SOIL DYNAMICS

PROF. PARAMITA BHATTACHARYA
Department of Civil Engineering
IIT Kharagpur

PREREQUISITES: Geotechnical Engineering-I/Soil Mechanics,Geotechnical Engineering -II/Foundation Engineering at UG level

INTENDED AUDIENCE: UG, PG and PhD level students and practicing engineers in the field of Geotechnical Engineering

INDUSTRY SUPPORT: All Industries related to Civil Engineering

COURSE OUTLINE : The course is designed for the UG students interested in advanced level of Geotechnical Engineering, PG students and research scholars of Geotechnical Engineering and other relevant specialization of Civil Engineering. The practicing engineers in the field of Civil and Geotechnical Engineering may also be benefited from this course. The objective of the course is to understand the fundamentals of vibrations, response of soils and foundations under dynamic loadings and design criterion of foundations subjected machine vibration and earthquake loading. For this purpose, theory of vibrations, response of single and multiple degree of freedom undamped and undamped systems under free and forced vibrations, dynamic properties of soils say, dynamic shear modulus, elastic modulus, damping ratio etc., liquefaction potential and design of machine foundations will be discussed.

ABOUT INSTRUCTOR : Prof. Paramita Bhattacharya is an assistant professor in the department of Civil Engineering at IIT Kharagpur. She received Bachelor in Civil Engineering from Jadavpur University, Master of Technology in Civil Engineering from IIT Kanpur and Doctoral of Philosophy in Civil Engineering from IISc. Bangalore. She has approximately 10 years of teaching and research experiences in the field of Geotechnical Engineering. Her research area is Computational Geomechanics. She is working in the area of numerical modeling on ground improvement, stability of underground excavations and tunnels in soil and rock. She published more than 30 papers in international and national journals indexed by science web and Scopus.

COURSE PLAN :

Week 1: Introduction, Theory of vibrations (Single-degree-freedom systems: undamped and damped free vibration)

Week 2: Theory of vibrations (under damped system, logarithmic decrement, steady state forced vibration, rotating mass type excitation, Rayleigh's method)

Week 3: Coulomb's damping, Multi-degree of freedom system, Numerical problems on theory of vibrations

Week 4 : Duhamel's integral, Wave propagation (longitudinal and torsional wave propagation in an elastic rod, longitudinal and torsional wave propagation in an elastic infinite medium, wave propagation in a semi-infinite elastic half space)

Week 5: Determination of dynamic properties of soils by laboratory tests (resonant column test, cyclic triaxial test, torsional shear test))

Week 6: Determination of dynamic properties of soils by field tests (seismic reflection and refraction survey, block vibration test)

Week 7: Liquefaction of soils: liquefaction mechanism, factors affecting liquefaction, studies by dynamic tri-axial testing, assessment of liquefaction potential)

Week 8: Machine foundations (design criteria for machine foundations; elastic homogeneous half space)

Week 9: Machine foundations (lumped parameter solutions, design of foundations for impact type machines, other dynamically loaded foundations part-1)

Week 10: Machine foundations (analysis and design of dynamically loaded foundations part-2)

Week 11: Analysis of pile foundations under dynamic loading

Week 12: Effect of machine foundation on adjoining structures. isolations of vibrations Online