

**ZMG 510E
Soil Dynamics
Fall 2017**

Catalog Description: *Dynamic soil behavior, wave propagation, vibration principles, liquefaction, ground response analysis, seismic behavior of slopes and embankments*

Expected computer skills: Access to the web, Use of Ninova, word/data processing (MS Excel and Word)

Text and Other Required Materials:

1. Lecture Notes
2. Geotechnical Earthquake Engineering, by *S.L.Kramer, Prentice Hall Publishing Inc , 1996*
3. Textbook: Principles of Soil Dynamics, Braja, M. Das and G. V., *Ramana CL Engineering; International SI edition, 2011*
4. Soil Behavior in Earthquake Engineering, *K.Ishihara, 1996*

Website: refer to the Ninova website for this course

Instructor: Assist. Prof. Dr. E. Ece Bayat, Office 264, Phone: 285 3860, email: ebayat@itu.edu.tr

Office hours:

| Monday | Tuesday | Wednesday | Thursday | Friday |
|--------|---------|-----------|----------|-------------|
| | | | | 13:30-16:30 |

➤ also by e-mail

Class Hours: Fridays 09:30-12:30 in Geotechnical Seminar Room

TOPICS COVERED

1. Nature of Dynamic Loads
2. Fundamentals of Vibration
3. Wave Propagation
4. Dynamic Soil Properties
5. Soil Strength under cyclic loads
6. Liquefaction
7. Ground Response Analysis
8. Seismic Behavior of Slopes and Embankments

COURSE OBJECTIVES

1. To give students understanding and problem-solving ability in the topics listed above.
2. To help students understand the scientific foundation for soil behavior under dynamic (cyclic and irregular) loading.
3. To provide students analytical and numerical tools for the evaluation of soil strength against dynamic loads.

COURSE SCHEDULE

| Week | TOPICS | Date | Reading Assignment, p. | Homework |
|-------------|--|-------------|---------------------------------|-----------------|
| 1 | Introduction, Nature of Dynamic Loads, Earthquakes | 15 /09 | Ref.3 1-6 | HW |
| 2 | Vibration Principles (Undamped and Damped SDOF systems), Vibration attenuation | 22 /09 | Ref.3 7-40 | HW |
| 3 | Vibration Principles (Undamped and Damped SDOF systems), Vibration attenuation | 29 /09 | | |
| 4 | Wave Propagation | 06/10 | Ref.2 143-183 | |
| 5 | Dynamic Soil Behavior and Dynamic Soil Properties Internet Conference Lecture | 13/ 10 | Ref.2 228-249 | |
| 6 | Undrained strength of soils under dynamic loads (flow liquefaction, cyclic mobility, level ground liquefaction) Internet Conference Lecture | 20/10 | Ref.2 348-413 398-454 | |
| 7 | Liquefaction induced ground deformations Internet Conference Lecture | 27 /10 | Ref.2 414-420 Ref.4 308-315 | HW |
| 8 | Fall Break (Internet Conference Lecture) | 03 /11 | | |
| 9 | Dynamic Soil Characteristics and Measurement of Dynamic Soil Properties Internet Conference Lecture | 10 /11 | Ref. 2 191-228 Ref. 3 96-195 | HW |
| 10 | Dynamic Soil Characteristics and Measurement of Dynamic Soil Properties Internet Conference Lecture | 17 /11 | Ref. 2 191-228 Ref. 3 96-195 | |
| 11 | Dynamic Strength of Cohesive and Non-Cohesive Soils under Cyclic Loading Internet Conference Lecture | 24 /11 | Ref. 3 389-394 96-134 | |
| 12 | Ground Response Analysis (GRA) | 01/12 | Ref.2 254-291 | HW |
| 13 | Site Amplification/Deamplification, Response Spectra | 08 /12 | Ref.2 323-339 | Project |
| 14 | GRA Software Programs, Ground Response Analysis Design Guidelines | 15/12 | | |
| 15 | Seismic Behavior of Slopes and Embankments | 22/12 | Ref.3 525-553 | |

EXAMS AND HOMEWORK

| Class Performance Evaluation | Quantity | Contribution to the Overall Grade (%) |
|-------------------------------------|-----------------------|--|
| Homework | 5 | 40 |
| Term Project | 1 | 20 |
| Final Exam | 1 | 40 |
| Final Exam Condition | Attendance %70 | |

Late homework and project are not accepted.

COURSE POLICIES

- University policies on neatness and academic honesty will be adhered to.
- The instructor will start and end class as scheduled.
- It is expected that those in the class will respect one another and contribute to a constructive learning environment.

Internet Conference Lecture –D-Learning

Oct. 06

Ground Motion Modeling and Implications for Earthquake Engineering (Prof. Askan, METU)

Oct. 13

Tsunami Disaster and the 2011 Great East Japan Earthquake (Prof. Suzuki, Tokyo Tech)

Oct. 20

Liquefaction
(Prof. Bayat, ITU)

Oct. 28

Slope Engineering
(Prof. Hung, NCU)

Nov. 03

Steel Structures
(Prof. Hsu, NCU)

Nov. 10

Seismic Design of Reinforced Concrete Building Structures (Prof. Sucuoglu, METU)

Nov. 17

Seismic Retrofit of Historical Building
(Prof. Ilki, ITU)

Nov. 24

Remote Sensing
(Prof. Matsuoka, Tokyo Tech)