COMPUTATIONAL METHODS IN STRUCTURAL ENGINEERING

(CE-1781/CE-1175)

LECTURE PLAN

S.N.	TOPICS TO BE COVERED	HOURS
1.	Review of basic principles of Structural Engineering.	1
2.	Classification of various methods of structural analysis and introduction to Matrix Methods.	2
3.	Principle of Virtual Work & Principle of Stationary Potential - Revision	1
4.	Principle of Contragradience. Stiffness and Flexibility Matrices.	1
5.	Element Stiffness Matrix for Bar, Beam and torsion elements; Frame and Grid Elements.	2
6.	Transformation from Local to Global system of coordinates- Forces and Displacements.	1
7.	Steps of Direct Stiffness Method (DSM).	1
8.	Analysis of Pin-jointed structures by DSM.	2
9.	Analysis of Beams, Frames and Grid structures by DSM.	2
10.	Analysis of Composite structures by DSM; Various loads and their combinations.	1
11.	Concept of Bandwidth; Various Storage Schemes employed in Structural Analysis.	1
12.	Static Condensation; Various Equation Solvers .	2
13.	Exploiting Symmetry, Antisymmetry and Cyclic Symmetry in Strucures; Use of Sub structures.	2
14.	Imposition of Constraints-Lagrange Multiplier and Penalty Function Methods.	2
15.	Introduction to Finite Element Analysis.	1
16.	Fundamental equations of Theory of Elasticity and basic concepts of FEA.	2
17.	Derivation of Element Stiffness Matrix and Load Vector from the first principles.	1
18.	Shape functions for CST, Beam, Bar Elements and derivation of their Element Stiffness Matrix.	2
19.	Pascal's Triangle and Convergence Criteria in FEA.	1
20.	Isoparametric Elements, Jacobian Matrix; Stiffness Matrix in Natural Coordinate system.	2
21.	Shape functions for Simplex, Lagrangian and Serendipidity family of various elements.	2
22.	Numerical Integration in FEA, Gauss Quadrature formula.	2
23.	Modeling of Beams on Elastic foundations, Nonprismatic and Curved beams.	2
24.	Elastic stability analysis of 2-D rigid jointed frames.	2
25.	Degrading of elements, Plate bending elements.	2
	TOTAL	**40**