MATH 901: Advanced Engineering Mathematics

Credit Hours: 3

Pre-requisites: Nil

Course Objectives

1. To impart advanced techniques of linear algebra and differential specially the applied differential equations to the students.

Course Contents

2. Advanced Linear Algebra: Mathematical and numerical investigation of direct, iterative and semi-terative methods of solution of linear systems. Singular algebraic systems and least squares computations. Methods for calculation of eigenvalues and eigenvectors.
3. Differential Equations: Ordinary Differential Equations: Ordinary differential equations including existence and uniqueness theorems and the theory of linear systems. Topics may also include stability theory, the study of singularities, and boundary value problems.

4. Applied Differential Equations: Wave, heat and Laplace equations. Solutions by separation of variables and expansion in Fourier Series or other appropriate orthogonal sets. Use of power series as a tool in solving ordinary differential equations.

5. Solutions in series of eigen functions, maximum principles, the method of characteristics, Green's functions, and discussion of well-posedness problems.

6. Perturbation theory and asymptotic approximations: Perturbation theory for algebraic equations; Regular perturbation theory (power series) and its shortcomings; Asymptotics and uniformity; stretched time; Boundary-layer problems.

Course Outcomes

1. The module will help the students solve practical engineering problems through the advanced mathematical techniques.

2. **Reading / Text / Reference Books**

a. Advanced Engineering Mathematics, Kreyszig, E. 7th. edn., Wiley 1993

b. Perturbation Methods, E. J. Hinch

c. Perturbation Methods in Applied Mathematics, J. D. Cole,

d. Computational and Applied Mathematics for Engineering Analysis, A. S. Cakmak

e. Fourier Series, G. P. Tolstov

f. Basic Partial Differential Equations, D. Bleecker and G. Csordas

g. An on-line textbook from Georgia Tech: Linear Methods of Applied Mathematics, Evans Harrell and James Herod (http://www.mathphysics.com/pde/)

h. Applied Mathematics: A Contemporary Approach, J. D. Logan