19CE211 STRUCTURAL ANALYSIS - I

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	-	20	30	6	10	3	4

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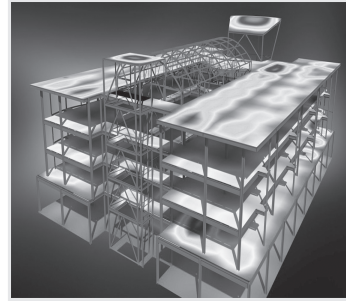
PRE-REQUISITE COURSES: Strength of Materials

COURSE DESCRIPTION AND OBJECTIVES:

This course offers fundamental concepts to analyse all structural components for different load conditions. It gives a detailed idea about different methods involved in calculating the deformations in a structure. The objective is to make students understand the influence of loads and forces on determinate structures. In addition to that, provide knowledge about strain energy concepts for an alysing determinate and indeterminate structures.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Compute the slope and deflection of different beams by various methods.	2
2	Determine the displacements of determinate structures using strain energy principles	2
3	Analyse the indeterminate structures using various theorems	2
4:	Compute SFD & BMD using influence line diagrams for determinate beams	2
5	Analyse the two and three hinged arches	2

SKILLS:

✓ *Classify different types of structures based on degrees of freedom.*

✓ *Identify the deflection profile of structures subjected to several types of loadings.*

✓ *Analyze the behavior of structures subjected to moving loads.*

✓ *Analyze pin jointed frames for dead and live loads.*

✓ *Analyze steel beams and columns.*

UNIT I   **L-9,T-3**

DEFLECTION OF BEAMS
Introduction to structural analysis, Classification of structures, Deflection equation for elastic curve of a beam, Deflection and slope for cantilever beam and simply supported beams using double integration method, Macaulay's method, Area moment method

UNIT II   **L-9,T-3**

ENERGY PRINCIPLES
Displacements of determinate structures using energy methods, Maxwell's reciprocal theorem,Maxwell-Betti's generalized reciprocal theorem,Castigliano's theorems,Application of Castigliano's theorem for calculating deflection of beams,Frames and trusses,Virtual work method for deflections.
STRAIN ENERGY METHOD: Strain energy method for analysis of continuous beams and rigid joined plane frames up to second degree redundancy

UNIT III   **L-9,T-3**
PROPPED CANTILEVER& FIXED BEAMS: Analysis of propped cantilever by method of consistent deformation, fixed end moments for a fixed beam of uniform section for different types of loading, Effect of sinking of supports, Effect of rotation of a support, bending moment diagram for fixed beams.
CLAPEYRON'S THEOREM OF THREE MOMENTS: Analysis of continuous beam by Clapeyron's theorem of three moments.
Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

UNIT IV   **L-9,T-3**

INFLUENCE LINES FOR DETERMINATE BEAMS
Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment –absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.

UNIT V   **L-9,T-3**
THREE-HINGED ARCHES: Introduction, Eddy's theorem for bending moment, parabolic arch, Circular arch, horizontal thrust, Arch supported at different levels.
TWO-HINGED ARCHES: Introduction, Horizontal thrust, Circular and parabolic arches carrying concentrated load and uniformly distributed load, Effect of change in temperature, Introduction to fixed arches.

TEXTBOOKS:
1. Bhavikatti,S.S, StructuralAnalysis, Vol.1, &2, Vikas PublishingHousePvt.Ltd. NewDelhi-4, 2014.
2. Vazrani.V.N and Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

REFERENCES:
1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi,2004.
2. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall,2012.
3. Reddy.C.S, "Basic Structural Analysis", TataMcGraw Hill Publishing Company, 2005.