Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Autonomous

Course Structure for B.Sc. (Computer Science) Mathematics

F. Y. B. Sc. (Computer Science) Mathematics

Semester	Paper Code	Title of Paper	No. of Credits
I	CSMT1101	Graph Theory	2
	CSMT1102	Algebra	2
	CSMT1103	Mathematics Practical based on CSMT1101 & CSMT1102	2
II	CSMT1201	Discrete Mathematics	2
	CSMT1202	Calculus	2
	CSMT1203	Mathematics Practical based on CSMT1201 & CSMT1202	2

S. Y. B. Sc. (Computer Science) Mathematics

Semester	Paper Code	Title of Paper	No. of Credits
III	CSMT2301	Linear Algebra	3
	CSMT2302	Numerical Analysis	3
	CSMT2303	Mathematics Practical I	2
IV	CSMT2401	Computational Geometry	3
	CSMT2402	Operations Research	3
	CSMT2403	Mathematics Practical II	2

Choice Based Credit System Syllabus (2019 Pattern)

Class: S.Y.B.Sc. (Computer Science). (Sem IV) **Subject:** Mathematics
Course: Computational Geometry **Course Code:** CSMT2401

A. Course Objectives:

1. Provide students with a foundational understanding of two-dimensional transformations and their applications in computer graphics.
2. Introduce methods for representing points in two-dimensional space and emphasize the importance of coordinate systems.
3. Teach students the concept of transformation matrices and how they are used to perform various geometric transformations.
4. Instruct students on the midpoint transformation, emphasizing its application and significance in graphics algorithms.
5. Demonstrate the application of transformations to parallel and intersecting lines, emphasizing practical scenarios.
6. Provide students with the skills to apply multiple transformations sequentially, enabling them to achieve complex transformations.
7. Introduce solid body transformations, allowing students to extend their understanding to three-dimensional transformations.

B. Course Outcome:

1. Student will be able to apply knowledge of the fundamental problems within computational geometry and general techniques for solving problems.
2. Student will be able to construct algorithms for simple geometrical problems.
3. Understand the fundamental concepts of two-dimensional transformations in computer graphics.
4. Perform rotations about axes parallel to coordinate axes and arbitrary lines.
5. Apply axonometric projections to three-dimensional objects.
6. Understand the representation of curves in computer graphics.
7. Perform reflections through coordinate planes, planes parallel to coordinate planes, and arbitrary planes.

Topics/Contents

Unit 1- Two Dimensional Transformation : [16 lectures]

- Representation of Points, Transformations and matrices.
- Transformations of Points, Transformations of straight lines.
- Midpoint transformation, Transformation of parallel lines.
- Transformation of Intersecting lines.
- Transformation: rotation , reflection , scaling , shearing.
- Combined transformation, Transformation of Unit square.
- Solid body transformation.
- Transformation and Homogeneous co-ordinates , Translation,
- Rotation about an arbitrary point.
- Reflection through an arbitrary line.
- Projection – a geometric Interpretation of homogeneous co-ordinates.
- Overall Scaling.

Unit 2- Three Dimensional transformations : [16 lectures]

- Three dimensional – Scaling , shearing , rotation , reflection , translation.
- Multiple transformations.
- Rotation about – an axis parallel to co-ordinate axes, arbitrary axis in space.
- Reflection through – co-ordinate planes , planes parallel to co-ordinate planes , arbitrary planes .
- Affine and perspective transformations,Orthographic projections.
- Axonometric projections, Oblique projections.
- Single point perspective transformations.

Unit 3- Plane curves : [10 lectures]

- Curve representation, Non – parametric curves.
- Parametric curves.
- Parametric representation of circle, ellipse, parabola, hyperbola and generation of them.

Unit 4- Space curves: [06 lectures]

- Bezier curves – definition , properties (without proof), curve fitting (up to n=3) , equation of in matrix form(up to n=3).

Text Book: D. F. Rogers, J.A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Indian Edition.

Reference Books:

1) M. E. Mortenson, Computer Graphics Handbook, Industrial Pres Inc
2) Schaum Series, Computer Graphics.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)						
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	2					2	2
CO 2	1	2					
CO 3	3	2					1
CO 4	2						
CO 5	2		3				
CO 6	1					3	
CO 7	1	3					

Justification for the mapping

PO1: Computer Knowledge

CO1: Student will be able to apply their knowledge of fundamental computational geometry problems and general problem-solving techniques to address real-world challenges in computer science and related fields.
CO2: Student will be able to construct algorithms for simple geometrical problems in computer knowledge to develop problem-solving skills and apply geometric concepts in practical programming tasks.
CO3: Student will gain a foundational understanding of two-dimensional transformations in computer graphics, essential for creating and manipulating graphical elements in various applications.
CO4: Student will gain proficiency in performing rotations around both coordinate axes and arbitrary lines, enhancing their 3D graphics and spatial manipulation skills in computer knowledge.
CO5: Student will acquire the ability to apply axonometric projections to three-dimensional objects, enhancing their proficiency in computer graphics and visualization.
CO6: Student will gain a comprehensive understanding of curve representation in computer graphics, enabling them to effectively create and manipulate visual elements in digital environments.
CO7: Student will gain the ability to perform reflections through various planes, enhancing their understanding of geometric transformations in computer graphics and 3D modeling.

PO2: Design / Development of solution

CO2: Student will be able to construct algorithms for simple geometrical problems to facilitate the design and development of efficient and accurate solutions in computer graphics and geometric modeling.
CO3: Student will be equipped to design and develop solutions in computer graphics by comprehending the fundamental concepts of two-dimensional transformations, enabling them to manipulate and transform graphical elements effectively.
CO7: Student will perform reflections through various planes to enhance their ability to visualize and manipulate 3D objects, a fundamental skill in design and solution development for computer graphics and engineering applications.

PO3: Modern tool usage

CO5: Student will apply axonometric projections to three-dimensional objects as a modern tool usage to enhance their ability to create accurate and visually appealing 3D representations in various fields, including computer graphics and engineering.

PO6: Individual and Team work

CO1: Student will develop the ability to apply their knowledge of computational geometry and problem-solving techniques to tackle fundamental problems both individually and as part of a team, enhancing their practical problem-solving skills and collaboration capabilities.
CO6:Student will understand the representation of curves in computer graphics to enable them to contribute effectively both individually and as part of a team in creating visually appealing and accurate graphical content.

PO7: Innovation, employability and Entrepreneurial skills

CO1: Student will apply knowledge of computational geometry and problem-solving techniques to enhance their innovation, employability, and entrepreneurial skills by tackling real-world challenges and developing creative solutions.

CO3: Understanding two-dimensional transformations in computer graphics enhances students' innovation, employability, and entrepreneurial skills by providing them with the foundational knowledge necessary for creating innovative visual content, which is valuable in various industries and entrepreneurial ventures.

Choice Based Credit System Syllabus (2019 Pattern)

Class: S.Y.B.Sc.(Computer Science). (Sem IV) **Subject:** Mathematics
Course: Operations Research **Course Code:** CSMT2402

A. Course Objectives:

1. Develop proficiency in representing real-world scenarios using LP models with two decision variables.
2. Develop skills in visually analyzing and optimizing solutions for two-variable LP models.
3. Develop the ability to model and optimize decision-making processes using linear programming.
4. Translate real-world problems into algebraic expressions suitable for linear programming analysis.
5. Provide a comprehensive understanding of the simplex method for solving linear programming problems.
6. Develop strategies for addressing and solving special cases efficiently.
7. Analyze decision-making under uncertainty using decision analysis techniques.

B. Course Outcome:

1. Student will be able to formulate and solve the linear programming problem using different methods.
2. Student will able to solve transportation and assignment problems.
3. Utilize the Big-M method for solving linear programming problems.
4. Recognize and address unbounded and infeasible solutions in linear programming.
5. Apply the modified distribution method to find optimal solutions for transportation problems.
6. Apply the Hungarian method to solve assignment problems.
7. Interpret the relationship between primal and dual solutions.

Topics/Contents

Unit 1-Modeling with Linear Programming [06 lectures]

- Two-Variable LP Model.
- Graphical LP Solution
- Linear Programming Applications

Unit 2- The Simplex Method [10 lectures]

- LP Model in Equation form
- Transition from Graphical to Algebraic Solution
- The Simplex Method
- Special cases in Simplex Method

Unit 3-Duality [08 lectures]

- Definition of the Dual problem
- Primal dual relationships

Unit 4- Transportation Model and its Variants [12 lectures]

- Definition of the Transportation problem
- The Transportation Algorithm
- The Assignment Model

Unit 5- Decision Analysis and Games [12 lectures]

- Decision Under Uncertainty
- Optimal solution of two person zero sum games
- Solution of mixed strategy games.

Text Book:

Operation Research (An Introduction) Ninth Edition, by Hamdy A. Taha.
Sections : 2.1, 2.2, 2.4.2, 3.1, 3.2, 3.3, 3.5, 4.1, 4.2, 5.1, 5.3, 5.4, 15.3, 15.4

Reference Books:

1) Operation Research by S.D.Sharma.
2) Operation Research by J.K.Sharma.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)						
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	1	3					3
CO 2	3	2	3			2	2
CO 3	2	2					
CO 4	2		1				
CO 5	2						3
CO 6	1					3	
CO 7	3	2					1

Justification for the mapping

PO1: Computer Knowledge

CO1: Student will gain the ability to formulate and solve linear programming problems using various methods, enhancing their computational knowledge and problem-solving skills.
CO2: Student will gain proficiency in solving transportation and assignment problems to enhance their computational skills and problem-solving capabilities in computer science and related fields.
CO3: Student will be equipped with the essential skill of applying the Big-M method to effectively tackle complex linear programming problems, enhancing their proficiency in computer-aided optimization.
CO4: Student will develop the ability to identify and resolve unbounded and infeasible solutions in linear programming, enhancing their problem-solving skills in computer-aided optimization.
CO5: Student will develop the ability to apply the modified distribution method to efficiently determine optimal solutions for transportation problems, enhancing their problem-solving skills in computer science and logistics.
CO6: Student will gain a comprehensive understanding of curve representation in computer graphics, enabling them to effectively create and manipulate visual elements in digital environments.
CO7: Student will interpret the relationship between primal and dual solutions to gain a deeper understanding of the duality concept in linear programming, a fundamental component of their computer knowledge.

PO2: Design / Development of solution

CO1: Student will be equipped to formulate and solve linear programming problems using various methods, enabling them to design and develop optimal solutions for real-world challenges in operations research and decision-making.
CO2: Student will be able to solve transportation and assignment problems, equipping them with essential skills for optimizing resource allocation and logistics in the design and development of practical solutions.
CO3:Student will be equipped with the ability to employ the Big-M method as a powerful tool in the design and development of solutions for complex linear programming problems, ensuring optimal problem-solving strategies.
CO7: Student will be able to interpret the relationship between primal and dual solutions to optimize and enhance the design and development of solutions in various problem-solving scenarios.

PO3: Modern tool usage

CO2: Student will be equipped to solve transportation and assignment problems efficiently using modern computational tools, enhancing their problem-solving skills in real-world logistics and allocation scenarios.
CO4:Students will be able to identify and resolve unbounded and infeasible solutions effectively in linear programming using modern computational tools.

PO6: Individual and Team work

CO2: Student will develop problem-solving skills through individual and team work, enabling them to effectively solve transportation and assignment problems, both independently and collaboratively.
CO6:Students will learn to apply the Hungarian method for efficient assignment problem solving, both independently and collaboratively, promoting problem-solving skills in real-world scenarios.

PO7: Innovation, employability and Entrepreneurial skills

CO1: Student will gain the ability to formulate and solve linear programming problems using various methods, enhancing their innovation, employability, and entrepreneurial skills by providing them with a valuable analytical and decision-making toolset for problem-solving in real-world applications.

CO2: Student who can solve transportation and assignment problems develop problem-solving and analytical skills, enhancing their innovation, employability, and entrepreneurial abilities by addressing real-world logistics and resource allocation challenges.

CO5:Student will employ the modified distribution method for transportation problems, fostering innovation and enhancing their employability and entrepreneurial skills through practical problem-solving and optimization techniques.

CO7:Understanding the relationship between primal and dual solutions fosters critical problem-solving abilities, enhancing students' innovation, employability, and entrepreneurial skills in optimizing complex business and engineering processes

Choice Based Credit System Syllabus (2019 Pattern)

Class: S.Y.B.Sc. (Computer Science). (Sem IV)
Subject: Mathematics
Course: Mathematics Practical II **Course Code:** CSMT2403

A. Course Objectives:

1. Develop proficiency in implementing sorting algorithms to arrange a given set of points with respect to a specified line and rectangle.
2. Enable students to use efficient algorithms to find a pair of points with the least mutual distance and the farthest mutual distance within a given set.
3. Understand the simplex method and apply it to solve linear programming problems, developing skills in optimizing solutions for real-world scenarios.
4. Teach students the principles of two-dimensional transformations, including translation, rotation, scaling, and shearing, and enable them to apply these transformations to geometric objects.
5. Introduce the assignment problem and guide students in formulating and solving assignment problems, demonstrating proficiency in resource allocation.
6. Develop skills in sorting a given set of points with respect to a rectangular box, emphasizing the application of spatial organization algorithms.
7. Enable students to apply geometric and optimization algorithms to practical problems, fostering the ability to address real-world challenges through computational methods.

B. Course Outcome:

1. Students will demonstrate the ability to sort a set of points with respect to a given line and rectangle, showcasing proficiency in geometric algorithms.
2. Students will develop skills in identifying a pair of points with the least mutual distance and the farthest mutual distance from a given set, demonstrating efficiency in distance computations.
3. Understand and apply the simplex method for solving linear programming problems, demonstrating proficiency in optimizing solutions.
4. Students will grasp the concepts of two-dimensional transformations, including translation, rotation, scaling, and shearing, and be able to apply these transformations to geometric objects.
5. Students will learn to formulate and solve assignment problems, demonstrating proficiency in allocating resources optimally.
6. Develop the ability to generate a uniformly distributed set of points on a standard circle, demonstrating proficiency in geometric algorithms.
7. Apply sorting algorithms to arrange a given set of points with respect to a rectangular box, showcasing skills in spatial organization.

Topics/Contents:

- Sorting a set of points w.r.t. a line and Sorting a set of points w.r.t. a rectangle.
- Find a pair of points with least mutual distance from the given set and Find a pair of points with farthest mutual distance from the given set.
- Solution of L.P.P. by simplex method.
- 2-D transformation.
- Transportation Problem
- Assignment Problem.
- 3-D transformation.
- Generation of uniformly n-points on standard circle
- Sort given set of points w.r.t. rectangular box.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	1					3	3
CO 2		2	3				
CO 3		1	2				3
CO 4	1	3				2	
CO 5			2				1
CO 6			1			2	
CO 7		3	2			1	

Justification for the mapping

PO1: Computer Knowledge

CO1: Students showcase proficiency in geometric algorithms within computer knowledge by demonstrating the ability to sort a set of points with respect to a given line and rectangle.

CO4: Students grasp two-dimensional transformations, applying translation, rotation, scaling, and shearing to geometric objects, demonstrating proficiency in computer knowledge.

PO2: Design / Development of solution

CO2: Students develop skills in efficiently identifying a pair of points with the least and farthest mutual distance from a given set, showcasing proficiency in distance computations in the design/development of solutions.

CO3: Students understand and apply the simplex method for solving linear programming problems, demonstrating proficiency in optimizing solutions in the design/development of solutions.

CO4: Students grasp two-dimensional transformations, applying translation, rotation, scaling, and shearing to geometric objects, showcasing skills applicable in the design/development of solutions.

CO7: Students apply sorting algorithms to arrange points with respect to a rectangular box, showcasing spatial organization skills in the design/development of solutions.

PO3: Modern tool usage

CO2: Students develop efficiency in distance computations by identifying a pair of points with the least and farthest mutual distance from a given set, showcasing skills in modern tool uses.
CO3: Students understand and apply the simplex method for solving linear programming problems, demonstrating proficiency in optimizing solutions within the context of modern tool uses.
CO5: Students learn to formulate and solve assignment problems, demonstrating proficiency in optimally allocating resources within the context of modern tool uses.
CO6: Students develop proficiency in geometric algorithms by generating a uniformly distributed set of points on a standard circle, showcasing skills in modern tool uses.
CO7: Students apply sorting algorithms to arrange points with respect to a rectangular box, showcasing spatial organization skills in the context of modern tool uses.

PO6: Individual and Team work

CO1: Student demonstrate proficiency in geometric algorithms by sorting a set of points with respect to a given line and rectangle, showcasing skills applicable to both individual and team work.
CO4: Student grasp two-dimensional transformations and apply them to geometric objects, showcasing proficiency in geometric algorithms for both individual and team work.
CO6: Student develop proficiency in geometric algorithms by generating a uniformly distributed set of points on a standard circle, showcasing skills applicable to both individual and team work.
CO7: Student apply sorting algorithms to arrange points with respect to a rectangular box, showcasing spatial organization skills in geometric algorithms for both individual and team work.

PO7: Innovation, employability and Entrepreneurial skills
CO1: Student demonstrate proficiency in geometric algorithms by sorting points with respect to a given line and rectangle, showcasing skills beneficial for innovation, employability, and entrepreneurial endeavors.

CO3: Student understanding and applying the simplex method for solving linear programming problems in geometric algorithms showcase proficiency in optimizing solutions, fostering skills beneficial for innovation, employability, and entrepreneurial endeavors.

CO5: Student learning to formulate and solve assignment problems in geometric algorithms demonstrate proficiency in optimally allocating resources, fostering skills beneficial for innovation, employability, and entrepreneurial endeavors.