

Geo-environmental Engineering - Web course

COURSE OUTLINE

“Geotechnical engineering” has evolved as a highly multidisciplinary subject for the past few decades, dealing with a wide range of geo-hydro-chemico-mechanical problems. The subject has grown far beyond the conventional problems and a geotechnical engineer need to deal with environmental problems related to the reduction of waste, waste disposal facilities and cleanup of contaminated sites.

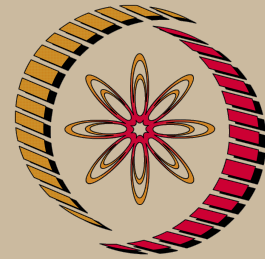
To effectively take up these new challenges, there is a need to acquaint with the knowledge of soil physics, soil chemistry, hydrogeology, and biological processes along with the principles of soil mechanics.

The proposed course on “geoenvironmental engineering” is a blend of geotechnical engineering and environmental concepts and introduces multidisciplinary problem domains to the undergraduate and graduate students. Case histories are discussed to exemplify the importance of this subject in the current age of rapid industrialization and urbanization.

Contents: Fundamentals of geoenvironmental engineering, multiphase behavior of soil, case histories on geoenvironmental engineering problems, Soil-water-contaminant interaction studies, concepts of unsaturated soil in geoenvironmental engineering, Waste containment system, property evaluation of soil, design practices, Vertical barriers, Contaminant site remediation, some examples of in-situ remediation, Advanced soil characterization for geoenvironmental applications.

COURSE DETAIL

Sl. No.	Topic	No. of Hours



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Civil Engineering

Pre-requisites:

1. Soil Mechanics (Geotechnical Engineering I).
2. Environmental Engineering.

Additional Reading:

1. Journal/ Conference publications.
2. Freely downloadable reports pertained to above topics.

Coordinators:

Dr. S. Sreedeeep
Department of Civil
Engineering IIT Guwahati

1	<p>Fundamentals of Geoenvironmental Engineering</p> <p>Scope of geoenvironmental engineering - multiphase behavior of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on geoenvironment - case histories on geoenvironmental problems.</p>	3			
2	<p>Soil-Water-Contaminant Interaction</p> <p>Soil mineralogy characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of interaction between soil particles.</p> <p>Concepts of unsaturated soil – importance of unsaturated soil in geoenvironmental problems - measurement of soil suction - water retention curves - water flow in saturated and unsaturated zone.</p> <p>Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants.</p>	16			
3	<p>Waste Containment System</p> <p>Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.</p>	11			
4	<p>Contaminant Site Remediation</p>	6			

	Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation.	
5	Advanced Soil Characterization Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.	9

References:

Text

1. Rowe R.K., "Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000.
2. Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, 2000.
3. Yong, R. N., "Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York, 2001.
4. Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004.
5. Fredlund D.G. and Rahardjo, H., "Soil Mechanics for Unsaturated Soils" Wiley- Interscience, USA, 1993.
6. Mitchell, J. K., "Fundamentals of Soil Behavior" Wiley, 2005.
7. Hillel D., "Introduction to Environmental Soil Physics" Academic Press, New York, 2003.

References

1. Hillel D., "Introduction to Soil Physics" Academic Press, New York, 1982.
2. Sparks, D.L., "Environmental Soil Chemistry" Academic

Press, New York, 2002.

3. Bagchi, A., "Design of landfills and integrated solid waste management" John Wiley & Sons, Inc., USA, 2004.
4. Alvarez-Benedi J. and Munoz-Carpena, R., "Soil-Water-Solute Process Characterization: An Integrated Approach" CRC Press, New York, 2005.
5. Berkowitz, B. Dror, I. and Yaron, B., "Contaminant Geochemistry" Springer, Germany, 2008.
6. Mohamed, A. M. O., "Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, New York, 2006.