**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 Examination Scheme

Lectures : 4 hrs / week 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 (9th 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 (5th 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.

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**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.