GOVT. DEGREE COLLEGE FOR MEN

DEPARTMENT OF MATHEMATICS

INNOVATIVE TEACHING-LEARNING METHODS

INTRODUCTION:

The Department of Mathematics at Govt. Degree College for Men employs a variety of innovative teaching-learning methods to enhance student engagement, critical thinking, and problem-solving skills. Through brainstorming sessions, mathematical modelling, reflective assessment, metacognition, group work, collaborative problem-solving, games, puzzles, problem-based learning, and inquiry-based investigations, students are encouraged to actively participate in their learning process, fostering a deeper understanding of mathematical concepts and their real-world applications.

1. BRAINSTORMING SESSIONS:

Brainstorming sessions are regularly conducted in the linear algebra class to stimulate creative thinking and encourage students to generate and share ideas freely. These sessions provide a platform for students to explore different approaches to solving mathematical problems and to express their thoughts and perspectives. For instance, when students encounter a complex problem involving systems of linear equations, they engage in collaborative brainstorming to generate diverse strategies. They may suggest using matrix operations to solve the equations or employing Gaussian elimination to find row echelon form. This interactive process not only encourages students to explore multiple approaches but also fosters critical thinking skills and a deeper understanding of linear algebra concepts.

BRAINSTORMING SESSION

Date and Time	18-04-2022
Class	II B.Sc., (MPC)-4th Semester
No. of students participated	28
Name of the Activity	Brainstorming Session
Title	LINEAR ALGEBRA

Objective	The role of linear algebra concepts in general life is multifaceted and extends across various fields. Its primary objective is to provide a mathematical framework for analysing and solving systems of linear equations, which are ubiquitous in everyday situations. Here are some brief objectives of linear algebra in general life: students will develop a deeper understanding of linear algebra concepts, enhance problem-solving skills, and cultivate a greater appreciation for the role of linear algebra in various disciplines.
Teacher Activity in this session	1. What are the fundamental concepts of linear algebra, and why are they important? 2. How can we apply linear algebra in everyday life or in various academic disciplines? 3. Can you think of any real-world problems that could be solved using linear algebra techniques? 4. What are some challenges or limitations you foresee in applying linear algebra concepts to practical scenarios? 5. How do linear algebra concepts intersect with other areas of mathematics or fields like computer science and engineering? 6. Can you provide examples of industries or research areas where linear algebra plays a crucial role?
Student Activity in this Session	**1. Reviewing Fundamental Concepts**: Students in the groups can discuss and refine their hypotheses based on the input from their peers. **2.Exploring Applications:** Students might discuss real-world applications of linear algebra, such as computer graphics, data analysis, machine learning, engineering, physics, and economics. Exploring these applications helps students understand the practical relevance of the concepts they are learning. **3.Problem-Solving:** The session could include problem-solving activities where students work through example problems together. **4.Visualizing Concepts:** Visual aids such as graphs, diagrams, and geometric interpretations can help students visualize abstract concepts in linear algebra. Activities involving geometric transformations, vector spaces, and linear transformations can aid in conceptual understanding. **5.Group Discussing Advanced Topics:** Depending on the level of the students, the session might delve into more advanced topics.

	6.Collaborative Learning: Students can collaborate in pairs or small groups to solve problems and discuss concepts.
Name of the Lecturers who planned & conducted the activity	Sri R. Ravisankar, Smt. S. Aruna Kumari Sri. V. V. Ravikumar

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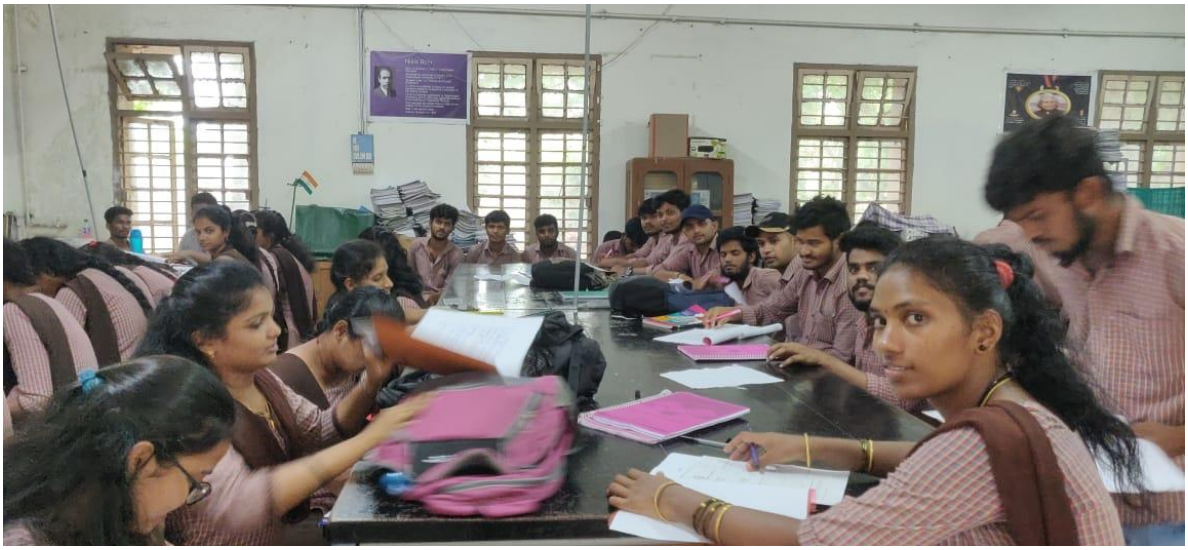

Problem solving session

(Problem solving session)

BRAINSTORMING SESSION

Date and Time	20-11-2023
Class	II B.Sc., (MECs & MPCs)-5th Semester
No. of students participated	38
Name of the Activity	Brainstorming Session
Title	MULTIPLE INTEGRALS-CHANGE OF AXES
Objective	The objective of studying multiple integrals with a focus on changing axes is to provide a powerful mathematical tool for analysing complex systems in various dimensions. By transitioning from Cartesian coordinates to alternative systems such as polar, cylindrical, or spherical coordinates, students aim to simplify calculations, exploit symmetries, and gain deeper insights into geometric and physical properties. This understanding equips learners to tackle real-world problems more efficiently and effectively, extending their problem-solving capabilities beyond traditional Cartesian frameworks. students will develop a deeper understanding of this concepts, enhance problem-solving skills, and cultivate a greater appreciation for the role of linear algebra in various disciplines.
Teacher Activity in this session	1. Introduction to Concept. 2. Theory Overview. 3. Demonstration. 4. Interactive Problem-solving. 5. Discussion and Clarification. 6. Application Exercises. 7. Feedback and Assessment. Throughout the session, the teacher fosters a supportive learning environment where students feel encouraged to ask questions, explore new ideas, and collaborate with their peers. By actively engaging students in problem-solving and discussion, the teacher helps them develop a deeper understanding of multiple integrals and their applications in changing axes.
	1. Exploration & Visualizing of Coordinate Systems: Students begin by exploring different coordinate systems, such as polar, cylindrical, and spherical coordinates. They examine how each system is defined and how it relates to Cartesian coordinates. Students use visual aids, such as graphs and diagrams, to visualize how coordinates transform from one system to another. They observe the geometric interpretations of these

Student Activity in this Session	transformations and understand how they affect the shape and orientation of regions in space. **2. Problem-solving:** Students work on a series of practice problems that involve changing axes using different coordinate systems. They apply the techniques learned to evaluate double and triple integrals in non-Cartesian coordinates**.** **3. Collaborative Work of Real-World Applications:** Students collaborate in pairs or small groups to solve more complex problems that require changing axes in fields such as physics, engineering, and economics to solve practical problems related to volumes, densities, and probabilities. They discuss strategies, share insights, and help each other understand difficult concepts. **4. Interactive Demonstrations:** The instructor may conduct interactive demonstrations using mathematical software or interactive whiteboards to illustrate how coordinate transformations affect integrals and geometric shapes. **5. Peer Teaching:** Students take turns explaining concepts and problem-solving techniques to their peers. This peer teaching activity reinforces their understanding of the material and encourages active participation in the learning process. **6. Creative Problem-solving Challenges:** Students are presented with creative problem-solving challenges that require them to think critically and apply their knowledge in novel ways. These challenges may involve designing coordinate systems for specific applications or solving integrals in unconventional coordinate systems. By engaging in these activities, students develop a deeper understanding of multiple integrals and how coordinate transformations can simplify calculations and provide insights into complex mathematical problems**.**
Name of the Lecturers who planned & conducted the activity	Sri R. Ravisankar, Smt. S. Aruna Kumari Sri. V. V. Ravikumar

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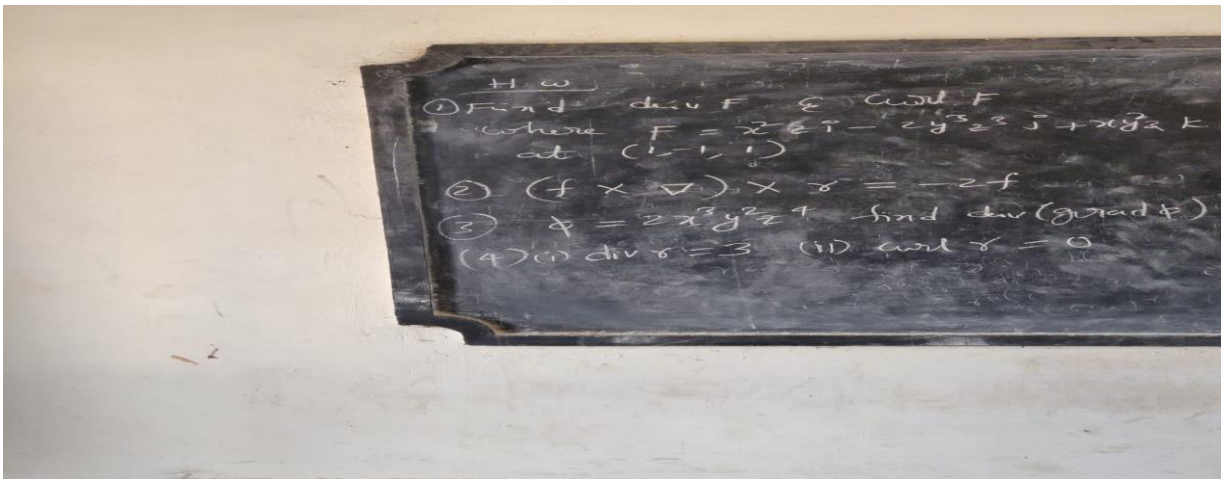
(Problem solving session)

(Advanced Problems given to students for solving session)



2. MATHEMATICAL MODELING:

The department emphasizes the use of mathematical modelling to represent real-world situations mathematically. Through mathematical modelling activities, students develop problem-solving skills and gain insights into the applications of mathematics in various fields such as engineering, economics, and biology. Evaluate students based on their ability to understand and apply mathematical concepts to real-world problems.

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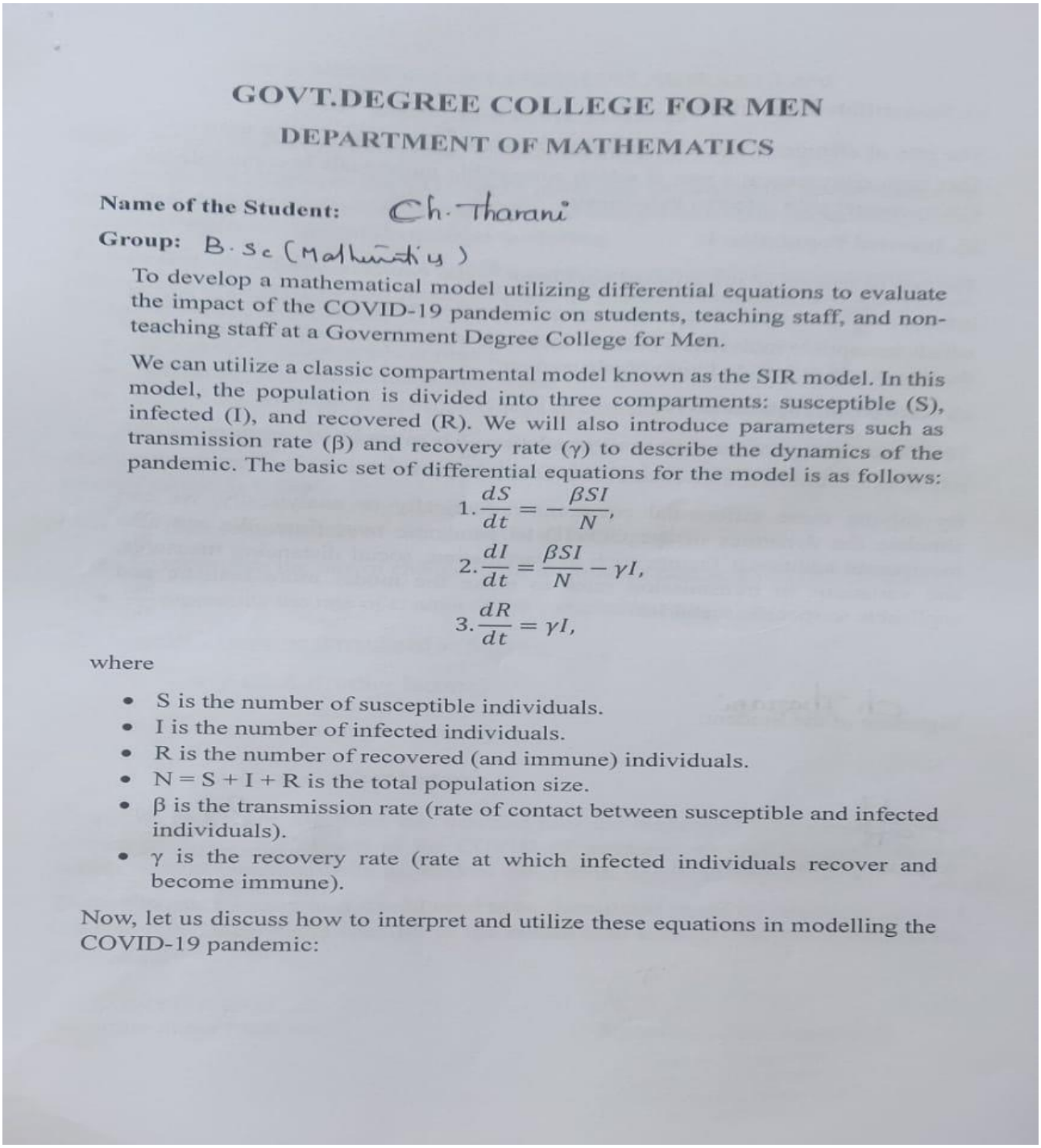

GOVT.DEGREE COLLEGE FOR MEN

DEPARTMENT OF MATHEMATICS

Name of the Student: Ch. Tharani

Group: B.Sc (Mathematics)

To develop a mathematical model utilizing differential equations to evaluate the impact of the COVID-19 pandemic on students, teaching staff, and non-teaching staff at a Government Degree College for Men.

We can utilize a classic compartmental model known as the SIR model. In this model, the population is divided into three compartments: susceptible (S), infected (I), and recovered (R). We will also introduce parameters such as transmission rate (β) and recovery rate (γ) to describe the dynamics of the pandemic. The basic set of differential equations for the model is as follows:

$$1.\ \frac{dS}{dt} = -\frac{\beta SI}{N},$$

$$2.\ \frac{dI}{dt} = \frac{\beta SI}{N} - \gamma I,$$

$$3.\ \frac{dR}{dt} = \gamma I,$$

where

- S is the number of susceptible individuals.
- I is the number of infected individuals.
- R is the number of recovered (and immune) individuals.
- N = S + I + R is the total population size.
- β is the transmission rate (rate of contact between susceptible and infected individuals).
- γ is the recovery rate (rate at which infected individuals recover and become immune).

Now, let us discuss how to interpret and utilize these equations in modelling the COVID-19 pandemic:

a). Susceptible Population S:

The rate of change of the susceptible population $\frac{dS}{dt}$ is given by the term $-\frac{\beta SI}{N}$. This term represents the rate at which susceptible individuals become infected due to contact with infected individuals.

b). Infected Population I:

The rate of change of the infected population $\frac{dI}{dt}$ has two components: the rate of infection $\frac{\beta SI}{N}$ and the rate of recovery γI. The first term represents the rate at which susceptible individuals become infected, while the second term represents the rate at which infected individuals recover.

c). Recovered Population R:

The rate of change of the recovered population $\frac{dR}{dt}$ is given by γI, representing the rate at which infected individuals recover and become immune.

By solving these differential equations numerically or analytically, we can simulate the dynamics of the COVID-19 pandemic over time. We can also incorporate additional factors such as vaccination, social distancing measures, and variations in transmission rates to make the model more realistic and applicable to specific scenarios.

Ch. Thaarani
Signature of the Student:

Signature of the supervisor

Signature of the HOD
Lecturer in charge
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Name of the Student: Ch. Chekradhar

Group: 3rd MPC

LINEAR ALGEBRA APPLICATIONS

1. Network Traffic Optimization:

In telecommunications or computer networks, linear algebra is used to optimize network traffic flow. Suppose we have a network with multiple nodes (e.g., routers or servers) interconnected by links. The objective is to minimize congestion and maximize data transfer efficiency. Linear algebra techniques such as matrix manipulation and solving systems of linear equations can be employed to model the network topology, analyze traffic patterns, and optimize routing strategies. By formulating the problem as a linear programming or optimization task, network administrators can allocate resources effectively, balance traffic loads, and improve overall network performance.

2. Portfolio Optimization in Finance:

In finance, investors often face the challenge of constructing an optimal investment portfolio to achieve desired returns while managing risk. Linear algebra provides tools for portfolio optimization. The problem can be framed as follows: Given a set of financial assets with different risk-return characteristics, how can we allocate capital across these assets to maximize expected return while minimizing portfolio risk? Linear algebra techniques such as matrix operations, eigenvector analysis, and optimization algorithms (e.g., Markowitz's mean-variance optimization) are used to construct efficient frontier curves, which represent the trade-off between risk and return for different portfolio allocations. By solving systems of linear equations and performing eigenvalue decomposition, investors can identify the optimal asset allocation that maximizes expected return for a given level of risk tolerance or minimizes risk for a target level of return. This enables investors to make informed decisions and build diversified portfolios that align with their investment objectives and risk preferences.

Ch. Chekradhar.

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GOVT. DEGREE COLLEGE(MEN), SRIKAKULAM

Department of Mathematics

Task given to moderate students : B. Indraja

1.Quantify the impact of the COVID-19 pandemic on academic performance by analysing changes in grades, attendance, and completion rates using differential equations methods and mathematical modelling.

To represent the impact of the COVID-19 pandemic on academic performance using differential equations, we can model changes in grades, attendance, and completion rates over time. Let us denote:

- G(t) as the average grade at time t,
- A(t) as the attendance rate at time t, and
- C(t) as the completion rate (percentage of courses completed) at time t.

We can then construct a system of differential equations to describe how these metrics change over time due to the influence of the pandemic. Let us denote the rate of change of each metric as follows:

- $\frac{dG}{dt}$ represents the rate of change of the average grade,
- $\frac{dA}{dt}$ represents the rate of change of the attendance rate, and
- $\frac{dC}{dt}$ represents the rate of change of the completion rate.

The equations could be formulated as follows:

1. $\frac{dG}{dt} = f\,(G, A, C, \text{other factors})$
2. $\frac{dA}{dt} = g\,(G, A, C, \text{other factors})$
3. $\frac{dC}{dt} = h\,(G, A, C, \text{other factors})$

Here, f, g, and h are functions that describe how the respective metrics change over time, considering the impact of the COVID-19 pandemic as well as other relevant factors such as teaching methods, student motivation, access to resources, etc.

These differential equations would need to be formulated based on empirical data and theoretical considerations specific to the educational context and the effects of the pandemic.

B. Indraja
Signature of the Students

Signature of the Supervisor

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Dept. of Mathamatics
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SRIKAKULAM

3. REFLECTIVE ASSESSMENT & METACOGNITION:

Reflective assessment techniques are employed to help students evaluate their own learning progress and identify areas for improvement. By reflecting on their learning experiences, students develop metacognitive skills, enabling them to monitor and regulate their own learning effectively. Emphasize the importance of being aware of one's own thinking processes in mathematics, as it helps in identifying strengths, weaknesses, and effective learning strategies.

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strengths, weaknesses of the students

4. GROUP WORK & COLLABORATIVE PROBLEM-SOLVING:

Group work and collaborative problem-solving tasks are integral components of the teaching-learning process in the department. Students work together in small groups to solve complex mathematical problems, exchange ideas, and learn from each other's perspectives. Collaborative problem-solving activities foster teamwork, communication skills, and a deeper understanding of mathematical concepts.

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GROUP WORK PHOTO

5. GAMES & PUZZLES:

Games and puzzles are used as interactive learning tools to engage students and reinforce mathematical concepts in a fun and enjoyable manner. These activities not only enhance students' problem-solving abilities but also promote critical thinking and strategic planning skills.

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MAGIC OR TRICK
PROOF OF 0! = 1


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6. PROBLEM-BASED LEARNING:

Problem-based learning approaches are employed to challenge students to apply their mathematical knowledge to solve real-world problems. By presenting authentic, open-ended problems, students are encouraged to explore multiple solutions, think critically, and develop innovative problem-solving strategies.

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7. INQUIRY BASED INVESTIGATIONS AND CROSS-CURRICULAR AWARENESS:

Inquiry-based investigations are conducted to encourage students to explore mathematical concepts through hands-on experimentation and exploration. These investigations promote active learning and help students develop a deeper understanding of mathematical principles. Furthermore, students are made aware of the interdisciplinary nature of mathematics and its connections to other fields of study, fostering cross-curricular awareness.

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CONCLUSION:

The Department of Mathematics at Govt. Degree College for Men employs a diverse range of innovative teaching-learning methods to enrich the educational experience of students. Through the integration of brainstorming sessions, mathematical modelling, reflective assessment, collaborative problem-solving, games, puzzles, problem-based learning, and inquiry-based investigations, students are empowered to become active learners, critical thinkers, and proficient problem solvers in mathematics and beyond.