INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING)**
SEMESTER	**4**
COURSE TITLE	**STRUCTURAL ANALYSIS-1**
COURSE CODE	**01CI1402**
COURSE CREDITS	**4**

Objective:

1 To understand the concept of determinate and indeterminate structures and impart the principles of elastic structural analysis to identify the behaviour of determinate structures.

2 To know and apply the different techniques available for the analysis of structures to identify internal forces and displacement in different structures

3 To understand the concept of determinate and indeterminate structures and impart the principles of elastic structural analysis to identify the behaviour of determinate structures

4 To know and apply the different techniques available for the analysis of structures to identify internal forces and displacement in different structures

5 To calculate the stresses and strain energy stored in the bar due to the application of various loading like axial, shear, bending, and torsion

Course Outcomes: After completion of this course, student will be able to:

1 Classify structures and apply principles of statics to analyze statically determinate structures

2 Analyze the determinate structures i.e., beam, frame, truss, arches, and cable, and draw its internal force diagram.

3 Apply various methods to determine deflections in statically determinate structures.

4 Calculate buckling load for long columns with different end conditions using Rankine's and Euler's theory

5 Compute strain energy stored in a body due to the application of axial, shear, bending, and torsional forces.

Pre-requisite of course:MOS

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	1	0	50	30	20	25	25

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Contents : Unit	Topics	Contact Hours
1	**Analysis of Determinate Structures** Introduction: Indeterminacy - Static and Kinematic, statically determinate & indeterminate structures, its merits and de-merits, stability of structures based on static indeterminacy, Calculation of static and kinematic indeterminacy of beams, plane frames, plane trusses, Grid, Space truss, and space frames, Beams: Definition of shear force and bending moment. Correlation between loading, shear force & bending moment in beams. Shear force and Bending moment diagrams for statically determinate beams subjected to different loading and boundary conditions. Point of Contra flexure and maximum bending moment in a beam., Plane Frames: Computation of internal forces and diagrams in statically determinate plane frames, Plane Truss: Computation of internal forces of Truss using method of joint and method of section, Arches and Cables: Calculation of internal forces in three hinge arches with circular and parabolic shapes subjected to various types of loading. Forces and end actions in cables due to various types of loading	17
2	**Displacement of Determinate Beams** Slope & Deflection equation of the beam subjected to uniform bending, Double Integration Method, Macaulay's Method, Moment Area Method, Conjugate Beam Method, Castigliano's 1st Theorem, Unit Load Method	17
3	**Column and Strut** Definition of the Long column, Short Column, Euler's theory-its assumptions and Euler's Buckling load for various end conditions, the effective length of a long column, and radius of gyration, Rankine's theory-its assumption and its comparison with Euler's theory. Analysis of columns with Rankine's and Euler's load	4
4	**Strain Energy** Strain Energy, Resilience, proof resilience and modulus of resilience, Strain Energy stored in the body subjected to Axially gradual, sudden and impact loading, Strain Energy stored in the members subjected to torsional and shear forces. Strain Energy stored in the members subjected to bending	4
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Tutorial-1** Classify the structures and Calculations of S.I and K.I.	1
2	**Tutorial-2** Analyze the determinate beams and draw its Shear Force and Bending Moment diagrams.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
3	**Tutorial-3** To study the behavior of a portal frame under different end conditions experimentally and draw Axial Force, Shear Force and Bending Moment diagram of determinate Frames analytically.	2
4	**Tutorial-4** Analysis of Truss by Method of Joint and section	2
5	**Tutorial-5** To find the value of flexural rigidity (EI) and determine deflection for a given beam and compare it with the theoretical value.	1
6	**Tutorial-6** To determine displacement by various methods Double Integration Method, Macaulay's Method, Moment Area Method, Conjugate Beam Method, Castigliano's First Theorem, and Unit Load Method.	4
7	**Tutorial-7** To calculate Strain energy due to different loading	1
8	**Tutorial-8** To calculate the critical load on column and Strut by Euler's and Rankine's Theory	1
Total Hours		**14**

Textbook :

1 Mechanics of Structures Vol-I, Junarkar S.B. & Shah H.J., Charotar publishing house, Anand, 2019

References:

1 Theory of Structures, Theory of Structures, Ramamrutham, S., Dhanpat Rai Publication, 2018

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
5.00	10.00	35.00	30.00	10.00	10.00

Instructional Method:

1 At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

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Supplementary Resources:

1 https://onlinelibrary.wiley.com/doi/book/10.1002/9781119544265

2 https://www.researchgate.net/figure/The-link-structure-of-a-Web-site-consisting-of-Web-pages-structural-and-secondary-links_fig1_42790037

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