College of Engineering Pune

(An Autonomous Institute of Government of Maharashtra, Pune-411005)

Department of Mathematics

(MA-) Compulsory Mathematics- Coursework for Ph.D.

Teaching Scheme
Lectures : 4 hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Unit I : Linear Algebra and Matrices

Vector spaces. Inner Product spaces, Linear Transformations with applications and importance in Engineering. Significance of Eigen Values and Eigen Vectors with analytical and numerical methods to find the same. **[12 Hrs]**

Unit II : Transform Techniques

Importance of different types of transforms with their definitions, properties and applications. Laplace and Fourier Transforms with applications in solving differential equations and image processing. **[12 Hrs]**

Unit III : Differential Equations

Numerical solutions of ODE using Taylor series method, Euler's method, Runge Kutta method, Predictor-corrector methods with applications to Engineering problems. Elliptic, Parabolic and Hyperbolic systems, solution methods (separation of variables), multigrid and other efficient algorithms. **[12 Hrs]**

Unit IV : Complex Analysis

Integration in the complex plane, residues, improper integral evaluation, conformal mapping. **[12 Hrs]**

Text Book :

- Advanced Engineering Mathematics (9^{th} Student Edition) by Erwin Kreyszig, Wiley Eastern Ltd.

Reference Books :

- Engineering Mathematics Vol I, II, III by P.N. Wartikar, J. N. Wartikar Pune Vidyarthi Gruha Prakashan.
- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (5^{th} edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Differential Equations With Applications and Historical Notes by George F Simmons
- Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill Publ.)
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

Outcomes : Students will be able to

1. **define** and **understand** basic concepts such as vector spaces, linear dependence / independence of vectors, basis and linear maps, **calculate** eigen values and eigen vectors.
2. **list** different types of transforms, **prove** basic properties, **solve** differential equations using transform techniques.
3. **recall** basic concepts of ordinary / partial differential equations and **solve** them numerically using different methods**.**
4. **know** basic concepts of complex analysis, **evaluate** integrals / improper integrals in the complex plane, **understand** residues and conformal mapping.
5. **apply** all concepts in the syllabus to various Engineering applications including real life problems.

Note :

At the end of the course students will be able to think logically, understand and appreciate the basic importance of a strong Mathematics base for research in Engineering.