

## ENVIRONMENTAL GEOTECHNIQUES

Offering branch: CE														
Course Category:	Honours					Credits:			4					
Course Type:	Theory					Lecture-Tutorial-Practical:			3-1-0					
Prerequisites:	PC - Geotechnical Engineering					Continuous Evaluation:			30					
						Semester End Evaluation:			70					
						Total Marks:			100					
<b>Course Outcomes</b>														
Upon successful completion of the course, the student will be able to:														
<b>CO1</b>	<b>Examine</b> clay behavior concerning clay chemistry and reaction dynamics												K3	
<b>CO2</b>	<b>Analyze</b> clay's hydraulic, mechanical behaviour												K4	
<b>CO3</b>	<b>Evaluate</b> the engineering landfill design considerations												K5	
<b>CO4</b>	<b>Justify</b> the monitoring parameter of landfill and determine the stability of liner slope												K6	
<b>CO5</b>	<b>Determine</b> the landfill's dynamic factor and use various remedial processes to change the soil.												K3	
<b>Contribution of Course Outcomes towards achievement of Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2	2	2		2	2	2				2	2	2
<b>CO2</b>	2	2	2	2		3	3	3				3	2	3
<b>CO3</b>	3	3	3	3		3	3	3				3	3	3
<b>CO4</b>	2	2	2	2		3	3	3				3	2	3
<b>CO5</b>	2	2	2	2		2	2	2				2	2	2
<b>Avg.</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>		<b>3</b>	<b>3</b>	<b>3</b>				<b>3</b>	<b>2</b>	<b>3</b>
<b>1- Low</b>				<b>2-Medium</b>				<b>3-High</b>						
<b>Course Content</b>														
<b>UNIT-1</b>	<b>Introduction to geo-environmental engineering</b> Introduction to geo environmental, clay chemistry, clay minerals, Reaction dynamics, Engineering, Soil-water-environment interaction relating to geotechnical problems												<b>CO1</b>	
<b>UNIT-2</b>	<b>Hydraulic-properties of clay:</b> Hydraulic conductivity, gas conductivity, ion diffusion capacity, swelling potential, compressibility, and rheological properties. Terzaghi theory of one dimensional consolidation,3-D consolidation equation <b>Mechanical properties;</b> Shear strength of Clay: Triaxial test (UU,CU,CD),Derivation skempton pore pressure equation, Different failure criteria for clay, Introduction of critical state soil mechanics												<b>CO2</b>	
<b>UNIT-3</b>	<b>Landfills:</b> Chemical and geotechnical characterization of municipal solid waste, Landfill layout and capacity, components of landfill and its functions. Types and functions of liner and cover systems												<b>CO3</b>	
<b>UNIT-4</b>	<b>Leachate, gas management and geosynthetics</b> Management of Leachate and gas. Various components of leachate collection and removal system and its design., gas disposal/utilization. Closure and post closure monitoring system. Compacted clay liner, selection of soil for liner, slope stability analysis of liner slope, methodology of construction.												<b>CO4</b>	
<b>UNIT-5</b>	<b>Landfill Design:</b> Design criteria of the landfill, Dynamic analysis <b>Remediation:</b> Bio remediation, thermal remediation, pump and treat method, phyto remediation and electro-kinetic remediation												<b>CO5</b>	
<b>Learning Resources</b>														
<b>Text Books</b>	<ol style="list-style-type: none"> <li>Donald L. Wise, Debra J. Trantolo, Hilary I. Inyang, Edward J. Cichon (2000) Remediation Engineering of Contaminated Soils, Publisher: Marcel Dekker Inc.</li> <li>Koerner, R.M. (2005). Designing with Geosynthetics. Fifth Edition. Prentice Hall, New Jersey</li> <li>Dr. G V Rao and Dr. R S Sasidhar (2009) Solid waste Management and Engineered Landfills, Saimaster Geoenvironmental Services Pvt. Ltd. Publication.</li> </ol>													
<b>Reference</b>	<ol style="list-style-type: none"> <li>Hari D. Sharma, Krishna R. Reddy (2004) Geoenvironmental Engineering: Site</li> </ol>													

<b>Books</b>	Remediation, Waste Containment, and Emerging Waste Management Technologies, Publisher: John Wiley & Sons Inc.
<b>e-Resources &amp; other digital material</b>	<ol style="list-style-type: none"><li>1. <a href="https://www.elsevier.com/books/geoenvironmental-engineering">https://www.elsevier.com/books/geoenvironmental-engineering</a></li><li>2. <a href="https://nptel.ac.in/courses/105/103/105103025/">https://nptel.ac.in/courses/105/103/105103025/</a></li></ol>