

PROGRAM: M. Sc. Mathematics *IInd* yr

Program Outcome:

- PO1. Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO2. Problem Solving:** Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from mathematics/ sciences/social sciences/humanities.
- PO3. Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO4. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.
- PO5. Ethics:** Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.
- PO6. Environment and sustainability:** Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.
- PO7. Self-directed and life-long learning:** Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.
- PO8. Design/Development of Solutions:** Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO9. Computational Thinking:** Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.
- PO10. Effective Citizenship:** Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO11. Global Perspective:** Understand the economic, social and ecological connections that link the world's nations and people.
- PO12. Aesthetic Engagement:** Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Program Specific Outcome:

- PS01: **Rational Thinking:** Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.
- PS02: **Problem solving ability:** Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.
- PS03: **Revisiting the question:** Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.
- PS04: **Analytical ability:** In the growing field of research, it is necessary for students to learn to use some packages like La-Tex, Matlab, Scilab, Mathematica, Maxima, etc, so that analytical tools be available to investigate the functions, problems through graphs, programming, etc.
- PS05: **Numerical Ability:** Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.
- PS06: **Simulation Ability:** The problems that cannot be solved directly, can at times be solved through techniques of simulation by honors/research students.
- PS07: **Research:** Students thus motivated would prepare themselves for research studies in Mathematics and related fields.
- PS08: **Application:** Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc.

M.Sc. Semester III (MATHEMATICS)	
Semester III Paper I- M10 Code: MMT3T10 DSC (Core) Credits-4 No. of hours 60	Course Title: COMPLEX ANALYSIS Course Outcomes: CO1: Foundational Knowledge: Students will be able to learn about complex number. They will get the knowledge about complex number in polar coordinate as well. CO2: Elementary Skills: Students will be able to learn the Mobius Transformation, they come to know about the Analytic Function and Elementary Properties, Power Series. CO3: Basic Analytic skills: The Objective of this Course is to study the topic like Cauchy-Riemann Equations, Poles and Residues, Mobius Transformation. CO4: Application: By applying the principles of basic tools through the course curriculum, Student can solve variety of practical problems.

Semester III Paper II- M11 Code: MMT3T11 DSC (Core) Credits-4 No. of hours 60	Course Title: FUNCTIONAL ANALYSIS Course Outcomes: CO1: Foundational Knowledge: Students will be able to update their basics knowledge in spaces, subspace, sequences, continuity and Normed space CO2: Elementary Skills: Students will able to understand the importance of uniform convergence, inner product space, orthogonal sets and orthonormal sets. CO3: Basic Analytic skills: The main outcome of the course is to equip students with necessary basic analytical skills and to help sharpen the student's understanding of the mathematical structure of the subject. CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.
--	--

Semester III Paper III- M12 Code: MMT3T12 DSC (Core) Credits-4 No. of hours 60	Course Title: ADVANCE MATHEMATICAL METHODS Course Outcomes: CO1: <i>Application in Engineering:</i> By applying the principles of basic formulae of Fourier series through the course curriculum, students can solve a variety of logical problems in science and engineering. CO2: <i>Application in physics to Solve Boundary value Problem:</i> Students will be able to understand the importance of Laplace Transform to solve physical and Electrical Problem. CO3: <i>Application to Solve Boundary Value Problem:</i> The main outcome of the course is to equip students with necessary basic analytic skills for problem solving on Partial Differential Equation. CO4: <i>Application in Engineering:</i> By applying the principles of basic formulae of Z-Transform through the course curriculum, students can solve a variety of logical problems in science and Electrical engineering.
---	--

Semester III Paper – IV M13:(A) Code: MMT3T13 DSE (Elective 3) Credits-4 No. of hours 60	Course Title: GENERAL THEORY OF RELATIVITY Course Outcomes: CO1: <i>Foundational Knowledge:</i> Students will be able to update their basics of Tensors and learn different types of tensors with their applications. CO2: <i>Elementary Skills:</i> Students will be able to understand the approximation theories of Newton's equations to Poisson equations and vice-versa CO3: <i>Basic Analytic skills:</i> The main outcome of the course is to equip students with necessary basic analytic skills for problem solving. CO4: <i>Application:</i> By applying the principles of basic tools, like Christoffel symbols, through the course curriculum, students can solve a variety of practical problems in cosmology.
---	---

Semester III Paper IV- M13:(B) Code: MMT3T13 DSE (Elective 3)	Course Title: FLUID DYNAMICS Course Outcomes: CO1: Foundational Knowledge: Students will develop a profound understanding of the basic ideas of fluid velocity, streamlines, vortex motion, rotational and irrotational flows. Students will also get know about interrelating these concepts with one another and draw distinction between local and particle rates of change CO2: Elementary Skills: Students will learn about Sinks, Sources and doublets,
Credits-4 No. of hours 60	<i>Milne Thomson Circle theorem and Blasius theorem. They will get to know about two- and three-dimensional inviscid fluid flows</i> CO3: Basic Analytic skills: Students will study and understand inviscid fluid flow and use the continuity equation to determine whether an inviscid flow is incompressible. Students will gain analytical skill and analyse properties of various fluid flows. CO4: Application: Students will get a deep understanding of fluid flow behaviours and will be able to think critically and apply the knowledge in the study of analysis of fluid motion. This course will also make the students able to prove the results related to Fluids Dynamics.

Semester III	Syllabus for Practical-4 MMT3P04: Python Programming
Practical-4 Code: MMT3P04 DSC (Core) Credits-2 No. of hours 30	Course Outcomes: CO1: <i>Students describe basic properties of Forier series, Laplase Transform and Z-transform using python programming.</i> CO2: <i>Students implement their knowledge in solving various problems on related concepts and develop the proof of coutably subadditive property.</i> CO4: <i>Students determine questions related to Forier series, Laplase Transform and Z-transform.</i> CO5: <i>Students will understand its significance and relevance to various mathematical disciplines and its applications in other fields.</i> CO6: <i>They will develop teamwork and communication skills while learning from each other's approaches and insight.</i>

M.Sc. Semester IV (MATHEMATICS)	
SemesterIV Paper I- M14 Code: MMT4T14 DSC (Core) Credits-4 No. of hours 60	Course Title: DYNAMICAL SYSTEM Course Outcomes: CO1: Foundational Knowledge: Students will learn the basic concepts related to Dynamical System. They will also gain the knowledge about The Flow of a Differential Equation and understand their global dynamics. CO2: Elementary Skills: Students will study about the nonlinear phenomena in physical systems by using a basic knowledge. They will be Capable of determining fixed points and their stability and solve the mathematical problems. CO3: Basic Analytic skills: Students will study about limits sets, flow boxes, Poincare Bendixson Theorem and its application . Students will gain analytical skill to describe the time evolution of systems which arise from biology and others subjects. CO4: Application: Students will be able to think critically about how autonomous and non autonomous Differential equation are differentiated. They will be apply the knowledge of Dynamical systems in the study of analysis using mathematical Concepts and techniques.

SemesterIV Paper – II M15 Code: MMT4T15 DSC (Core) Credits-4 No. of hours 60	Course Title: MEASURE AND INTEGRATION THEORY Course Outcomes: CO1:Foundational Knowledge: Students will be able to understand the fundamental concept of measure and Lebesgue measure. Students should be able to understand the construction of the Lebesgue integral and know its key properties. CO2: Elementary Skills: Students will be able to investigate fundamental concepts of measure and integration theory and apply the definition and properties of Lebesgue Measure and measurable sets. CO3: Basic Analytic skills: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving with various types of measurable sets, measurable functions, and solution to a problem of the Lebesgue integral of the bounded measurable functions, unbounded measurable function and integral of a non-negative functions. CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems involving borel measurability sets, measurable functions, Riemann and Lebesgue integral.
---	---

SemesterIV Paper – III M16 Code: MMT4T16 DSC (Core) Credits-4 No. of hours 60	Course Title: PARTIAL DIFFERENTIAL EQUATIONS Course Outcomes: CO1: Foundational Knowledge: <i>Students will be able to classify partial differential equations upon their linearity and find corresponding integral surfaces.</i> CO2: Elementary Skills: <i>Students will be able to solve linear partial differential equations of both first and second order.</i> CO3: Basic Analytic skills: <i>Students will be able to classify partial differential equations and transform second order partial differential equations into canonical form.</i> CO4: Application: <i>Students will be able to solve boundary value problems for Laplace's equation, the heat equation, the wave equation by separation of variables, in Cartesian, polar, spherical and cylindrical coordinates.</i>
--	--

SemesterIV Paper – IV M17 Code: MMT4T17 DSE (Elective 4) Credits-4 No. of hours 60	Course Title: COSMOLOGY Course Outcomes: CO1: Foundational Knowledge: <i>Student will be able to update their basis knowledge about cosmology studies. How the history of universe led to the stars, galaxies, and other features we can observe today.</i> CO2: Elementary Skills: <i>Student will able to study of cosmology. Cosmology is the study of outer space or the universe came to be, what its structure is like, and what the future may hold.</i> CO3: Basic Analytic Skills: <i>The main outcome of the course is to equip student to develop techniques to solve cosmological problem to find the new model.</i> CO4: Application: <i>Cosmology helps to understand how the universe began and how it has evolved over the nature of the universe.</i>
---	---

SemesterIV Paper – IV M17 Code: MMT4T17 DSE (Elective 4) Credits-4 No. of hours 60	Course Title: NUMBER THEORY Course Outcomes: CO1: Foundational Knowledge: Student will be able to update their basis of divisibility and modular arithmetic. CO2: Elementary Skills: Student will able to handle theory of congruence, understand Mobius inversion formula, Euler's theorem. CO3: Basic Analytic Skills : The main outcome of the course is to equip student to develop techniques to solve congruence problem for degree one and some special cases of degree two, using Chinese remainder theorem CO4: Application: Number theory is applied in Cryptography, Device authentication, Coding, websites for Ecommerce, Security system, many more .
---	---