GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Geotechnical Engineering

Course / Subject Code:ME01076061

Course / Subject Name : Geosynthetics and Reinforced Earth

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

Prerequisite:	Geotechnical Engineering, Foundation Engineering, Advance Soil Mechanics
Rationale:	To introduce the students to the different types of geosynthetics, their manufacturing technique, testing methods and their applications in different types of Civil Engineering projects. The study of geosynthetics and reinforced earth is crucial for advancing modern engineering practices. It addresses key challenges in construction, environmental protection, and sustainable development. This subject provides students and professionals with the necessary tools to innovate and excel in their fields, contributing to safer, more efficient, and environmentally friendly engineering solutions.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Know the different types of geosynthetics, their manufacturing technique, testing methods.
02	Understand and able to design reinforced earth wall and selection of reinforcement material.
03	Analyze reinforced soil slope and reinforced foundation.
04	Understand drainage and filtration, road pavement and landfills application of geosynthetics

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: Historical background of reinforced soil, Principles of reinforced soil through Mohr circle analysis.	3	05
2.	Different types of geosynthetics and its Testing: Types of geosynthetics like geotextiles, geogrids, geonets, geocells, geocomposites and geomambrane, their manufacturing methods. Various properties of geosynthetics, physical properties, mechanical properties, hydraulic properties & endurance properties. Extrapolation of long term strength properties from short term tests.	9	20
3.	Reinforced Soil retaining walls: Different types of walls like wrap-around walls, full-height panel walls and discrete-facing panel walls, modular block walls Design methods for RE wall, Construction methods for reinforced soil retaining walls.	10	25
4.	Reinforced soil slopes: Basal reinforcement for construction on soft clay soils, construction of steep slopes with reinforcement layers on competent soils, Different slope stability analysis methods like planar wedge method, bi-linear wedge method and circular slip methods. Erosion control on slopes using geosynthetics.	7	15
5.	Various Civil Engg Applications of Geosynthetics/Case-Studies: For Foundations: Binquet and Lee's approach for analysis of foundations with reinforcement layers. Drainage and filtration: Different filtration requirements, filtration in different types of soils and criteria for selection of geotextiles, estimation of flow of water in retaining walls, pavements, etc. and selection of geosynthetics. Pavement application: Mechanism and concept of pavement, Design of unpaved roads, Design by Giroud-Noiray approach Landfills application: Different components of modern landfills, collection techniques for leachate, application of different geosynthetics like geonets, geotextiles for drainage in landfills, use of geomembranes and Geosynthetic Clay Liner (GCL) as barriers.	16	35
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
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/Suggested Learning Resources:

(a) Books:

1. Koerner, R.M. (2012)"Designing with Geosynthetics", 6 th edition, Vol-1 and 2,Xlibris corp.ion.
2. S.kumar Shukla (2002) "Geosynthetics and Their Applications", Thomas Telford Ltd.
3. Ingold T. S. (1982) "Reinforced Earth" Thomas Telford Ltd., London.
4. G.V. Rao, PK Banerjee, J.T. Shahu, G.V.Ramana (2004) "Geosynthetics - New Horizons", Eds, Asian Books Private Ltd., New Delhi,.
5. Hoe I. Ling, Dov Leshchinsky Fumio (2003)-" Reinforced Soil Engineering: Advances in Research and Practice"
6. Tatsuoka. R. W. Sarsby "Geosynthetics in Civil Engineering" edited by, CRC press
7. G. V Rao & G. K. Pothal "Geosynthetics Testing, Laboratory Manual" SAGES Pvt. Ltd.

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:

Demonstration of testing of geosynthetics and application in laboratory/site/manufacturing unit.

Minimum 5 assignment questions from above topics.

List of Laboratory/Learning Resources Required:

Suggested Project List:

1) Design of RE Wall using software's with stability checks based on IS Codes or BS 8006.

2) Design of Geosynthetics for Subgrade or Footings for increasing bearing capacity or Gabion walls for slope stability.

Suggested Activities for Students:

1) Visit of ATIRA (Ahmedabad) Geosynthetics/Geotextiles Testing Laboratory and prepare report.
2) Referring IS/BS/ASTM CODES and Practicing Manuals

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