GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: GEOTECHNICAL ENGINEERING
SUBJECT NAME: GEOSYNTHETICS AND REINFORCED EARTH
SUBJECT CODE: 3714313
M.E. Semester-I

Type of course: Program Elective II

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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Historical background of reinforced soil, Principles of reinforced soil through Mohr circle analysis.	2	5
2	**Different types of geosynthetics:** Types of geosynthetics like geotextiles, geogrids, geonets, geocells, geo-composites and geomambrane, their manufacturing methods.	4	10
3	**Testing of Geosynthetics:** Various properties of geosynthetics, physical properties, mechanical properties, hydraulic properties & endurance properties. Extrapolation of long term strength properties from short term tests.	4	10
4	**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
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 and circular slip methods. Erosion control on slopes using geosynthetics.	6	15
6	**Various Civil Engg Applications of Geosynthetics:** For Foundations: Binquet and Lee's approach for analysis of foundations with reinforcement layers.	16	35

	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.		

Reference 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"Tatsuoka.
6. 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.

Additional reading : Design guidelines from FHWA, BS and other codal organizations.

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/Tutorial:

Demonstration of testing of geosynthetics and application in laboratory/site/manufacturing unit.
Minimum 5 assignment questions from above topics.

Major Equipments:

1. UTM for geosynthetics
2. Pull-out tester
3. Large size box shear setup

List of Open Source Software/learning website:

- NPTEL lecture series
- MIT open source material