Devi Ahilya University, Indore, India Institute of Engineering & Technology				**II Year B.E. (Mechanical Engg.) (Full Time)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
AMR3C1: APPLIED MATHEMATICS-III	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	**1**	**-**	**3**	**1**	**-**	**4**
Duration of Theory Paper: 3 Hours							

Learning Objectives:

1. To develop an understanding of the underlying mathematics as a preparation for a specialist study of applications areas like, Laplace transform to solve the diffusion equation, heat transfer equation, mass transport, heat transport, fluid transport, and process controls; Complex Analysis in fluid mechanics and potential theory useful in steady state conduction, electrostatic and gravitational fields; Fourier analysis relevant for PDE-solving and probably the heat equation in three dimensions. Vibration sensitive instruments with Fourier transformers attached can be used for tuning pianos and motor engines, for aircraft and submarine detection and so on.
2. Numerical approach enables solution of a complex problem with a great number of very simple operations. It is useful to find the solution with use of computers making calculation easy and fast.

Pre requisite(s): Basic knowledge of determinants, matrices, differentiation and integration of functions and complex numbers.

COURSE CONTENTS

UNIT-I

Laplace transform: Definition and properties of Laplace transform, Inverse Laplace Transforms. Convolution theorem, Application of Laplace transform in solution of ordinary differential equations, Simultaneous differential equations with constant coefficients.

UNIT-II

Function of Complex variables: Analytic functions, Cauchy-Riemann conditions, Harmonic functions, Conjugate functions and their applications, Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent' series, Residue theorem, Solution of integrals, Conformal transformation, bilinear transformation, their properties and classification.

UNIT-III

Numerical solutions of algebraic and transcendental equations-Bisection method, Regula- Falsi method, Newton-Raphson method.

Solution of system of linear algebraic equation-Iterative methods: Gauss-Seidel and Gauss-Jacobi's iterative methods.

Numerical Solutions of ordinary differential equations - Single and multi-step methods.

Numerical solution of partial differential equation: Classification of second order Partial differential equation, Solution of elliptic, parabolic and hyperbolic equations by Iteration method.

UNIT-IV

Interpolation: Finite difference operator, Interpolation formula with equal and unequal intervals, Numerical differentiation, General quadrature formula, Numerical integration using Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddle's rule.

UNIT-V

Fourier series, Fourier Integral, Fourier transforms, Finite Fourier sine and cosine transform, Parseval's theorem, continuous time and discrete time Fourier Transform, DFT and FFT, solution of partial differentialequations with constant and variable coefficients.

Learning Outcomes:

Upon completing the course, students will be able to:

1. Apply Laplace Transform methods, useful in problems where mechanical/electrical driving force has discontinuities, is impulsive or is a complicated periodic function.
2. The course aims at developing the fundamentals of Complex Analysis, applicable to potential theory useful in steady state conduction, electrostatic and gravitational fields.
3. Apply Fourier Theory to analyze the quality of signals, how crosstalk, interference, noise, and distortion affect signal quality and to extract information from noisy signals.
4. Learn that many problems were analytical methods seems to fail, like solving highly nonlinear equation, numerical methods works very well.

BOOKS RECOMMENDED:

1. B.S. Grewal, Engineering Mathematics, Khanna Publishers, 42/e, 2015.
2. Erwin. Kreyszig, Advanced Engineering Mathematics, 8th edition, John Willy and sons Publications, 1999.
3. Gupta P.P. & Malik G.S., Calculus of Finite Differences and Numerical Analysis, Krishna Prakashan Mandir, Meerut, 21/e, 2006.
4. Kasana H.S., Complex Variables: Theory and Applications, Prentice-Hall of India Pvt. Ltd, 2nd edition, 2005.
5. A.R. Vasishtha and R.K. Gupta, Integral Transforms, Krishna Prakashan Media Ltd, Meerut, India, 2000.
6. Murray R. Spiegel, Schaum's Outline of Fourier Analysis, McGraw-Hill, New York, 2004.
7. J. F. James, A Student's Guide to Fourier Transforms with Applications in Physics and Engineering, 3rd Edition, Cambridge University Press, 2011.
