GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch : Civil (Structural Engineering)

Subject Code : ME01000061

Course / Subject Name : Advanced Solid Mechanics

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite:	Mechanics of Solids, Structural Analysis and Mathematics
Rationale:	In this course, general theory available to study the response of solids to applied forces will be developed and will be used to study simple boundary value problems. In all the treatment would be three dimensional. The present course provides the student with the mathematical and physical principles of "Theory of Elasticity" and "Stability" with various solution strategies and their practical applications.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the basic concepts and solve simple problems of elasticity and plasticity
02	Solve the advanced practical problems related to the theory of elasticity, concepts of stress and strain, strain energy, and failure criteria.
03	Propose materials and structural elements to the analysis of complex structures.
04	Apply numerical methods to solve continuum problems.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction: Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.	04	05
2.	Stress Analysis: Body Force, Surface Force and Stress Vector, Stress at a Point, Normal and Shear Stress Components, Rectangular Stress Components, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Equilibrium Equations for Plane Stress State, Boundary Conditions. Application example based on the these theories.	10	25
3.	Strain Analysis: Change in Length of a Linear Element & Components, Rectangular Strain Components, Strain at a Point, Principal Axes of Strain and Principal Strains, Plane State of Strain, Compatibility Conditions. Application example based on the these theories.	10	25
4.	Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems. Application example based on the these theories.	07	15
5.	Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates. Application example based on the these theories.	07	15
6.	Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Walled Tubes.	07	15
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	20	20	15	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.
2. Elasticity, Saddm. H., Elsevier, 2005.

3. Engineering Solid Mechanics, Ragab A. R., Bayoumis E., CRC Press,1999.
4. Computational Elasticity, Ameenm., Narosa,2005.
5. Solid Mechanics, Kazimis. M. A., Tata McGraw Hill,1994.
6. Advanced Mechanics of Solids, Srinath L. S., Tata McGraw Hill, 2007.

(b) Open source software and website:

http://nptel.ac.in/
http://ocw.mit.edu/courses/civil-and-environmental-engineering/
http://www.brown.edu/Departments/Engineering/Courses/En175/notes.htm
http://www.ktubtechquestions.bid/2017/07/advanced-mechanics-of-solids-useful.html

Suggested Course Practical List: If any

Tutorial work shall consist of presentations / problems / preparation of learning material based on above topics. Apart from above assignments a group of students has to undertake one open ended design problem based on engineering application of elasticity and analysis or stability and analysis

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