

Master of Science
in
Applied Mathematics



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|--------------------------|-----------------------|
| Programme Level | Post Graduate |
| Year of Commencement | 2016 |
| Minimum Duration | 2 Years (4 Semesters) |
| Maximum Duration | 3 Years (6 Semesters) |
| Senate Meeting Reference | 9.3/18.5/20.4 |

Preamble : M.Sc. in Applied Mathematics program at IIT Mandi has many distinctive features that set it apart from the conventional master's in mathematics programs in the country. It is intended to give the students an in-depth exposure of the essential areas of Mathematical sciences while expanding their knowledge in the allied areas through elective courses. The unique curriculum of the program is designed in such a way that students are not only skilled to take up research career in academia but are also well equipped to take up R&D jobs in industry after the completion of the program.

The hallmark of the program is its broad based curriculum with interdisciplinary approach that provides a good balance among theory, application, and research components. In the first year of the program the students make a strong foundation through carefully designed core courses. In the second year, the option to choose courses from a large pool of electives offered within and outside the school enables the students to build a strong foundation in the area of their interest and empower them to work on challenging application problems in various fields.

The final year project is one of the most important component of the program that gives an all-round learning experience to the students with an early career training to start working on challenging research problems. While working on the project, students not only enhance the understanding of the concepts learned in the courses but also get an exposure to *learning by doing*, an important aspect that give them confidence and ability to independently carry the research work.

- Unique broad based curriculum with a strong focus on essential fundamental concepts.
- Option for choosing courses from a pool of discipline and free electives for in-depth exposure to individuals area of interests.
- Interdisciplinary approach wherein students blend the mathematical concepts and their application to different domains.
- Learning of advanced mathematical and computational tools to solve engineering and real-life problems.
- Emphasis on project based learning for exposure to different aspects of solving research problems.
- Courses and project together put strong emphasis on problem solving skills that gives an advantage while targeting for jobs in industry.

Semester-wise credit distribution :

| Semester-I | Semester-II |
|---------------------------------------------------|------------------------------------------------|
| Real Analysis(MA-511) 4 Credit | Functional Analysis(MA-521) 4 Credit |
| Linear Algebra(MA-512) 4 Credit | Partial Differential Equation(MA-522) 4 Credit |
| Ordinary Differential Equation(MA-513) 4 Credit | Numerical Analysis(MA-523) 4 Credit |
| Computer Programming(MA-514) 3 Credit | Probability and Statistics(MA-524) 4 Credit |
| Computer Programming Lab(MA-514P) 2 Credit | Discipline Elective- I 4 Credit |
| Applied Mathematical Programming(MA-515) 4 Credit | Technical Communication(HS-541) 1 Credit |
| Total 21 Credit | Total 21 Credit |

| Semester-III | Semester-IV |
|------------------------------------|------------------------------------|
| Discipline Elective - II 3 Credit | Discipline Elective - VII 3 Credit |
| Discipline Elective - III 3 Credit | Elective - VIII 3 Credit |
| Elective - IV 3 Credit | Elective - IX 3 Credit |
| Elective - V 3 Credit | Project (Part-2) 8 Credit |
| Elective - VI 3 Credit | |
| Project (Part-I) 6 Credit | |
| Total 21 Credit | Total 17 Credit |

- **Credit Structure:** A student, to be awarded M.Sc. degree, must need to earn 80 credits.
- **Open Electives:** Open electives from outside the discipline of program should be at least of 6 credits.
- **Discipline Electives:** Discipline electives will be provided according to the requirement of the students and the availability of the faculties. The list of discipline electives are attached herewith.
- **Discipline Elective Courses:** The following existing senate approved courses can be offered as discipline electives. More elective courses will be added time to time as required.

List of Discipline Elective Courses*

| Course Numbers | Course Titles | Credits |
|----------------|---------------------------------------------------|---------|
| MA-549(4) | Abstract Algebra | 4 |
| MA-552(3) | Number Theory | 3 |
| MA-780 (3) | Topics in Semigroup Theory | 3 |
| MA-550(3) | Statistical Data Analysis | 3 |
| MA-553(3) | Mathematical Foundations of Financial Engineering | 3 |
| MA-565(3) | Numerical Methods in Quantitative Finance | 3 |
| MA-608(3) | Computational Fluid Dynamics | 3 |
| MA-609(3) | Numerics of Partial Differential Equation | 3 |
| MA-651(3) | Optimization Techniques | 3 |
| MA-652(3) | Stability Theory of Differential Equations | 3 |
| MA-653(3) | Computational Financial Modelling | 3 |
| MA-653P(1) | Computational Financial Modelling Lab | 1 |
| MA-654(3) | Financial Engineering | 3 |
| MA-656(3) | Stochastic Calculus for Financial Engineering | 3 |
| MA-704(3) | Dynamical System | 3 |
| MA-705(3) | Modeling Population Dynamics | 3 |
| MA-709(3) | Numerical Linear Algebra | 3 |
| MA-765(4) | Fractional Differential Equations | 4 |
| MA-516(4) | Topology | 4 |
| MA-611(4) | Statistical tools and Computing | 4 |
| MA-527(4) | Field and Galois Theory | 4 |
| MA-528(4) | Graph Theory | 4 |
| MA-5XX(4) | Measure Theory and Integration | 4 |
| MA-525(3) | Heuristic Optimization | 3 |
| MA-560(3) | Nonlinear Dynamics and Chaos | 3 |
| MA-605(3) | Statistical Data Analysis | 3 |
| MA-510(3) | Climate Change Analysis | 3 |
| MA-611(3) | Statistical tool and computing | 3 |

* This is a dynamic list of elective courses that may be updated based on the requirements.

Project: The project focuses on an interdisciplinary approach wherein students learn theory and its applications, those are required for research in Mathematics and industry jobs. Students need to complete 14 credit project in the third and fourth semester. We offer the research projects on the following topics:

1. Differential Equations
2. Mathematical Control Problems
3. Optimization,
4. Soft Computing
5. Machine Learning
6. Financial Mathematics
7. Dynamical Systems
8. Nonlinear Dynamics
9. Harmonic Analysis
10. Wavelet Analysis
11. Computational Fluid Dynamics
12. Numerical Methods for PDEs
13. Topology and Combinatorics
14. Algebraic Topology
15. Classical K-theory, Commutative Algebra
16. Statistical Time Series Analysis
17. Climate Modelling
18. Ecological Modelling
19. Deep Learning
20. Any Interdisciplinary Topics with applications in Mathematics

In project, students are expected to read research papers, advance mathematical courses and to do literary survey about research problems and their application to the real life problems. Also, some motivated students works on new research topic suggested by their project mentor.

Project Evaluation: A continuous evaluation process will be followed to evaluate the project/thesis work progress to award letter grades for the credits assigned to project/thesis component, as mentioned in the institute's Ordinance for M.Sc. programme.