21UMAC300	Engineering Mathematics-III	(2- 2 - 0)3

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

Course Learning Objectives (CLOs):

To have an insight into Fourier series, Fourier transforms, Z-transforms. To develop the proficiency in variational calculus. To solve algebraic, transcendental and ordinary differential equation arising inengineering applications using numerical methods.

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	**Express** periodic function as a Fourier series and obtain the various harmonics of the Fourier series expansion for the given numerical data.			1,2
CO-2	**Transform** the given function using Fourier transforms depending on the nature of engineering applications. **Apply** Z-transform for series of mathematical conversion to mathematical framework used as digital filter. **Solve** difference equations using Z-transform.			1,2
CO-3	**Apply** the knowledge of numerical methods to fit an interpolating curve to the experimental data and **obtain** solution of transcendental equation.			1,2
CO-4	**Solve** first and second order ordinary differential equations arising in engineering problems using single step and multi-step numericalmethods.			1,2
CO-5	**Determine** the extremals of functional using calculus of			1,2

	variations and **solve** problems arising in engineering.			

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	1.0	2.0										

Pre-requisites: 1.Differentiation of function.
2. Integration of function.

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) problems. Inverse Z-transform. Simple problems. Difference equations-basic definition. Application of Z-transform to solve Difference equations. **7L + 2T**

Unit-III

ElementaryNumericalMethods:
Solution of algebraic and transcendental equations: Newton-Raphson's and Regula-Falsi methods (onlyformulae) -Illustrative examples.
Finite differences.Interpolation usingNewton's forwardand backwarddifference formulae, Newton's divided difference andLagrange's formulae (formulae withoutproof). **7L + 1T**

Unit-IV

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified

Euler's method. Runge –Kutta's method of fourth order, Milne's predictor and corrector method (Noderivations of formulae). Problems. **6L + 1T**

Unit-V

Numerical integration: Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule (without proof) & problems. **Calculus of Variations:** Variation of function and functional, variational problems, Euler's equation (without proof),Geodesics(plane),Hanging chain problems.

6L + 1T

Reference Books:

1. **B.S. Grewal**: HigherEngineeringMathematics, KhannaPublishers, 44^{th} Ed., 2017.
2. **E.Kreyszig**: Advanced EngineeringMathematics,John Wiley&Sons, 10^{th} Ed.(Reprint).2016.
3. **Srimanta Pal et al**: Engineering Mathematics, Oxford University Press, 3^{rd} Edition, 2016.
4. **B. V. Ramana**:"HigherEngineeringMathematics"11^{th}Edition,TataMcGraw-Hill, 2010.

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Contact Hours: 39

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

- The basic terminologies of mathematical and logical reasoning, functions, and relations associated with its properties and corresponding practical examples.
- Various counting principle methods to solve complex problems in combinatorics.
- Demonstration with examples, the basic terminologies of graphs and its types.
- Identify the applications of mathematical structures in other fields of computer science such as data structures and algorithms, databases, networks, operating systems etc.

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	**Verify**the correctness of an argument using various techniques and strategies.	1	2	4,15
CO-2	**Solve**problems using counting techniques and combinatorics.	1	2	4,15
CO-3	**Solve**the problems on different types of functions, relations, and Generating functions.	1	2	4,13
CO-4	**Solve**the problems pertaining to graphs and related discrete structures.	1	2	4,13
CO-5	**Explain**the concepts and properties of algebraic structures such as groups and coding theory.	1	2	4,15

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	-

Pre-requisites: None

Contents:

Unit-I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference, The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems**8L + 1T**

Unit-II

Fundamental Counting: The Rules of Sum and Product, Permutations and Combinations, The Binomial coefficients, The Pigeon-hole Principle.
Relations: Cartesian Products and Relations, Properties of Relations, Equivalence Relations and Partitions**8L + 1T**

Unit-III

Functions: Definition,Plain and One-to-One, Onto Functions, Function Composition, Inverse Functions, Directed Graphs, Hasse Diagrams. 6**L + 1T**

Unit-IV

Generating Functions: Definitions and examples, Exponential Generating Functions.
Recurrence Relations: Recursive definitions. First Order Linear Recurrence Relations, Second order linear homogeneous recurrence relation with constant coefficients.**6L + 1T**

Unit-V

Graphs: Elements of graph theory, Graphs and its properties, Directed graphs, Sub-graph, Complements, Planar graphs, Euler Graph, Hamiltonian Graphs, Graph Colouring, Representation of graphs, Trees. Application to engineering. **6L + 1T**

Reference Books:

1) Ralph P Grimaldi&B.V.Ramana “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education, 2006.
2) Kenneth H Rosen, “Discrete Mathematics and its Applications”, 7th Edition, McGraw Hill, 2012.

3) Kolman B & Busby R C, “Discrete and Mathematical Structures for Computer Science”, 5th Edition, Prentice Hall of India 2004.
4) Thomas Kosay,“Discrete Mathematics with Applications”, Elsevier, 2005, Reprint 2008.

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Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on learning mathematical model for a signal, properties of a signals and systems, representation of a signal in different domains. Also, the courseemphasizes on relation between Fourier representations, sampling and reconstruction of a signal.

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	**Analyze** different types of signals. Systems and its properties.	1	2	
CO-2	**Analyze**thetime domain signalsand solve for the system response.	1,2		13
CO-3	**Analyze**the frequency domain signals	1	2	
CO-4	**Relate** different Fourier representations and applyit for various applications.	1	2	3, 13
CO-5	**Apply** the Z- transform to analyze discrete-time signals and systems	1	2	

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

Pre-requisites: Calculus

Unit-I

Introduction: Definitions of signals and systems, classification of signals, basic operations on signals, elementary signals, Properties of systems.

6L + 1T

Unit-II

Time Domain Representation: Convolution, Interconnection of LTI systems, Relations between LTI system properties and impulse Response, Solving Differential and Difference Equations, Block diagram representation. **7L + 1T**

Unit-III

Fourier Representations: Complex Sinusoids and Frequency response of LTI Systems, Fourier Representations for four classes of signals: Discrete Time Fourier Series(DTFS), Continuous Time Fourier series(FS),Discrete Time Fourier Transform(DTFT), Continuous Time Fourier Transform(FT).

7L + 1T

Unit-IV

Properties of Fourier Representations: Linearity and Symmetry Properties, Convolution Property, Differentiation Property, Integration Property, Time, and Frequency Shift Property, MultiplicationProperty, Scaling Property, Parseval's Relationships, Frequency response of LTI systems.

Applications of Fourier Representations: Relating FT to FS, Relating DTFT to DTFS, FT to DTFT, FT to DTFS. **7L + 1T**

Unit-V

z-Transforms : z-transform, properties of Region of Convergence, Properties of z transform, Inverse z-transform: Partial Fraction Expansion,Power Series Expansion, Unilateral z-transform, Transfer function. **7L + 1T**

Reference Books:

1. ErwinKreyszig:AdvancedEngineeringMathematics,JohnWiley&Sons 10th edition, 2016.
2. B.S. Grewal: HigherEngineeringMathematics, KhannaPublishers, 44th edition,2017.
3. Simon Haykin, Barry Van Veen, "Signals and Systems", 2/e, Wiley Publications, reprint 2009.
4. H. P Hsu and R. Ranjan, "Signals and Systems", Schaum's outlines,TMH, 2006.

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Contact Hours:39

Course Learning Objectives (CLOs):

To have an insight into Fourier transforms, Z-transforms. Use statistical methods for analyzing, interpreting and presenting data.To transform given data into meaningful information to help in decision-making. Investigate a sequence of repeated trails of an experiment through Markov process.

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 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate the principles of counting and fundamentals of logic to solve elementary counting and logic arguments.			1,2
CO-2	Design different practical models for estimation and prediction.		1,2	
CO-3	Apply discrete and continuous probability distributions in analyzing the probability models arisingin engineeringfield.		1,2	
CO-4	Explain Markov chains and describe stochastic process.			1,2
CO-5	Apply Fourier transforms for series of mathematical conversion and Solve difference equations			1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	1.4	1.4										

Pre-requisites: 1. Basic probability theory 2.Statistical averages.
3. Differentiation, partial differentiation and integration of functions.

Contents:

Unit-I

COMBINATORICS: Principles of counting: The rules of sum and product, permutations. Combinations, Catalan numbers, the principle of inclusion and exclusion.Derangements.

Fundamentals of Logic: Basic connectives, Tautologies, Logical equivalence, Quantifiers and its use**. 6L+1T**

Unit-II

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems **Curve Fitting**: Curve fitting by the method of least squares.

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. **7L+1T**

Unit-III

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.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation.**7L+1T**

Unit –IV

MARKOV CHAIN AND QUEUING THEORY: Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chains. Queuing Models: Concept of Queue, M/M/1 queuingsystem.**7L+1T**

Unit – V

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. 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.Difference equations-basic definition.Application of Z-transform to solve Difference equation.**7L+1T**

Reference Books:

1. Ralph GrimaldiandB.V.Ramana, “Discrete and Combinatorial Mathematics(An applied introduction) “, 5th edition,2004.
2. B.S. Grewal, “HigherEngineeringMathematics”, KhannaPublishers,44th edition.