IV Year I Semester	L	T	P	To	C
	3	1	-	4	4

MT427 FINITE ELEMENT ANALYSIS

Course Description & Objectives:

To teach students to create finite elements of a given domain to understand its behavior under varied practical conditions, study each element separately and combine their solutions to get overall behavior of the domain

Course Outcomes:

On completion of this course, students would be able to:

1. *familiarize with the energy methods used for fem procedure*
2. *solve 1d static structural bar problems subjected to axial loading.*
3. *solve the plane truss problems under different loading*
4. *solve the 2d plane problems associated with plane stress and plane strain by using 3 noded triangular elements*
5. *familiarize with the higher order elements used for solving 2d problems*
6. *solve complicated integral equations by using numerical methods*
7. *find the solutions for analysis of beam problems under various boundary conditions*
8. *solve 1d steady state heat conduction problems like plane wall, composite wall, and fins*
9. *solve 2d steady state heat conduction problems by using linear triangular elements.*
10. *solve the eigen value and eigen vectors of 1d un-damped free vibration bar problems.*
11. *find eigen value problems of 1d beam structures subjected to free vibrations without damping.*

UNITI: Introduction:

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method.

UNIT II: One Dimensional Problem:

Finite element modeling – Coordinates and shapes functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses.

UNIT III: Two Dimensional Continuums:

Introduction – Finite element modeling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects.

UNIT IV: Axi-symmetric Continuum:

Axi-symmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs.

UNIT V: Isoparametric Elements for Two Dimensional Continuums:

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for Axi-symmetric problems.

TEXT BOOKS:

1. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, 3rd ed., Pearson Education 2002.
2. David V Hutton “Fundamentals of Finite Element Analysis”, McGraw Hill International, 2004.

REFERENCES:

1. Rao S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989
2. Logan D.L., “A First course in the Finite Element Method”, 3rd ed., Thomson Learning, 2002.
3. Reddy J.N., “An Introduction to Finite Element Method”, McGraw Hill International, 1985.
4. O.C.Zienkiewicz, and R.L.Taylor, “The Finite Element Methods – The basic formulation and linear problems”,5th ed., Butterworth

methodologies: ladder diagram, STL,