Bachelor of Arts/Science (Applied Mathematics)

6th SEMESTER
DISCIPLINE SPECIFIC ELECTIVE COURSE
OPTION - I
AMM620DA APPLIED MATHEMATICS: METHODS OF APPLIED MATHEMATICS-II

CREDITS THEORY-4, TUTORIAL: 2

THEORY (4 CREDITS: 60 HOURS) **MAXIMUM MARKS: 60, MINIMUM MARKS: 24**

Objectives: i). To study the different types of matrices and to find the solutions of systems of equations and their consistency rising from various branches of science and social science.

ii). To study the properties of limits, continuity, differentiation and integration of vector functions.

iii). To learn the techniques and approximations to solve numerical problems arising in physical and engineering sciences.

UNIT-1 (15 HOURS)

Types of matrices, Inverse of a square matrix, reversal law and its generalization, trace of a matrix, matrix polynomials, characteristic equation, matrix polynomials, Cayley-Hamilton Theorem, rank of a matrix, invariance of rank matrix under elementary row and column transformations. Reduction of matrix to normal form, elementary matrices, equivalence of matrices, linear dependence and linear independence of row(column) vectors, conditions for columns of a matrix to be linearly dependent, matrix A has rank r iff it has r linearly independent columns, analogous results for rows.

UNIT-2 (15 HOURS)

Linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four. Inner product of two vectors, orthogonal and unitary matrices, determination of orthogonal matrices, eigen values and eigen vectors and their determination.

UNIT-3 (15 HOURS)

Parametric representation of curves and surfaces; limit, continuity and differentiability of vector functions, derivative of sum, dot product and cross product of two vectors, gradient of a scalar field and directional derivative, geometrical representation. Divergence of vector field, curl of vector field, physical interpretation of divergence and curl, line integrals and Green's Theorem, surface area and surface integrals, Divergence Theorem of Gauss, Stoke's Theorem.

UNIT-4 (15 HOURS)

Introduction to numerical methods, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Seidel and SOR iterative methods. Algorithms and Convergence of solution. Lagrange and Newton interpolation, linear and higher order, finite difference operators, numerical differentiation, Forward difference, backward difference and central difference. Integration: trapezoidal rule, Simpson's rule, Euler's method.

TUTORIALS (2 CREDITS: 30 HOURS) **Maximum Marks: 30 Minimum Marks: 12**

- Tutorials based on Unit I & II - **1 credit**
- Tutorials based on Unit III & IV – **1 credit**.

Text Books Recommended:

1 A.Aziz, Nissar A.Rather & B.A.Zargar, A Text Book of Matrices, KBD.

2. Shanti Narayan, A Text Book of Matrices.

3. S. S. Sastry, Introductory Numerical Methods, Prentice- Hall of India, New Delhi (1998).

4. M.K.Jain, S.R.K, Iyengar and R.K.Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.

5.G.B.Thomas and R.L. Finney, calculus, 9th Ed., Pearson Education, Delhi, 2005.

6. Shanti Narayan, Vector Calculus.

7. Schaum's Outline Series, Vector Analysis.

Bachelor of Arts/Science (Applied Mathematics)

6th SEMESTER
DISCIPLINE SPECIFIC ELECTIVE COURSE
OPTION - II
AMM620DB APPLIED MATHEMATICS: LAPLACE AND FOURIER TRANSFORMATIONS

CREDITS THEORY-4, TUTORIAL: 2

THEORY (4 CREDITS: 60 HOURS) **MAXIMUM MARKS: 60, MINIMUM MARKS: 24**

Objectives:

UNIT-1 (15 HOURS)

Laplace transform-definition, Laplace transform of some elementary functions, piecewise continuity, functions of exponential order, sufficient conditions for existence of Laplace transform, linearity property, first and second translation (shifting property), Laplace transform of derivatives, Laplace transform of integrals, periodic functions, initial and final value theorems and their generalizations, methods of finding Laplace transform, differential equations, evaluation of integrals, the Gamma function, Bessel functions, the error function, sine and cosine integrals, exponential integral, unit step function, Dirac delta function, null functions, Laplace transform of special functions.

UNIT-2 (15 HOURS)

Definition and uniqueness of inverse Laplace transform, Lerch's theorem, some inverse Laplace transform, some properties of Laplace transform, inverse Laplace transform of derivatives and integrals, the convolution property, methods of finding inverse Laplace transform, the complex inversion formula, the Heaviside expansion formula, the beta function, evaluation of integrals, ordinary differential equations with constant coefficients and with variable coefficients, simultaneous ordinary differential equations,

UNIT-3 (15 HOURS)

Periodic functions, Fourier series, determination of Fourier coefficients, even and odd functions and their Fourier expansion, change of interval, half range series (sine and cosine series), Riemann-Lebesgue Lemma, Dirichlet's conditions.

UNIT-4 (15 HOURS)

Fourier transform, inverse Fourier transform, Fourier sine and cosine transforms and their inversion, properties of Fourier transforms, Fourier transform of the derivative, convolution theorem, discrete Fourier transform and fast Fourier transform and their properties, applications of Fourier transform in partial differential equations with special reference to heat and wave equation.

TUTORIALS (2 CREDITS: 30 HOURS) **Maximum Marks: 30 Minimum Marks: 12**

- Tutorials based on Unit I & II - **1 credit**

- Tutorials based on Unit III & IV – **1 credit**.

Recommended Books:

1. I
2. . Murrey R. Spiegel, Laplace Transforms, Schaum's outline series.
3. I. N. Sneddon: The use of Integral Transforms, McGraw-Hill, Singapore 1972.
4. R. R. Goldberg, Fourier Transforms, Cambridge University Press, 1961.
5. D. Brain, Integral Transforms and their applications, Springer, 2002
6. L. Debnath and F. A. Shah, Wavelet Transforms and their applications, Springer, 2015.
7. R.V. Charchill, Foruier Series and Boundary Value Problems.