Marwadi University

Syllabus for Master of Technology

Civil Engineering (Geotechnical)

Ground Improvement Techniques
01GT0201 (PC)

Objective of the Course: Objectives of introducing this subject at first year level in Masters of civil engineering are:

1. Impart the knowledge of identification of the problems encountered on site related to soils
2. Educate students with numerous ground improvement principles and methods to overcome the problems related to soil on site.

Credits Earned: 5

Students learning outcomes:

After the successful completion of the course student will be able to..

1. Identify the problematic soil
2. Suggest the appropriate ground improvement technique as per the requirement of the project (dewatering, densification, stabilization, swelling control etc)
3. Analyse and design the technique for ground improvement

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE (M)	Internal (I)	Viva (V)	Term Work (TW)	
4	0	2	5	50	20	30	25	25	150

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Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Introduction**	
	Scope and necessity of ground improvement in Geotechnical engineering- basic concepts and philosophy.	2
	Identification of problematic soils.	3
2	**Dewatering**	
	Drainage - Ground Water lowering by well points deep wells, vacuum and electro-osmotic methods.	3
	Stabilization by thermal and freezing techniques.	2
	Preloading with sand drains, fabric drains, wick drains etc. – theories of sand drain – design and relative merits.	3
3	**Soil densification**	
	Insitu compaction of granular and cohesive soils	2
	Shallow and Deep compaction	1
	sand piles concept design	2
	factors influencing compaction Blasting and dynamic consolidation	1
	Stone column: Functions, Methods of installation, design	2
	lime piles: Functions, Methods of installation, design	2
	estimation of load carrying capacity and settlement	1
4	**Grouting Technology**	
	Grouting techniques types and suitability	1
	Characteristics of grout material ,Suspension and solution grouts	2
	Basic requirements of grout	1
	Grouting equipment	1
	principle of injection-injection methods	1
	properties of treated grout	1
	application of jet grouting-grout monitoring	1
5	**Soil Stabilization Technique**	
	Introduction	1
	chemical stabilization	2
	lime stabilization	1
	mechanical stabilization	1
	Thermal stabilization.	1
	Stabilization with cement, lime and bituminous material	2
	Electro – chemical stabilization	1
	Stabilization of expansive clays/collapsible soils	2

Suggested lists of experiments

1. Swell pressure & swelling index
2. Engineering properties of soil with and without stabilization
3. Viscosity of the grout material
4. Setting time of grout
5. Model of elctrokinetic grouting

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	25%	25%	20%	15%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through ppt and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

Recommended Study Material:

Reference Books:

1. Hausmann, H.R. " Principles of Ground Modification", McGraw-Hill Book Company.
2. Ground Engineering - The Institute of Civil Engineers, London, 1970.
3. Gulati and Datta "Geotechnical Enginnering", Tata Mc Graw Hill.
4. R. F. Bowen, "Grouting in Engineering Practice", Applied Science Pub. 1978.
5. A.V. Shroff & D.L. Shah, Grouting technology for dam construction and tunneling, Oxford & IBH Publishers, 2nd edition, 1999
6. A.C. Houlsby, Grouting Manual, Water Resources Commission, Australia-1977.
4. R.H. Karol, Chemical Grouting, Applied Science Publishers-1986.
5. Zeevart L, "Foundation Engineering for Difficult Subsoil Conditions"
7. Bell F G, "Foundation Engineering in Difficult Ground", Butterworth, 1978.
8. Van Impe W.F, "Soil Improvement technique and their evaluation"
9. Rao V.V S, "Ground Improvement techniques

Web Resources:

1. http://nptel.ac.in/courses/105108075/
2. www.sunzo1999.com/
3. http://engineeringvideolectures.com/course/320

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