GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: CIVIL (STRUCTURAL ENGINEERING)
SUBJECT NAME: ADVANCED SOLID MECHANICS
SUBJECT CODE: 3712017
Semester: I

Type of course: Program Elective-II

Prerequisite: It is assumed that all students have a working familiarity with the basics of Mechanics of Solids and Structural Analysis along with mathematical differential equations.

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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.	03	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.	06	15
5	**Two-Dimensional Problems of Elasticity:** Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar	06	15

	Coordinates**.** Application example based on the these theories.		
6	**Torsion of Prismatic Bars:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Walled Tubes.	06	15

Reference Books:

- Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.
- Elasticity, Saddm. H., Elsevier, 2005.
- Engineering Solid Mechanics, Ragab A. R., Bayoumis E., CRC Press,1999.
- Computational Elasticity, Ameenm., Narosa,2005.
- Solid Mechanics, Kazimis. M. A., Tata McGraw Hill,1994.
- Advanced Mechanics of Solids, Srinath L. S., Tata McGraw Hill, 2007.

Course Outcome:

After learning the course the students should be able to:

- Understanding the basic concepts and solve simple problems of elasticity and plasticity.
- Solve the advanced practical problems related to the theory of elasticity, concepts of stress and strain, strain energy, and failure criteria.
- Propose materials and structural elements to the analysis of complex structures.
- Apply numerical methods to solve continuum problems.

List of Experiments/Assignments:

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.

Major Equipments:

(None)

List of Open Source Software/learning 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