COMPLEX VARIABLES & REGRESSION ANALYSIS (CHEMICAL Engg.)

23MA1110 **Credits:3**

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

Prerequisites: Differentiation, Integration, Complex numbers and Functions.

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	Use of Cauchy's theorem and Cauchy's integral theorems and apply these in evaluation of complex contour integrals and able to represent the given functions as Taylor's and Laurent's series, and determine their intervals of convergence.
3	Compute the definite integrals by using Cauchy's residue theorem.
4	Familiar with numerical solution of ordinary differential equations.
5	Evaluate simple correlation between the two variables and fit curves by the method of least square approximation.

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			

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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 definite integrals by using residues.
4	CO4 deals with finding the numerical solution of a given IVP problems.
5	CO 5 deals with the knowledge of curve fitting is widely used as an aid for data visualization and regression is to summarize the relationship among two or more variables.

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

Complex integration – Cauchy's theorem – Cauchy's integral formula – Series of complex terms: Taylor's series – Maclaurin's series expansion – Laurent's series. (All theorems without proof)

UNIT III **10 Periods**

RESIDUES

Singularities – Residues – Calculation of residues – Residue at a pole of order m. (All theorems without proofs)

Evaluation of real definite integrals: Integration around the unit circle – Integration around a semicircle.

UNIT IV **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 V **10 Periods**

CORRELATION, REGRESSION ANALYSIS AND CURVE FITTING

Correlation : Definition – Karl pearson's coefficient of correlation – Measures of correlation – Rank correlation coefficients.

Regression : Simple linear regression – Regression lines and properties.

Curve Fitting : Principle of least squares – Method of least squares – Fitting of straight lines – Fitting of second degree curves and exponential curves.

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.