MATH-MD-CC1-1-Th Calculus, Geometry & Vector Analysis			
Week Number	**Topics Covered**	**Teaching Pedagogy**	**Faculty Name**
1	Differentiability of a function at a point and in an interval; Meaning of the sign of derivative	Lecture, Examples, Q&A	Ms. Manisha Basu
2	Differentiating hyperbolic functions; Introduction to higher-order derivatives	Lecture, Worked examples, Practice exercises	Ms. Manisha Basu
3	Leibnitz rule and its applications to functions (e.g., eax+bsin⁡xe^{ax+b} \sin xeax+bsinx, (ax+b)nsin⁡x(ax+b)^n \sin x(ax+b)nsinx)	Problem-solving sessions, Interactive practice	Ms. Manisha Basu
4	Indeterminate forms; Introduction to L'Hospital's rule	Demonstrations, Real-life applications	Ms. Manisha Basu
5	Reduction formulae; Derivation of reduction formulae for ∫sin⁡nx dx\int \sin^n x \, dx∫sinnxdx, ∫cos⁡nx dx\int \cos^n x \, dx∫cosnxdx	Step-by-step derivations, Examples, Q&A	Ms. Manisha Basu
6	Reduction formulae for ∫tan⁡nx dx\int \tan^n x \, dx∫tannxdx, ∫sec⁡nx dx\int \sec^n x \, dx∫secnxdx, ∫(log⁡x)ndx\int (\log x)^n dx∫(logx)ndx	Practice-based learning, Problem-solving	Ms. Manisha Basu
7	Reduction formulae for ∫sin⁡nxsin⁡mx dx\int \sin^n x \sin^m x \, dx∫sinnxsinmxdx, ∫sin⁡nxcos⁡mx dx\int \sin^n x \cos^m x \, dx∫sinnxcosmxdx	Lecture, Group work, Peer feedback	Ms. Manisha Basu
8	Parametric equations; Parametrizing a curve; Arc length of a curve and parametric curves	Interactive session, Visual aids, Q&A	Ms. Manisha Basu
9	Area under a curve; Area and volume of surface of revolution	Demonstrations, Examples, Hands-on calculations	Ms. Manisha Basu
10	Rotation of axes; Second-degree equations; Classification of conics using the discriminant	Interactive lecture, Visual examples, Real-life applications	Ms. Manisha Basu
11	Reduction to canonical form; Tangent and normal to conics; Polar equations of conics	Problem-solving, Graphical illustrations	Ms. Manisha Basu
12	Spheres; Cylindrical surfaces; Central conicoids and paraboloids	Visual demonstrations, Q&A, 3D models	Ms. Manisha Basu
13	Plane sections of conicoids; Generating lines; Classification of quadric surfaces	Problem-solving, Illustrative models, Group discussion	Ms. Manisha Basu
14	Vector Analysis: Triple product; Applications to geometry and mechanics (concurrent forces, theory of couples)	Lecture, Real-life applications, Worked examples	Ms. Manisha Basu

Subject: C Language with Mathematical Applications (MATH-MD-SEC1-1-Th)			
Week Number	**Topics Covered**	**Teaching Pedagogy**	**Faculty Name**
1	Overview of computer architecture, compiler, assembler, machine language, high-level language, object-oriented language, programming language	Lecture, Demonstrations, Q&A	Ms. Manisha Basu
2	Constants, Variables, and Data Types in C: Character set, constants, variables, data types, expressions, assignment statements, declaration	Interactive lecture, Coding examples	Ms. Manisha Basu
3	Operations and Expressions: Arithmetic, relational, and logical operators	Hands-on coding, Problem-solving	Ms. Manisha Basu
4	Decision Making with if and if-else statements	Practice-based learning, Coding exercises	Ms. Manisha Basu
5	Nested if statements, switch statement, break and continue statements	Examples, Demonstrations, Real-life applications	Ms. Manisha Basu
6	Control Statements: Introduction to while loop	Problem-solving, Group practice	Ms. Manisha Basu
7	Control Statements: do-while loop and for loop	Coding exercises, Q&A	Ms. Manisha Basu
8	Arrays: One-dimensional arrays, declaration, and initialization	Step-by-step examples, Practice	Ms. Manisha Basu
9	Arrays: Two-dimensional arrays, declaration, and initialization	Hands-on coding, Visual demonstrations	Ms. Manisha Basu
10	Arrays: Multidimensional arrays, declaration, and initialization	Coding exercises, Examples	Ms. Manisha Basu
11	User-defined Functions: Function definition, scope of variables, return types	Lecture, Code-along examples	Ms. Manisha Basu

12	User-defined Functions: Function declaration, function call by value, nesting of functions	Problem-solving, Hands-on coding	Ms. Manisha Basu
13	User-defined Functions: Passing arrays to functions, recursion	Real-life applications, Q&A	Ms. Manisha Basu
14	Introduction to Library Functions: stdio.h, math.h, string.h, stdlib.h, time.h	Practical exercises, Function demonstrations	Ms. Manisha Basu

Subject: Ordinary Differential Equations – I and Group Theory - I (MATH-H-CC 4-3-TH)

Week Number	Topics Covered	Teaching Pedagogy	Faculty Name
1	Formation of differential equations, Order and degree of a differential equation	Lecture, Examples, Q&A	Ms. Manisha Basu
2	First-order and first-degree differential equations, Homogeneous and exact differential equations	Problem-solving, Step-by-step examples	Ms. Manisha Basu
3	Conditions for exactness, Integrating factors, Rules for finding integrating factors	Interactive lecture, Practice exercises	Ms. Manisha Basu
4	Linear equations and Bernoulli equations; First-order higher-degree differential equations solvable for x, y, and p	Problem-solving sessions, Real-life examples	Ms. Manisha Basu
5	Clairaut's forms; Singular solutions, Equations of tac-locus, nodal locus, and cuspidal locus	Lecture, Visual demonstrations, Q&A	Ms. Manisha Basu
6	Higher-order linear and nonlinear equations; Concept of Wronskian and its properties	Theory explanation, Examples, Practice	Ms. Manisha Basu
7	Complementary functions, Particular integrals for linear homogeneous and non-homogeneous equations	Problem-solving, Hands-on exercises	Ms. Manisha Basu
8	Method of undetermined coefficients and Method of variation of parameters; Simultaneous linear differential equations	Worked examples, Q&A	Ms. Manisha Basu

9	Higher-order linear equations with variable coefficients reducible to constant coefficients (Euler's equation)	Problem-solving, Visual aids	Ms. Manisha Basu
10	Condition for exactness of higher-order linear equations; Integrating factors	Practice-based learning, Q&A	Ms. Manisha Basu
11	Introduction to Group Theory: Definition and examples of groups including permutation, dihedral, and quaternion groups	Interactive lecture, Examples	Ms. Manisha Basu
12	Elementary properties of groups; Commutative and non-commutative groups; Subgroups and examples	Lecture, Group activities	Ms. Manisha Basu
13	Necessary and sufficient conditions for a subset to be a subgroup; Order of elements and groups; Cyclic groups	Problem-solving, Step-by-step demonstrations	Ms. Manisha Basu
14	Permutations, Cycle notation for permutations, Alternating group, Cosets, Lagrange's theorem and consequences including Fermat's little theorem	Examples, Application-based learning	Ms. Manisha Basu

Subject: Linear Programming and Rectangular Games (MATH-H-SEC3-3-Th)			
Week Number	**Topics Covered**	**Teaching Pedagogy**	**Faculty Name**
1	Introduction to Linear Programming Problem (L.P.P.), Formation of L.P.P. from real-life scenarios	Lecture, Real-life examples, Q&A	Ms. Manisha Basu
2	Graphical solution of L.P.P., Basic solutions, Basic Feasible Solutions (B.F.S.)	Interactive lecture, Graphical demonstrations	Ms. Manisha Basu
3	Matrix formulation of L.P.P., Degenerate and Non-degenerate B.F.S.	Examples, Hands-on exercises	Ms. Manisha Basu
4	Hyperplane, Convex set, Cone, Extreme points, Convex hull, Convex polyhedron	Visual aids, Lecture, Q&A	Ms. Manisha Basu
5	Feasible solutions of an L.P.P. as a convex set; B.F.S. and extreme points, Optimality at extreme points	Step-by-step explanations, Problem-solving	Ms. Manisha Basu
6	Slack and surplus variables, Standard form of L.P.P., Introduction to simplex method	Lecture, Practice problems	Ms. Manisha Basu

7	Theory of simplex method, Feasibility and optimality conditions	Worked examples, Q&A	Ms. Manisha Basu
8	Simplex Algorithm and Two-phase method, Degeneracy in L.P.P. and resolution	Hands-on coding, Step-by-step guide	Ms. Manisha Basu
9	Duality theory: Relation between primal and dual problems, Optimal values	Interactive lecture, Examples	Ms. Manisha Basu
10	Post-optimal Analysis: Discrete changes in cost vector, requirement vector, and coefficient matrix	Lecture, Real-world applications	Ms. Manisha Basu
11	Post-optimal Analysis (cont.): Addition of variables and constraints	Hands-on exercises, Q&A	Ms. Manisha Basu
12	Transportation and Assignment problems, Mathematical justification for optimality, Hungarian method	Problem-solving, Case studies	Ms. Manisha Basu
13	Traveling Salesman problem; Concept of game problem, Rectangular games	Lecture, Practical examples	Ms. Manisha Basu
14	Pure and Mixed strategies, Saddle point, Optimal strategy, Concept of Dominance, Solving rectangular games	Visual aids, Problem-solving sessions	Ms. Manisha Basu
15	Fundamental Theorem of rectangular games, Algebraic, Graphical, and Dominance methods	Group activities, Q&A	Ms. Manisha Basu
16	Inter-relation between theory of games and L.P.P., Course Review and Q&A	Summary discussion, Practice review	Ms. Manisha Basu

Subject: Particle Dynamics (MTM-G-DSE-A-TH & MTM-G-DSE-A-TU)			
Week Number	**Topics Covered**	**Teaching Pedagogy**	**Faculty Name**
1	Velocity and Acceleration of a particle; Expressions in rectangular Cartesian and polar coordinates	Lecture, Examples, Q&A	Ms. Manisha Basu
2	Tangential and normal components of velocity and acceleration for a particle moving along a plane curve	Visual aids, Problem-solving	Ms. Manisha Basu
3	Concept of Force: Newton's laws of motion, Work, power, and energy	Interactive lecture, Practical applications	Ms. Manisha Basu
4	Principles of conservation of energy and momentum; Motion under impulsive forces	Lecture, Real-life examples	Ms. Manisha Basu

5	Equations of motion for a particle moving in a straight line	Problem-solving, Practice exercises	Ms. Manisha Basu
6	Equations of motion for a particle moving in a plane	Interactive lecture, Worked examples	Ms. Manisha Basu
7	Motion of a particle in a straight line under constant forces	Problem-solving, Step-by-step guidance	Ms. Manisha Basu
8	Motion under variable forces: Simple Harmonic Motion (S.H.M.), Inverse square law	Lecture, Examples, Q&A	Ms. Manisha Basu
9	Motion under variable forces: Damped oscillation, Forced and Damped oscillation	Visual aids, Problem-solving	Ms. Manisha Basu
10	Motion in an elastic string; Equation of energy, Conservative forces	Interactive lecture, Practice problems	Ms. Manisha Basu
11	Motion in two dimensions: Projectiles in vacuum	Lecture, Visual examples	Ms. Manisha Basu
12	Motion in a medium with resistance varying linearly as velocity	Problem-solving, Q&A	Ms. Manisha Basu
13	Motion under forces varying as distance from a fixed point	Real-life applications, Problem-solving	Ms. Manisha Basu
14	Central orbits; Kepler's laws of motion and motion under inverse square law	Summary lecture, Case studies	Ms. Manisha Basu

Subject: Advanced Calculus (MTM-G-DSE-B-TH & MTM-G-DSE-B-TU)			
Week Number	**Topics Covered**	**Teaching Pedagogy**	**Faculty Name**
1	Concept of Point-wise and Uniform convergence of sequence of functions and series of functions, Introduction to Power Series	Lecture, Examples, Q&A	Ms. Manisha Basu
2	Weierstrass M-Test for Uniform convergence of sequence of functions and series of functions	Interactive lecture, Problem-solving	Ms. Manisha Basu
3	Applications of Weierstrass M-Test, Boundedness, Continuity, Differentiability, and Integrability in Uniform Convergence	Visual aids, Worked examples	Ms. Manisha Basu
4	Radius of convergence of Power Series; Continuity of sum function of Power Series	Problem-solving, Step-by-step explanations	Ms. Manisha Basu

5	Term-by-term integration and differentiation of Power Series, Statement of Abel's Theorems on Power Series	Lecture, Practice problems	Ms. Manisha Basu
6	Convergence of Power Series, Expansions of elementary functions (e^x, sinx, log(1+x), $(1+x)^n$)	Examples, Practice exercises	Ms. Manisha Basu
7	Periodic Fourier Series on $(-\pi, \pi)$; Introduction to Periodic Functions	Visual demonstrations, Examples	Ms. Manisha Basu
8	Determination of Fourier coefficients, Simple problems	Interactive lecture, Problem-solving	Ms. Manisha Basu
9	Dirichlet's Conditions for convergence, Convergence of Fourier Sine and Cosine series	Lecture, Examples, Q&A	Ms. Manisha Basu
10	Introduction to Laplace Transform; Existence theorem, Elementary properties of Laplace Transform	Lecture, Problem-solving	Ms. Manisha Basu
11	Inverse Laplace Transform, Elementary properties of Inverse Laplace Transform	Worked examples, Q&A	Ms. Manisha Basu
12	Application of Laplace Transform to solving ordinary differential equations of second order with constant coefficients	Problem-solving, Practical applications	Ms. Manisha Basu
13	Additional applications of Laplace Transforms in differential equations, Real-world scenarios	Examples, Group exercises	Ms. Manisha Basu
14	Course Review, Summary of Key Concepts, and Practice Problem Session	Summary discussion, Practice review	Ms. Manisha Basu