Department of Maths, Statistics and Physics

I. Course Title : Finite Element Methods

II. Course Code : MATH 501

III. Credit Hours : 2+1

IV. Theory

Unit I

Introduction. Historical background, Stress equilibrium, boundary condition,stress strain relation, potential energy and equilibrium. Rayleigh-Ritz method. Galerkin method.

Unit II

coordinates and shape functions, potential energy approach,element stiffness matrix,Galerkin approach, assembly of global stiffness matrix. The finite element equation, boundary conditions.

Unit III

Trusses: Two dimensional problems, modeling by constant strain triangle, two dimensional iso-parametric elements, the four-node quadrilateral.

Unit IV

Scalar field problems, steady state heat transfer, torsion, potential flow, seepage and fluid flow index, dynamic analysis, principles.

V. Practical

Use of simple FEM software for FEM software for understanding, principles of FEM. Working out simple problems using LISA or any simple software with understanding of operation. Solving one dimensional problem. Solution to planar and spatial trusses, solving simple two-dimensional problems, Axisymmetric problems, solution of problems with two dimensional iso-parametric elements,solving simple beams and frames, three dimensional problems, solution to heat transfer problems and flow problems.

Learning outcome

Ability to formulate problems based on use of FEM and solve them using software tools.

VI. Lecture Schedule

S.No.	Topic	No.of Lectures
1.	Introduction. Historical background, Stress equilibrium, boundary condition	4
2.	Stress strain relation, potential energy and equilibrium, Rayleigh-Ritz method, Galerkin method.	4
3.	coordinates and shape functions, potential energy approach,element stiffness matrix	3

S.No.	Topic	No.of Lectures
4.	Galerkin approach, assembly of global stiffness matrix, The finite element equation, boundary condition	3
5.	Trusses: Two dimensional problems,	3
6.	modeling by constant strain triangle	3
7.	two dimensional iso-parametric elements, the four-node quadrilateral.	3
8.	Scalar field problems, steady state heat transfer	3
9.	torsion, potential flow,	3
10.	seepage and fluid flow index, dynamic analysis, principles.	3
	Total	**32**

VII. List of Practicals

S.No.	Topic	No.of Practicals
1.	Use of simple FEM software for FEM software for understanding, principles of FEM.	3
2.	Working out simple problems using LISA or any simple software with understanding of operatio	3
3.	Solving one dimensional problem, Solution to planar and spatial trusses	2
4.	Solving simple two-dimensional problems, Axisymmetric problems	2
5.	Solution of problems with two dimensional iso-parametric elements	2
6.	Solving simple beams and frames	2
7.	Three dimensional problems, solution to heat transfer problems and flow problems.	2
	Total	**16**

VIII. Suggested Reading

- Tirupathi R, Patla C and Belegundu AD. 1999. *Introduction to Finite Element in Engineering*. Prentice Hall of India Pvt. Ltd, New Delhi
- Singiresu RaoS. 2001. *The Finite Element Method in Engineering*. Butter worth Heinemann, New Delhi.
- Rajasekaran S 1999. *Finite Element Analysis in Engineering Design*. Wheeler Publishing, Division of A.h.Wheeler and Co. Ltd, Allahabad.
- *Tutorials and Reference Guide*, LISA Finite Element Analysis Software Version 8.0.0 2013

I. Course Title : Numerical Methods for Engineers

II. Course Code : MATH 502

III. Credit Hours : 2+1

IV. Aim of the course

To expose students to various numerical methods for solving algebraic equations, ordinary and partial differential equations.

V. Theory

Unit I

Solution of Algebraic Equations: Solution of non-linear and transcendental equations in one or more than one variable using bisection, false position, iteration, Newton Raphson, Secant methods. Solution of linear simultaneous equations: Matrix