



स्वाध्यायान्मा प्रमदः

CAPACITY BUILDING PROGRAM PGT MATH

2025-2026

REPORT OF

CAPACITY BUILDING PROGRAM FOR
PGT MATH AT IIT MANDI FROM
22 TO 26 SEPTEMBER 2025

SUBMITTED BY
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RESOURCE PERSON (S.ST)
SCERT, DELHI



VENUE: IIT MANDI
HIMACHAL PRADESH



स्वाध्यायान्मा प्रमदः

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
(AN AUTONOMOUS ORGANIZATION DEPARTMENT OF EDUCATION, GNCT. OF DELHI)
VARUN MARG, DEFENCE COLONY, NEW DELHI-110024

DETAIL OF THE PROGRAMME

NAME OF THE PROGRAM: FIVE DAYS CAPACITY BUILDING PROGRAM FOR PGT MATH

DURATION: 22 TO 26 SEPTEMBER 2025

VENUE: INIDAN INSTITUTE OF TECHNOLOHY, MANDI

NO.OF PARTICIPANTS PROPOSED : 36

NO OF PARTICIPANTS ATTENDED : 35

STAKEHOLDER : PGT MATH

NAME OF PROGRAM INCHARGE: DR MUKESH KUMAR

NAME OF INSET NODAL OFFICER: DR SANJAY KUMAR

NAME OF COORDINATOR: MOHAMMED SHAHNAWAZ



DAY-1

INAUGURATION SESSION

The first day of the CPD/PGT Mathematics Building Program at IIT Mandi commenced with great enthusiasm and energy. The morning began with a warm welcome address by the faculty, accompanied by welcome gifts that instantly created a cordial atmosphere. This opening gesture set a positive tone for the sessions ahead, making participants feel valued and included.



The introduction session was designed to familiarize participants with the institute's environment, resources, and learning opportunities. Faculty members and coordinators introduced themselves and shared valuable insights into the design of the program. Their brief overviews gave participants a clear idea of the learning journey that awaited them, while also clarifying expectations and objectives. This orientation session created an engaging platform for participants to interact, ask questions, and feel oriented toward the new learning experience.



SESSION- 1 & 2
PROF. MANOJ THAKUR**TEACHING STRATEGIES IN MATHEMATICS EDUCATION
AND PROBABILITY-BASED PUZZLES**

A key highlight of the morning session was the motivational talk delivered by Professor Manoj Thakur, who emphasized the importance of effective teaching strategies in mathematics education. He encouraged participants to think beyond traditional methods and inspired them to embrace innovative pedagogical tools. His stirring address highlighted the potential for growth and mastery within the teaching profession.



In addition, interactive introductions among participants proved to be an excellent ice-breaker. Each participant was invited to share their name, background, and teaching experience. This light-hearted activity not only broke down barriers but also created a sense of camaraderie and collaboration among the participants. The session was well received, laying the foundation for teamwork and group learning throughout the program.

The morning further included an interactive puzzle session facilitated by Prof. Thakur. Two thought-provoking probability-based puzzles were presented, challenging participants to think critically and collaboratively. The activity not only engaged everyone in problem-solving but also demonstrated how puzzles can be effectively used in classrooms to spark curiosity and deepen mathematical understanding. Discussions around these puzzles highlighted the practical application of mathematical reasoning, leaving participants both entertained and intellectually enriched.



Overall, the morning session provided inspiration, orientation, and engagement, setting the stage for a highly productive program.

The post-lunch session focused on hands-on training in LaTeX and Overleaf, led by Professor Preeti and supported by PhD scholars. This session aimed at equipping teachers with modern tools for professional document preparation and scientific writing, positioning LaTeX as a superior alternative to conventional word processors such as MS Word.

The workshop began with an introduction to the basics of LaTeX, covering topics such as:

- Document structure and text formatting
- Incorporation of equations and mathematical symbols
- Functions and commands for scientific writing
- Use of Overleaf for collaborative academic work



Participants were guided step-by-step, ensuring even beginners could follow and gain confidence in using the platform. The interactive nature of the session made it highly engaging, as participants practiced on their own systems with real-time assistance from the Ph.D scholars. The supportive environment encouraged active participation and allowed teachers to directly visualize the potential application of these tools in their academic and professional work.



Prof. Preeti emphasized that LaTeX is not just a tool for creating documents, but a way to present ideas with clarity, precision, and professionalism. The ability to write complex equations, design structured documents, and collaborate online through Overleaf was particularly appreciated by mathematics educators, who saw its relevance in preparing notes, research papers, and presentations.



By the end of the session, participants expressed that Overleaf and LaTeX were far superior to traditional word typing, especially for mathematical writing. The session empowered them with practical skills to make their presentations and academic documents more impressive and impactful.

KEY TAKE AWAYS FROM DAY 1

1. The welcome and orientation session successfully created a collaborative learning environment and familiarized participants with the program design and expectations.
2. Prof. Manoj Thakur's motivational address highlighted innovative approaches to teaching mathematics and inspired participants to think creatively about classroom strategies.
3. The interactive introductions and puzzle session fostered camaraderie, critical thinking, and problem-solving skills, demonstrating how such activities can be integrated into teaching practices.
4. The LaTeX and Overleaf workshop provided hands-on experience in professional document preparation, equipping participants with skills that will significantly enhance their academic writing and teaching resources.

CONCLUSION

Day 1 of the Capacity Building Program for PGT Mathematics at IIT Mandi was an unqualified success. The day offered a balanced combination of inspirational talks, interactive activities, and practical skill development. The contributions of Prof. Manoj Thakur and Prof. Preeti, supported by Ph.D. scholars, were instrumental in creating an intellectually stimulating and supportive environment.

Participants concluded the day feeling motivated, better connected, and newly equipped with modern pedagogical tools. The blend of theory, interaction, and practice set a strong foundation for the coming sessions, leaving participants eager to continue their learning journey in the days ahead.

**TEACHING PROBABILITY, CENTRAL TENDENCY, AND
DISPERSION**

Mr. Rishikesh Yadav began the day with a comprehensive session on probability and statistics, reminding participants of Kolmogorov's axioms as the foundation. He skillfully transitioned through key probability concepts:

- Classical Probability – Principles and real-world applications.
- Theoretical Probability – Underlying mathematical framework and axioms.
- Conditional Probability – Events influenced by prior outcomes, with examples.
- Bayes' Theorem – Application in updating probabilities with new evidence.



The session then moved to Central Tendency and Dispersion, where Mr. Yadav provided relatable, real-life examples to explain complex concepts such as mean, median, variance, and standard deviation. His clarity, engaging delivery, and classroom-oriented approach made the session particularly impactful for teachers.

Prof. Preeti delivered a dynamic and interactive session on determinants and their relation to vectors. She ensured participants first mastered the basics before progressing to advanced applications.

Key highlights included:

DEFINITION AND CALCULATION OF DETERMINANTS (2×2 AND 3×3 MATRICES).

VECTOR-BASED METHODS OF CALCULATING DETERMINANTS.

VECTOR-BASED METHODS OF CALCULATING DETERMINANTS.

PROPERTIES SUCH AS ZERO DETERMINANT, TRIANGULAR MATRIX DETERMINANTS, AND ROW/COLUMN OPERATIONS.

GEOMETRICAL INTERPRETATIONS OF MATRICES USING VECTORS, DOT PRODUCT, CROSS PRODUCT, SUM, AND DIFFERENCE.

THE CONCEPTUAL LINKAGE BETWEEN MATRICES AND VECTORS WAS PARTICULARLY WELL RECEIVED, PROVIDING TEACHERS WITH NEW WAYS TO EXPLAIN ABSTRACT CONCEPTS TO STUDENTS.

SESSION- 3 MS. QAISAR JAHAN

NUMBER SYSTEM AND SET THEORY

Ms. Jahan's session was described as interactive, joyful, and deeply insightful. She guided participants through the Number System, highlighting the discovery of $\sqrt{2}$ as the first irrational number by the Pythagorean society in the 5th century. She further explained how irrational numbers can be defined using the Dedekind cut, citing the 19th-century work of mathematician Cantor.

The session also covered Set Theory and Functions, with strategies to simplify abstract concepts for classroom teaching. Her elegant and "beautiful" explanation of Root 2 left a lasting impression on participants, fostering deeper appreciation for the logical foundations of mathematics.

SESSION- 4 PROF. PREETI

MATHEMATICS LAB – LATEX, GEOGEBRA, AND HANDS-ON PRACTICE

This session was practical and technology-driven, conducted in the Mathematics Lab. Participants were introduced to digital tools such as LaTeX for scientific writing and GeoGebra for mathematical visualization.

The hands-on component allowed participants to directly experiment with these tools, equipping them to:

Prepare professional documents and mathematical resources with LaTeX.

Use GeoGebra to demonstrate mathematical concepts dynamically in the classroom.

This technology integration was seen as crucial for modern teaching, enabling teachers to make mathematics more interactive, visual, and accessible.



The concluding session was led by Professor Manoj Thakur, who delivered a motivational and pedagogically rich lecture. He emphasized creating a curious and enquiring mindset among students to sustain long-term interest in mathematics. His strategies included:

- Using problem-solving to foster engagement.
- Employing puzzles and real-world connections.
- Encouraging creativity alongside rigor in mathematical thinking.
- The session left participants motivated, with practical ideas to apply in their classrooms.

KEY TAKE AWAYS FROM DAY 2

- Probability and Statistics: Refreshed understanding of Kolmogorov's axioms and Bayes' Theorem, with strategies to simplify these topics for students.
- Matrices and Determinants: Learned innovative ways to connect algebraic operations with vectors and geometry for conceptual clarity.
- Number System & Set Theory: Gained historical and logical insights into irrational numbers, Dedekind cuts, and Cantor's contributions, enriching classroom narratives.
- Technology Integration: Acquired practical skills in GeoGebra and LaTeX, equipping teachers to bring digital tools into daily teaching.
- Motivational Pedagogy: Understood the importance of fostering curiosity, inquiry, and lasting interest in mathematics among students.

CONCLUSION

Day 2 of the Capacity Building Program at IIT Mandi was a resounding success. The five sessions collectively offered:

Strong conceptual foundations in probability, determinants, number systems, and set theory.

Practical skill development through LaTeX, GeoGebra, and Mathematics Lab tools.

Motivational insights on classroom pedagogy to inspire students' curiosity and love for mathematics.

The resource persons—Mr. Rishikesh Yadav, Prof. Preeti, Ms. Qaiser Jahan, and Prof. Manoj Thakur—demonstrated outstanding expertise and teaching skills. Their contributions ensured that participants concluded the day feeling enriched, confident, and equipped with innovative strategies to enhance their teaching practice.

SESSION- 1

PROF. MANOJ THAKUR

DAY-3

BLOOM'S TAXONOMY AND ASSESSMENT

The day began with an enlightening session by Professor Manoj Thakur, who focused on Bloom's Taxonomy and assessment techniques for PGT Mathematics. The session emphasized the knowledge, comprehension, and application levels of Bloom's framework. Participants learned how to design effective assessments to evaluate student learning outcomes more meaningfully.

Professor Thakur also connected Bloom's levels to practical classroom objectives, showing how teachers can align their teaching methods and assessments. This session laid a strong foundation for improving pedagogical practices and gave participants strategies to assess understanding beyond rote learning.



SESSION- 2

PROF. PREETI & MANOJ THAKUR

HANDS-ON PRACTICE IN MATHEMATICS LAB



The second session was an engaging hands-on practice session in the Mathematics Lab, where participants used GeoGebra software to visualize and construct geometric shapes such as circles, lines, angles, and sectors.

Interactive tools like sliders, colors, and dynamic movement helped participants explore mathematical concepts in innovative ways. The session was highly interactive and enjoyable, empowering teachers with valuable digital skills for classroom teaching.

PERMUTATION AND COMBINATION

The post-lunch session on Permutation and Combination was conducted by Mr. Sampath. Using real-life examples and simple formulas, he made the concepts highly accessible.



A highlight of the session was the card game activity (Magic trick), which turned a complex topic into an enjoyable and interactive experience. Participants found this activity especially useful as it provided practical strategies to engage students with abstract concepts.



KEY TAKE AWAYS FROM DAY 3

DEEPER UNDERSTANDING OF BLOOM'S TAXONOMY AND ITS APPLICATION IN DESIGNING EFFECTIVE ASSESSMENTS.

**ASSESSMENT
SKILLS**

**PRACTICAL EXPERIENCE WITH
GEOGEBRA, ENHANCING DIGITAL
TEACHING COMPETENCIES.**

**TECHNOLOGY
INTEGRATION**

**USE OF REAL-LIFE EXAMPLES AND
INTERACTIVE GAMES TO TEACH
CHALLENGING CONCEPTS LIKE
PERMUTATION AND COMBINATION.**

**ENGAGING
PEDAGOGY**

CULTURAL VISIT: MANDI, HIMACHAL PRADESH

DAY-3

As part of the program, participants had the opportunity to explore Mandi, a city rich in cultural heritage and natural beauty. The excursion included visits to several historical and spiritual landmarks:

MATA CHANDI TEMPLE

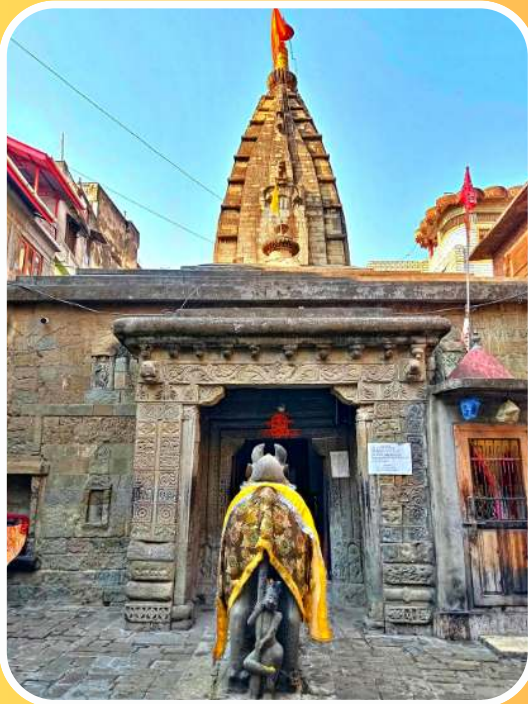
The Mata Chandi Temple in Kataula is located in the Mandi district of Himachal Pradesh, on the Mandi-Parashar Lake road. Known for its beautiful paintings, carvings, and clean surroundings, the temple draws a large number of devotees with wishes during the Navaratri festival.



BHOOTNATH TEMPLE

An iconic temple that reflects Mandi's religious diversity and architectural splendour.

DAY-3



BHIMA KALI TEMPLE

Bhima Kali Temple, situated on the banks of the Beas River in Mandi District of Himachal Pradesh. Bhima Kali Temple is devoted to Goddess Bhima Kali. Goddess Bhima Kali is considered to be the family deity of the erstwhile Bushahar Rulers of Mandi. Kali Mata is the aspect of Durga Mata and is so widely worshiped in north eastern parts of India. There is a huge museum inside the temple that has various statues and images of Hindu Gods and Goddesses. It is regarded as the site where Lord Krishna fought against demon Banasura.



PANCHVAKTRA SHIV TEMPLE

DAY-3

Situated at the confluence of the Rivers Suketi and Beas, the serene beauty of the Panchvaktra temple attracts a large number of visitors from across the country. The temple stands on a huge platform and is very well furnished. Panchvaktra temple is a supreme shrine dedicated to Lord Shiv.

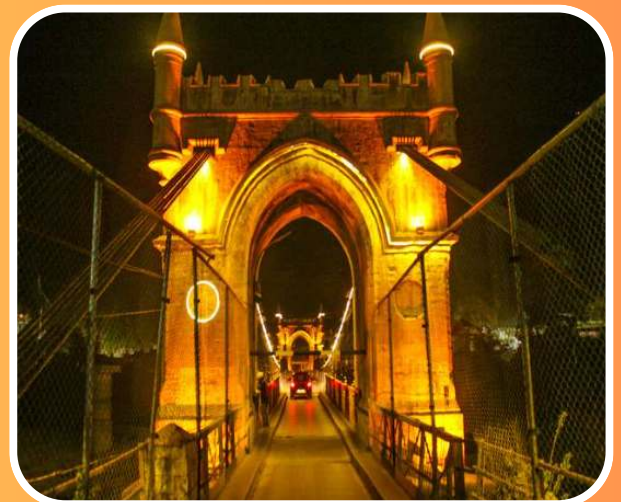
The temple is built in the typical Shikhara architecture style which looks astounding. Temple got its name from the five faced statue image of Lord Shiva, out of which only three can be seen when viewed from the front.



VICTORIA BRIDGE

Victoria Bridge links Purani Mandi and Mandi town in Himachal Pradesh, India. It was built in 1877 under Raja Vijay Singh, ruler of Mandi with assistance from Britain.

The Bridge resembles the hanging Victoria Bridge on the Thames River. It is also like Jhulla bridges and can carry small vehicles. However, as this is a value bridge Government of Himachal Pradesh, built and inaugurated another bridge named Sardar Patel Bridge in 2019 (or New Victoria Bridge) near Victoria Bridge and it was opened for transport. Victoria Bridge was closed for all means of transport after its 142 years of service



HIGHLIGHTS OF THE VISIT

**GAINED INSIGHTS INTO THE
SPIRITUAL SIGNIFICANCE OF
THE TEMPLES**

**APPRECIATED THE
ARCHITECTURAL HERITAGE
AND CRAFTSMANSHIP**

**EXPERIENCED THE SCENIC
BEAUTY OF THE BEAS RIVER**

**UNDERSTOOD THE HISTORIC
IMPORTANCE OF VICTORIA
BRIDGE**

**THE CULTURAL VISIT PROVIDED PARTICIPANTS WITH A
MEMORABLE AND ENRICHING EXPERIENCE, OFFERING A
PERFECT BLEND OF SPIRITUALITY, HISTORY, AND NATURAL
BEAUTY.**

COUNCLUSION

Day 3 of the Capacity Building Program was a fruitful blend of academic learning and cultural exploration. The sessions on Bloom's Taxonomy, GeoGebra practice, and permutation and combination equipped teachers with both pedagogical and technological tools for effective classroom teaching.

The visit to Mandi further enriched the experience by exposing participants to the region's rich cultural heritage and natural splendour. Overall, the day was informative, interactive, and inspiring, reinforcing the holistic development of teachers as both educators and lifelong learners.

SESSION- 1
PROF. MANOJ THAKUR

DAY-4

HANDS-ON TRAINING WITH GEOGEBRA

Dr. Manoj Thakur conducted an interactive session in the Maths Lab on GeoGebra. Participants explored:
Creating and visualizing geometric shapes

Using sliders and angles

Designing different types of animations and forms

Dr. Thakur emphasized, “Let your imagination flow and use the commands to create and solve mathematical problems.” This session empowered teachers to use GeoGebra as a tool to make mathematics more dynamic and interactive for students.



HANDS-ON TRAINING WITH LATEX

SESSION- 2
PROF. PREETI



In the Maths Lab, participants engaged in a practical training on LaTeX, covering:
Technical document design
Coding for functions of different sizes, underlined and colorful expressions
Creating presentations using Beamer
Participants found Beamer particularly empowering, as it provided a professional edge to classroom presentations and academic content creation.

SESSION- 3 DR. SAMEER

INTEGRATION AND GRAPHICAL REPRESENTATION

DAY-4

Dr. Sameer delivered a thought-provoking session on Integration, covering:

- Area of a circle
- Area under simple curves
- Length of bounded curves
- Graphical representation for deeper conceptual understanding

He highlighted the importance of developing students' curiosity and critical thinking, remarking: "Stop pampering students; instead, make them thought-provoking, curious, and deep learners."



GOLDEN RATIO IN MATHEMATICS

SESSION- 4 DR. RAHUL



This engaging interdisciplinary session explored the Golden Ratio, linking mathematics with nature, art, and engineering. Highlights included:

Demonstration of Teaching-Learning Materials (TLMs) by students for effective classroom representation

The Fibonacci Series and its applications in mechanical engineering

Real-life examples showcasing the aesthetic and mathematical significance of the Golden Ratio

The session emphasized how abstract mathematical concepts can be made engaging and relatable across disciplines.



SESSION- 5

MR.SHIVAM DUBEY

TINKERING LAB VISIT & PROBABILITY GAMES

DAY-4

The long-awaited visit to the Tinkering Lab allowed participants to explore innovative experiments and student-created models, guided by Mr. Shivam Dubey and the faculty team.

Later, an interactive session on Probability games by Prof. Rishikesh and Prof. Thakur brought energy and fun to the learning process, reinforcing classroom strategies to make probability engaging for students.



KEY TAKE AWAYS FROM DAY 4

**GEOGEBRA CAN MAKE ABSTRACT CONCEPTS
VISUALLY CLEAR AND INTERACTIVE**

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VISUALLY CLEAR AND INTERACTIVE**

EVENING EVENT: GALA DINNER

DAY-4

The day concluded with a prestigious Gala Dinner at Fountain Park, hosted by IIT Mandi. It provided participants with an opportunity to interact informally with faculty members, fostering camaraderie and a sense of community. The hospitality of the CCE and faculty team was warmly appreciated.



Collaborative activities and informal gatherings, like the Gala Dinner, strengthen professional bonds and shared learning.

CONCLUSION

Day 4 of the Capacity Building Program at IIT Mandi was enriching, interactive, and inspiring. With a mix of hands-on training, theoretical exploration, interdisciplinary learning, and cultural bonding, the day successfully equipped participants with innovative strategies, digital tools, and fresh perspectives for classroom teaching.

The day began with Prof. Anil's lecture on maxima and minima problems, focusing on cylinders and cuboids. He further introduced concepts of limits, differentiation, and continuity, explaining:

- Meaning of tends to zero
- Removable and non-removable discontinuities
- Practical applications, such as slope calculation in bridge design

This session connected abstract concepts of calculus with real-life applications, encouraging teachers to adopt practical approaches in classrooms.

Prof. Manoj Thakur engaged participants in an interactive activity through a Google Form on question paper analysis. He explained types of questions under Bloom's Taxonomy—Remembering, Understanding, and Applying—emphasizing how to frame balanced assessments.

Highlights of this session included:

- Birthday Paradox, showing surprising results in probability
- Importance of surveys and feedback in refining pedagogy

This revision-oriented session provided practical strategies for better assessment design.

SESSION- 3
PROF. PREETI

**PROBABILITY PUZZLES – MONTY HALL
PROBLEM**

DAY-5

Dr. Preeti's session on the famous Monty Hall Problem was interactive and insightful, helping participants understand probability and decision-making in a fun way. The Spaghetti Problem was also discussed, highlighting how simple puzzles can bring depth to mathematical reasoning.

INDIAN CONTRIBUTION TO MATHEMATICS

SESSION- 4
PROF. C. K. RAJU

Professor C.K. Raju delivered a thought-provoking lecture on the Indian heritage of mathematics (Ganit). Key highlights:

- India's contribution of zero and the place-value system
- Works of Aryabhata, Brahmagupta, Bhaskaracharya, and Madhava
- Contrast between Indian Ganit and European mathematics introduced during colonial times
- His unique approach of teaching calculus through Ganit instead of conventional limits and derivatives

The session instilled pride in India's rich intellectual tradition and encouraged participants to rethink mathematical pedagogy through indigenous knowledge systems.

An introduction to IIT Mandi's programs, campuses, and opportunities was provided, covering:

- North and South campuses
- New programs like 5-year BBA-MBA (through JEE & interview)
- Opportunities for part-time PhD programs for educators

This session broadened awareness of academic opportunities for students and teachers alike



KEY TAKE AWAYS FROM DAY 5

- Calculus and continuity concepts can be made engaging by linking them to real-life applications.
- Bloom's Taxonomy helps teachers frame balanced assessments, encouraging higher-order thinking.
- Probability puzzles like Monty Hall and Spaghetti make abstract concepts more interactive.
- India's mathematical heritage (Ganit) offers rich pedagogical insights that can complement modern methods.
- Exposure to higher education opportunities at IIT Mandi can inspire both students and teachers.
- Gratitude and cultural exchanges (like the felicitation) strengthen professional and personal bonds.

The program concluded with a felicitation ceremony where participants received:

- Traditional Himachali Caps
- Certificates of participation
- A group photograph and memento

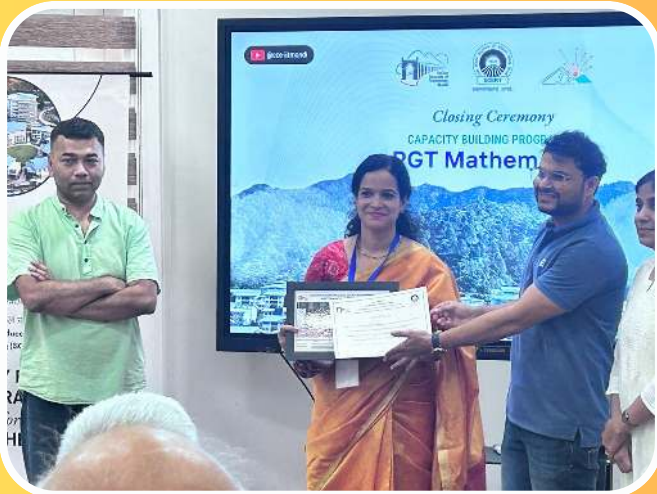
The participants expressed heartfelt gratitude to the faculty and staff of IIT Mandi, appreciating not only the quality of sessions but also the warm hospitality extended throughout the program.

COUNCLUSION

Day 5 served as a culmination of learning, reflection, and appreciation. With its blend of rigorous academic sessions, interdisciplinary insights, and cultural warmth, the day left participants not only enriched with knowledge but also empowered with fresh pedagogical approaches. The program concluded on a memorable and inspiring note, creating a lasting impact on all participants.

CERTIFICATE DISTRIBUTION

DAY-5



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Thank You