

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
First Semester 2016-2017
Course Handout (Part II)

Date: 02.08.2016

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further details regarding the course.

Course No. : **CE G619**
Course Title : **FINITE ELEMENT ANALYSIS**
Instructor-in-charge : **P N RAO**

1. Course Description:

Fundamentals of Finite Element Method (FEM); basic formulations of FEM; assembly of elements, solution techniques; 2D and 3D problems; review of the isoparametric elements; thin and thick plate elements; introduction to shell formulations; use of newly developed elements; mixed finite element method; material and geometric nonlinear problems; application of FEM to civil engineering problems, programming FEM.

2. Scope and Objective of the Course:

Finite element method is one of the most powerful numerical methods widely used for solving problems in different branches of engineering specially Civil Engineering. This method can be used to solve even complex and difficult problems such as nonhomogeneous material, complex loading and complicated boundary conditions, material and geometric nonlinear problems, dynamics including earthquake analysis. The course is aimed to enable students to understand the advanced concept of finite element method and its application to Civil Engineering.

3. Text Books

T1: R.D.Cook, D.Malkus, M.E. Plesa, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, Third Edition, 2003.

4. Reference Books:

- R1: J.N.Reddy, An introduction to the finite element method, Third edition, TMH, 2005.
- R2: C.S. Krishnamurthy, Finite Element Analysis: Theory and programming, Second Edition. 1994.
- R3: C.S.Desai and J.F. Abel, Introduction to Finite Element Method, EWP, New Delhi, 1972.
- R4: P. Seshu, Textbook of Finite Element Analysis, PHI. Pvt, New Delhi, .2009.
- R5: O.C.Zienkiewicz, The Finite Element method, TMH, 1987.

5. Course Plan:

Lecture No.	Learning Objective	Topics to be covered	Reference
1-3	Fundamentals of Finite element method	Introduction of FEA, Modeling, Discretization, Interpolation, Elements, Nodes and DOF, Example applications	T1 – Ch-1
4-11	Basic formulations of FEM	Formulation techniques: variational methods, Galerkin and weighted residual methods	T1 – Ch-4,5 & Class Notes
12-14	Assembly of elements, solution techniques	Introduction to bar elements, beam elements, Numerical examples	T1 – Ch-2, 5 & Class Notes
15-20	2D and 3D Problems	Area Coordinate system, Plane stress and Plane strain Problems, Volume Coordinate system and axisymmetric problems	T1 – Ch-3, 6, 7 & Class Notes
21-25	Review of the Isoparametric elements	Isoparametric bar element, plane bilinear element, quadratic plane element, triangular element, hexahedral element, numerical integration.	T1 – Ch-6, 7 & Class Notes
26-27	Thin and thick plate elements	Plate Bending Theory, Plate Elements.	T1 – Ch-15 & Class Notes
28-29	Introduction to shell formulations.	Shell Theory and shell elements.	T1 – Ch-16 & Class Notes
30-31	Use of newly developed elements	Newly developed elements.	Research papers & Material
32-33	Mixed finite element method	Mixed Finite elements.	Research papers & Material
34-36	Material and geometric nonlinear problems	Solution methods, small-strain plasticity relation, elastic-plastic analysis procedure, nonlinear dynamic, problems, geometric nonlinear problems.	T1 – Ch-17 & Class Notes
37-40	Application of FEM to Civil Engineering problems, programming FEM	Structural and Civil Engineering, Fluid flow problems, Modeling and Programming in FEM	Class Notes

6. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date, Time & Venue	Nature of Component
1.	Test I	60 Min	15%	10/9, 1.00--2.00 PM	CB
2.	Test II	60 Min	15%	22/10, 1.00--2.00 PM	CB
5.	Assignments		15%		OB
6.	Term Projects & Research topics & Seminars		25%		OB
7.	Compre Exam.	180 Min	30%	01/12 FN	CB

7. Chamber Consultation Hour: F-9th hr.

8. Notices: All notices concerning the course will be displayed on Notice Board of Civil Engineering Department.

9. Make up policies: Make-up would be granted only for genuine cases with prior permission.

Instructor-In-Charge
CE G619