

**GOVERNMENT DEGREE COLLEGE (Autonomous), BARAMULLA.**

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

**6<sup>th</sup> Semester**

**MMTC1622M** Mathematics/Applied Mathematics: DIFFERENTIAL EQUATIONS

**Credits: (4 THEORY+2 TUTORIAL)**

**Theory: 64 Hours & Tutorial: 32 Hours**

**Course Objectives:** To familiarize the students with various methods of solving differential equations and to have a qualitative applications through models

**Expected Outcomes:** After completion of this course the students shall be able to handle various real life problems and their dynamical processes.

**Theory: 4 Credits**

**Unit- I**

First order ODE, Singular solution, p-discriminant and c-discriminant, initial value problem of first order ODE, general theory of homogeneous and non-homogeneous linear ODE, simultaneous linear equations with constant coefficients, normal form, factorization of operators, method of variation of parameters, Picard's theorem on the existence and uniqueness of the solutions to an initial value problem.

**Unit-II**

Solution in series: (i) roots of an indicial equation, unequal and differing by a quantity not an integer (ii) roots of an indicial equation, which are equal (iii) roots of an indicial equation differing by an integer making a coefficient infinite (iv) roots of an indicial equation differing by an integer making a coefficient indeterminate.

Simultaneous differential equations  $dx/P = dy/Q = dz/R$  and its solution by use of multipliers and second integral found by the help of first, Total differential equations  $Pdx+Qdy+Rdz=0$ , Necessary and sufficient condition for an equation to be integrable, Geometrical interpretation of  $Pdx+Qdy+Rdz=0$ , Wronskian and its properties.

Dr. Sheikh Bilal Ahmad

Dr. Tariq Ahmad Naikoo

Dr. Farooq Ahmad Sheikh

Dr. Firdous Ahmad Malla

Dr. Shabir Ahmad Ahanger

Dr. Sameer Gupkari

Dr. Nisar Ahmad Lone

(Head/Chairperson)

Prof. Mahnaz Shafi Chishti

### Unit-III

Origin of partial differential equations-PDE, formation of PDE by elimination of arbitrary constant and arbitrary functions, linear partial differential equations, complete, general and singular solution of PDE, Lagrange's and Charpit's methods for the solution of linear and non-linear PDE's.

### Unit-IV

D'Alembert's solution of wave equation with finite, infinite string length, Duhamel's principle for solving inhomogeneous wave equation, Poisson method of spherical methods, Hadamard's method of descent, mean value property and Max-Min principle.

**Tutorials: 2 Credits.**

### Unit- V

Problems based on homogeneous and non-homogeneous differential equations, simultaneous and total differential equations, linear dependence and independence of solutions using Wronskian.

### Unit – VI

Problems based on singular solutions, simultaneous system of equations, total differential equations, Problems on solution of PDE's using Lagrange's and Charpit's methods.

### Books Recommended:

1. M.D Raisinghannia, ordinary and Partial differential Equations.
2. Zafar Ahsan, Differential Equations and their Applications, PHI, Pvt. Ltd. New Delhi-Second edition, 2004
3. HTH Piaggio, Differential Equations, CBS Publishers and Distributors, New Delhi, 2004.
4. Lawrence C. Evans , Partial Differential Equations .
5. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

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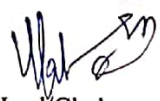
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4. C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005. 5. K.S. Rao, Introduction to Partial Differential Equations, PHI, New Delhi, Pvt Ltd, 2011.

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**MMTC2622M**

**Mathematics/Applied Mathematics: GRAPH THEORY**

**Credits: (4 THEORY+2 TUTORIAL)**

**Theory: 64 Hours & Tutorial: 32 Hours**

**Objectives:** To expose the students to the theory of graphs and combinatorics and to make them aware of their applications in different branches of science.

**Course outcome:** After the completion of degree, students shall be able to understand graph theoretical concepts, and discrete structures and their applications in other disciplines.

**Theory: 4 Credits**

**Unit- I**

Graphs- types and properties, walks, paths and cycles, bipartite graphs and Konigs theorem, graph operations, distance and eccentricity, Eulerian graphs and Euler's theorem, Konigsberg bridge problem, Hamiltonian graphs, Dirac's theorem, Ore's theorem, Degree sequences, Wang-Kleitman theorem, Havel Hakimi theorem, Hakimi's theorem, Erdos-Gallai theorem (statement only), degree sets.

**Unit – II**

Trees and their properties, Centers in trees, binary and spanning trees, degrees in trees, Cayley's theorem on number of labeled trees, fundamental cycles, generation of trees, Helly property, directed, signed and line graphs (definitions and examples only), balanced signed graphs and characterizations.

**Unit – III**

Connectivity and planarity of graphs: Cut vertex and cut edge, their properties, vertex connectivity, edge connectivity, cut of a graph, Whitney's theorem, properties of a bond, block graphs, planar graphs, Kuratowski's two graphs, embedding on a sphere, Euler's formula, Kuratowski's theorem,

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geometric dual, Whitney's theorem on duality, regular polyhedras, theorem on existence of five regular polyhedras.

#### Unit – IV

Matrices of graphs: Incidence matrix  $A(G)$ , reduced incidence matrix  $A_f$ , cycle matrix  $B(G)$ , cut-set matrix  $C(G)$ , fundamental cycle and cut set matrices  $B_f$  and  $C_f$ , relation between  $A_f$ ,  $B_f$  and  $C_f$ , adjacency matrix  $X(G)$ , determination of number of different edge sequences, characteristic polynomial of a graph, structure theorem-statement and examples only, spectrum of a graph, Laplacian matrix, matrix tree theorem

#### Tutorials: 2 Credits


Unit – V Problems based on Unit I and Unit II

Unit – VI Problems based on Unit III and Unit IV

#### Recommended Books;

1. R. Balakrishnan, K. Ranganathan, A Text Book of Graph Theory, Springer-Verlag, New York, 2012
2. F. Harary, Graph Theory, Addison-Wesley, 1969.
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, PHI, 1974.
4. S. Pirzada, An Introduction to Graph Theory, Universities Press, Orient Blackswan, 2012. 5. 5. D. B. West, Introduction to Graph Theory, Prentice Hall, 2000.

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**MATC3622SIP: Mathematics/Applied Mathematics: ADVANCED CALCULUS**

**SUMMER INTERNSHIP PROGRAMME**

**Credits: 2 THEORY**

**Course Objectives:** To enable students to understand functions of several variables. To make students able to understand the techniques for solving double and triple Integrals.

**Course Outcome:** After the completion of this course, students shall be able to solve double and triple integrals and surface integrals for solution of integrals.

**Theory: 2 Credits**

**Unit- I**

Functions of several variables. Limit and continuity of a function of two variables. Algebra of limits. Partial derivative of function of two variables. Mean value theorem. Sufficient condition for continuity. Differentiability of functions of two variables, sufficient condition for differentiability for functions of two variables. Explicit and implicit functions, Quadrature.

**Unit – II**

Functions from  $R^n$  to  $R^m$ : Partial derivative, continuity, directional derivative, total derivative and related results. Sufficient condition for equality of mixed partial derivatives, matrix representation of total derivative, Taylor's theorem, Inverse function theorem.

**Recommended Books;**

1. Mathematical Analysis, S. C. Malik and Savita Arora, 6th Edition, New Age, 2021.

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2. W. Rudin, Principles of Mathematical Analysis
3. T.M Apostol, Mathematical Analysis, Narosa Publication house, 2002.

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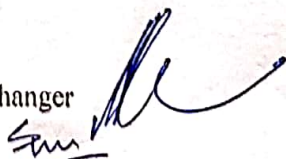


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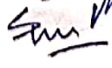


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