GOVERNMENT DEGREE COLLEGE (Autonomous), BARAMULLA.

B.A/B.Sc (Honors) with Mathematics as Major/Minor

5th Semester

MATC1522M: Mathematics/Applied Mathematics: INTEGRAL TRANSFORMS

Credits: (4 THEORY+2 TUTORIAL) **Theory: 64 Hours & Tutorial: 32 Hours**

Course Objectives: To develop skill in students about i) Fourier series, Fourier and Laplace transforms as a tool to solve various problems of Mathematics. ii) Integral transforms to be used in the field of applied Mathematics and especially in the field of physics and electronics to express periodic functions that comprise communication signal in waveform.

Course Outcome: After the completion of this course, students shall be able to use Fourier and Laplace transforms to solve the differential equations and to understand signal processing in frequency and time domain.

Theory: Credits 4

Unit- I

Fourier Series, Periodic functions, Properties, Even and Odd functions, Special waveforms, Square wave, Saw tooth wave, and Triangular wave, Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period 2L, Dirichlet's conditions, Sum of Fourier series, if $f(x)$ is bounded and integrable function on $(-\pi, \pi)$ and if a_n, b_n are its Fourier coefficients, then $\sum({a_n}^2 + {b_n}^2)$ converges, Half Range Series for sine and cosine functions, examples, Riemann Lebesgue theorem.

Unit – II

Fourier Transform ,Fourier Integral Theorem, , inverse Fourier transform, Fourier sine and cosine transforms and their inversion, properties of Fourier transforms Fourier transform of the derivative and integrals, convolution theorem, discrete Fourier transform and fast Fourier transform and their properties.

Unit-III

Laplace transform: Definition, examples and properties, Laplace transform of periodic functions, derivative and integrals, Dirac's Delta function, Heavyside function, Inverse Laplace transform, Convolution theorem, Applications of Laplace transform to ODE's.

Unit-IV

Applications of Laplace transform to PDE's, Integral equations, Application of Laplace transform to boundary value problems. Electrical circuits, dynamics, Beams, Heat conduction equations and wave equations.

Tutorials: Credits 2

Unit – V

Problems based on unit-I and unit-II with special reference to Advanced Engineering Mathematics by Erwin, Kreysgiz.

Unit – VI

Problems based on unit-III and unit-IV with special reference to Ronald Bracewell, The Fourier Transform and its Applications.

Recommended Books:

1. Ruel Churchill, Fourier series & Boundary Value Problems, 8th Edition McGraw Hill Education 2011.

2. Davies, Brian, Integral Transforms and Their Applications, Springer, 2002.

3. Erwin, Kreysgiz, Advanced Engineering Mathematics, John Willey & Sons. 10th Edition, 2011.

4.Ronald Bracewell,The Fourier Transform and its Applications.

5. K.S. Rao, Introduction to Partial Differential Equations, K.S. Rao, PHI, India.

6. Murrey R. Spiegel, Laplace Transforms, Schaum's outline series.

7. I. N. Sneddon: The use of Integral Transforms, McGraw-Hill, Singapore 1972.

8. R. R. Goldberg, Fourier Transforms, Cambridge University Press, 1961.

9. D. Brain, Integral Transforms and their applications, Springer, 2002.

GOVERNMENT DEGREE COLLEGE (Autonomous), BARAMULLA.

B.A/B.Sc (Honors) with Mathematics as Major

5th Semester

MATC2522M: Mathematics/Applied Mathematics: ALGEBRA- I

Credits: (4 THEORY+2 TUTORIAL) **Theory: 64 Hours & Tutorial: 32 Hours**

Course Objective: (i) To introduce students towards basic concepts of algebraic structures viz Groups and Rings. (ii) To identify various properties associated with the Groups and Rings. (iii) To expose students towards Advanced Mathematics such as Advanced Abstract Algebra and Commutative Ring Theory.

Course Outcomes: After the completion of this course, students shall be able to (i) Understand symmetries in nature and identify patterns. (ii) Apply these concepts in linear classical groups, to the problems arising in physics, computer science, economics and engineering etc.

Theory: 4 Credits

Unit I

Equivalence relations & equivalence classes, Binary operation, Groups, Finite & Infinite groups, Semi-groups, various properties of groups, order of an element, subgroups and Cosets, Criteria for subgroups, cyclic groups, Structure theorem for cyclic groups, Lagrange's theorem and its converse, Examples of General linear groups, Symmetric and Alternating groups, Dihedral groups and their applications.

Unit II

Normal subgroups and its various criteria, product of subgroups, counting principle, Quotient groups, homomorphism, kernel of a homomorphism, Fundamental theorem of homomorphism, Isomorphism theorems, Automorphism, inner automorphism and related results, Conjugate elements, Normalizer of an element, Centre of a group, theorems and related results.

Unit III

Rings: Definition, examples and properties, zero divisors, units and related results, Integral domain, skew fields and field, Subrings and Subfields, Ideals and Quotient rings, Algebra of Ideals, Idempotent and Boolean rings, Homomorphism, fundamental theorem and ring isomorphism, Polynomial rings.

Unit IV

Prime and Maximal ideals in a ring and related results, Quadratic Integer Rings, Euclidean domain(ED), Principal ideal domain (PID), Unique factorization domains (UFD), Universal side divisors and their properties, Greatest common divisor (GCD) and least common multiple (LCM) in rings, Relationship between ED, PID and UFD with counter examples.

Tutorial: 2 Credits

Unit V

Problems on Unit I and Unit II with special reference to I. N. Herstein, Topics in Algebra, John Wiley, 1975.

Unit VI

Problems based on Unit III and Unit IV with special reference to D. S. Dumit and R. M. Foote, Abstract Algebra, John Wiley, 2003

Recommended Books:

1. I. N. Herstein, Topics in Algebra, John Wiley, 1975.
2. D. S. Dumit and R. M. Foote, Abstract Algebra, John Wiley, 2003
3. Joseph Gallian , Abstract Algebra, Narosa Publishers, New Delhi, 1999.

4. M. Artin, Algebra, Pearson Education India, 2011.

5. P.B. Bhattachariya, S.K. Jain, S. R. Nagpaul, Basic Abstract Algebra, Cambridge University Press, 1994

6. Surjeet singh and Qazi Zameeruddin, Modern Algebra, S Chand And Company Ltd, 2021