Marwadi University

Syllabus for Master of Technology

Geotechnical Engineering

SUBSURFACE INVESTIGATION AND INSTRUMENTATION

01GT0210 (PEC)

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

1. To recall the various soil investigation techniques.
2. To identify the appropriate technique for soil exploration.
3. To classify soil strata using direct and in direct methods.
4. To interpret the investigated data to design suitable foundation system.

Credits Earned: 3

Students learning outcomes:

After successful completion of the course it is expected that student will be able to..

1. plan subsurface investigation based on the requirement of civil engineering project and site condition.
2. execute different subsurface exploration tests, collect disturbed/undisturbed samples for laboratory tests and can suggest design parameters.
3. Expose different methods for estimation of dynamic soil properties required for design purpose.
4. Develop instrumentation scheme for monitoring of critical sites.

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)	
3	0	0	3	50	20	30	25	25	150

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Teaching and Examination Scheme

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Planning of Ground Investigation Program**	**12**
	Planning of ground investigation program for different types of infrastructure projects in various site conditions, Soil exploration techniques – soil samplers and sampling, number and disposition of trial pits, depth of exploration, sampling disturbances, storage, labeling and transportation of samples, sampler design, influence on properties, Recording of field data, Interpretation and analysis of Laboratory & field testing data, Codal provisions for subsurface investigation, Reporting, Safety measures	
2	**Site Investigation Methods**	**12**
	Direct methods, semi-direct methods and indirect methods, Drilling methods. Boring in soils and rocks, methods of stabilizing the bore holes, measurement of water table, field record. Field tests: In-situ shear test, in-situ permeability test, SPT, DCPT, SCPT, in-situ vane shear test, plate load test. Geophysical methods: Electrical resistivity and Seismic refraction methods	
3	**Various Tests**	**8**
	Introduction to Dilatometer Test, Pressure Meter Test, Dynamic triaxial test, pneumatic shear test, NDT for soils: falling weight deflectometer (FWD), spectral analysis of surface wave (SASW) test	
4	**Instrumentation**	**10**
	Instrumentation: Piezometers, settlement gauges, (mechanical and electronic), pressure transducers, strain gauges, earth pressure cells, extensometers, load cells, data logger/data acquisition systems, etc., analysis of periodic readings / measurements to assess behaviour and deviation from expected designed behaviour, case studies. Modern testing techniques: Scanning Electron Microscopy (SEM), XRD, EDAX analysis of soil, Centrifuge testing and modeling	

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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%	15%	15%	25%	20%	20%

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 Book:

1. Hanna T H, "Foundation Instrumentation", Trans Tech Publication, Ohio, 1985
2. Dunnicliff J & Gree G E, "Geotechnical Instrumentation for Monitoring Field Performance", John Wiley, 1988
3. Singh Alam, "Soil Engineering in Theory and Practice", Asia Pub. House. 1981.
4. Schnaid, F., " In Situ Testing in Geomechanics", Taylor and Francis. 2009
5. Bowles, J.E., Foundation Analysis and Design, McGraw-Hill International Edition, 1997.
6. I.S. codes, relevant to Geotechnical Instrumentation