Introduction:

The institution practices a blended learning system and it is ensured that the teaching-learning process is updated as per new guidelines issued by the UGC/NAAC/parent University. The faculty stay abreast of latest developments in the field of education. IQAC of the institution is a key force in guiding the teaching community in guaranteeing the introduction and implementation of outcome-based teaching and learning. As **KASCC** is affiliated to the **Gulbarga University of Kalaburagi**, the institution is bound by the norms stipulated in this regard by the latter. In compliance with the affiliated University's norms, the IQAC not only ensures the enumeration of PO/PSO/COs of all UG and PG programs and courses but also the implementation of innovative ways for outcome attainment and mapping.

Process of Establishing the PO-PSO-CO:

The university has implemented outcome based education from 2020 and the POs and COs are listed in the syllabus for each programs. A committee comprising of HODs, faculty advisors and IQAC members prepares a final version by compiling the data given in syllabus.

Statements of PO Program outcomes:

Describe what students are expected to know and would be able to do by the time of graduation. These relate to the skills, knowledge, and behaviours that students acquire as they progress through the program.

POSTGRADUATE PROGRAMME - M. Sc – Mathematics	
PO1	**Problem Solving and Research Skill:** Carry out research/investigation and development work to solve practical problems
PO2	**Lifelong Learning:** Demonstrate a degree of mastery over the area as per the specialization of the program.
PO3	**Scholarship of knowledge:** Apply advanced knowledge and skills appropriate to the discipline.
PO4	**Collaborative and Multidisciplinary work:** Think critically and apply appropriate logic, analysis, judgment and decision making and to function as an effective member or leader of teams to achieve common goals.
PO5	**Communication:** Write and present a substantial technical report/document.

PROGRAMME SPECIFIC OUTCOMES (PSO):

PSO1: Understand notion and concepts of set, function, real and complex number system.

PSO2. Understand the concepts of continuous function, limit, continuity, vector space, metric space, normed space, inner product space, topology, group theory, system of linear equation etc.

PSO3. Understand the concept of ordinary and partial differential equation and can solve both ODE and PDE by using different methods.

PSO4. Increase problem solving technique by using the concept of numerical analysis, complex analysis, graph theory, number theory, fluid dynamics, mathematical methods.

PSO5. Understand the recent development in universe and cosmology by using the concepts of theory of relativity.

PSO6. Programming in C and Mathematica helps in building technical, computing web services, including numerical, symbolic, and graphical applications that solve technical problems quickly and easily

COURSE OUTCOME (COs):

COURSE CODE	NAME OF THE COURSE	COURSE OUTCOME(COs)
MSM 101	**Real Analysis**	CO1. Introduction to the notion of set and functions
		CO2. Understand the properties of real number system
		CO3. Introduction to the concept of sequence and limit, cantor set, Metric space.
		CO4.Understand the concepts of continuous and discontinuous function.
		CO5.Introduction and applications of Mean value theorem.
		CO6.Understand the properties of Heine-Borel theorem, Cantors theorem
MSM 102	**Algebra-I**	CO1.Understand definition and example of group, some special groups, subgroups, normal subgroup and their properties, center and normalizer of a group, cyclic group, class equation of a group, Sylow's theorems and their applications and classification of groups.
		CO2. They will learn about Simple group, separable and non-separable group.

		CO3. They will learn Definition and example of Ring, Ideal, prime and maximal ideal, integral domain, Euclidian domain, PID, UFD, reducibility of polynomial ring etc.
		CO4. They will learn the basic concept and properties of finite field.
MSM 103	**Ordinary Differential Equations**	CO1.Concept of Differential Equation
		CO2. Classification of differential equation according to linearity and order.
		CO3. Solution of Differential equation interpretation.
		CO4. Using integrating factor, Separable and Homogeneous equations can be convert to exact differential Equation.
MSM 104	**Discrete Mathematics**	CO1. Explains permutation notion.
		CO2. Use mathematical induction method in proofs.
		CO3. Use inclusion-exclusion principle.
		CO4. list combinatorial tools and solve related problems.
		CO5. Solve problems via pigeonhole principle.
MSM 105	**Topology**	CO1.They will learn about countable and uncountable sets, Cantor's theorem and continuum hypothesis, Zorn's lemma and well ordering theorem and definition and examples of topology.
		CO2. They will learn about base and sub base of topology, ordered, product and subspace topology and their relation.
		CO3. They will learn about the closed set, closure, derive set, and limit point and boundary of a set.
		CO4. They will learn the countable and separation axioms of topology.
		CO5. Understand about the basic properties of compactness.
		CO6. Learn about connected space and component.
MSM 106	**Operation Research**	CO1.Identify and develop Operational research models from the verbal description of the real system
		CO2. Understand the mathematical tools they are needed to solve optimization problems.
		CO3.Use mathematical software to solve the proposed models
		CO4.Develop a report that describe the models and solving Techniques
		CO5. Analyze the result and propose recommendations in language, understandable to the decision making processes.

MSM 201	**Partial Differential Equation**	CO1. Partial differential equations have a remarkable ability to predict the world around us.
		CO2. They can describe exponential growth and decay.
		CO3. Partial differential equation helps in calculating the population growth of a species or the change in investment return over time.
		CO4.They are also used in medicine estimation for modeling cancer cells growth
MSM 202	**Algebra-II**	CO1. Introduction to basic concepts of system of linear Equations.
		CO2. Understand the concepts of vector space, basis and dimension.
		CO3. Study of linear transformation, representation of linear Transformation by matrices.
		CO4. Introduction to canonical product, Diagonalization, orthogonality, inner product space etc.
		CO5. Increase problem solving technique like finding eigen value, eigen vectors, linear dependence, independence, rank and nullity etc.
MSM 203	**Programming in C**	CO1. As a middle level language ,C program combines both high level and low level languages.
		CO2.It can be used for scripting for drivers and software applications and kernels.
		CO3. Companies like Facebook, Google, etc use C for operating systems, games, embedded technology, etc.
MSM 204	**Complex Analysis**	CO1. Introduction to the basic concept and properties of complex numbers.
		CO2. Study of differentiability, limit, continuity of a complex number.
		CO3. Introduction to analytic function, C-R equation, harmonic function, harmonic conjugate etc.
		CO4. Study of complex Integration, Cauchy Integral theorem, Lioville's theorem power series etc.
		CO5. Understand the concept of singularity
		CO6. Increase problem solving method.
MSM 205	**OET Operation Research**	CO1. recognize the importance and value of Operations Research and linear programming in solving practical problems in industry
		CO2. Interpret the transportation models' solutions and infer solutions to the real-world problems.

		CO3. Recognize and solve game theory and assignment problems.
		CO4. Gain knowledge of drawing project networks for quantitative analysis of projects
		CO5. Know when simulation and dynamic programming can be applied in real world problems.
MSM 301	**Functional Analysis**	CO1.Understand the basic principles of functional analysis
		CO2. Understand the concept of Banach spaces, linear operators and continuous linear functional.
		CO3. Introduction to Hilbert space, operators on Hilbert space.
		CO4. Understand the concept of Representation Theorems and Hahn–Banach extension theorem.
		CO5.Understand the principles of Spectral theory.
MSM 302	**Graph theory**	CO1. Student will learn the definition and example of graphs, various operation on graphs, homomorphism and isomorphism of graphs.
		CO2.They will learn about graph connectivity and complete graph.
		CO3. They will learn various properties of Tree, types of tree and some algorithms. And also cycle and co-cycle space.
		CO4. They will learn basic concept and properties of Eulerian, Hamiltonian and Planer graph.
		CO5. They will learn the basic concept of coloring and covering of graphs and their applications
MSM 303	**Computational Numerical Analysis**	CO1. Problem solving using numerical methods
		CO2. Graphical representation of complex problems to solve accurately
		CO3.Simulation with the help of numerical analysis can be done accurately and easily
		CO4. Helps in multidisciplinary fields like electronics and electrical engineering to design complex circuits using finite difference equations.
MSM 304	**OET Operation Research**	CO1: To understand the methodology of OR problem solving and formulate linear programming problem
		CO2. To develop formulation skills in transportation models and finding solutions
		CO3. To understand the basics in the field of game theory and assignment problems
		CO4. To know how project management techniques help in planning and scheduling a project
		CO5.To know the basics of dynamic programming and simulation.
MSM 305	**Fluid**	CO1. Bernoulli's principle in Fluid Dynamics helps

	Mechanics	in the design ofairplane's wings, which helps in maintaining the pressure over the plane.
		CO2.Fluid Dynamics is used in turbines for the generation of power from hydroelectric dams.
		CO3. Fluid dynamics help in the design of pumps, compressors, and piping used in air conditioning system of homes.
		CO4. The fundamental principles of fluid dynamics are used to explain the mechanisms of biological flows and their interrelationships with physiological processes in health and disease disorder
MSM 401	**Measure Theory**	CO1.To introduce the concepts of measure and integral with respect to a measure
		CO2.To show their basic properties, and to provide a basis for further studies in Mathematical Analysis
		CO3. To construct Lebesgue's measure and learn the theory of Lebesgue integrals on real line.
		CO3. Provides information for effective production planning and maintenance procedures.
MSM 402 MSMMSM	**Graph Theory**	CO1. To understand and apply the fundamental concepts in graph theory.
		CO2.Understand the basics of graph theory and their various properties
		CO3.Model problems using graphs and to solve these problems algorithmically
		CO4.Apply graph theory concepts to solve real world applications like routing, TSP/traffic control, etc.
		CO4.Optimize the solutions to real problems like transport problems etc.,
MSM 403	**Computational Numerical Method**	CO1. Acquire basic knowledge in solving interpolation with equal interval problems by various numerical methods. Estimate the missing terms through interpolation methods.
		CO2. Develop skills in analyzing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method
		CO3. Implement numerical methods for a variety of multidisciplinary applications and a variety of numerical algorithms using appropriate technology
		CO4.Use relevant numerical techniques for interpolation with equal and unequal intervals by using various central difference formulae and code a numerical method in a modern computer language.

		CO5. Apply appropriate numerical methods to solve the problem with most accuracy.
MSM 404	**Differential Geometry**	CO1: Explain differential maps between surfaces and find derivatives of such maps, express definition and parameterization of surfaces.
		CO2: Find the derivative map of an isometry, defines surfaces and their properties
		CO3: Analyze the equivalence of two curves by applying some theorems, express tangent spaces of surfaces.
		CO4: Define the equivalence of two curves, Integrate differential forms on surfaces.
		CO5: Defines the concept of manifolds, give examples of manifolds and investigate their properties.
MSM 405	**Fluid Mechanics-II**	CO1:To derive the equation of conservation of mass and its application
		CO2:To solve kinematic problems such as finding particle paths and stream lines
		CO3:To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
		CO4: To analyze laminar and turbulent flows
MSM-406	**Major Project**	CO1.The students take up research work applying the knowledge and Experience acquired during the course.
		CO2. Increase problem solving technique and get the idea to write a Research paper or article.
		CO3.Will help in their future research work.
		CO4. Introduce to new dimension of knowledge with better Understanding of the subject.

CO- PO MAPPING

Courses /PO's	PO1	PO2	PO3	PO4	PO5
HCT 1.1 Real Analysis	✓	✓	✓	✓	✓
HCT1.2 Algebra-I	✓	✓	✓	✓	✓
HCT 1.3 Ordinary Differential Equation	✓	✓	✓		✓
HCT 1.4 Discrete Mathematics	✓	✓	✓		✓
HCT 1.5 General Topology		✓	✓	✓	✓
SCT 1.1 Operation Research	✓	✓		✓	✓
HCT 2.1 Partial Differential Equation	✓	✓	✓	✓	✓
HCT 2.2 Algebra II		✓	✓	✓	✓
HCT 2.3 Programming in C	✓	✓	✓	✓	✓
SCT 2.1 Complex Analysis	✓	✓	✓		✓
OET 2.1 Basic Statistics	✓		✓	✓	✓
HCT 3.1 Functional Analysis	✓	✓	✓	✓	✓
HCT 3.2 Graph Theory-I			✓		✓
HCT 3.3 Computational Numerical Method-I	✓		✓	✓	✓
SCT 3.2 Fluid Mechanics –I	✓	✓		✓	✓
OET 3.1 Basic Statistics	✓	✓	✓		✓
HCT 4.1 Measure Theory		✓	✓	✓	✓
HCT 4.2 Graph Theory -II		✓	✓	✓	✓
HCT 4.3 Computational Numerical Method-II	✓	✓	✓	✓	
HCT 4.4 Differential Geometry	✓	✓	✓	✓	✓
SCT 4.1 Fluid Mechanics –II	✓	✓	✓	✓	
HCMP 4.5 Major Project	✓	✓		✓	✓

CO- PSO MAPPING

Courses /PO's	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
HCT 1.1 Real Analysis	✓	✓			✓	✓
HCT1.2 Algebra-I	✓	✓		✓	✓	
HCT 1.3 Ordinary Differential Equation	✓		✓	✓	✓	✓
HCT 1.4 Discrete Mathematics	✓	✓			✓	✓
HCT 1.5 General Topology	✓	✓	✓	✓		✓
SCT 1.1 Operation Research	✓	✓			✓	✓
HCT 2.1 Partial Differential Equation	✓		✓	✓	✓	
HCT 2.2 Algebra II	✓	✓		✓	✓	
HCT 2.3 Programming in C	✓	✓		✓		✓
SCT 2.1 Complex Analysis	✓	✓			✓	✓
OET 2.1 Basic Statistics	✓		✓	✓	✓	✓
HCT 3.1 Functional Analysis			✓		✓	✓
HCT 3.2 Graph Theory-I	✓	✓	✓		✓	
HCT 3.3 Computational Numerical Method-I	✓		✓	✓	✓	✓
SCT 3.2 Fluid Mechanics –I		✓		✓	✓	✓
OET 3.1 Basic Statistics	✓	✓	✓			✓
HCT 4.1 Measure Theory		✓	✓	✓	✓	✓
HCT 4.2 Graph Theory -II	✓	✓	✓		✓	
HCT 4.3 Computational Numerical Method-II	✓	✓	✓	✓	✓	
HCT 4.4 Differential Geometry	✓	✓		✓		✓
SCT 4.1 Fluid Mechanics –II	✓	✓	✓		✓	
HCMP 4.5 Major Project	✓	✓		✓	✓	