

**Course: SEC**  
**Mathematics Practical using Maxima**

<b>Semester: II</b>	<b>Credits: 2</b>	<b>Subject Code:BSSECCSM22301</b>	<b>Lectures: 60</b>
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**Course Outcomes:**

At the end of the course, the learner will be able to do the following

- CO1- Demonstrate the skills of programming handling the mathematical concepts using a new mathematical open-source software MAXIMA.
- CO2- Solve problems based on Linear Algebra using MAXIMA commands.
- CO3-Applying commands in MAXIMA solve problems from Graph Theory.
- CO4- Enhance visualization skills.

**Unit 1:**

**30**

- Introduction to Graph Theory, Graphs - Basic terminologies, Types of graphs, Draw graphs
- Introduction to Linear Algebra, Matrices – Determinant, Inverse, Transpose, Row Echelon form and Reduced Row Echelon form of a matrix
- Types of Graphs and Adjacency - To draw different types of graphs, to generate adjacency matrix of the graph, to draw graph from its adjacency matrix
- Isomorphism and Operations on Graphs- Isomorphism, Operations on Graphs – Complement, Vertex induced subgraph
- Connected 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.
- Linear Algebra - Solving system of linear equations, finding rank, row space, column space of a matrix, nullity of a matrix.

**Unit 2:**

**30**

- Eigen Values and Eigen Vectors - Defining Characteristic Polynomial, finding Eigen values and Eigen vectors of a matrix, diagonalization of a matrix, verify Caley Hamilton Theorem
- Vectors - Define vectors, Addition, subtraction, multiplication, and division of two vectors, cross product of two vectors, find norm of vector, projection of vector
- Eulerian and Hamiltonian Graphs - Find Hamilton path and Hamilton Cycle in the given graph, solve Travelling Salesperson Problem.
- Trees - 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
- Directed graphs - Draw directed graph, find in-degree and out-degree of each vertex in the digraph, based on in degree and out degree check whether the digraph is -Weakly connected, strongly connected, regular digraph or balanced digraph.
- Planarity - Planar Graphs, Dual of planar graph, Applications, find chromatic number of graphs, Coloring Problems



Board of Studies	Department	Name	Signature
Chairperson (HoD)	B.Sc. (Computer Science)	Gitanjali Phadnis	<i>G. Phadnis</i> 02/06/2023

**Recommended Text Books:**

- Anil Kumar Verma, SCILAB: *A Begineer's Approach*, Cengage Learning India Pvt. Ltd.; First Edition (1 January 2018)
- Vaisakh Venu, *MAXIMA: THE COMPUTER-ALGEBRA SYSTEM*, Notion Press (21 January 2022)

**Websites:**

- <https://maxima.sourceforge.io>
- <https://nptel.ac.in>
- <https://swayam.gov.in>

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