SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Civil Engineering

B. Tech. III Semester V

Subject Name : Geo-Environmental Engineering **Subject Code:** BTCL14502

Type of course : PEC I

Prerequisite : Fundamentals of Soil Mechanics (BTCL13402)

Rationale : The course of action of the curriculum is to make students acquainted with soil pollutants, effect of contamination on soil, waste disposal and soil improvement materials, advanced soil characterization techniques.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Teaching Hrs.	Module Weightage
1	**Introduction Geo-Environmental Waste:** Introduction and scope of geo-environmental engineering. Source-classification-management of waste, physical- chemical-geotechnical characterization of municipal solid waste, Environmental Concerns with waste, waste management strategies and Waste disposal facilities.	**8**	**15 %**
2	**Site Characterization:** Sources and Site Characterization, various sources of contaminations, Need for contaminated site characterization and methods.	**7**	**10 %**

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3	**Landfill:** Types of landfills, Site Selection, Landfill layout and capacity, components of landfill and its functions. Types and functions of liner and cover systems, Waste Containment Liners, Compacted clay liner, selection of soil for liner, methodology of construction. Parameters controlling the selection of the site for sanitary and industrial landfill.	**8**	**20 %**
4	**Geosynthetic Application in Leachate and Gas Management:** Leachate and gas management. Leachate collection components and removal system, disposal of gas. Monitoring system. Testing and design aspects of Geosynthetics - Geo membranes - geosynthetics clay liners.	**8**	**20 %**
5	**Soil Remediation:** Objectives of site remediation, Investigation of contaminated soil, sampling, assessment Transport of contaminants in saturated soil. Remediation of contaminated soil- in-situ / exit remediation, bio-remediation, thermal remediation, pump and treat method, Phyto remediation and electro-kinetic remediation	**8**	**20 %**
6	**Impact of Environment on Soil Engineering Properties:** Variation in Engineering properties of soil – Atterberg limit, Shear strength, Permeability and Swelling due to change in environment/pore fluid.	**6**	**15 %**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	30	15	15	0

Legends: R: Remembrance**; U:** Understanding**; A:** Application**, N:** Analyze and **E:** Evaluate **C:** Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Reference Books:

Sr. no.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Geotechnical Practice for Waste Disposal	Daniel, D.E.	Chapman, and Hall, London. ISBN 0 412 35170 6	1993	1st
2	Geo-environmental Engineering: Principles and Applications	Reddi L.N and Inyang HI	Marcel Dekker Inc Publication ISBN-10 : 0824700457	2000	1st
3	Designing with Geosynthetics	Koerner, R.M.	Prentice Hall, New Jersey.	2005	5th
4	Solid waste Management and Engineered Landfills	Dr. G V Rao and Dr. R S Sasidhar	Saimaster Geo-environmental Services Pvt. Ltd. Publication.	2009	-
5	Soil engineering in relation to environment	Ayyar TSR	LBS centre for Science and Technology, Trivandrum.	2000	-
6	Geo-environmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies	Hari D. Sharma, Krishna R. Reddy	Publisher: John Wiley & Sons Inc. ISBN: 978-0-471-21599-8	2004	1st
7	Geotechnical & Geo-environmental Engineering Handbook	Rowe, R. K.	Kluwer Academic, ISBN 978-1-4615-1729-0	2001.	1st

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Course Outcomes:

Sr. No.	CO statement After successful completion of this course, the students will be able to	Marks % Weightage
CO-1	Deal with geo-environmental engineering problems and utilize waste in geotechnical applications. *(U, A, N, E – Cognitive level)*	15
CO-2	Investigate the contaminated site and suggest soil remediation. *(U, A, N – Cognitive level)*	30
CO-3	Suggest a suitable method to design a landfill. *(U, A, N – Cognitive level)*	20
CO-4	Analyze the effective geo-synthetic application in leachate and gas management. *(U, A, N – Cognitive level)*	20
CO-5	Distinguish the variation in engineering properties of soil due to changes in the environment. *(U, A, N – Cognitive level)*	15

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	2	1	1	1	2	2	1	-	-	-	-	1	1	1
CO-2	2	2	1	1	1	1	2	1		-	-	-	2	2	2
CO-3	2	2	1	1	2	1	2	1	-	-	-	-	1	2	2
CO-4	2	2	1	1	2	1	2	1	-	-	-	-	1	1	1
CO-5	2	2	1	1	1	-	2	-	-	1	-	1	-	1	2
Rationale*	**10**	**10**	**5**	**5**	**7**	**5**	**10**	**4**	**-**	**1**	**-**	**1**	**5**	**7**	**8**

Rationale*: All CO's are compatible and matching to be derived POs to several extents. It will help to develop understanding about soil pollutants, effect of contamination on soil, leachate, and waste disposal and soil improvement materials, advanced soil characterization techniques.

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List of Open learning website:

- **https://nptel.ac.in/courses/105/103/105103025/**
    - Soil water contamination
    - Waste containment system
    - Contaminated Site remediation
    - Advanced soil characterization

- **https://nptel.ac.in/courses/105/102/105102160/**
    - Waste soil interaction
    - Landfill (Planning, Liner, Slope stability, Settlement, Monitoring)
    - Control and remedial measures for contaminated site
    - Slurry disposal in land
    - Planning and design of slurry pond

FOR LAB SESSIONS:

List of Experiments: (Any Five)

1. Demonstration of chemical analysis test (pH, Conductivity, Determination of organic matter, Sulphate and Chloride content).
2. pH of soil.
3. Demonstration for thermal properties of soil and electric properties of soil.
4. Study of hazardous waste control techniques and detailed report.
5. Study on change of soil characterization due to contamination.
6. Study different advanced soil characterization techniques.
7. Case study on failures of foundation due to pollutants.
8. Case study on geo-synthetic application in leachate and hazardous management.
9. Site visit of safe waste disposal site and detailed report.