UMA301C: ENGINEERING MATHEMATICS-III

4 Credits (4-0-0)

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various engineering fields by making them

- to understand the method of solving algebraic, transcendental equations .
- to determine the approximate value of the derivative & definite integral for a given data using numerical techniques.
- able to expand the given periodic function defined in the given range in terms of sine and cosine multiple of terms as a Fourier series.
- able to extremise the functional using integration technique.
- able to form and solve the partial differential equation using different analytical techniques.
- to solve different forms of heat and wave equations.

Course outcomes:

On completion of this course, students are able

- to know how root finding techniques can be used to solve practical engineering problems.
- to apply the concept of numerical analysis to find the relative strengths and weaknesses of each computation method and know which are most applicable for given problem.
- to apply the analytical technique to express periodic function as a Fourier sine and cosine series.
- to apply partial differential techniques to solve the physical engineering problems.
- to implement integration technique to determine the extreme values of a functional.

UNIT-I

Numerical Analysis: 13 Hours

Bisection Method, Newton-Raphson method.Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.

Numerical solutions of first order ODE :

Taylors Series Method, Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method, Milne's predictor and corrector method (problems only).

UNIT-II

Numerical integration: 13 Hours

Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems.

Fourier Series:

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

UNIT-III

Fourier transforms: 13 Hours

Infinite Fourier transforms and inverse Fourier transforms-simple properties, complex Fourier transform, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms

Calculus of Variations

Variation of a function and a functional, extremal of a functional, variational problems, Euler's equation, standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT-IV

Partial Differential Equations: 13 Hours

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, Solution of equation of the type: Pp + Qq = R, Charpit's method. Solution of PDEs by the method of separation of variables.

Derivation of one-dimensional heat and wave equations. Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using standard five point formula.

Total 52 Hours

Resources:

1. Numerical Methods for Engineers by Steven C Chapra &Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Question paper pattern for SEE

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

UMA401C: ENGINEERING MATHEMATICS-IV

4 Credits (4-0-0)

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various Engineering fields by making them

- to identify the functions in engineering problems as analytic function and their study as a functions of a complex variables.
- to specify some difficult integration that appear in applications can be solved by complex integration.
- to understand the method of finding the series solution of Bessel's and Legendre's differential equations.
- to form a specific relation for the given group of data using least square sense method.
- to specify probability is an area of study which involves predicting the relative likely hood of various outcomes.

Course outcomes:

On completion of this course, students are able

- to solve Engineering problems using complex variable techniques.
- to evaluate the line integrals of a complex valued function.
- to apply series solution of Bessel's and Legendre's differential equations for BVP arising in cylindrical and spherical coordinate system respectively.
- to apply the least square sense method to construct the specific relation for the given group of data.
- to apply the concept of probability to find the physical significance of various distribution phenomena.

UNIT-I

Complex Variables: 13 Hours

Analytic function, Cauchy-Reimann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms), Discussion of conformal transformations: z^2, e^z and $z + a^2/z$ *(z # 0),* Bilinear transformations.

Complex Integration: Line integral, Cauchy's theorem - corollaries, Cauchy's integral formula. Taylor's and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy's residue theorem (without proof) - problems.

UNIT-II

Special Functions: 13 Hours

Series solution of Bessel's differential equation, recurrence formulae, generating function, orthogonal property, Bessel's integral formula. Series solution of Legendre's differential equation, recurrence formulae, generating function, orthogonal property, Rodrigue's formula.

UNIT-III

Statistics and Probability: 13 Hours

Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$. Correlation, expression for the rank correlation coefficient and regression.

Probability: addition rule, conditional probability, multiplication rule, Baye's rule.

UNIT-IV

Probability distributions: **13 Hours**

Discrete and continuous random variables-Probability density function, Cumulative distribution Function, Binomial distributions Poisson distributions and Normal distributions

Joint Probability Distribution and Markov Chains:

Concept of joint probability, Joint distributions - discrete and continuous random variables, Independent random variables, Problems on expectation and variance.

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.

Total 52 Hours

Resources: 13 Hours

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. A first course in Complex analysis with applications by Dennis G. zill Patrick D shanahan, 2nd edition 2010.
7. Advanced Engineering Mathematics by Peter V. O'Neil.

Question paper pattern for SEE

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.