CE 421: DYNAMICS OF SOILS AND FOUNDATIONS (3-0-0: 3)

Introduction
Scope and objective, nature and types of dynamic loading, importance of soil dynamics.

Vibration Theory
Vibration of elementary systems, degrees of freedom (sdof and mdof systems), equation of motion for sdof system, types of vibrations, earthquake excitation, undamped and damped free vibrations, torsional vibration, critical damping, decay of motion, undamped and damped forced vibration, constant force and rotating mass oscillators, dynamic magnification factor, transmissibility ratio, non-harmonic, arbitrary, impact and other types of forced vibrations, duhamel's integral, introduction to fourier transform, taxing of vehicles on uneven roads, vibration isolation, vibration measuring instruments, equation of motion for mdof system. strong ground motion: measurement, characterization and estimation, amplification theory and ground response analysis.

Dynamic Soil Properties
Stresses in soil element, determination of dynamic soil properties, field tests, laboratory tests, model tests, stress-strain behavior of cyclically loaded soils, estimation of shear modulus, modulus reduction curve, damping ratio, linear, equivalent-linear and non-linear models, ranges and applications of dynamic soil tests, cyclic plate load test, liquefaction, screening and estimation of liquefaction, simplified procedure for liquefaction estimation, factor of safety, cyclic stress ratio, cyclic resistance ratio, crr correlations with spt, cpt, sasw test values.

Machine Foundations
Types of machines, basic design criteria, methods of analysis, mass-spring-dashpot model, elastic-half-space theory, tschebotarioff's reduced natural frequency method, types of foundations, modes of vibrations, vertical, sliding, torsional (yawing) and rocking (and pitching) modes of oscillations, design guidelines as per codes, typical design problems, design of foundations for reciprocating machines, impact machines, and rotary machines, pile foundation under machine induced vibrations.

Soil Improvement Techniques
Basic concept of soil improvement due to dynamic loading, various methods, mitigation of liquefaction.

Dynamic Soil-Structure Interaction
Dynamic earth pressures, force and displacement based analysis, pseudo-static and pseudo-dynamic analysis, guidelines of various design codes, dynamic analyses of various geotechnical structures like retaining wall, soil slope, railway subgrade and ballast using msd model.

Text Books:
1. S. Saran, "Soil Dynamics and Machine Foundations", Galgotia Publications (P) Ltd.
2. B. M. Das, "Fundamentals of soil dynamics", Elsevier.
S. Prakash, "Soil Dynamics", McGraw-Hill Book Company