Mathematics Practical
[CORE COURSE]

Semester: II	Credits: 1.5	Subject Code: BSP22010	Lectures: 36

Course Outcomes:

At the end of this course, the learner will be able to:
- Demonstrate the skills of programming handling the mathematical concepts using a new mathematical software Maxima and 'C' Programming.
- Write C- Programs more efficiently with the help of arrays in 'C'.
- Learn new Mathematical Software MAXIMA.
- Apply commands in MAXIMA verify all theoretical concepts learned in class.
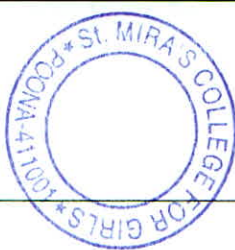- Enhance visualization skills.

Unit 1: Practical 1	4
C- Program • To find the pair of points which are farthest and nearest apart.	

Unit 2: Practical 2	4
C- Program • To find the nearest neighbor of every point in the given set of points	

Unit 3: Practical 3	4
Practical using Maxima software on Graph Theory Unit 1 Graphs and Operations on Graphs. • Introduction to Maxima and Basic commands. • Basic commands to plot graph. • Find number of vertices, degree of each vertex, minimum and maximum degree vertex in the given undirected graph. • Generating different types of graphs and representing their adjacency matrix. • NP completeness Computational complexity explanation. • Isomorphism of Graphs • Operations on Graphs	

Unit 4: Practical 4	4
Practical using Maxima software on Graph Theory Unit 3 Connected Graphs and Unit 4 Eulerian and Hamiltonian Graphs • To check whether the graph is connected or not. • Commands on path, connected component, edge and vertex connectivity. • Generate a weighted graph and find the Shortest path from a vertex in this graph to every other vertex using Dijkstra's algorithm. • Find Hamilton path and Hamilton Cycle in the given graph.	

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Unit 5: Practical 5	4

- Practical using Maxima software on Graph Theory Unit 4 Trees and
- Unit 5 Directed Graphs
- Generate a random tree.
- Check whether the graph is a tree or not.
- Find vertex eccentricity, radius, diameter, and center of a tree.
- Find the shortest spanning tree for the given graph using Kruskal's Algorithm and Prim's algorithm
- Draw a directed graph.
- Find in-degree and out-degree of each vertex in the digraph.

Unit 6: Practical 6	4

Practical using Maxima software on Calculus and Number theory Unit 2 Limit, Continuity and Differentiability
- Use limit definition to define derivative of the function.
- Basic commands of differentiation to find derivative trigonometric functions and algebraic expressions, derivative at a given point.
- Find derivatives of the functions using chain rule and division rule.
- Check whether function is increasing or decreasing.
- Find slope of a line and tangent of a line.
- Verify Rolle's Theorem.
- Verify Lagrange's Mean Value Theorem.

Unit 7: Practical 7	4

Practical using Maxima software on Calculus and Number theory Unit 3 Applications of Differentiation, Unit 4 First Order Linear Differential Equations
- Compute Taylor's Series
- Define First order Linear Differential equation.
- Check whether given function is a solution of then given ODE.
- Solving Homogenous Linear Differential equation
- Define Second Order Linear Differential equation and find its solution.

Unit 8: Practical 8	4

Practical using Maxima software on Linear Algebra Unit 2 and 4 Linear Equations and Vector Spaces
- Solving system of linear equations
- Define matrix, coefficient matrix and solve system.
- Define vectors
- Addition, subtraction, multiplication, and division of two vectors

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- Cross product of two vectors
- Find norm of vector, projection of vector
- Find column space and basis for column space.
- Find Rank and null space, nullity of a matrix.

Unit 9: Practical 9	**4**
Practical using Maxima software on Linear Algebra unit 5 Eigenvalues and Eigenvectors and • Define characteristic polynomial • Find Eigenvalues and eigenvectors • Diagonalization of a matrix. • Verify Cayley Hamilton theorem.	

Mini Project.

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Chairperson (HoD)	Ms. Gitanjali Phadnis	G.M.Phadnis 01/8/2020	
Faculty	Ms. Vrushali Paranjpe		BParanjpe 1/8/2020
Subject Expert (Outside SPPU)	Dr. Machchhindra Gophane	1/8/2020	
Subject Expert (Outside SPPU)	Dr. Prashant Malavadkar		01-08-2020
VC Nominee	Dr. Vinayak Joshi	Joshi 1/8/2020	
Industry Expert	Mr. Anup Manakeshwar		Manakeshwar AB 01-08-2020
Alumni	Ms.Jyoti Sharma	Jyoti 01/08/2020	

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