

Branch Name:	Civil Engineering (Structural Engineering)
Semester/Year:	Semester I / First Year
Subject Title:	Advanced Solid Mechanics (Elective - I)
Subject Code:	2ET2060105T
Pre-requisite Subject:	Mechanics of Solids and Structural Analysis

Course Objective:

1. To analyze the transformation of stresses and strains in 2D & 3D.
2. To study engineering properties of materials, force-deformation, and stress-strain relationship.
3. To understand the plastic behavior of deformable bodies.

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
01	Introduction: State of stress and strain at a point in two and three dimensions, stress and strain invariants, Hooke's law, plane stress and plane strain.	10	20
02	Two dimensional problems in Cartesian and polar co-ordinates, solution by Airy's stress function, stress concentration, problems of torsion, curved elements, membrane analogy method, stress function of circular plates.	16	40
03	Concept of stability, static dynamic and energy criterion of stability, flexibility and stiffness criteria, buckling, post buckling stages, stability of columns, beams, inelastic bending, Beams – Column, Stability of frames, methods applied to stability problems.	16	40

List of Experiments/Tutorials:

Tutorial work shall consist of presentations / problems / preparation of learning material based on above topics.
Experiment will be based on above topics.

List of References:

1. Theory of elasticity N. Filonenko - Borodich
2. Theory of elasticity - S. P. Timoshenko and J.N. Goodier
3. Buckling of bars, plates and shells - Don O. Brush and B. O. Almorth
4. Theory of elastic stability - S. P. Timoshenko and J.M. Gere
5. Principles of structural stability theory - Chajes
6. Structural stability of plates and shells - N.G.R. Iyengar
7. An introduction to elastic stability to structure - G.J. Siitses.

Course Learning Outcomes:

After learning the course, the students should be able to:

1. Understand the mathematical and physical foundations of the continuum mechanics of solids, including deformation and stress measures and constitutive relations.

2. Apply the basic principles of solid mechanics to solve engineering problems and design systems or components to meet the desired needs.
3. Understand basic concepts of structural stability, various approaches to stability analysis and their practical applications.

Open Ended Problems:

Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below.:

1. Finding engineering application of elasticity and analysis.
2. Finding engineering application of stability and analysis.

List of Open Source Software/learning website:

<http://nptel.ac.in/>

<http://ocw.mit.edu/courses/civil-and-environmental-engineering/>

Course Learning Outcomes (CLO):

After successful completion of the course the students shall be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the mathematical and physical foundations of the continuum mechanics of solids, including deformation and stress measures and constitutive relations.	L-1, L-2
CLO2	Apply the basic principles of solid mechanics to solve engineering problems and design systems or components to meet the desired needs.	L-1, L-2, L-3
CLO3	Understand basic concepts of structural stability, various approaches to stability analysis and their practical applications.	L-1, L-2

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with Pos & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO1	M	M	M	M		M						M	M	M	M
CLO2	M	M	M	M	M		M						M	M	
CLO3	M	M	M	M								M	M	M	

H:High, M:Medium, L:Low