

Academic Course Description

<p>BHARATH UNIVERSITY Faculty of Engineering and Technology Department of civil Engineering</p> <p>BCE073 - GROUND WATER CONTAMINATION AND TRANSPORT MODELING Sixth Semester, 2016-17 (even Semester)</p>

Course (catalog) description

To educate the students on the hydraulics related ground water contamination and modeling ground water quality

Compulsory/Elective course : Elective course for CE students

Credit / Contact hours : 3 credits / 45 hours

Course Coordinator : Mr.S.Rajesh

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@bharathuniv.ac.in)	Consultation
Mr.S.Rajesh	Third year CE	Civil block			9.00 - 9.50 AM
B.Kaviya	Third year CE	Civil block			12.45 - 1.15 PM

Relationship to other courses:

Pre –requisites : BCE 064 Ground Water Engineering

Assumed knowledge : Basic knowledge in Water Resources Management

Following courses : BCE 406 Environmental Studies

Syllabus Contents

UNIT I INTRODUCTION

9hrs

Ground water and the hydrologic cycles – Ground water as resources – Ground water contamination – Water quality standards- Sources of contamination-Land disposal of solid wastes – Sewage disposal on Land. Ground water and geologic processes. Physical properties and principles-Darcy's Law- Hydraulic Head and Fluid Potential- Piezometers and Nestes. Hydraulic conductivity and permeability Homogeneity and Anisotropy – Porosity and voids Ratio- Unsaturated flow and the water table- steady state flow and transient flow – Compressibility and effective stress – Transmissivity and storability – Equations of ground water flow – Limitations of Darcian Approach – Hydro dynamic dispersion – Case Studies.

UNIT II HYDROLOGIC CYCLE AND FLOW NETS

9hrs

Flow nets – Graphical construction – Flow nets by numerical simulation. Steady state Regional Ground Water flow – steady state hydrologic budgets – Fluctuations in ground water levels – Case Studies.

UNIT III RESOURCE EVALUATION

9hrs

Development of Ground Water resources – Exploration for Aquifers – the response of Ideal acquifers to pumping – Measurement of parameters – Laboratory tests - Piezometer test – Pumping tests – Estimation of saturates Hydraulic conductivity – Numerical simulation for aquifer yield prediction – Artificial recharge and induced infiltration – Land subsidence – Sea water intrusion –Case Studies..

UNIT IV CHEMICAL PROPERTIES AND PRINCIPLES

9hrs

Development of Ground Water resources – Exploration for Aquifers – the response of Ideal acquifers to pumping – Measurement of parameters – Laboratory tests - Piezometer test – Pumping tests – Estimation of saturates Hydraulic conductivity – Numerical simulation for aquifer yield prediction – Artificial recharge and induced infiltration – Land subsidence – Sea water intrusion –Case Studies.

UNIT V SOLUTE TRANSPORT

9 hrs

Constituents – Chemical equilibrium _ Association and Dissociation of dissolved species – effects of concentration gradients – Mineral dissolution and solubility – Oxidation and reduction process – Ion exchange and Adsorption – Environmental isotopes – Field Measurement of Index parameters- Hydro chemical facies – Ground water in carbonate terrain – Ground Water in crystalline rocks- ground water in complex sedimentary systems – Geochemical interpretation of¹⁴ C Dates – Process rates and molecular diffusion.

Total 45 hours

TEXT BOOK AND REFERENCES:

1. Randall J. Charbeneau, "Ground water Hydraulics and Pollutant transport " Prentice Hall,Upper Saddle.
2. Todd David Keith , Ground water Hydrology, second edition , john Wiley and sons New York, 1980.
3. Allen Freeze, R. and John A. Cherry , "Ground Water " , Prentice Hall, Inc.1979.

Computer usage: Microsoft office Excel

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Water Resources Management

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 1 st week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2 nd week	Session 15 to 28	2 Periods
3	Model Test	April 2 nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To educate the students on the hydraulics related ground water contamination and modeling ground water quality.	Correlates to program outcome		
	H	M	L
1. To make them understand the fundamentals of Ground water and the various hydrologic cycles.	a,b	f	j
2. To understand about the various steady state hydrologic budgets and various case studies associated with it.	b,c	i	
3. To understand in detail about the development of Ground Water resources and Aquifers.	a,b,h,i		j
4. To improve the knowledge on the basics of Chemical equilibrium and Geochemical interpretation of ¹⁴ C Dates		i	
5. To know about the basics of the Transport process in solute transfer and hydro chemical behavior of contaminants in the ground water.	a,f	b	

H: high correlation, M: medium correlation, L: low correlation

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I INTRODUCTION			
1.	Ground water and the hydrologic cycles – Ground water as resources	No	[R3]
2.	Ground water contamination – Water quality standards- Sources of contamination	No	
3.	Land disposal of solid wastes – Sewage disposal on Land. Ground water and geologic processes.	No	
4.	Physical properties and principles-Darcy's Law- Hydraulic Head	No	
5.	Fluid Potential- Piezometers and Nestes.	No	
6.	Hydraulic conductivity and permeability Homogeneity and Anisotropy – Porosity and voids Ratio- Unsaturated flow	No	
7.	the water table- steady state flow and transient flow – Compressibility and effective stress	No	
8.	Transmissivity and storability – Equations of ground water flow	No	
9.	Limitations of Darcian Approach – Hydro dynamic dispersion – Case Studies	No	
UNIT II HYDROLOGIC CYCLE AND FLOW NETS			
10.	Flow nets	No	[R1]
11.	Graphical construction	No	
12.	Flow nets by numerical simulation	No	
13.	Steady state Regional Ground Water flow	No	
14.	steady state hydrologic budgets	No	
15.	Fluctuations in ground water levels	No	
16.	Fluctuations in ground water levels	No	
17.	Case Studies.	No	
18.	Case Studies.	No	
UNIT III RESOURCE EVALUATION			
19.	Development of Ground Water resources	No	[R1]
20.	Exploration for Aquifers – the response of Ideal acquifers to pumping	No	
21.	Measurement of parameters	No	
22.	Laboratory tests	No	
23.	Piezometer test – Pumping tests – Estimation of saturates Hydraulic conductivity	No	
24.	Numerical simulation for aquifer yield prediction	No	
25.	Artificial recharge and induced infiltration	No	
26.	Land subsidence – Sea water intrusion	No	
27.	Case Studies.	No	
UNIT IV CHEMICAL PROPERTIES AND PRINCIPLES			

28.	Constituents – Chemical equilibrium _ Association and Dissociation of dissolved species	No	[R2]
29.	Effects of concentration gradients	No	
30.	Mineral dissolution and solubility	No	
31.	Oxidation and reduction process	No	
32.	Ion exchange and Adsorption	No	
33.	Environmental isotopes – Field Measurment of Index parameters	No	
34.	Hydro chemical facies – Ground water in carbonate terrain	No	
35.	Ground Water in crystalline rocks- ground water in complex sedimentary systems	No	
36.	Geochemical interpretation of ¹⁴ C Dates – Process rates and molecular diffusion.	No	
UNIT V SOLUTE TRANSPORT			
37.	Transport process	No	[R3]
38.	non-reactive constituents in homogeneous media	No	
39.	Heterogeneous media	No	
40.	Transport in Fracture media	No	
41.	Hydro chemical behavior of contaminants	No	
42.	Trace metals – Trace nonmetals	No	
43.	Nitrogen, organic substance		
44.	Measurement of parameters – Velocity – Dispersivity		
45.	chemical partitioning.	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	5%
Assignment	-	5%
Attendance	-	10%
Final exam	-	70%

Prepared by: Mr S.Rajesh Asst Prof , Department of CE

Dated :

Addendum**ABET Outcomes expected of graduates of B.Tech / Civil / program by the time that they graduate:**

- a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.
- b) The ability to identify, formulate, and solve engineering problems
- c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d) The ability to design and conduct experiments, as well as to analyze and interpret data
- e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- f) The ability to apply reasoning informed by the knowledge of contemporary issues
- g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- h) The ability to understand professional and ethical responsibility and apply them in engineering practices
- i) The ability to function on multidisciplinary teams
- j) The ability to communicate effectively with the engineering community and with society at large
- k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

Program Educational Objectives**PEO1: PREPARATION:**

To provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the chosen field of Engineering and Technology.

PEO2: CORE COMPETENCE:

To enhance the skills and experience in defining problems in the appropriate field of Engineering and Technology, designing, implementing, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:

To enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: SKILL:

To provide Industry based training for developing professional skills and soft skills such as proficiency in languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:

Apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

Course Teacher	Signature
Mr.S.Rajesh	
Ms.B.Kaviya	

Course Coordinator

HOD/Civil