Courses in MA/M.Sc. Mathematics

Semester wise Distribution of Courses

	Sl. No.	Course Code	Course Title	Credit
1st Semester	1	MAT 1016	Algebra	6
	2	MAT 1026	Mathematical Methods	6
	3	MAT 1036	Mechanics and Tensor	6
	4	MAT 1046	Real Analysis and Lebesgue Measure	6
	5	MAT 1056	Numerical Analysis	6
2nd Semester	1	MAT 2016	Complex Analysis	6
	2	MAT 2026	Topology	6
	3	MAT 2036	Functional Analysis	6
	4	MAT 2046	Number Theory	6
	5	MAT 2056	Differential Equations	6
3rd Semester	1	MAT 3016	Mathematical logic (O)/ Continuum Mechanics and Hydrodynamics	6
	2	MAT 3026	Graph Theory/ Special Theory of Relativity	6
	3	MAT 3036	Operations Research / Computer Programming in C	6
	4	MAT 3046	Measure Theory/ Special functions and Partial differential equations	6
	5	MAT 3056	Project	6
4th Semester	1	MAT 4016	Fuzzy Sets and Systems/ Space Dynamics	6
	2	MAT 4026	Advanced Functional Analysis/ Dynamical System and Fractal Geometry	6
	3	MAT 4036	Advanced Algebra (O)/ Fluid dynamics	6
	4	MAT 4046	Algebraic Topology/ General Theory of Relativity and Cosmology	6

Course Outcomes

MAT 1016 – Algebra

Preparing in a logical and systematic and simple way so that the students can compare the studies of different algebraic systems called groups, rings, fields and vector spaces.

The students can justify the concept of relations, mappings and composition in the study of algebraic systems called groups and rings. The concept of groups and rings play a significant role in the development of geometry and number theory in recent times.

MAT-1026 Mathematical Methods

To introduce the concept of integral equations and its applications.

To introduce Volterra Integral Equations, Fourier Integral Transform, Laplace Transform etc. and their uses.

To introduce Calculus of variations.

MAT 1036- Mechanics and Tensor

To differentiate the properties of motion in various coordinate systems viz. cylindrical, spherical, conical surfaces.

 To handle various physical laws of motion viz. Carnot's theorem, Kelvin's theorem, Hamiltonian's principle etc with mathematical tools.

 To identify that application of tensors is invaluable to most of the branches of Mathematics, Engineering and Theoretical Physics such Mechanics, Elasticity, Electrodynamics, Relativity etc.

MAT-1046: Real Analysis and Lebesgue Measure

 Understand how Lebesgue measure on R is defined, how measures may be used to construct integrals, know the basic convergence theorems for the Lebesgue integral, the relation between series and the Hilbert space of square integrable functions.

MAT-1056 Numerical Analysis

 Students can find the approximate solutions of boundary value problems by using numerical technique

 Students can identify different types of approximation functions such as trigonometric functions, exponential functions etc.

MAT2016 – Complex Analysis

 It is common to encounter an integral that seems impossible to evaluate but with the knowledge of Residue theorem and its consequences students can make it possible.

 Holonomic functions have the property that they can be uniquely analytically continued to (almost) the entire complex plane. Using the analytic continuation students can understand the behavior of a function at much larger scale by just knowing how the function behaves at a teenie-weenie open disc in the complex plane. This section has a tremendous use in physics and engineering.

 Conformal mapping is an important technique used in complex analysis and has many applications in different physical situations. If the physical problem can be represented by complex functions but the geometric structure becomes inconvenient then by appropriate mapping it can be converted to a problem of convenient geometry. With the help of conformal mapping students can solve boundary value problems that arise in heat conduction, electrostatic potential and fluid flow.

MAT 2026 – Topology

 to identify topological spaces and will be familiar with different types of subsets like open sets, closed sets, neighbourhoods, interior, boundary, derived sets, etc ., together with the ideas of bases, subbases, relative topology, continuous functions and homeomorphisms. They can be able to classify different spaces like first countable, second countable, separable spaces and give the characterization of these spaces using some important results like Urysohn's lemma, Tietze extension theorem.

 To use the idea of compactness and connectedness and give their different characterizations.

 To explain the product topology and its relationship with compactness, connectedness, countability, etc. They can also provide examples of metrizable spaces, and can explain the relationship between embedding and metrization.

MAT 2036 Functional Analysis

 To identify normed linear spaces and Banach spaces and can provide and construct examples of these spaces. They will be familiar with different types of convergence of series in normed linear spaces and various types of subsets like absorbing, balanced, convex sets, convex hull, linear hull of a subset etc. They can be able to classify finite dimensional spaces and can provide different characteristics of such spaces.

 To identify inner product spaces, Hilbert spaces and can provide examples of such spaces. They can classify different types of operators like normal, unitary, self adjoint, positive, compact operators with examples and

characteristics. They will also be able to explain the underlying idea of fixed point theorem, extreme points and Krein Milman theorem.

MAT-2046 Number theory

 The main objective of introducing this paper in the PG syllabus is that number theory is extensively used in the financial and defence sector of a country whereas Graph theory serves as an Mathematical model in any system involving a binary relation. Both Number and Graph Theory are used in computer application

 Students can use the concept of primitive roots and indices for solvability of congruence of higher order. The students can explain the quadratic reciprocity law using Legendere's and Jacobi's symbol.

MAT 2056– Differential Equation

 To identify and know the methods of finding solutions of differential equations in explicit form

 The subject Partial Differential equations have wide range of applications in engineering and technological sciences. Using Partial Differential equations, students can solve wave equations, heat equations, Laplace equations etc.

MAT-3016 Mathematical Logic

 This course explores the logical and foundational aspects of mathematics. A special emphasis is given in understanding and writing proofs.

 Students learn to manipulate mathematical statements involving quantifiers and logical connectives.

 Students are able to write clear and rigorous proofs or disproofs of mathematical statements utilizing several proof techniques including direct proof, proof by contrapositive, proof by contradiction, proof by cases, mathematical induction, and by providing examples or counterexamples.

MAT-3016 Continuum Mechanics and Hydrodynamics

 The objective of this course is to explain the fundamental concept of the principles of classical continuum physics as applied to elasticity and fluid mechanics.

 Using the theory of Cartesian tensors and matrices the students can realize the physical stress components, deformation, emphasizing force balance and constitutive models with applications in different branches of engineering and technology.

MAT-3026 Special Theory of Relativity

 To find difference between classical relativity and Einstein's relativity. They will know the postulates of special theory of relativity, Lorentz transformations.

 To use addition law of velocities and its interpretation. They will learn the fact that a clock attached to any moving system runs at different rhythm from a stationary clock; and a measuring rod attached to any moving system changes its length according to the velocity of the system.

MAT-3036 Operations Research

 The subject operation Research originated during World War II where Mathematical techniques were used to tackle the problem of maximum utilization of limited military resources.

 Students studying this subject learn the technique of maximizing the profit and minimizing the cost.

MAT-3036: Programming in C

 Computer programming nowadays has become an integral part of any mathematics syllabus of M.Sc level particularly due to handle nonlinear equations as those can not be handled analytically. Keeping this aspect in mind the department introduced a paper on Programming since early 90s. This course has equipped the students

to carry out long and tedious computational works particularly when they go for research in some application oriented field after completion of M.Sc degree.

MAT 3046 Measure Theory

 to identify the measure space and its properties

MAT-3046 Special functions and Partial differential equations

 The subject Partial Differential equations have wide range of applications in engineering and technological sciences. Using Partial Differential equations, students can solve wave equations, heat equations, Laplace equations etc.

MAT-3056 Project

MAT-4016 Fuzzy Sets and Systems

 Be able to distinguish between the crisp set and fuzzy set concepts through the learned differences between the crisp set characteristic function and the fuzzy set membership function, able to draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership functions respectively. Become aware of the use of fuzzy inference systems in the design of intelligent or humanistic systems.

MAT-4016 Space Dynamics

 The method of launching satellite can be known by studying the syllabus

 For the determination of the orbit of a satellite the primary objectives are to know the elements of the orbit involved in the system

 For orbit determination the prerequisite of it are to identify the distances of perigee and apogee which can be properly known by means of such studies.

MAT-4026: Advanced Functional Analysis

 Facility with the main, big theorems of functional analysis, the notion of C*-algebra and various examples of C*-algebras, and their basic properties

MAT- 4026 Dynamical Systems and Fractal Geometry

 Dynamical systems and Fractal Geometry is an interdisciplinary topic which became popular in late 1970s. Mainly stability aspect of nonlinear systems are discussed with taking tools from topology, functional analysis, linear algebra, differential equation, computer etc. With the introduction of this paper, the students has got acquaintance with many interesting and challenging real life problems including bio-science which are dealt with many geometrical and other tools.

 This course will enable the students to pursue for research in many application oriented fields like bio-science.

MAT-4036 Advanced Algebra

 Based on the UGC syllabus the paper is prepared in a logical, systematic and simple way so that the students can have the ideas on some advanced topic in Algebra like, Sylow's theorems, finitely generated abelian groups, free groups, free abelian groups, presentation of a group, primitive rings, radical, completely reducible rings as well as some advanced algebraic structures like poset, lattice and module.

MAT-4036 Fluid Dynamics

 Students will come across many laws of Physics in Mathematical form. For instance, law of conservation of mass in terms of Equation of continuity; law of conservation of momentum in terms of Equation of motion; law of conservation of energy in terms of Energy equation etc.

MAT-4046 Algebraic Topology

 To explain the concepts of fundamental group, homotopy of maps.

 To calculate fundamental group using Van Kampen's theorem, fixed point theorem.

MAT-4046 General Theory of Relativity and Cosmology

 To use Riemannian Geometry in Relativity

 To explain the theory of gravitation, principle of covariance and equivalence, equality of inertial and gravitational masses, clock paradox, energy momentum tensor.

 To use Einstein's field equations in empty and in presence of matter and energy modified equations with cosmological constant. They learn the Schwarzscild solution of Einstein's equations, the three crucial tests in relativity viz., advance of perihelion, bending of light rays and gravitational red-shift in spectral lines.