GUJARAT TECHNOLOGICAL UNIVERSITY
BRANCH NAME: B.ARCH.
SUBJECT CODE: 2X25004
SUBJECT NAME: STRUCTURE - I
1st Year, 2nd SEMESTER

Type of course: B.Arch.

Prerequisite: Basic understanding of Physics and Mathematics

Rationale: Application of laws of mechanics to field problems is termed as engineering mechanics. Here the students will learn the laws and principals of mechanics along with their applications to a problem. As a matter of fact, knowledge of mechanics of solids is very essential for a student in planning, designing and construction of various types of structures and machines, so that the design is safe and economical.

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)	
2	1	0	3	50	50	0	0	100

Content:

Sr. No.	Topics	Teaching Hrs.	Weightage %
1	**Introduction :** Definition of space, time, particle, rigid body, deformable body. Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces. Fundamental Principle of superposition, Law of parallelogram of forces. Introduction of Structure, Types of structure, Frame (Plain and Space) Structure, Load bearing Structure, Various structural elements of frame and load bearing structure like slab, beam, column, wall, footing, foundation, lintel and weather shed. The importance of all structural members, their load transfer mechanisms and various materials used for construction for structural elements. Understanding the basic properties and uses of materials.	**04**	**20**
2	**Fundamentals of Statics** **Coplanar concurrent forces:** Resultant of coplanar concurrent force system by analytical, Law of triangle of forces, Law of polygon of forces, Equilibrium conditions for coplanar concurrent forces, Lami's theorem. **Coplanar non-concurrent forces:** Moments & couples, Characteristics of moment and couple, Varignon's theorem, Resultant of non-concurrent forces by analytical method, Equilibrium conditions of coplanar non-concurrent force system. Types of loads, Types of supports, Types of beams; Determination of support reactions of simply supported beam,	**06**	**20**

3	**Centroid and moment of inertia:** Centroid of plane areas, Examples related to centroid of composite geometry, Pappus – Guldinus first and second theorems. Moment of inertia of planar cross-sections: Parallel & perpendicular axes theorems, polar moment of inertia, radius of gyration of areas, section modulus. Examples related to moment of inertia of composite plane geometry	**08**	**20**
4	**Plane Truss** – Introduction, assumptions used in the analysis of Truss. Perfect, imperfect and redundant truss, analysis of Truss by method of joints and method of sections.	**06**	**20**
5	**Simple stresses & strains:** Basics of stress and strain, Tensile & compressive Stresses: Shear and complementary shear Strains: Linear, shear, lateral, thermal and volumetric. Hooke's law, Elastic Constants: Modulus of elasticity, Poisson's ratio, Modulus of rigidity and bulk modulus. Application of normal stress & strains: Homogeneous and composite bars having uniform & stepped sections subjected to axial loads.	**06**	**20**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**30**	**20**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Structure & Architecture, Angus J Macdonald
2. Structure as Architecture: A source book for architects and structural engineers by Andrew Charleson
3. Mechanics of Structure Vol. I S. B. Junnarkar & H. J. Shah
4. Engineering Mechanics by R S Khurmi
5. Engineering Mechanics by S S Bhavikatti

Course Outcome:

Sr.No	**CO Statement**	**Marks % Weightage**
Upon completion of this course, the students should be able to:		
1	Apply fundamental principles of mechanics, equilibrium and statics to practical problems of engineering.	25
2	Determine centroid and moment of inertia of a different geometrical shape and its use in engineering problem.	25
3	Determine different types of stresses and strains developed in the member subjected to axial, bending, shear.	25

4	Differentiate behaviour and properties of different engineering materials.	25

Term Work:
The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.

List of Tutorials:

1. Prepare model of types of beams, types of support and types of loading
2. Prepare model truss.
3. Prepare model of various shape for understanding of centroid and moment of inertia.
4. Prepared model of load bearing structure and frame structure for students.