Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2022-2023

Course Handout (Part II)

Date: 16/01/2023

In addition to part I (General Handout for the course appends to the time table) this portion gives further specific details regarding course.

Course No. : **CE F426**

Course Title : **Geosynthetics and Reinforced Soil Structures**

Instructor-in-charge : **Prof. A. GuhaRay**

Course Description, Scope and Objectives:

The main goal of this course is to provide an in-depth understanding of different ground improvement techniques with geosynthetics and stability analysis of reinforced earth structures. The course provides an insight into the different guidelines of ground improvement suggested by IS Code, IRC and AASHTO. In addition, the course also provides knowledge about other popular ground improvement techniques such as soil nailing, rock bolting by illustration through case studies. Recent trends in ground improvement with the use of waste materials will also be covered in the course.

Course Outcomes: At the end of this course, the students will develop:

1. An ability to identify different ground improvement techniques for different soil conditions.
2. An ability to design earth structures with geosynthetics with application to retaining walls, slope stabilization and foundations.
3. An ability to design preloading and surcharge, sand drains, pre-fabricated drains, stone columns by different methods.

Student Learning Outcomes (SLOs) assessed in this course – **(a), (c), (f), (j), (k).**

Text Book:

T1. Purushothama Raj P. “Ground Improvement Techniques”, Laxmi-Publications, 2nd Edition, 2016.

Reference Books:

R1. G.L. Sivakumar Babu, “An Introduction to Soil Reinforcement and Geosynthetics”, Universities Press, 3rd Edition, 2013.
R2. Manfired R. Hausmann, “Engineering Principles of Ground Modification”, McGraw-Hill Pub, Co., 2013
R3. Koerner, R. M., “Designing with geosynthetics”, Prentice Hall Inc. 1998.
R4. Jie Han, “Principles and Practice of Ground Improvement”, John Wiley & Sons, 2015.
R5. G.V. Rao, “Geosynthetics – An Introduction” SAGES – Bangaluru, 2007

Course Plan

No. of Lectures	Topics to be Covered	Learning Objectives	Chapter in the Text Book / Reference Book	SLO
1-2	Introduction	● Study the need for ground improvement ● Study different types of problematic soils and their origin, Reclaimed Soils ● Study the effect of Temperature, Seepage, Erosion, Vibration on Soil ● Study major classifications of ground improvement techniques	TB 1 Ch1	(a), (j)
3-8	Mechanical Stabilisation	● Study requirements for shallow and deep compaction, Properties of compacted soil and compaction control, Principles and methods of soil compaction ● Study about different types of rollers.	TB 1 Ch2	(a), (k)

		● Study dynamic compaction, vibro-compaction, vacuum consolidation, blast densification.		
9-17	Ground Improvement by Geosynthetics	● Study types, properties and applications of Geosynthetics ● Study filtration, drainage and seepage control with Geosynthetics ● Design Earth Structures with geosynthetics with application to retaining walls, slope stabilization and foundations.	TB 1 Ch 8, R1 Ch 10, 19	(a), (c), (f), (k)
18-21	Grouting	Study permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions, different applications of grouting	TB 1 Ch 6	(a)
22-25	Modification by Admixtures/ Chemical Stabilisation	Study cement stabilization and cement columns, Lime stabilization and lime columns, Stabilization using bitumen and emulsions	TB 1 Ch 7	(a)
26-31	Accelerated Consolidation Methods for Soft Clay Soils	● Study dewatering methods ● Design preloading and surcharge, Sand drains, Pre-fabricated drains, Stone columns according to IS code and other methods. ● Design ground improvement techniques by consolidation	TB 1 Ch 4	(a), (c), (f), (k)
32-35	In-situ Soil Treatment Method	Study and design soil nailing, rock anchoring, micro-piles, rock bolting.	R2 Ch 20	(c), (f), (k)
36-38	Ground Improvement using Waste Materials	Study ground improvement using natural fibers, fly ash, GGBS, shredded rubber chips and other waste materials, LDPE and HDPE.	Class Notes	(a)
39-42	Ground	Study bio-clogging, bio-cementation	Class Notes	(a)

	Improvement by Microbial Activities			

***Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-semester Examination	90 mins.	30	18/03 9.30 - 11.00AM	Closed Book
Assignments	-	15	Throughout the semester	Open Book
Project	-	15	Throughout the semester	Open Book
Comprehensive Examination	3 hours	40	19/05 FN	Closed Book

Chamber Consultation Hour: W and Th 10-11 AM, or by prior appointment based on urgency through BITS email only.

Notice: All notices concerning the course will be conveyed through Google Classroom.

Make-up Policy:

1. Make-up will be granted only on genuine reasons (medical emergencies). For medical cases, a certificate from the concerned physician of the Medical Centre must be produced.
2. For the skill tests, surprise tests, lab demo sessions and tour case study (if any), make-ups are not possible.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
CE F426