COMPLEX VARIABLES & STATISTICAL METHODS (MECHANICAL Engg.)

23MA1109 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40
End Exam : 3 Hours End Exam Marks:60

Prerequisites: Differentiation, Integration, Complex numbers, Partial fractions.

Course Objectives:

The aim of this course is to study the techniques of complex variables and functions together with their derivatives, contour integration and provide the foundations of probabilistic and statistical analysis.

Course Outcomes: By the end of the course, students will be able to

1	Analyze limit, continuity and differentiation of functions of complex variables and understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
2	Understand Cauchy's theorem and Cauchy's integral formulas and apply these to evaluate complex contour integrals and represent functions as Taylor's and Laurent's series and determine their intervals of convergence.
3	Familiar with numerical solution of ordinary differential equations.
4	Examine, analyze and compare Probability distributions**.**
5	Analyze the Statistical data by using statistical tests and to draw valid inferences about the population parameters.

CO-PO –PSO Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	2										1			

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

CO-PO-PSO Justification	
1	CO1 deals with properties of analytic functions and finding analytic functions, these are widely used in many areas of engineering.
2	CO2 deals with finding the values of complex contour integration and series representation of a given complex function by using Taylor's and Laurent's series, and these are used in various fields of engineering.
3	CO3 deals with finding the numerical solution of a given IVP problems.
4	CO4 deals with knowledge of probability distributions and is widely used in many areas of engineering.
5	CO5 deals with the testing of hypothesis and is mainly used for making statistical decision using experimental data in various fields of engineering.

SYLLABUS

UNIT I **10 Periods**

FUNCTIONS OF A COMPLEX VARIABLE

Complex function – Real and Imaginary parts of complex function – Limit – Continuity and derivative of a complex function – Cauchy-Riemann equations – Analytic function, entire function, singular point, conjugate function – Cauchy-Riemann equations in polar form – Harmonic functions – Milne-Thomson method – Simple applications to flow problems – Applications to flow problems.

UNIT II **10 Periods**

COMPLEX INTEGRATION, SERIES OF COMPLEX TERMS AND RESIDUES

Complex integration – Cauchy's theorem – Cauchy's integral formula – Series of complex terms: Taylor's series – Maclaurin's series expansion – Laurent's series – Singularities – Residues – Calculation of residues – Cauchy's residue theorem. (All theorems without proofs)

UNIT III **10 Periods**

NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Picard's method – Taylor's series method – Euler's method, Runge - Kutta method, Predictor - Corrector methods, Milne's method.

UNIT IV **10 Periods**

PROBABILITY AND DISTRIBUTIONS

Introduction – Basic terminology – Probability and set notations – Addition law of probability – Independent events – Baye's theorem – Random variable – Discrete probability distribution: Binomial distribution and Poisson distribution– Continuous probability distributions: Normal distribution (mean , variance , standard deviation and their properties without proofs).

UNIT V **10 Periods**

SAMPLING THEORY

Introduction – Sampling distribution – Testing a hypothesis – Level of significance – Confidence limits – Test of Significance of large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown mean – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – chi square test – Goodness of fit.

TEXT BOOKS:

B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

2. N. P. Bali, Engineering Mathematics, Lakshmi Publications.

3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Calculus, 13/e, Pearson Publishers, 2013.

4. H. K. Dass, Advanced Engineering Mathematics, S. Chand and complany Pvt. Ltd.

5. Michael Greenberg, Advanced Engineering Mathematics, Pearson, Second Edition.