

Soil Dynamics & Geotechnical Earthquake engineering

01GT1202 (PCC)

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

1. Impart the knowledge of causes, types and measurements of earthquake and related effects
2. Educate student with the properties and response of soil as a material subjected to the dynamic loading.

Credits Earned: 3

Students learning outcomes:

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

1. Understand the earthquake occurrence and damages possible
2. Estimate the dynamic properties of soils
3. Apply the mitigation techniques to liquefiable soil
4. Estimate the seismic bearing capacity and seismic stability of the slopes

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)	
3	0	0	3	50	20	30	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	Earthquake engineering	
	Earthquake types causes and measurements	3
	Strong Ground Motion.: Measurement, characterization and estimation	3
2	Vibrations of SDOF system	
	Nature of dynamics loads free vibrations and forced vibrations of spring mass systems	3
	Damping, Resonance and their effects, equation of motion for free and forced vibrations, solution and graphical representation	3
3.	Wave propagation through soil media	
	elastic continuum medium and semi-infinite elastic continuum medium	4
4	Liquefaction of soils	
	Definition, Assessment of liquefaction susceptibility	2
	Evaluation of liquefaction potential	3
	Principles & methods of liquefaction mitigation.	3
5	Soil dynamic properties	
	small strain and large strain dynamic soil properties, typical values of soil constants soil damping, shear wave velocity etc.	3
	Field and Laboratory tests like resonant column apparatus –cyclic shear test-SCPT,DCPT	3
6	Dynamic deformation and strength of soils	
	Effect of transient and pulsating loads on dynamic bearing capacity	3
	Seismic earth pressure	3
7	Seismic stability of the slopes	
	Seismic slope stability analysis various methods	3
	Codal provisions, Case Studies	3

Geotechnical Engineering
Suggested lists of experiments

1. Resonance effect by SDOF system on shake table –learning by doing
2. Free and forced vibration
3. Effect of damping on vibration
4. Block vibration test
5. Dynamic triaxial shear test
6. Bender element test
7. Resonant column test

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	5	25	35%	20%	10%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through ppt, animations, videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning
5. Project based learning
6. Learning by doing

Recommended Study Material:
Reference Books:

1. Das B M, "Fundamental of Soil Dynamics", Elsevier Scientific Publishing Co., NewYork,1983
2. Shamsheer Prakash, "Soil Dynamics", McGraw-Hill Book Company.
3. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall Inc.
4. Winpigel R. (Coordinating Editor) Earthquake Engineering, Prantice Hall, 1970
5. Richart, Hall and Woods Vibrations of soils and Foundations -, Practice-Hall, New Jercey.

Web resources:

1. <https://www.nicee.org/EQTips.php>
2. <http://nptel.ac.in/courses/105101005/>
3. <http://nptel.ac.in/courses/105101004/>
4. <http://nptel.ac.in/courses/105101134/>