# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Civil Engineering

**Subject Code: CEC-525**          **Course Title: Engineering Behaviour of Rocks**

**L-T-P: 3-0-2/2**          **Credits: 03**          **Subject Area: PCC**

**Course Outline:** Introduction of applications of rock mechanics; concept of intact rocks, laboratory testing and analysis for UCS, and tensile tests, shear tests; triaxial strength of rocks, Coulomb's theory, Mohr's envelope and p-q plots; failure criteria for intact rocks; classification of intact rocks; concept of rock masses; classification of rock masses; deformational behavior of jointed rocks; flow through jointed rock mass.

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:  Civil Engineering**

**Subject Code: CEC-527**          **Course Title: Soil Dynamics and Machine Foundations**

**L-T-P: 3-0-0**          **Credits: 03**          **Subject Area: PCC**

**Course Outline:** Theory of Vibrations; Wave Propagation in Elastic Media; Evaluation of Dynamic Soil Properties; Seismic Earth Pressure; Seismic Bearing Capacity; Pile Foundations; Assessment of Liquefaction Potential; Machine Foundations: Evaluation of Design Constants, Reciprocating Machines and Impact Foundations

**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

**NAME OF DEPARTMENT/CENTRE/SCHOOL:  Civil Engineering**

**Subject Code: CEC-521**          **Course Title: Advanced Numerical Analysis**

**L-T-P: 2-0-2**          **Credits: 03**          **Subject Area: PCC**

**Course outline:** Errors in computation:  source and types of errors, error propagation.  Computer representation  of numbers.  Roots of a non-linear  equation and roots of a polynomial  of nth degree using various methods, solution of (non-homogeneous)  linear  and non-linear  algebraic equations, Cholesky's  decomposition  method, Eigen values and Eigen vectors, time marching  schemes, Integration  using interpolation:  Newton-Cotes formulas,  Gauss quadrature rules,  different solutions of ordinary  and partial differential  equations.

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Civil Engineering

**Subject Code: CEC-523**          **Course Title: Advanced Soil Mechanics**

**L-T-P: 3-0-2**          **Credits: 04**          **Subject Area: PCC**

**Course Outlines:** Soil characteristics, Weight volume relationship, Flow of water through soils, Effective stress concept, Permeability, Seepage, Laplace Theory, Flownet, Consolidation, Terzaghi's consolidation theory in 1-D and 3-D, Variation of pore water pressure with depth, Consolidation in layered soils, Secondary consolidation, Sand drains, Shear strength of soils, Mohr's circle, Laboratory tests, UU, CU and CD conditions, Drained and undrained conditions, Determination of PWP parameters, Stress path, Critical state soil mechanics, NCL, CSL, Roscoe surface, Hvorslev surface.

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Civil Engineering

**Subject Code: CEC-529**          **Course Title: FEM in Geotechnical Engineering**

**L-T-P: 2-0-2**          **Credits: 03**          **Subject Area: PCC**

**Course Outline:** Introduction; Fundamentals of discretization, Iso-parametric element, Lagrange polynomial; One-dimensional element, Beam element; Constant strain triangle (plane-stress, plane-strain and axisymmetric); Bilinear quadrilateral element; Modelling considerations (geometry, symmetry, mesh, boundary); Modelling of soil behaviour, Undrained and drained behaviour, Effective stress and total stress analysis; Mohr-Coulomb yield criterion, Associated flow rule, Non-associated flow rule, Material parameters for advanced soil models (Von Mises, Tresca, Drucker Prager, Mohr Coulomb, Hardening soil, Cam Clay); Modelling excavation and tunnel problems; Modelling consolidation.