Groundwater Hydrology

Code	Credit Hours
CE-880	3-0

Course Description

The objectives of this course are to:

1. Describe the governing equations for groundwater flow and solute transport
2. Estimate flows between aquifers and surface water systems
3. Explain the principles of radial flow associated with groundwater wells, and be able to use these concepts to undertake pump tests analysis
4. Demonstrate enhanced problem-solving, critical-thinking and reasoning abilities

Text Book:

1. Herman Bouwer, Groundwater Hydrology, McGraw Hill, 2000.

Reference Book:

2. Jacob Bear, Hydraulics of Groundwater (McGraw-Hill Series in Water Resources and Environmental Engineering), McGraw-Hill College Division, 1979.
3. ASCE Manuals and Reports on Engineering Practice No. 40, Ground Water Management – 3rd Edition, ASCE Press, 1995.
4. Harry R. Cedergren, Seepage, Drainage, and Flow Nets (3rd Ed.), Interscience, 1997.
5. C. Walton, Groundwater Resource Evaluation, McGraw Hill.
6. H. M. Raghunath, Ground Water Hydrology (2nd Reprint), Wiley Eastern Ltd., 2000.
7. ASCE Standards EWRI/ASCE 34-01, Standard Guidelines for the Artificial Recharge of Ground Water, ASCE Press, 2001.
8. Randall J. Charbeneau, Groundwater Hydraulics & Pollutant Transport, Prentice-Hall, 1999.
9. Ghislain De Marsily, Quantitative Hydrogeology: Groundwater Hydrology for Engineers, Academic Press, 1986.
10. K. R. Rushton & S. C. Redshaw, Seepage and Groundwater Flow, John Wiley & Sons, 1979.

Prerequisites

NIL

Assessment System for Theory

Quizzes	10-15%
Assignments	5-10%
Mid Terms	25-30%
Project	0-10%
ESE	45-50%

Teaching Plan

Week No	Topics	Learning outcomes

1	Introduction	Course Outline, objectives, teaching plan, assessment method, concepts review
2-6	Basics of Groundwater Hydrology	Equations for steady and unsteady flow in confined and unconfined aquifers. Application of these equations to some practical problems on seepage. Well hydraulics for all types of flow and boundary conditions. Analysis and evaluation of pumping test data by analytical methods.
7-8	Types of Models	Types of models: Physical models, Resistance Network; flow net, Conductive sheet and liquid analogues, Sand models, Hele-Shaw models.
9	**MID TERM EXAM**	
10-11	Design and Theorical Applications	Theoretical analysis and application to some practical problems. Design analogues and models to solve some specific groundwater problems.
13-17	Groundwater Development	Groundwater Development: Collector wells, infiltration gallery, conjunctive use, artificial recharge, safe yield, yield test, geophysical methods, selection of pumps Groundwater balance studies.
18	**End Semester Exams**	