SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Civil Engineering

B. Tech. IV Semester VII

Subject Name : Geo-Synthetics and Reinforced Soil **Subject Code:** BTCL14710

Type of course: PEC - V

Prerequisite : Advances in Geotechnical Applications (BTCL14606)

Rationale : The course of action of the curriculum is to make students acquainted with the use of geo-synthetics for soil reinforcement and different applications.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
3	0	0	3	60	25	15	-	-	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in the course.

Content:

Sr. No	Content	Teaching Hrs.	Module Weightage
1	**Introduction:** General overview and historical development need of geo-synthetics, Principles, concepts, and mechanisms of reinforced soil. Types and functions of geo-synthetics with application area, Advantages, and disadvantages.	5	5 %
2	**Reinforcing Material and Properties:** ***Materials***: Raw materials used for geo-synthetics, the manufacturing process of woven and nonwoven geo-textiles, geo-membranes, geo-grids. ***Properties and methods of Testing:*** Physical properties (mass per unit area, thickness, specific gravity), hydraulic properties (apparent open size, permittivity, transmissivity). Mechanical properties (uniaxial tensile strength, burst and puncture strength, soil geo-synthetic friction tests), Durability (abrasion resistance, ultraviolet resistance, creep, and long term performance). Reinforced soil, factors affecting the performance of reinforced soil, fills types of facings, advantages, and disadvantages.	10	25 %

PEC - V: Professional Elective Course - V

w.e.f. AY 2021-22

3	**Soil Reinforcement Design** Mechanism of reinforcement action - equivalent confining stress concept, Pseudo cohesion concept. ***Reinforced soil retaining walls:*** Design and analysis of vertically faced reinforced soil retaining walls; external stability and internal stability, tie back wedge analysis and coherent gravity analysis. Assumptions, limitations and numerical problems, Construction methods. ***Bearing capacity:*** Improvement using soil reinforcement, analysis methods, assumptions, failure mechanisms. Simple problems in bearing capacity. ***Geosynthetics in embankments and pavement***: Short term stability of embankments on soft soils. Natural geotextiles, advantages and disadvantages, functions, erosion control- types of erosion control products, installation methods. Application in pavements, function, and benefits.	**14**	**30 %**
4	**Geo-synthetics as Separation, Filtration, and Drainage:** Use of geosynthetics for filtration and drainage, the requirement for the design of separation and filtration, General behavior, filtration behind retaining wall, erosion control and silt fence, drainage design, liners for liquid containment, geomembrane and geosynthetic clay liners.	**8**	**20 %**
5	**Application and Case studies** Prefabricated vertical drains along with design principles and installation method Concept of geo-cells, gabion walls, encased stone columns, geo-composites, soil nailing, basic concepts of geotubes, geobags, and application in landfills. Case studies of reinforced dams, embankments, pavements, railroads, foundations, and underground structures.	**8**	**20 %**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	15	20	20	20	15

Legends: R: Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze and **E:** Evaluate **C:** Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

PEC - V: Professional Elective Course - V

Reference Books:

Sr. no.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Earth Pressure and Earth Retaining Structures	Clayton, C.R.I., Milititsky J. and Woods, R.I.	Boca Raton : CRC Press ISBN-13: 978-1138427297 ISBN-10: 1138427292	2017	3rd
2	Reinforced Earth	Ingold. T	Thomas Telford Ltd. ISBN-10 : 0727700898 ISBN-13 : 978-0727700896	1982	1st
3	Earth Reinforcement and Soil Structures	Jones C.J	Butterworth-Heinemann ISBN-13: 978-040803549	2013	2nd
4	Designing with Geosynthetics	Koerner, R.M.	Prentice Hall ISBN-13 :145415-3	1993	5th
5	Earth Reinforcement – Design and Construction.	Rao, G.V., Kumar, S. J. and Raju, G.V.S.S.	Publication No. 314, Central Board of Irrigation and Power, New Delhi. ISBN-10 : 8173363218 ISBN-13 : 978-8173363214	2018	2nd
6	Engineering with Geosynthetics	G. Venkatappa Rao and G.V.S Suryanarayana Raju.	Tata Mc Graw Hill, New Delhi. ISBN-10 : 007460323X ISBN-13 : 978-0074603239	1990	2nd
7	An introduction to Soil reinforcement and geosynthetics.	Sivakumar Babu, G.L.	United Press (India) Pvt. Ltd.	2005	1st

PEC - V: Professional Elective Course - V

SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Civil Engineering

Course Outcomes:

Sr. No.	CO statement After successful completion of this course, the students will be able to	Marks % Weightage
CO-1	Describe the mechanism and different types of geo reinforced with their functions. *(U – Cognitive level)*	5
CO-2	Acquaint with properties and testing methodology of geosynthetics. *(R, U, A – Cognitive level)*	25
CO-3	Evaluate the applications and suitability of different soil reinforcement techniques. *(A, N, E – Cognitive level)*	20
CO-4	Analyze and design simple reinforced soil structures with all safety measures. *(A, N, E , C– Cognitive level)*	40

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	2	-	-	-	2	1	-	-	-	-	1	-	-	-
CO-2	2	1	1	-	-	-	1	-	-	-	-	1	1	-	-
CO-3	3	3	2	2	1	2	1	1	-	-	-	1	1	1	1
CO-4	3	3	3	3	3	2	1	1	1	-	1	1	1	1	1
Rationale*	**11**	**9**	**6**	**5**	**4**	**6**	**4**	**2**	**1**	**-**	**1**	**4**	**3**	**2**	**2**

Rationale*: All CO's are compatible and matching to be derived POs to several extents. It will help to develop understanding about the use of different geo-synthetics materials and methods for soil reinforcement and different applications.

List of Open learning websites:

https://nptel.ac.in/courses/105/106/105106052/

- Types and functions
- Strength Analysis and Testing
- Design of retaining wall with case studies
- Bearing capacity analysis
- Pavement design application
- Drainage and filtration
- Erosion control and landfill

PEC - V: Professional Elective Course - V

SARVAJANIK UNIVERSITY