INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-541 **Course Title:** Continuum Mechanics

L-T-P: 3-1-0 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Vector and Tensors Algebra, Stresses; Translational and Rotational Equilibrium; Principal Stresses and Principal Planes in 3D, Stress Invariants, Cauchy and Kirchhoff Stress Tensor; Deviatoric and Volumetric Components; Work Conjugancy; Octahedral and von-Mises stresses; Kinematics, Linearized Kinematics; Strain Quadric of Cauchy, Principal Strains, Invariants; Compatibility, Finite Deformation, Deformation Gradient; Polar Decomposition, Volume change, Area Change; Generalized Hooke's Law, Anisotropic, Orthotropic and Isotropic Elasticity Tensor; Plane Stress and Strain Problems; Airy Stress Functions; Isotropic Hyper elasticity; Three-Dimensional Elasticity Solutions.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-543 **Course Title:** Advanced Concrete Design

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Plastic Section, Theory for Reinforced Concrete including interaction of flexure, Shear-Axial effects, Upper bound and lower bound plastic theorems, Plastic analysis to frames – instantaneous centre of rotations, Pushover Analysis, Strut-Tie Models, Strut-Tie Models for Deep Beams, Beam-Column Joints& Shear walls, Yield line analysis and application for slabs, raft foundations etc., Pre-stressed concrete and behaviour for simple elements, Creep/shrinkage and long term effects for RCC and prestressed concrete, Crack widths and crack control designs.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-545 **Course Title:** Structural Dynamics

L-T-P: 3-1-0 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Single Degree of Freedom System, Free Vibrations: undamped and damped systems, logarithmic decrement method. Equation of motion for generalized SDOF dynamic problems, virtual work method, Response of SDOFS systems to Harmonic, Periodic, Impulse Loads, Equation of motion for two/three DOF systems. Mode shapes and frequencies: determinantal equation, and iterative techniques. Sweeping matrices for higher modes. Convergence. Modal superposition and Response Spectrum Methods. Response of single and multiple DOFS systems to Earthquake Loading, Time Stepping Methods based on Forward Cauchy Euler, Backward Cauchy Euler and Trapezoidal Rule. Accuracy, stability and algorithmic damping in step-by-step methods. Earthquake response analysis of Multi-DOF systems. Modal mass and mode participation factors, Newark and Hall's linear and inelastic response spectra for earthquakes, Introduction to IS codes.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-547 **Course Title:** Behaviour & Design of Steel Structures

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Stability, Buckling of Columns, Stability of Beam-Columns and Frames, Lateral Instability of Beams, Local Buckling and Post Buckling of Plates, Behaviour and Design of Cold Formed Thin Walled Structures, Plastic Analysis and Design of Steel Structures, LRFD, Advanced Topics in Bolted and Welded Connections, Steel Concrete Composite Construction, Introduction to Brittle, Fracture and Fatigue, Design of Steel Truss Bridges.