NIRMA UNIVERSITY

Institute of Technology

School of Engineering

Master of Technology - Civil Engineering

(Computer Aided Structural Analysis and Design)

Semester- II

L	T	P	C
3	0	2	4

Course Code	6CL151
Course Name	Finite Element Method for Structural Engineering

Course Outcomes:

At the end of the course, students will be able to –

1. apply theory of elasticity for stress and strain analysis
2. formulate finite element properties for structural mechanics problems
3. analyze continuum problems of solid mechanics domain.

Syllabus: Teaching hours: 45

Unit-1: Introduction to Elasticity **Hours: 10**

Displacement, strain and stress field, Equation of equilibrium and compatibility conditions, Stress and strain transformation, Stress and Strain invariants, Principal stress and strain, Generalized Hooke's law, Plane stress and plane strain problems.

Unit-2: Finite Element Formulation **Hours: 10**

Concept and solution procedure for analysis of skeletal and continuum structures by finite element displacement approach, Principles of discretization, Element stiffness and mass formulation based on direct, variational and weighted residual techniques.

Unit-3: Application to Solid Mechanics **Hours: 20**

Computation of element properties using generalised coordinators and natural coordinators for one dimensional elements, two dimensional elements such as plane stress, plane strain, plate bending and axisymmetric, three dimensional solid elements, Displacement formulations for isoparametric elements, Numerical integrations, Nonlinear analysis.

Unit-4: Computer Implementations **Hours: 05**

Pre-processing, Solution, Post-processing, Use of FEA packages, Development of computer program.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 05 exercises to be incorporated.

Suggested Readings:

1. Timoshenko, S. & Goodier, J. N. *Theory of Elasticity*, McGaw Hill.
2. Srinath, L. S. *Advanced Mechanics of Solids,* Tata McGraw Hill.
3. Logan, D. L. *A First Course in Finite Element Method*, Cengage Learning
4. Zienkiewicz, O. C., Taylor, R. L. & Zhu, J. Z. *The Finite Element Method: Its Basic & Fundamentals*, Butterworth Heinemann.
5. Chandrupatla, T. R. & Belegundu, A. D. *Introduction to Finite Elements in Engineering*, Pearson.
6. Desai, Y. M., Eldho, T. I. & Shah, A. H. *Finite Element Method with Applications in Engineering*, Pearson.
7. Desai, C. S. & Abel, J. F. *Introduction to the Finite Element Method: A Numerical Method for Engineering Analysis*, CBS Publishers.

L= Lecture, T= Tutorial, P= Practical, C= Credit

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w.e.f. academic year 2019-20 and onwards