

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL (GEOTECHNICAL ENGINEERING) (43)

SOIL IMPROVEMENT TECHNOLOGY

SUBJECT CODE: 2714306

SEMESTER: I

Type of course: Master of Engineering in **Geotechnical Engineering**

Prerequisite: NA

Rationale: This subject is introduced in the first semester as a major elective with a view that student can identify and explore various problematic soils and suggest various improvement techniques based on available technology and need of construction industry

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	2	5	70	30	20	10	20	0	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Concepts of soil type and its physical and mechanical relevance on engineering properties of soil including soil structure changes, Engineering properties of soft, weak and compressible deposits and problems associated with these deposits.	7	15
2	Introduction, Need for soil improvement *(cohesive soils and cohesionless soils), Compaction, Preloading, dewatering, admixtures, grouting, heat treatment, ground freezing, anchorage, micropiles, stone columns, accelerated consolidation with prefabricated drains, granular columns, lime columns, electro-osmosis, compaction piles heavy tamping, deep mixing, vibro-replacement, vibro-compaction, blast densification, soil nailing, ground anchors.	13	30
3	Physical and Chemical improvement: Classification of stabilizing agents and stabilization processes, principles of mechanical stabilization, inorganic stabilizing agents and their characteristics - lime, cement, lime-flyash, hydroxides, carbonates etc., inorganic stabilizers, reaction mechanism in relation to strength improvement, characteristics under various conditions of soil properties such as, time, temperature and stress, bituminous stabilization, electrical and thermal stabilization	15	35
4	Grouting technology, Grout materials, physical and chemical properties, strength, Rheological aspects of coarse and fine grouts, penetrability and performance aspect of coarse and fine grouts, Various application of grouting.	9	20

Reference Books:

1. Proceedings of the Conference on Soil Stabilization, Massachusetts Institute of Technology, June 18-30, 1959.
2. A.C. Houlsby, Grouting Manual, Water Resources Commission, Australia-1977.
3. R.H. Karol, Chemical Grouting, Applied Science Publishers-1986.
4. A.V. Shroff & D.L. Shah, Grouting technology for dam construction and tunneling, Oxford & IBH Publishers, 2nd addition, 1999
5. Koerner R M, "Construction and Geotechnical Methods in Foundation Engineering",
6. McGraw Hill Publishing Co. Ltd., 1984
7. Hausmann M.R. 'Engineering Principles of Ground Modification' McGraw Hill
8. Publishing Company, New York - 1990.
9. Zeevart L, "Foundation Engineering for Difficult Subsoil Conditions"
10. Bell F G, "Foundation Engineering in Difficult Ground", Butterworth, 1978.
11. Van Impe W.F, "Soil Improvement technique and their evaluation"
12. Rao V.V S, "Ground Improvement techniques

Course Outcome:

After learning the course the students should be able to:

1. The course would help the students in reinforcing their knowledge for determination of engineering properties of different soils and interpreting the results.
2. The course would provide insight into identifying various engineering problems associated with soft and compressible soil deposits.
3. The course would impart knowledge about design and implementation of various soil improvement techniques.
4. The course would develop the understanding for selection of appropriate soil improvement technique based on the soil type and application.
5. The course would cover details related to determination of various properties of different grouts, which is a necessary knowledge for grouting design for various engineering applications in the field.
6. The course would cover various engineering applications of grouting, the awareness of which would help in the field to decide the suitability of grouting for solving an engineering problem.

List of Experiments:

1. Determination of various index properties of soil (specific gravity, liquid limit, plastic limit, shrinkage limit, relative density, soil classification)
2. Determination of various engineering properties of soil (permeability, shear strength, compaction, swell pressure)
3. Determination of various physical and chemical properties of grout (fluidity, bleeding potential, gelation, gel strength, specific gravity, Ph, colour change, water retentivity, syneresis)
4. Chemical analysis of soil

Open Ended Problems:

Major Equipments:

Complete tri-axial system with pore pressure measurements, unconfined compression system, automated soil compactor, California bearing ratio (CBR) machine, permeameter (Flexiwall & Blaine's), pH and Electrical conductivity probes/meters, Viscometers

List of Open Source Software/learning website: Nil