Soil Dynamics

Code	Credit Hours
CE- 881	3+0

Course Description

The course introduces the fundamentals of soil dynamics and its application to earthquake engineering and machine vibrations. After an introduction to soil dynamics and its main differences to soil mechanics, the students are introduced to engineering seismology, ground motions and seismic hazard assessment. This is followed by dynamic soil properties, wave propagation theory, ground response and local site effects, and soil liquefaction.

Textbook:

1. Braja M. Das, (1992), Soil Dynamics, Thomson-Engineering.

Reference Book:

2. Richard, F.E. etal (1970) Vibrations of Soils and Foundations, Prentice-Hall Inc.
3. Bowles, J.E., (1992), Foundation analysis and design, McGraw-Hill.

Prerequisites

Nil

Assessment System for Theory

Quizzes	10-15%
Assignments	5-10%
Mid Terms	25-30%
Project	0-10%
ESE	45-50%

Teaching Plan

Week No	Topics	Learning Outcomes
1	Introduction	Course Outline, objectives, teaching plan, assessment method, concepts review
2	Fundamentals of Vibration	Fundamental Definitions, Single Degree of Freedom System, Two Degrees of Freedom Systems.
3-4	Dynamic Properties of Soil	Soil behavior under cyclic alternating and dynamic loads, evaluation of dynamic soil behavior with laboratory and field tests
5-6	Stress Wave Propagation in Bounded Elastic Medium	One-dimensional waves, stress waves in semi-infinite half-space, stress waves attenuation, stress waves reflection/refraction across a boundary.
7-8	Foundation Vibration	Theories of Elastic Half Space, analysis of Foundation Vibration, Lumped Parameter System.
9	**MID TERM EXAM**	
10	Bearing Capacity	Estimation of dynamic bearing capacity of shallow foundations, bearing capacity in clay, bearing capacity in sand, behavior of foundations in transient loads, seismic bearing capacity and settlement in granular soil.

11-12	Lateral Earth Pressure on Retaining Wall	Mononobe-Okabe earth pressure theory, effects of various parameters on the value of active earth pressure coefficient, design of gravity retaining wall based on limited displacement, dynamic passive force on retaining wall.
13-14	Compressibility of soils under dynamic loads	Compaction of granular soils: effects of vertical stress acceleration, settlement of strip foundation on granular soil under cyclic vertical stress, settlement of sand due to cyclic shear strain, calculation of settlement of dry sand layers subjected to seismic effect.
15	Earthquake and ground vibration	Characteristics of rock motion during an earthquake, vibration of horizontal soil layers with linearly elastic properties, equivalent number of significant uniform stress cycles for earthquakes.
16-17	Liquefaction of Saturated Sand	Fundamental concept of liquefaction, dynamic triaxial test, cyclic simple shear test, development of a procedure for determination of field liquefaction.
18	**End Semester Exam**	