

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL (GEOTECHNICAL ENGINEERING) (43)

GEOSYNTHETICS AND REINFORCED EARTH

SUBJECT CODE: 2724303

SEMESTER: II

Type of course: Elective

Prerequisite: Geotechnical Engineering, Foundation Engineering Applied 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.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs	% Weightage
1.	Introduction: Historical background of reinforced soil, Principles of reinforced soil through Mohr circle analysis.	2	
2	Different types of geosynthetics: Types of geosynthetics like geotextiles, geogrids, geonets, geocells, geo-composites, their manufacturing methods.	4	
3	Testing methods for geosynthetics: Techniques for testing of different index properties, strength properties, Apparent Opening Size, In-plane and cross-plane permeability tests, assessment of construction induced damage, extrapolation of long term strength properties from short term tests.	5	
4	Reinforced Soil retaining walls: Different types of walls like wrap-around walls, full-height panel walls, discrete-facing panel walls, modular block walls Design methods as per BS-8006 and FHWA methods, Construction methods for reinforced soil retaining walls.	9	
5	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, circular slip methods. Erosion control on slopes using geosynthetics.	7	
6	Applications in foundations: Binqet and Lee's approach for analysis of foundations with reinforcement layers.	4	
7	Drainage and filtration applications of geosynthetics:	4	

	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.		
8	Pavement application: Geosynthetics for separation and reinforcement in flexible pavements, design by Giroud-Noiray approach, reflection cracking and control using geosynthetics. Use of geosynthetics for construction of heavy container yards and railway lines.	4	
9	Construction of landfills using geosynthetics: 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.	3	

Reference Books:

1. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 4th edition.
2. Jewell, R.A., "Soil Reinforcement with Geotextiles", Special Publication No. 23, CIRIA, Thomas Telford. London, UK, 1996.
3. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.
4. Reinforced Soil Engineering: Advances in Research and Practice, Hoe I. Ling, Dov Leshchinsky Fumio 2003-Tatsuoka.
5. Design and Practice of Geosynthetic-Reinforced Soil Structures, Hoe I. Ling, Guido Gottardi Daniele, 2013-Cazzuffi
6. Geosynthetics and Their Applications, Sanjay Kumar Shukla – 2002

Course Outcome:

After learning the course the students should be able to:

1. Know the different types of geosynthetics, their manufacturing technique, testing methods
2. Understand and able to design reinforced earth soil
3. Analyse reinforced soil slope and reinforced foundation
4. Understand drainage and filtration application of geosynthetics
5. Understand application of geosynthetics in road pavement and landfills

List of Experiments/ Tutorials:

Minimum 15 problems from above topics

List of Open Source Software/learning website:

1. NPTEL lecture series
2. MIT open source material

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU

website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website