GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil Engineering

Subject Code: ME02065121

Subject Name: Environmental Geotechniques

w. e. f. Academic Year:	2024-2025
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Knowledge of Geotechnical Engineering.
Rationale:	Geotechnical engineering has evolved as a multidisciplinary subject for the past few decades, dealing with a wide range of geo-hydro-chemico-mechanical problems. Geotechnical engineer need to deal with environmental problems related to waste and its management. Discussion of case histories to exemplify the importance of this subject in the current era of rapid industrialization and urbanization is need of the day. This will help them to analyze, design and execute suitable landfill systems and waste management w.r.t various types of domestic and industrial contaminants.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Important characteristics of the waste containment and remediation industry and the potential areas for improvement, know the relevant governmental regulations and engineering design requirements.	R,U
02	Check the compaction quality using field tests, evaluate the success of clay liner installation	U,A,N
03	Evaluate difference in flow through geomembranes and composite liners.	A,N,E
04	Analyse Contaminant transport in sub surface – advection – diffusion – dispersion – governing equations – contaminant transformation – sorption – biodegradation – ion exchange – precipitation– hydrological consideration in land fill design – ground water pollution – bearing capacity of compacted fills – foundation for waste fill ground.	A,N,E

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction & Soil-Contaminant Interaction: Need of environmental geo-technology, role of soil and its various phases in geo-environmental engineering, Types of Soil-Contaminant , Environmental cycles and their interaction -soil water environment interaction relation to geotechnical problems –pollution effect on soil behavior and foundations -effect of bacteria -pore fluid on soil water behavior -load factor versus environmental factor -environmental technology and public concerns.	**9**	**15**
2.	Site Selection & Disposal of Waste : characterization of land fill sites – Characterization of waste – stability of landfills – current practice of waste disposal -criteria for geotechnical construction on sanitary landfills - liners – types and design - passive containment systems-leachate contamination- land fill gases and their properties, landfill gas monitoring systems–use and application of geo-synthetics in solid waste management.	**9**	**25**
3.	Transport of Contaminants: Contaminant transport in sub surface – advection – diffusion – dispersion – governing equations – contaminant transformation – sorption – biodegradation – ion exchange – precipitation – hydrological consideration in land fill design – ground water pollution –bearing capacity of compacted fills – foundation for waste fill ground – Case studies	**10**	**20**

4.	Impact of Environmental Issues: Environmental effects caused by pile driving and their control -dynamic response of soil under environmental stress -contribution of environmental stress such as hazardous waste –acid rain, tree cutting etc.	**7**	**20**
5.	Remediation Measures: Remediation methods for soil and groundwater – selection and planning of remediation methods, bio – remediation, incineration, soil washing, electro kinetics, soil heating, –examples of in-situ remediation, Case studies	**10**	**20**
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**20**	**20**	**20**	**20**	**5**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonom5

References/Suggested Learning Resources:

(a) Books:

1. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
2. Daniel, B.E., Geotechnical Practice for waste disposal, Chapman and Hall, London, 1993.
3. Proceedings of the International symposium of Environmental Geotechnology (Vol.I and II), Environmental Publishing Company, 1986 and 1989.
4. Ott, W.R., Environmental Indices, Theory and Practice, Ann. Arbor, 1978.
5. Hsai-Yang Fang, "Introduction to Environmental Geotechnology", CRC Press, New York
6. ASTM Special Technical Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
7. Westlake, K., (1995), Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
8. Lagrega, M.d., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994.
9. Edward A., McBean, Frank A. Rovers "Solid Waste Landfill Engineering and Design", Prentice Hall PTR.
10. Zheng C., "Applied Contaminant Transport Modeling", John Wiley & sons, First edition.

(b) Open source software and website:

1. http://nptel.ac.in/
2. http://ocw.mit.edu/courses/civil-and-environmental-engineering/

Suggested Course Practical List:

1. Design of landfill and selection of landfill site for each type of waste as per codal environmental clausesand
2. 2 case studies. Relating to above .

Few examples of the same are given below:

1. Make detail spreadsheet of classification of waste of your local city including both dry and wetwaste.
2. Selection of sites for waste dumping based on sub soil profile and design of suitable landfill coverusing local materials and geosynthetics.

Major Equipment/Resources in Laboratory :

Programming language C/C++/Java,

MATLAB, SIMULINK

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