Devi Ahilya University, Indore, India Institute of Engineering & Technology				II Year B.E. (Civil Engineering)			
Subject Code & Name	Instructions Hours per Week			Credits			
AVR3C1: Applied Mathematics - III	L	T	P	L	T	P	Total
	3	1	-	3	1	-	4
Duration of Theory Paper:3 Hours							

Learning Objectives:

- To develop an understanding of the underlying mathematics as a preparation for a specialist study of applications areas like, Laplace transform converts a given ordinary or partial differential equation into a polynomial- Partial Differential Equation can be used to describe a wide variety of phenomena such as sound, heat, electrostatics, fluid flow, elasticity and quantum mechanics, -Differential equation are used to calculate population growth, exponential decay of radioactive, substances, motion of a falling object, Newton's law of cooling and various electrical circuits; Statistics useful in risk assessment, random decrement analysis, to monitor remotely the structural health of a structure (such as a bridge, tall building, dams etc); Fourier analysis relevant for PDE-solving and probably the heat equation in three dimensions. The Fast Fourier Transform is employed as a method of Laplace transform inversion to solve problems in the civil engineering fields of visco-elasticity and hydrology.
- 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 requisites: Basic knowledge of determinants, matrices, differentiation and integration of functions and probability theory.

COURSE CONTENTS

UNIT –1:
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 – 2:
Statistics: Brief idea of sampling, t, F and χ^2 distributions and their applications, ANOVA, Statistical Quality Control (SQC), Control Charts, Sampling inspection, Acceptance sampling, Producer’s and Consumer’s risk, O. C. curve.

UNIT – 3:

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 – 4:

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 – 5:

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 differential equations 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. Learn how to apply Statistics in solving problems of modern Civil Engineering.
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, 8^{th} 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. S.C.Gupta, Fundamentals of Statistics, Himalaya Publishing House, Mumbai, 6^{th} Ed., 2009.
5. Freund John E, Mathematical Statistics, PHI, N.D., 7^{th} Ed., 2010.
6. A.R. Vasishtha and R.K. Gupta, Integral Transforms, Krishna Prakashan Media Ltd, Meerut, India, 2000.
7. Murray R. Spiegel, Schaum's Outline of Fourier Analysis, McGraw-Hill, New York, 2004.
8. J. F. James, A Student's Guide to Fourier Transforms with Applications in Physics and Engineering, 3^{rd} Edition, Cambridge University Press, 2011.