21UMAC400	Engineering Mathematics-IV	(2-2-0)3

Contact Hours:39 CIE:50 Marks SEE: 50 Marks Exam Duration:3 Hrs.

Course Learning Objectives (CLOs):

To provide an insight into applications of conformal mapping, integration of complex functions and application of statistics and probabilitydistributionsin Engineering.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Construct** and use the concepts of analytic function to solve the problems arising in Engineering field.			1
CO-2	**Utilize** conformal transformation and complex integral to transform irregular domain onto a relatively simple domain.		1	
CO-3	**Make** use of the correlation and regression analysis tofit a suitable mathematical model forthe statisticaldata.		1,2	
CO-4	**Apply** discrete and continuous probability distributions in analyzing the probability models arisingin engineeringfield.		1,2	
CO-5	**Recite** Markov chains and describe stochastic process.			1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	1.6	1.7	-	-	-	-	-	-		-	-	-

Pre-requisites: 1.Differentiationof function.

2. Integration of function.

3. Basic Probability theory.

Contents:

Unit-I

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic functions: Milne-Thomson method-Problems**.** **6L + 1T**

Unit-II

Conformal transformations: Introduction. Discussion of transformations:$w = e^z; w = z^2, w = z + \frac{1}{z}, z \neq o$)Bilinear transformations- Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's Integral theorem. **7L + 1T**

Unit-III

Statistical Methods: Correlation and Lines of regression-problems - Fitting the curves of the form $y = ax + b; y = ax^2 + bx + c; y = ax^b$ by the method of least squares**.** **7L + 1T**

Unit-IV

Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions-problems (No derivation for mean and standard deviation)-Illustrative examples**.** **7L + 1T**

Unit-V

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Markov chains – Introduction, probability vectors, Stochastic Matrices, Fixed points and Regular stochastic matrices, Markov chains, higher transition probabilities, stationarydistribution of regular Markov chains and absorbing states. **7L + 1T**

Reference Books:

1**. B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.

2. **E. Kreyszig**: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

3.**Peter V.O'Neil**: Advanced Engineering Mathematics,International students edition,2011.

4.**Kishor S. Trivedi**: Probabilty& Statistics with Reliabilty,Queuing, and Computer Science Applications,Prentice-Hall of India,2005.

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Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To have an insight into Fourier series, Fourier transforms, Difference equations and Z-transforms.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Express** periodic function as a Fourier series and **obtain** the various harmonics of the Fourier series expansion for the given numerical data.	-	-	1
CO-2	**Transform** the given function using Fourier transforms depending on the nature of engineering applications. Solve difference equations using Z-transform.	-	-	1
CO-3	Make **Use** of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	-	1,2	-
CO-4	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	-	1,2	-
CO-5	Estimate the correlation, covariance	-	1,2	-

	using joint probability distributions. Also use student's t-distribution, Chi-square distribution as a test of goodness of it.			

Pre-requisites:(1) Differentiation of function.
(2) Integration of function.
(3) Basic Probability theory.
(4) Statistical averages

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-

Contents:

Unit-I

Fourier Series: Periodic functions, Dirichlet's condition, Fourier series of periodic functions of period 2π and arbitrary period. Half-range Fourier series, Practical harmonic analysis, Examples from engineering field. **7L + 1T**

Unit-II

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms, Simple problems.

Z-Transforms and Difference equations: Z-transform – definition, Standard Z – transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems, Inverse Z-transform, Simple Problems, Difference equations – Basic definition, Application of Z-transform to solve Difference equation. **7L + 1T**

Unit-III

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression– problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form= $ax + b; y = ax^2 + bx + c; y = ax^b$.**7L + 1T**

Unit-IV

Probability Distributions: Review of basic probability theory, Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard

deviation)-Illustrative examples. **7L + 1T**

Unit-V

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **6L + 1T**

Reference Books:

1) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint) 2016.
2) B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
3) Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016.

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Contact Hours: 39

Course Learning Objectives (CLOs):

To provide an insight into curvilinear coordinates system. Study statistical methods, probability distribution and application of probability distributions in Engineering.

Course Outcomes (Cos):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to Pos(1-12)/PSOs(13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level(1)**
CO-1	**Understand** the significance of vectors and solve problems in various co-ordinate systems.	1	2	
CO-2	**Use** correlation and regression analysis to fit a suitable mathematical model for the statistical data.		1,2	
CO-3	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.		1,2	
CO-4	Recite Markov chains and describe stochastic process.		1,2	
CO-5	Determine Type-I and Type-II errors and test for goodness of fit using different methods.			

Pos/PSOs	1	2	3	4	6	7	8	9	10	11	12	13	14
Mapping Level	2.2	2	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: (1) Differentiatin of function.

(2) Integration of function.

(3) Basic Probability theory.

(4) Vector Algebra.

Unit-I

Curvilinear coordinates system: Vector Field, Dot product, Cross product of vectors, Other coordinate systems: Circular Cylindrical and Spherical coordinate systems. Laplace's and Poisson's equations. **7L + 1T**

Unit-II

Statistical Methods: Correlation and regression, Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form = $ax + b$; $y = ax^2 + bx + c$; $y = ax^b$. **6L + 1T**

Unit-III

Probability Distributions: Review of basic probability theory, Random variables (discrete and continuous), probability mass/density functions – Uniform, Binomial, Poisson, exponential and normal (Gaussian) distributions, problems (No derivation for mean and standard deviation) - Illustrative examples, Distribution of several random variables. **7L + 1T**

Unit-IV

Joint probability distributions: Joint Probability distribution for two discrete random variables, expectation and covariance.

Markov chains – Introduction, probability vectors, Stochastic Matrices, Fixed points and Regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **7L + 1T**.

Unit-V

Sampling Theory: Introduction to sampling, estimations of parameters, Confidence intervals, Testing of Hypotheses, Decisions, Standard error, Type-I and Type-II errors, Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **7L + 1T**

Reference Books:

1. ErwinKreyszig: Advanced Engineering Mathematics, John Wiley &Sons 10^{th}edition, 2016.

2. B. S. Grewal: Higher Engineering Mathematics, KhannaPublishers, 44th edition, 2017.
3. Hayt& Buck, “Engineering Electromagnetics”, Tata McGraw-Hill, 8th edition, 2010.
4. Edminister, “Electromagnetics”, Schaum Outline Series, McGraw Hill, 2nd edition, 2006.

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Contact Hours:39

Course Learning Objectives (CLOs):

To visualize combination, spaces, rotation, reflection and projection of vectors. To compute orthogonal vectors, Eigen values to solve differential and difference equation. Obtain least square solution to solve system of equations.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 12)/ PSO (1 to 2)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Describe the concept of vector spaces, subspaces, basis, dimension and their properties.			1,2
CO-2	Explain various matrix transformation such as linear transformation, orthogonal transformation and similarity transformation.			1,2
CO-3	Illustrate the concepts of symmetric matrices and quadratic forms.			1,2
CO-4	Apply characteristic polynomials to compute Eigen values and Eigen vectors and use Eigen spaces of matrix to diagonalizable a matrix.			1,2
CO-5	Apply the concepts of inner products to matrix decomposition.			1,2

PO's	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
Mapping Level	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: 1. Properties of determinants 2. Algebra of Matrices

Contents:

UNIT-I

VECTOR SPACES- Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates. **6L+1T**

UNIT-II

LINEAR TRANSFORMATIONS: Introduction, Linear Mappings, Geometric linear transformation of, Kernel and Image of a linear transformations, Matrix representation of linear transformations, Rank-Nullity Theorem (No proof), Singular and Nonsingular linear transformations, Invertible linear transformations.

7L+1T

UNIT-III

SYMMETRIC MATRICES AND QUADRATIC FORMS: Diagonalization of real symmetric matrices, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Singular value decomposition.**7L+1T**

UNIT-IV

EIGEN VALUES AND EIGENVECTORS: Introduction, Polynomials of Matrices, Characteristic polynomial, Cayley-Hamilton Theorem, eigenvalues and eigenvectors, eigen spaces of a linear transformation, Diagonalization, Minimal Polynomial, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form, Solving differential equations in Fundamental form.**7L+1T**

UNIT-V

INNER PRODUCT SPACES: Inner product, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error. **7L+1T**

Reference Books:

1) Linear Algebra and its applications, David C. lay, Steven R. lay, Judi J Mc. Donald, 5th edition, 2015, Pearson Education.
2) Linear Algebra and its applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.