COURSE CODE	COURSE TITLE	L	T	P	C
1152AE107	Approximate Methods in Structural Mechanics	3	0	0	3

Course Category:

Programme Elective

a. Preamble :

This course gives brief knowledge on approximate methods in structural mechanics

b. Prerequisite Courses:

Aircraft structural Mechanics

c. Related Courses:

- Finite element methods

d. Course Educational Objectives :

- To Study the Energy Concepts in Structures, Characteristics and Transformation of Structures.

e. Course Outcomes :

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain Energy concepts in structures	K2
CO2	Characterize structures –stiffness and flexibility	K3
CO3	Explain transformation of information in structures	K4
CO4	Apply the flexibility method to solve structural problems	K4
CO5	Apply the stiffness method to solve structural problems	K4

f. Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	**H**	**H**	**H**				**H**	**H**			
CO2	H	**H**	**H**	**H**				**H**	**H**			
CO3	H	**H**	**H**	**H**				**H**	**H**			
CO4	H	**H**	**H**	**H**				**H**	**H**			
CO5	H	**H**	**H**	**H**				**H**	**H**			

H- High; M-Medium; L-Low

g. Course Content :

UNIT I ENERGY CONCEPTS IN STRUCTURES 9

Introduction –Strain Energy –Symmetry of The Stiffness And Flexibility Matrices –Strain Energy in Terms of Stiffness And Flexibility Matrices –Stiffness And Flexibility Coefficients in Terms of Strain Energy –Additional properties of [a] and [k] –another Interpretation of coefficients aij and kij–Betti's law –Applications of Betti's law: Forces not at the coordinates – Strain energy in systems and in Elements.

UNIT II CHARACTERSTICS OF STRUCTURES STIFFNESS& FLEXIBILITY 9

Introduction –Structure with Single Coordinate-Two Coordinates-Flexibility and Stiffness Matrices in Coordinates-Examples-Symmetric Nature of Matrices-Stiffness and Flexibility Matrices in Constrained Measurements-Stiffness and Flexibility of Systems and Elements-Computing Displacements and Forces form Virtual Work-Computing Stiffness and Flexibility Coefficients.

UNIT III TRANSFORMATION OF INFORMATION IN STRUTURES 9

Determinate-Indeterminate Structures-Transformation of System Forces to Element Forces-Element Flexibility to System Flexibility -System Displacement to Element Displacement-Element Stiffness to System Stiffness-Transformation of Forces and Displacements in General –Stiffness and Flexibility in General –Normal Coordinates and Orthogonal Transformation-Principle of Contregradience

UNIT IV THE FLEXIBILITY METHOD 9

Statically Determinate Structures –Indeterminate Structures-Choice of Redundant Leading to Ill and Well Conditioned Matrices-Transformation to One Set of Redundant to Another-Internal Forces due to Thermal Expansion and Lack of Fit-Reducing the Size of Flexibility Matrix-Application to Pin-Jointed Plane Truss-Continuous Beams-Frames-Grids.

UNIT V THE STIFFNESS METHOD 9

Introduction-Development of Stiffness Method-Stiffness Matrix for Structures with zero Force at some Coordinates-Analogy between Flexibility and Stiffness-Lack of Fit-Stiffness Matrix with Rigid Motions-Application of Stiffness Approach to Pin Jointed Plane Trusses-Continuous Beams -Frames-Grids-Space Trusses and Frames-Introduction Only-Static Condensation Technique-Choice of Method-Stiffness or Flexibility.

Total Periods : 45 Hrs

h. Learning Resources

i. Text Books :

1. K. Rubinstein.F.M., " Matrix Computer Methods of Structural Analysis", Prentice Hall, Inc. N.J., 1966

2. Rubinstein.F.M., " Matrix Computer Methods of Structural Analysis", Prentice Hall, Inc. N.J., 1966

3.Dr.Devadas Menon., "Advanced Structural Analysis", Narosa Publishing House, New Delhi,2009

4.Pandit G.S. and Gupta S.P., "Structural Analysis-A Matrix Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997