Semester: 6				
Programme : B.Sc. Computer Sc Hons (Minor – Artificial Intelligence)				
Course : MATHEMATICAL TECHNIQUES AND DATA VISUALIZATION				
Paper code: B3CS250612T / B3CS250612P			**Credits: 4**	
Hours/week : Theory: 3 / Practical 2				
Category: Core/MDC/SEC/VAC/Minor : Minor				
Theory / Practical / Composite : Composite				
No of Modules : 1				
Course Overview: This course introduces mathematical foundations and visualization techniques essential for data analysis and artificial intelligence applications. It covers propositional logic, graph theory, and dynamic progamming for problem solving and optimization. The course also develops practical skills in spreadsheets, chart construction, and advanced data visualization methods. By integrating mathematical reasoning with visualization tools, students gain the ability to interpret data, model relationships, and communicate analytical insights effectively.				
Course Outcome:				
1. **Recall** fundamental definitions, symbols, and properties related to propositional logic, graph theory terminology, and basic spreadsheet components.				
2. **Understand** logical relationships, graph structures, and data representation concepts to demonstrate conceptual clarity in mathematical reasoning and visualization.				
3. **Apply** graph algorithms, dynamic programming techniques, and spreadsheet tools to solve structured computational and data-handling problems.				
4. **Analyze g**raph models, optimization strategies, and visualization methods by examining their structure, relationships, and suitability for given datasets or problems.				
5. **Evaluate** the effectiveness of algorithms, optimization approaches, and graphical representations in accurately solving problems and communicating insight.				
6. **Create** integrated mathematical models and advanced data visualizations to represent complex real-world scenarios and support informed decision-making.				
Prerequisites: Basic mathematics and fundamental computer knowledge				
SYLLABUS				
UNIT/Module	**CONTENT**	**HOURS**	**CO Mapping**	**COGNITIVE LEVEL**
Theory:				
I.	Propositional Calculus: Propositions, Logical Connectives and Truth Tables, Tautologies and Contradictions, Logical Equivalence, Algebra of Propositions, Propositional Functions, Quantifiers, Equivalences and Inference Theory	12	CO1, CO2	K1-K2 (Remember/Understand)
II.	Graph Theory: Definition of Graph, Graph Terminologies, Finite and Infinite graphs.	16	CO2, CO3	K2-K3 (Understand/Apply)

	Directed and undirected graphs, Labelled graphs, Degree, Isolated vertex, Pendant vertex. Null graphs. Walks: Paths and circuits. Connected and disconnected graphs, Representation of Graphs, Dijkstra's shortest Path Algorithm, Breadth First Search Algorithm, Depth First Search Algorithm Problems, Spanning tree algorithms.			
III.	Dynamic Programming: Bellman's principle of optimality, Make change algorithm, Shortest-path algorithms.	11	CO3, CO5	K3-K5 (Apply/Evaluate)
Practical:				
I.	Fundamentals: Overview of spreadsheet, formatting various elements of spreadsheet.	8	CO2, CO3	K2-K3 (Understand/Apply)
II.	Basics of charts and graphs: chart elements (title, subtitle, X-axis, Y-axis, Zaxis, display grids, legend), chart creation (selecting data series, selecting chart type, selecting chart components.	6	CO4	K4 (Analyze)
III.	Introductory charts and graphs: column chart, bar graph, pie chart, area chart, scatter plot, line graph, cylinder chart, cone chart, pyramid chart.	6	CO4, CO5	K4-K5 (Analyze/Evaluate)
IV.	Advanced charts and graphs: dynamic map, Gantt chart, variance chart, stacked chart, line chart (revisited), funnel chart, bar chart (revisited), progress circle chart, histogram chart.	6	CO5, CO6	K5-K6 (Evaluate/Create)
Text Books				
1. Discrete Mathematics and its Applications by Kenneth H. Rosen				
2. Introduction to Graph Theory by Douglas B. West				
3. Discrete Mathematics: Schaum's Outlines Series, Seymour Lipschutz				
4. Graph Theory With Applications To Engineering And Computer Science, Narsingh Deo, PHI				
Suggested Readings				
1. Introduction to Algorithms, Thomas H. Cormen				

Web Resources		
1. Discrete Mathematics, IIT Ropar, Prof. Sudarshan Iyengar, https://nptel.ac.in/courses/106106183		
Evaluation	Theory CIA: 12 Attendance: 3 Semester Exam: 45	Practical CA: 38 Attendance: 2
Paper Structure for Theory Semester Exam Module : Answer 3 out of 5 of 15 marks each		

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	Recall fundamental definitions, symbols, and properties related to propositional logic, graph theory terminology, and basic spreadsheet components	K1 (Remember)
CO2	Understand logical relationships, graph structures, and data representation concepts to demonstrate conceptual clarity in mathematical reasoning and visualization.	K2 (Understand)
CO3	Apply graph algorithms, dynamic programming techniques, and spreadsheet tools to solve structured computational and data-handling problems.	K3 (Apply)
CO4	Analyze graph models, optimization strategies, and visualization methods by examining their structure, relationships, and suitability for given datasets or problems.	K4 (Analyze)
CO5	Evaluate the effectiveness of algorithms, optimization approaches, and graphical representations in accurately solving problems and communicating insight	K5 (Evaluate)
CO6	Create integrated mathematical models and advanced data visualizations to represent complex real-world scenarios and support informed decision-making.	K6 (Create)