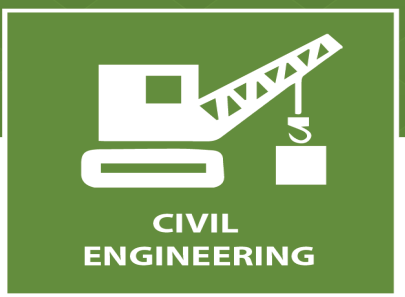
MECHANICS OF SOLIDS



Instructor Name : PROF. PRIYANKA GHOSH (IIT Kanpur **-** Civil Engineering **)**

COURSE DURATION : Jul-Oct 2017 **CORE / ELECTIVE :** Core **UG / PG:** UG

PRE-REQUISITES : Physics/Mathematics
INTENDED AUDIENCE : NIL
INDUSTRIES APPLICABLE TO : Civil construction companies, PWD, PHE, Irrigation, Mechanical companies, Aerospace engineering companies, Material engineering companies etc.

COURSE OUTLINE : This course is to serve as an introduction to mechanics of deformable solid bodies. The primary course objective is to equip the students with the tools necessary to solve mechanics problems, which involves (a) static analysis of a component to find the internal actions (forces and moments), (b) determine stresses, strains and deformation due to internal actions, and (c) compare them with known acceptable values. This requires the familiarity with the vocabulary of the subject, skill of drawing free body diagrams and the understanding of the material behavior under loads. It is expected to improve your engineering design skills.

ABOUT INSTRUCTOR : Dr. Priyanka Ghosh is an Associate Professor in the Department of Civil Engineering, IIT Kanpur. After completion of PhD from IISc, Bangalore in 2005, he served as faculty member at BITS, Pilani, IIT Kharagpur and IIT Kanpur. His primary research focus is in Computational Geomechanics and in particular, analysis of foundations, ground anchors, retaining structures, vibration isolation and geopolymers. He is the recipient of several awards like “IEI Young Engineers Award” by The Institute of Engineers (India), “Outstanding Young Investigator Award” by International Association for Computer Methods and Advances in Geomechanics (IACMAG), USA, “Scholarship for Young Indian Researchers” by the Italian Ministry of Education, University and Research, “Indo-US Research Fellowship” by Indo-US S&T Forum, “Class of 1982 Research Fellowship” by IIT Kanpur etc. He has published several research papers in various international journals and conferences. He has guided several post graduate students for their thesis work and taught different courses in various capacities. He has completed a number of sponsored research projects funded by different government organization such as Dept. of Science and Technology (DST), India; Research Design and Standards Organisation (RDSO), Indian Railway, India etc.

COURSE PLAN

Week 1**:**Free body diagram with examples on modeling of typical supports and joints, Conditions for equilibrium in 3D and 2D, Friction: limiting and non-limiting cases

Week 2**:** Force-displacement relationship and geometric compatibility (for small deformations) with illustrations through simple problems on axially loaded members and thin walled pressure vessels

Week 3**:** Concept of stress at a point, Plane stress case: transformations of stresses at a point, Principal stresses and Mohr’s circle

Week 4**:**Displacement field, Concept of strain at a point, Plane strain case: transformation of strain at a point, Principal strains and Mohr’s circle, Strain rosette

Week 5**:**Discussion of experimental results on 1D material behavior, Concepts of elasticity, plasticity, strain hardening, failure (fracture/yielding), Idealization of 1D stress-strain curve, Generalized Hooke’s law (with and without thermal strains) for isotropic materials, Complete equations of elasticity

Week 6**:**Force analysis (axial force, shear force, bending moment and twisting moment diagrams) of slender members

Week 7**:**Torsion of circular shafts and thin-walled tubes (plastic analysis and rectangular shafts not to be discussed

Week 8**:**Moment curvature relationship for pure bending of beams with symmetric cross-section, bending stress, shear stress (shear center and plastic analysis not to be discussed)

Week 9**:**Cases of combined stresses, Concept of strain energy, Yield criteria

Week 10**:**Deflection due to bending, Integration of the momentcurvature relationship for simple boundary conditions, Method of superposition

Week 11**:**Strain energy and complementary strain energy for simple structural elements (those under axial load, shear force, bending moment, and torsion), Castigliano's theorems for deflection analysis and indeterminate problems

Week 12**:**Concept of elastic instability, Introduction to column buckling, Euler's formula (post-buckling behavior not to be discussed)