## PG & RESEARCH DEPARTMENT OF MATHEMATICS

### Programme: B.Sc. Mathematics

| PO No. | Programme Outcomes<br>*Upon completion of the B.Sc. Degree Programme, the graduate will be able to* |
|---|---|
| PO 1: | Apply the basic concepts of mathematics to formulate and evaluate the real-world problems. |
| PO 2: | Utilize the mathematical principles to think analytically, systematically and critically while solving problems and making decisions. |
| PO 3: | Construct the logical arguments and apply the laws of logic in mathematical proofs. |
| PO 4: | Learn and apply the appropriate methods and procedures in Matlab, SPSS etc. |
| PO 5: | Pursue careers in academia, industry and the other areas of mathematics. |

| PSO No. | Programme Specific Outcomes<br>*Upon completion of these courses the student would* |
|---|---|
| PSO 1: | Identify the applications of mathematics in other disciplines and society. |
| PSO 2: | Formulate and develop mathematical arguments in a logical manner. |
| PSO 3: | Able to identify, locate and solve the issue or problem effectively. |
| PSO 4: | Acquire good knowledge in advanced areas of mathematics. |
| PSO 5: | Understand and formulate quantitative models arising in social science, business and other contexts. |

| Course Title | CORE COURSE I : DIFFERENTIAL CALCULUS AND TRIGONOMETRY | | |
|---|---|---|---|
| **Code** | **MUA** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Apply Leibnitz's Theorem for finding the $n^{th}$ derivative of product of functions. | PSO2,3,4 | U |
| CO-2 | Evaluate envelopes and curvatures of plane curves. | PSO1,2,3,4 | AP |
| CO-3 | Compute maxima and minima of plane curves. . | PSO1,2,3,4 | U |
| CO-4 | Interpret the relation between circular and hyperbolic functions | PSO1,2,3,4 | U |
| CO-5 | Find the sum of infinite series using appropriate methods | PSO1,2,3,4 | U |

| Course Title | CORE COURSE II : CLASSICAL ALGEBRA | | |
|---|---|---|---|
| **Code** | **MUB** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Understand the aspects of classical algebraic structures. | PSO2 | U,KN |
| CO-2 | Find the nature of the roots of the equations. | PSO3 | KN,AN,E |
| CO-3 | Solve and apply the inequalities. | PSO3 | E,AN,AP |
| CO-4 | Find the inverse and rank of the matrix. | PSO2,3 | E,AP |
| CO-5 | Calculate the Eigen values and vectors of a matrix and apply the C-H theorem for finding the inverse of a matrix. | PSO2,3,4 | E,AP |

| Course Title | CORE COURSE III : INTEGRAL CALCULUS | | |
|---|---|---|---|
| **Code** | **MUC** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Find the solutions of the integral. | PSO2,3 | CN,E |
| CO-2 | Solve the integration by parts. | PSO2,3 | E |
| CO-3 | Find the area of plane curves using Cartesian and polar coordinates | PSO2,3,1,5 | KN,E |
| CO-4 | Find the area by changing the given order of integration | PSO 2,3 | U,KN,E |
| CO-5 | Understand the concepts of Beta and Gamma functions | PSO 2,3 | U,KN,E |

| Course Title | CORE COURSE IV: ANALYTICAL GEOMETRY OF THREE DIMENSIONS | | |
|---|---|---|---|
| **Code** | **MUD** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Understand the three dimensional space, angle between lines and planes. | PSO1,3,4,5 | U |
| CO-2 | Find the coplanar lines, skew lines and to find shortest distance between them. | PSO1,3,4,5 | AP |
| CO-3 | Formulate the equation of sphere and their properties. | PSO1,3,4,5 | AP |
| CO-4 | Form the equation of cone with a conic as guiding curve and the tangent lines. | PSO1,3,4,5 | AP |
| CO-5 | Retrieve the equation of cylinder and right circular cylinder. | PSO1,3,4,5 | AP |

| Course Title | CORE COURSE V DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS | | |
|---|---|---|---|
| **Code** | **MUE** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Solve the higher order linear differential equations with constant coefficients. | PSO2,3,4 | KN,EN |
| CO-2 | Solve differential equations by using method of variation of parameters | PSO2,3,4 | CN,EN |
| CO-3 | Find solutions of first order partial differential equations of the standard forms | PSO3,5 | KN,CN,EN |
| CO-4 | Solve the PDE's using Charpit's method. | PSO1,3 | U,KN,EN |
| CO-5 | Apply the techniques of Laplace transform and inverse Laplace transform | PSO2,3,4 | U,CN,KN,EN |

| Course Title | **CORE COURSE VI** VECTOR CALCULUS AND FOURIER SERIES | | |
|---|---|---|---|
| **Code** | **MUF** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Explain the concepts of differentiation of vector field. | PSO1,3,4 | U,C,KN |
| CO-2 | Integrate the vector functions over curves and surfaces. | PSO1,2,3,4 | U,E |
| CO-3 | Compute integrals using Green's theorem, Stoke's theorem and the divergence theorem. | PSO1,2,3,4 | U,E,AP |
| CO-4 | Solve the wave equations, Laplace equations using Fourier series | PSO1,2,3,5 | U,E,AP |
| CO-5 | Derive the Fourier series to the periodic signals in half range. | PSO1,2,3,5 | U,E,AP |

| Course Title | CORE COURSE VII SEQUENCES AND SERIES | | |
|---|---|---|---|
| **Code** | **MUG** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Find the convergence of sequences | PSO4 | U,E |
| CO-2 | Evaluate the limits and describe the behavior of monotonic sequences | PSO1,2,3,4 | U,E,CN |
| CO-3 | Interpret the concepts of subsequences and Cauchy sequences. | PSO1,2,3,4 | U,CN,KN |
| CO-4 | Discuss the convergence or divergence of series using various tests | PSO1,2,3,5 | U,AN |
| CO-5 | Compute the absolute convergence of series. | PSO1,2,3,5 | KN,E |

| Course Title | CORE COURSE VIII NUMBER THEORY | | |
|---|---|---|---|
| **Code** | **MUH** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Find the divisor, sum and product of a given natural number | PSO2,3,4 | CN,EN |
| CO-2 | Gain the knowledge of number theoretic functions | PSO3,4 | KN,AN |
| CO-3 | Interpret the famous conjectures in number theory | PSO2,3,4 | CN,AN |
| CO-4 | Solve the system of linear congruences using the chinese remainder theorem. | PSO1,2,3,4 | CN,EN |
| CO-5 | Apply the law of quadratic reciprocity to classify numbers as quadratic residues and quadratic non-residues | PSO1,2,3,4 | AN,AP, EN |

| Course Title | CORE COURSE IX ALGEBRA | | |
|---|---|---|---|
| **Code** | **MUI** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Gain the knowledge of sets, mapping, relations, groups and subgroups. | PSO2,4,5 | U,KN |
| CO-2 | Interpret the notion of normal groups and isomorphism. | PSO2,4 | U,C |
| CO-3 | Analyze the concepts of homomorphism and isomorphism for rings and field. | PSO2,4 | U,AN |
| CO-4 | Recognize the facts of vector space and linear independence. | PSO1,2,3,4 | U,C |
| CO-5 | Calculate the basis, dimension, matrix of the linear transformation and inner product space | PSO2,4 | U,E |

| Course Title | CORE COURSE X REAL ANALYSIS | | |
|---|---|---|---|
| **Code** | **MUJ** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Apply the order completeness property. | PSO2,3,4 | AN,KN |
| CO-2 | Differentiate the continuity and discontinuity of functions. | PSO1,2,3,45 | E,AN,AP |
| CO-3 | Find the derivative of a given function. | PSO 1,3,4,5 | E,AN,AP |
| CO-4 | Demonstrate the mean value theorems. | PSO1,2,3,4 | E,AN,AP, KN |
| CO-5 | Interpret the integrability of functions | PSO1,3,4,5 | E,AN,AP, KN,C |

| Course Title | CORE COURSE XI MECHANICS | | |
|---|---|---|---|
| **Code** | **MUK** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Demonstrate the Equilibrium of a particle in static and dynamic. | PSO 3,5 | UN,KN |
| CO-2 | Understand the Hanging strings and suspension bridge. | PSO 1,2,3,4 | KN, CN |
| CO-3 | Acquire knowledge in the Impact of spheres and Impulsive forces. | PSO 3,4 | KN, CN |
| CO-4 | Interpret Central Orbit and Moment of Inertia. | PSO 2,3 | CN,EN,AN |
| CO-5 | Solve the practical problems of static and dynamic. | PSO 1,2,3,4 | CN,AN |

| Course Title | CORE COURSE XII COMPLEX ANLAYSIS | | |
|---|---|---|---|
| **Code** | **MUL** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Understand the basic concepts of Cauchy-Riemann equations in Cartesian and polar coordinates. | PSO2,3,4 | AN,E,KN,AP |
| CO-2 | Interpret the analytic functions, harmonic functions, elementary and bilinear transformation concepts. | PSO2,3,4 | AN,E,KN, AP |
| CO-3 | Apply the theorems using complex integration. | PSO1,2,3,4,5 | AP,AN,E |
| CO-4 | Expand the Taylor's and Laurent's series of functions. | PSO1,2,3,4,5 | AN,AP,E, KN |
| CO-5 | Solve the definite integrals using the concepts of residues. | PSO1,2,3,4 | E,AN,AP, KN |

| Course Title | CORE COURSE XIII NUMERICAL METHODS WITH C PROGRAMMING THEORY | | |
|---|---|---|---|
| **Code** | **MUM** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Find the variables, constants, expressions and operators. | PSO2,4,5 | U,KN |
| CO-2 | Use functions and arrays. | PSO2 | U,KN |
| CO-3 | Write the programmes on arithmetic operations and recursion. | PSO2,5 | U,AP,KN |
| CO-4 | Evaluate the linear equations and matrices numerically. | PSO2 | U,AP |
| CO-5 | Solve simultaneous system of equations using numerical techniques. | PSO2 | U,AP |

| Course Title | CORE COURSE XIV ASTRONOMY | | |
|---|---|---|---|
| **Code** | **MUO** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Perform calculations on celestial bodies. | PSO1,3,4 | U |
| CO-2 | Compare our galaxy with other galaxies. | PSO1,3,4 | U |
| CO-3 | Apply the principles and fundamental techniques of the astronomy. | PSO1,5 | AP |
| CO-4 | Analyze the size, age structure and motion of the universe over all using cosmological models. | PSO1,3,4 | AN |
| CO-5 | Understand the phases of moon and occurrence of Eclipses. | PSO1,3,4 | U |

| Course Title | MAJOR BASED ELECTIVE I OPERATION RESEARCH | | |
|---|---|---|---|
| **Code** | **MUE3** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Analyze and solve linear programming models of real life situations | PSO2,3 | CN,EN |
| CO-2 | Understand the problem solving method of Simplex and Big M Method. | PSO2,3 | EN |
| CO-3 | Exhibit the applications of Transportation Problem. | PSO2,3,1,5 | KN,EN |
| CO-4 | Solve Assignment problems. | PSO2,3 | U,KN, EN |
| CO-5 | Use PERT and CPM techniques in solving Network Analysis problems | PSO2,3 | U,KN, EN |

| Course Title | MAJOR BASED ELECTIVE II STOCHASTIC PROCESS | | |
|---|---|---|---|
| **Code** | **MUE4** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Carry out derivations involving conditional probability distribution and conditional expectations. | PSO2 | U,E |
| CO-2 | Define basic concepts from the theory of Markov chains and present proofs for the most important theorems. | PSO1,2,3,4,5 | C,E |
| CO-3 | Identify classes of states in Markov chains and characterize the classes. | PSO1,2,3,5 | KN,E,AP |
| CO-4 | Interpret the renewal process and theory. | PSO2,3 | KN,E |
| CO-5 | understand of the theoretical background of Queuing System | PSO2,3 | KN,E,AP |

| Course Title | MAJOR BASED ELECTIVE III GRAPH THEORY | | |
|---|---|---|---|
| **Code** | **MUE5** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Understand the concepts of graphs upto isomorphism. | PSO 2 | KN,AN |
| CO-2 | Acquire the knowledge of degree sequences, connectedness and components of graphs. | PSO1 | KN,AN |
| CO-3 | Demonstrate the characterization of Eulerian, Hamiltonian and trees. | PSO4 | AN,AP |
| CO-4 | Interpret the planarity of graphs. | PSO4 | AN,AP |
| CO-5 | Identify the chromatic number, index and polynomial of a graph. | PSO1 | AN,E |

# A.D.M. COLLEGE FOR WOMEN

(Autonomous)

*Affiliated to Bharathidasan University*

(Nationally Accredited with "A" Grade by NAAC – 3rd Cycle)

**NAGAPATTINAM 611 001.**


## PG & RESEARCH DEPARTMENT OF MATHEMATICS

### Programme: M.Sc. Mathematics

| PO No. | Programme Outcomes<br>*Upon completion of the M.Sc., Degree Programme, the graduate will be able to* |
|---|---|
| PO 1: | To understand the fundamental axioms in mathematics and capable of developing ideas based on them. |
| PO 2: | To maintain and develop the problem-solving skills. |
| PO 3: | To use the mathematical ideas in modelling the real world problems. |
| PO 4: | To analyze mathematical reasoning. |
| PO 5: | To demonstrate and communicate the mathematical concepts clearly. |
| PO 6: | To perform research activities independently towards Ph.D Degree in Mathematics. |

| PSO No. | Programme Specific Outcomes<br>*Upon completion of these courses the student would* |
|---|---|
| PSO 1: | Connect Mathematics to real life problems in their lives. |
| PSO 2: | Do intensive research in pure and applied Mathematics. |
| PSO 3: | Analyze problems of industry and Society. |
| PSO 4: | Model and provide solutions to scientific and real life situation. |
| PSO 5: | Prepare for a career in which critical thinking is a central feature. |

| Course Title | CORE COURSE I : ALGEBRA | | |
|---|---|---|---|
| **Code** | **PGMA** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Understand Sylow's theorem and its applications. | PSO2 | An |
| CO-2 | Analyze the various types of polynomials. | PSO1 | An |
| CO-3 | Develop the knowledge about modules. | PSO2 | Ap |
| CO-4 | Evaluate the roots and characteristics of polynomials. | PSO1 | An |
| CO-5 | Apply finite fields in Galois Theory | PSO1<br>PSO2 | An & Ap |

| Course Title | CORE COURSE II : REAL ANALYSIS | | |
|---|---|---|---|
| **Code** | **PGMB** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Acquire the basic topological properties on metric spaces. | PSO1 | U |
| CO-2 | Interpret the continuity and discontinuity of functions. | PSO1 | U |
| CO-3 | Analyze the Riemann - Stieltjes integral and their properties. | PSO1 | AN |
| CO-4 | Develop the knowledge of sequence and series of functions. | PSO1 | U |
| CO-5 | Understand functions of several variables. | PSO1 | AN |

| Course Title | CORE COURSE III : ORDINARY DIFFERENTIAL EQUATIONS | | |
|---|---|---|---|
| **Code** | **PGMC** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Obtain the solutions of ordinary differential equations. | PSO1 | U |
| CO-2 | Evaluate the special functions. | PSO2 | AP |
| CO-3 | Analyze the behavior of the solutions of the ODE. | PSO1<br>PSO2 | AP |
| CO-4 | Discuss the properties of boundary value problems. | PSO1,2,4 | AP |
| CO-5 | Solve the system of nonlinear equations. | PSO1,4 | AP |

| Course Title | CORE COURSE IV: ADVANCED GRAPH THEORY | | |
|---|---|---|---|
| **Code** | **PGMD** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Analyze the automorphism and operations on graphs. | PSO1 | U |
| CO-2 | Discuss the characterization, centers and centroids of trees. | PSO1 | U |
| CO-3 | Find the independent sets and matchings of graphs, Eulerian and Hamiltonian graphs. | PSO1,2 | U,AN |
| CO-4 | Color the graphs and find the chromatic polynomial. | PSO1,4 | AP |
| CO-5 | Interpret the planar and non-planar graphs. | PSO1,2 | AP |

| Course Title | ELECTIVE COURSE- I - ADVANCED NUMERICAL ANALYSIS | | |
|---|---|---|---|
| **Code** | **PGME1** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Solve transcendental and polynomial equations | PSO1 | U |
| CO-2 | Determine the solution of linear equations. | PSO1 | AP |
| CO-3 | Evaluate the higher order interpolation. | PSO1,4 | AP |
| CO-4 | Estimate the numerical differentiation and integration. | PSO1 | U |
| CO-5 | Interpret the methods of solving integration numerically. | PSO1,3 | AP |

| Course Title | CORE COURSE VII: PARTIAL DIFFERENTIAL EQUATIONS | | |
|---|---|---|---|
| **Code** | **PGMG** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Classify the PDE. | PSO1 | U |
| CO-2 | Apply Charpit’s and Jacobi’s method for solving PDE. | PSO1 | U |
| CO-3 | Solve second order and higher order PDE. | PSO1 | U |
| CO-4 | Evaluate non Linear equations of the second order. | PSO1,4 | AP |
| CO-5 | Compute boundary value problems. | PSO1,3 | AP |

| Course Title | CORE COURSE VIII: CLASSICAL DYNAMICS | | |
|---|---|---|---|
| **Code** | **PGMH** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Analyze the mechanical system of particles. | PSO1 | AN |
| CO-2 | Solve the Lagrange's equations of motion for the set of generalized coordinates. | PSO1 | U |
| CO-3 | Apply Lagrange's equations on various functions. | PSO1 | AP |
| CO-4 | Interpret Hamilton's equations and its principles. | PSO2 | U |
| CO-5 | Retrieve Hamilton – Jacobi Equation. | PSO1 | AP |

| Course Title | MAJOR BASED ELECTIVE COURSE II : FUZZY SETS AND ITS APPLICATIONS | | |
|---|---|---|---|
| **Code** | **PGME2** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Discuss the properties and extension principles of fuzzy sets. | PSO 1,2,3,4,5 | KN,CN |
| CO-2 | Apply the mathematical operations on fuzzy sets. | PSO 1,3,4 | KN,EN |
| CO-3 | Construct the arithmetic operations on fuzzy numbers. | PSO 1,4 | CN,EN |
| CO-4 | Interpret the relations on fuzzy sets. | PSO 1,2,3,4 | KN,AN |
| CO-5 | Analyze fuzzy concepts in decision making problems. | PSO 2,3,4 | AN,EN |

| Course Title | CORE COURSE XI : MEASURE AND INTEGRATION | | |
|---|---|---|---|
| **Code** | **PGMI** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Find the Lebesgue measure of measurable sets. | PSO2,5 | KN,CN |
| CO-2 | Discuss the integration of non-negative functions. | PSO2,5 | KN,CN,AN |
| CO-3 | Analyze abstract measure spaces. | PSO2,4,5 | CN,AN |
| CO-4 | Demonstrate Hahn decomposition theorem and signed measure. | PSO2,5 | CN,AN |
| CO-5 | Compute product measure. | PSO2,5 | KN,EN |

| Course Title | CORE COURSE X: TOPOLOGY | | |
|---|---|---|---|
| **Code** | **PGMJ** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Analyze the fundamental concepts of general topology. | PSO1,2 | U,KN,AN,AP |
| CO-2 | Determine the types of topological spaces and their properties. | PSO2 | U,KN,AN |
| CO-3 | Discuss Uryzohn's lemma and the Tietze Extension Theorem. | PSO1,2,4 | U,KN,AN,AP |
| CO-4 | Demonstrate Tychonoff theorem. | PSO2,4 | U,AN,AP,KN |
| CO-5 | Compute the complete and compactness in metric spaces. | PSO 2,4 | U,AN,AP,KN,E |

| Course Title | CORE COURSE XI: INTEGRAL EQUATIONS AND TRANSFORMS | | |
|---|---|---|---|
| **Code** | **PGMK** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Solve the linear integral equations. | PSO1 | E,AP |
| CO-2 | Find the solutions of Volterra and Fredholm integral equations. | PSO1,2 | C,E |
| CO-3 | Demonstrate the variational problems on moving boundaries and fixed boundaries. | PSO3 | KN,C |
| CO-4 | Evaluate the Fourier transform , finite sine and cosine transforms. | PSO1,2,3 | U,KN,AP |
| CO-5 | Apply Fourier transform in initial and boundary value problems. | PSO1,2,3 | U,KN,AP |

| Course Title | MAJOR BASED ELECTIVE III: MATHEMATICAL MODELLING | | |
|---|---|---|---|
| **Code** | **PGME3** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Create models on linear growth and decay of any system. | PSO1,2,3,4 | U,KN,AP |
| CO-2 | Form mathematical modeling in epidemics in population. | PSO3,4 | U,KN,E |
| CO-3 | Design mathematical modeling in any type of motions. | PSO1,3,4 | U,KN,C,AN |
| CO-4 | Solve problems in dynamics and genetics using modeling. | PSO2,3 | U,E |
| CO-5 | Demonstrate various real life situations through graphs. | PSO1,3,4,5 | U,CN,KN |

| Course Title | MAJOR BASED ELECTIVE IV: ADVANCED OPERATION RESEARCH | | |
|---|---|---|---|
| **Code** | **PGME4** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Write the algorithms in integer programming problem. | PSO1,3 | KN,C |
| CO-2 | Apply the OR techniques in various models. | PSO1,4 | CN,E |
| CO-3 | Analyze the problems on decision theory and game theory. | PSO3,4 | CN,AN |
| CO-4 | Optimize solutions of inventory models. | PSO3,4 | EN,AN,AP |
| CO-5 | Interpret the concepts of non-linear programming problems. | PSO2 | AN,AP |

| CourseTitle | CORE COURSE XII : FUNCTIONAL ANALYSIS | | |
|---|---|---|---|
| **Code** | **PGML** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Discuss the concept of normed linear spaces, dual spaces, weak convergence. | PSO2,4 | U,KN,AN |
| CO-2 | Apply the idea of the Hahn Banach theorem and open mapping theorem. | PSO2,3,4 | U,KN,AN,E |
| CO-3 | Analyze linear operators on Hilbert space. | PSO2,3,4,5 | U,KN,AN |
| CO-4 | Evaluate orthonormal basis. | PSO2,4 | E,AN |
| CO-5 | Demonstrate the commutative Banach algebras. | PSO 1,2,3 | U,AN,C |

| Course Title | CORE COURSE XIII : ADVANCED PROBABILITY THEORY | | |
|---|---|---|---|
| **Code** | **PGMM** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Interpret the field and σ - fields | PSO1,3 | U,CN |
| CO-2 | Analyze the probability spaces. | PSO3 | CN,AN |
| CO-3 | Apply the concepts of random variables and distributions. | PSO2 | U,KN,CN |
| CO-4 | Describe the ideas of expectation and characteristic functions. | PSO4 | U,KN,CN |
| CO-5 | Demonstrate the convergence of random variables. | PSO1,2,3 | KN,CN |

| Course Title | CORE COURSE XIV : FLUID DYNAMICS | | |
|---|---|---|---|
| **Code** | **PGMN** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Discuss the behavior of fluids in motion. | PSO1,2 | U,C,AN |
| CO-2 | Demonstrate the changes in flow when sphere of cylinder is introduced. | PSO1,2,3 | CN,AN |
| CO-3 | Estimate the applications of two dimensional flow. | PSO3,4 | CN,EN |
| CO-4 | Apply the stress components on viscous flow. | PSO3,4 | CN, E |
| CO-5 | Solve problems in viscous flow and describe the energy dissipation. | PSO 2,4 | EN,AP |

| Course Title | MAJOR BASED ELECTIVE COURSE V : DIFFERENTIAL GEOMETRY | | |
|---|---|---|---|
| **Code** | **PGME5** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | Discuss the concept of graphs and level sets-vector fields. | PSO1,2 | U,KN,AN |
| CO-2 | Analyze surfaces and vector field on surfaces. | PSO 2 | U,KN,AN |
| CO-3 | Apply the properties of geodesics. | PSO1,2 | U.KN,AN |
| CO-4 | Interpret the scope of develop tables, minimal and ruled surfaces. | PSO1,2 | U,KN,E |
| CO-5 | Compute the compactness and completeness of surfaces. | PSO1,.2,5 | U,KN,AN |

## PG & RESEARCH DEPARTMENT OF MATHEMATICS

### Programme: M.Phil. Mathematics

| PO No. | Programme Outcomes<br>*Upon completion of the M.Phil., Degree Programme, the graduate will be able to* |
|---|---|
| PO 1: | Mathematical Knowledge: Various branches of Mathematics are so selected and designed for M.Phil Mathematics course aiming at mathematical reasoning, sophistication in thing and acquaintance with enough number of subjects including application oriented ones to suit the present needs of various allied branches in Engineering and Science as well as provision of opportunities to pursue research in higher mathematics. |
| PO 2: | Problem Solving Skills: This programme also offers training in problem solving skills. |
| PO 3: | Analytical & Logical thinking: The student will be able to develop logical reasoning techniques and Techniques for analyzing the situation. |
| PO 4: | Learning Number theoretical concepts: Student will learn some important concepts in Number theory that are useful in Cryptography related to the advanced area of research namely Network security. |
| PO 5: | Understanding Ability: Student will develop ability for generation of mathematical model to a given real life situation as well as learning new areas of mathematics in future either for teaching or for research. |

| PSO No. | Programme Specific Outcomes<br>*Upon completion of these courses the student would* |
|---|---|
| PSO 1: | Connect Mathematics to real life problems in their lives. |
| PSO 2: | Do intensive research in pure and applied Mathematics. |
| PSO 3: | Analyze problems of industry and Society. |
| PSO 4: | Model and provide solutions to scientific and real life situation. |
| PSO 5: | Prepare for a career in which critical thinking is a central feature. |

| Course Title | CORE COURSE I : ALGEBRA AND ANALYSIS | | |
|---|---|---|---|
| **Code** | **RMA** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | To get a strong background of graph theory concepts. | PSO2,5 | U,KN,CN |
| CO-2 | To apply principles and concepts of graph theory in practical situation. | PSO2 | U,KN |
| CO-3 | To know the definitions of standard terms in topology. | PSO4 | U,CN |
| CO-4 | To know a variety of examples and counter example. | PSO1,4 | EN,AN |
| CO-5 | To get a strong knowledge of solving a linear system. | PSO1,2,3 | AN,AP |

| Course Title | CORE COURSE II : RESEARCH METHODOLOGY | | |
|---|---|---|---|
| **Code** | **RMB** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | To familiar with rings and fields and understand the structure theory of modules over a Euclidean domain along with its implications. | PSO2,5 | U,CN,KN |
| CO-2 | To know the various theorems and their mathematical concepts. | PSO1,2,5 | KN,AN,AP |
| CO-3 | To have a fundamental understanding of Fourier transforms | PSO1,2,3 | KN,CN |
| CO-4 | To investigate the concepts of transformations | PSO1,2 | AN,AP |
| CO-5 | To use Riemann mapping theorem in applications. | PSO3,4 | U,KN,CN |

| Course Title | CORE COURSE III : TEACHING AND LEARNING SKILLS | | |
|---|---|---|---|
| **Code** | **RMC** | | |
| **CO No.** | **Course Outcomes** | **PSOs Addressed** | **Cognitive Level** |
| CO-1 | To understand the operations and use of computers and common Accessories. | PSO1,3,4,5 | U |
| CO-2 | To develop skills of ICT and apply them in teaching learning context and Research. | PSO3,4,5 | AP |
| CO-3 | To appreciate the role of ICT in teaching, learning and Research. | PSO3,4,5 | U |
| CO-4 | To acquire the knowledge of Instructional Technology and its Applications. | PSO3,4,5 | AP |
| CO-5 | To develop different teaching skills for putting the content across to targeted. | PSO3,4,5 | AN |