THEORY OF STRUCTURES

IV Semester: CE

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEC07	Core	3	1	0	4	30	70	100
Contact Classes:45	Tutorial Classes:15	Practical Classes: Nil				Total Classes:60		

Prerequisite: Strength of Materials

I. COURSEOVERVIEW

Theory of Structures, deals with deformable solids, requires basic knowledge and principles of mechanics from Mechanics of Solids course and acts as a pre-requisite to the advanced courses on Structural Analysis and Design. This course introduces study of indeterminate beams and focuses on the deflections of determinate beams and simple trusses by energy methods. It also introduces the study of columns and struts. Eventually, through this course content, engineers can analyze the response of various structural members under different loading conditions and design the same, satisfying the safety and serviceability conditions.

II. COURSEOBJECTIVES

The Students will try to learn:

I The behavior of indeterminate beams, such as propped cantilevers, fixed beams and continuous beams, in response to various applied loads and load combinationsincluding support settlements.

II The differential equation for slopes and deflections of determinate beams and their behavior.

III The concepts of method of joints and sections and Castigliano's theorems foranalyzing pin-jointed frames

IV The behavior of compression members such as columns and struts under axialand eccentric loads.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Analyze** propped cantilevers and fixed beams using method of consistent deformation for finding the shear forces and bending moments at various locations and draw shear force and bending moment diagrams	Analyse
CO 2	**Illustrate** the concepts of clapeyron's theorem of three moments forsolving problems on continuous beams including sinking of supports.	Understand
CO 3	**Develop** the differential equation for elastic curve for finding slopesand deflections of determinate beams.	Apply
CO 4	**Analyze** the trusses using method of joints and sections for computingmember forces	Analyze
CO 5	**Apply** the concepts of energy methods for calculating deflections ofsimple beams and pin jointed frames.	Apply
CO 6	**Develop** the expressions for critical loads and stresses using Euler's and Rankin's methods for knowing behavior of columns and strutswith different end conditions.	Apply

IV. SYLLABUS:

MODULE-I:PROPPED CANTILEVERS AND FIXED BEAMS (12)

Analysis of propped cantilever and fixed beams using the method of consistent deformation, including the beams with varying moments of inertia, subjected to uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load and combination of loads, shear force and bending moment diagrams for propped cantilever and fixed beams, effect of sinking of support, effect of rotation of a support.

MODULE–II:CONTINUOUS BEAMS (12)

Introduction, Continuous beams, Clapeyron's theorem of three moments, analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed, continuous beams with overhang; effects of sinking of supports.

MODULE–III:DEFLECTION OF BEAMS (12)

Introduction, Differential equation of deflected beam, Slope and deflection at a point, double integration and Macaulay's methods, determination of slope and deflection for cantilever and simply supported beams subjected to point loads.

Uniformly distributed load and uniformly varying load- Mohr's theorems, moment area method, application to simple cases, conjugate beam method, application to simple cases.

MODULE–IV:ANALYSIS OF TRUSSES AND ENERGY METHODS (12)

ANALYSIS OF TRUSSES: Definition – Perfect, Deficient and Redundant frames – Methods of Analysis - Analysis of simple trusses by method of joints and method of sections.

ENERGY METHODS: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces, Castigliano's first theorem, deflections of simple beams and pin jointed trusses.

MODULE–V:COLUMNS AND STRUTS (12)

Introduction, slenderness ratio, equivalent length, Euler's formulae for long columns with different end conditions, Rankine's and I.S. Code formulae, combined direct and bending stresses, eccentric loading, Limit of eccentricity and core of section.

V. TEXT BOOKS

1. R. K. Bansal, "A Textbook of Strength of Materials", Laxmi publications Pvt. Ltd., New Delhi, 2nd Edition, 2007.
2. F. Beer, E. R. Johnston, J. DeWolf, "Mechanics of Materials", Tata McGraw-Hill Publishing Company Ltd., New Delhi, India, 1st Edition, 2008.
3. S. S. Bhavikatti, "Strength of Materials", Vikas Publishing House Pvt. Ltd., New Delhi, 5thEdition, 2013.

VI. REFERENCE BOOKS

1. B. C. Punmia, Ashok K Jain and Arun K Jain, "Mechanics of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 12th Edition, 2007.
2. R. Subramanian, "Strength of Materials", Oxford University Press, 2ndEdition, 2010.
3. Hibbeler, R. C., "Mechanics of Materials", East Rutherford, NJ: Pearson Prentice Hall, 6th Edition 2004.

VII. WEB REFERENCES

1. http://www.nptelvideos.in/2012/11/strength-of-materials- prof.html
2. http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-solid-mechanics-fall-2004/lecturenotes/
3. https://www.youtube.com/watch?v=coRgpxG2pyY&list=PLLbvVfERDon3oDfCYxkwRct1Q6YeOzi9g

VIII. E-TEXTBOOKS:

1. http://www.freeengineeringbooks.com/Civil/Strength-of-Material-Books.php
2. http://royalmechanicalbuzz.blogspot.in/2015/04/strength-of-materials-book-by-r-k-bansal.html
3. https://books.google.co.in/books?id=I8gg0Q4OQ4C&printsec=frontcover&dq=STRENGTH+OF+MATERIALS&hl=en&sa=X&ved=0ahUKEwjpveCD44HgAhWBad4KHacUAgYQ6AEIMDAB#v=onepage&q=STRENGTH%20OF%20MATERIALS&f=false.