EN551 : GROUNDWATER HYDROLOGY AND CONTAMINAION

(Departmental Elective – I)

Type of Course: - Engineering and Technology

Prerequisite: Basics & Fundamentals of Hydrological Cycle and Sources of Groundwater.

Rationale: To Develop Fundamentals of Groundwater Hydrology, Quality, Pollution and Conversion.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Tutorial/Practical Marks				
L	T/P	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	-	5	70	30	20	10	10	10	150

L- Lectures; T-Tutorial/Teacher guided student Activity; P-Practical; C-Credit; ESE-End Semester Examination; PA-Progressive Assessment; OEP-Open Ended Problem; AL-Active Learning

Content: -

Sr No.	Topics	Teaching Hrs.	Module Weightages
1.	**Introduction:** Definition of Ground Water, Aquifers, Vertical Distribution of Subsurface Water, Hydrological Properties of Water Bearing Strata, Ground Water in Hydrological Cycle.	6	15
2.	**Ground Water Hydraulics:** Darcy's law, its range of validity, dupuit forchheimer assumptions, application of Darcy's law for simple flow systems, governing differential equations for confined and unconfined aquifers, steady and unsteady flow solutions for fully penetrating wells, partially penetrating wells, interference of wells, test pumping analysis with steady and unsteady flows, delayed yield, methods of images.	10	25
3.	**Ground Water Quality**: Indian and international standards.	2	5
4.	**Ground Water Pollution:** Sources, remedial and preventive measures.	6	15
5.	**Ground water conservation:** Ground water budget, seepage from surface water, artificial recharge.	6	15
6.	Models for groundwater flow, sampling and monitoring methods, transport mechanism, modeling advective-dispersive trandport, adsorption and chemical reaction, biodegradation kinetics, numerical flow and transport modeling, waste site characterization/investigation, ground water remediation, legal issues in groundwater contamination.	10	25

Reference Book:

1. Dynamics of Fluids in Porous Media. J. Bear, Elsevier, New York.
2. Geohydrology by ROGER J.M. DE WIEST: John Wiley & Sons, New York, 1965.
3. Groundwater Assessment, Development and Management"" by K. Karanth, McGraw Hill Companies.
4. Groundwater by H.M Raghunath, 2nd edition, Wiley Eastern Ltd, New Delhi.

5. Groundwater Contamination: Transport and Remediation by P.B Bedient, H.S. Rifai and C.J. Newell, Prentice Hall, New Jersey.
6. Groundwater Hydraulics and Pollutant Transport by Randall J. Charbeneau, 2006 Waveland Press, ISBN 9781478608318.
7. Groundwater BY R. A. Freeze and J. A. Cherry, Prentice Hall, New York.
8. Groundwater Hydrology by D.K Todd, Wiley, New York.
9. Groundwater Hydrology by H. Bouwer, McGraw Hill, New York.
10. Groundwater Modelling Using Geographical Information Systems, by G.F. Pinder, Wiley New York.
11. Groundwater Remediation and Treatment Technologies, by Nicholas P. Cheremisinoff by Elsvier, ISBN 9780815517337.
12. Groundwater Resources Evaluation BY W.C. Walton McGraw Hill, New York.
13. Hydraulics of Groundwater, by J. Bear, McGraw Hill, New York.
14. Subsurface Hydrology, George F. Pinder, Michel A. Celia John Wiley & Sons, 2006 ISBN 9780470044193.
15. Theory of Groundwater Movement by Polubarinova-kochina, P. Y. Priceton Universitu Press, New jersey.
16. Groundwater by K. Raghunath

Course Outcome: On completion of the course, the students are expected to be able to:

- Understand Groundwater Flow and Contaminant Transport Issues and The Technologies Employed to Deal with Them
- Assess the Groundwater Hydrology, Quality, Pollution and Conservation.
- Understand the Groundwater Quality Parameters and Its Modeling.

List of Exercise: Term Work Will Comprise of Assignments on The Questions Related to Definition of Terms Used in Groundwater Hydrology, Groundwater Contamination, Numerical, Flow and Contaminant Modeling, Methods of Treatment of Contaminated Groundwater.

Design based problems (DP)/Open ended problems: problems based on groundwater hydraulics and contaminant transport.

List of Open Sources Software/Learning Website:

- http://nptel.ac.in/