GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Geotechnical Engineering

Course / Subject Code: ME01076051

Course / Subject Name : Environmental Geotechnical Engineering

w.e.f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite:	Knowledge of Geotechnical Engineering, Mechanics of Solids
Rationale:	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. Geotechnical engineer need to deal with environmental problems also related to waste and its management. Discussion of case histories to exemplify the importance of this subject in the current age 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
01	Understand the important characteristics of the waste containment and remediation industry, the responsibilities of a geotechnical engineer in this field, and the potential areas for improvement, know the relevant governmental regulations and engineering design requirements.
02	Check the compaction quality using field tests, evaluate the success of clay liner installation, evaluate difference in flow through geomembranes and composite liners.
03	Understand 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
04	Estimate bearing capacity of compacted fills – foundation for waste fill ground.

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, Environmental cycles and their interaction -soil water environment interaction relation to geotechnical problems - pollution effect on soil behaviour and foundations -effect of bacteria - pore fluid on soil water behaviour -load factor versus environmental factor environmental technology and public concerns, case studies.	10	15
2.	Site Selection & Disposal of Waste: characterization of land fill sites – waste characterization – 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 - 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 – 08 20 4 bearing capacity of compacted fills – foundation for waste fill ground – Case studies	8	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. to mechanism of landslides	8	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, – some examples of in-situ remediation.	10	20
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

DistributionofTheoryMarks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
16	14	12	10	10	8

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

References/SuggestedLearningResources:

(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:

List of Laboratory/Learning Resources Required:

1. Design of landfill and selection of landfill site for each type of waste as per codal environmental clauses and supported by at least two case studies.
2. Maximum no of problems may be equal to 10-15.

Few examples of the same are given below:

1. Make detail spreadsheet of classification of waste of your local city including both dry

and wet waste.

2. Selection of sites for waste dumping based on sub soil profile and design of suitable landfill cover using local materials and geosynthetics.

Suggested Project List:

1) Visit of NABL accredited soil/rock testing laboratory/research station

2) Preparation of Rock Borelog report based on conventional tests and geophysical tests.

Suggested Activities for Students:

1) Visits of landfill sites/industrial sewage treatment plants/companies manufacturing liners/geomembranes and prepare report.
2) Referring IS CODES and Practicing Manuals

****