

Course Number and Name												
BCE073 - GROUND WATER CONTAMINATION AND TRANSPORT MODELING												
Credits and Contact Hours												
3 & 45												
Course Coordinator's Name												
Mr. S.Rajesh												
Text Books and References												
REFERENCES:												
<ul style="list-style-type: none"> • Randall J. Charbeneau, "Ground water Hydraulics and Pollutant transport " Prentice Hall,Upper Saddle. • Todd David Keith , Ground water Hydrology, second edition , john Wiley and sons New York, 1980. • Allen Freeze, R. and John A. Cherry , "Ground Water " , Prentice Hall, Inc.1979. 												
Course Description												
<ul style="list-style-type: none"> • To educate the students on the hydraulics related ground water contamination and modeling ground water quality 												
Prerequisites						Co-requisites						
Transportation Engineering						NIL						
required, elective, or selected elective (as per Table 5-1)												
Course Outcomes (COs)												
CO1	To make them understand the fundamentals of Ground water and the various hydrologic cycles.											
CO2	To understand about the various steady state hydrologic budgets and various case studies associated with it.											
CO3	To understand in detail about the development of Ground Water resources and Aquifers.											
CO4	To improve the knowledge on the basics of Chemical equilibrium and Geochemical interpretation of ¹⁴ C Dates											
CO5	To know about the basics of the Transport process in solute transfer and hydro chemical behavior of contaminants in the ground water.											
Student Outcomes (SOs) from Criterion 3 covered by this Course												
COs/SOs	a	b	c	d	e	f	g	h	i	j	k	
CO1	H	H				M				L		
CO2		H	H						M			
CO3	H	H						H	H	L		
CO4									M			
CO5	H	M				H		W				

List of Topics Covered	
UNIT I INTRODUCTION	9
<p>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.</p>	
UNIT II HYDROLOGIC CYCLE AND FLOW NETS	9
<p>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.</p>	
UNIT III RESOURCE EVALUATION	9
<p>Development of Ground Water resources – Exploration for Aquifers – the response of Ideal aquifers 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.</p>	
UNIT IV CHEMICAL PROPERTIES AND PRINCIPLES	9
<p>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 Measurment 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.</p>	
UNIT V SOLUTE TRANSPORT	9
<p>Transport process – non-reactive constituents in homogeneous media and Heterogeneous media – Transport in Fracture media – Hydro chemical behavior of contaminants- trace metals – Trace nonmetals – Nitrogen, organic substances- Measurement of parameters – Velocity – Dispersivity – chemical partitioning.</p>	