

GROUND WATER CONTAMINATION AND REMEDIATION

Paper Code: ETEN-418

Paper: Ground Water Contamination and Remediation

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INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The students will be able to:

1. Describe the human activities that may modify groundwater chemistry;
2. Discuss pollutant classification and the nature of diffuse and point-source pollution, giving examples;
3. Describe the origin and properties of the major organic and inorganic pollutants;
4. Apply the principles of modelling solute transport;
5. Outline the various approaches to remediation of polluted groundwater.

UNIT-I

Ground Water Movement and Contamination: Introduction, Characteristics of Ground Water, Sources and Types of Ground Water Contamination, Principles of Ground Water Movement, General Flow Equations, Unsaturated Flow and Water Table, Ground Water Flow and Well Mechanics, Sustainable Yield, Mass Balance Equations, Specific Storage, Initial and Boundary Conditions, Boundary Surface, Particular Boundary Conditions, Complete 3-D Mathematical Flow Model, Modeling 2-D Flow in Aquifers, Complete Aquifer Flow Models, Groundwater Maps and Streamlines, Modeling Flow in the Unsaturated Zone.

[T1, T2][No. of Hours: 12]

UNIT-II

Contaminant transport mechanism: Underground storage tanks, Landfills, Septic Systems, Agricultural Wastes, Return Flow from Irrigation and Sewage, Strategy for Hydrologic Site Investigations, Geologic Data Acquisition, Hydrologic Data Acquisition, Acquisition of Soil and Groundwater Quality Data, Data Evaluation Procedures, Contaminant Transport Mechanism such as Advection, Diffusion and Dispersion, Sorption and Desorption, Biodegradation, Mass Transport Equations, One Dimensional Models, Governing Flow and Transport equations, Analytical Methods, Multi-Dimensional Methods.

[No. of Hours: 12]

UNIT-III

Numerical Modeling of Contaminant Transport: Introduction to Modeling Inorganic and Organic Solute Transport, Numerical Methods, Finite Difference Methods, Numeric Flow Methods, Contaminant Transport Models, Applying Numerical Models to Field Sites, Fate and Transport of organic Substances in Groundwater, Case Studies of Organic and inorganic Groundwater Pollution.

Non-aqueous Phase Liquids (NAPLs): Types of NAPL, Transport, Computational methods, Characterizing NAPLs at Remediation Sites.

[T1, T2][No. of Hours: 12]

UNIT-IV

Natural Attenuation and Risk Based Corrective Action: General Principles behind Natural Attenuation, Natural Attenuation Protocols and Guidance, Risk Based Corrective Action.

Ground Water Remediation Alternatives: Introduction to Remediation methods, Remedial Alternatives, Contaminant Methods for Source Control, Hydraulic Controls and Pump and Treat Systems. Bioremediation, Remediating NAPL Sites. Emerging Remediation Technologies, Case Studies of Remediation.

[T1, T2][No. of Hours: 12]

Text Books:

[T1] Bedient P.B., Rifai H.S., Newell C.J., "Groundwater Contamination- Transport and Remediation", Prentice Hall, New York.

[T2] Bear J. and Cheng A.H.D., "Modeling Groundwater Flow and Contaminant Transport (Theory and Applications of Transport in Porous Media)", Springer, New York.