terms related to ground water Governing equation of ground water flow in aquifers	10	4	
2.	Groundwater well Hydraulics Geophysical methods in ground water exploration Open wells or dug wells Tubewells Yield of wells and tubewells by Thiem's and Dupuit's equilibrium formula Hydraulics of wells Quality and quantity of ground water and its usefulness in water supply	9	6	0
3.	Salt Water Intrusion Saline water intrusion Relationship between fresh and saline water Structure of fresh-salt water interface Control of saline water intrusion	6	2	0
4.	Ground water contamination and management Contaminant transport in groundwater and management Concepts of basin management Equations of hydrologic equilibrium Groundwater basin investigation Salt balance	6	2	0

	Basin management by conjunctive use Water harvesting and recharging to aquifers			
	Total	31	14	
Evaluation criteria				
▪	2 minor tests:	20% each		
▪	Quizzes and tutorials:	20 %		
▪	Major test:	40%		
Learning outcomes				
•	Interpretation of groundwater field data, identify pollutants, saline water intrusion			
•	Ability to conduct surface and sub-surface investigations of groundwater using latest technology and methods available			
•	Would be equipped to decide on conjunctive water use, including ability to identify competing water demands, allot ground water usage according to yield of existing aquifer.			
Pedagogical approach				
Materials				
Required text				
1.	Fetter C.W. (2001) <i>Applied Hydrogeology</i> , Fourth Edition, CBS Publishers and Distributors, New Delhi.			
2.	Raghunath H.M. (2007) <i>Groundwater</i> , 3rd edition, New Age International Publishers.			
3.	Todd D.K. (1980) <i>Groundwater Hydrology</i> , John Wiley and Sons.			
Suggested readings				
1.	Fetter C.W. (1990) <i>Applied Hydrogeology</i> , 2nd Edition, CBS Publishers and Distributors, New Delhi.			
2.	McWhorter D.B. and Sundada D.K. (1977) <i>Ground-Water Hydrology and Hydraulics</i> , Water Resources Publications, P.O. Box 303, Fort Collins Colorado, U.S.A.			
3.	Raghunath H.M. (1987) <i>Groundwater</i> , 2nd Edition Wiley Eastern Ltd.			
4.	Rastogi A.K. (2008) <i>Numerical Groundwater Hydrology</i> , Penram International Publishing Pvt. Ltd., Bombay.			
5.	Todd D.K. (1980) <i>Groundwater Hydrology</i> , John Wiley and Sons.			
Case studies				
Websites				
Journals				
1.	ASCE Journal of Water Resources Planning and Management			
2.	Water Resources Research			
Additional information (if any)				
Student responsibilities				
Attendance, feedback, discipline, guest faculty etc				