VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
Jnana Sagara Campus, Vinayakanagara, Cantonment,
BALLARI - 583 105.

Department of Studies in Mathematics

Programme Outcomes (POs):

At the end of the programme students will be able to:

PO1: After completion of the programme, student will have in depth knowledge of topics in mathematical sciences, which includes mathematical analysis, algebra, numerical methods, Differential equations and Mathematical methods etc.

PO2: Evaluate how his/her own knowledge is sufficient and being capable of finding and evaluating new sources to further mathematical science, renew and develop his/her academic skills, combine insight from multiple disciplines and contribute to multidisciplinary collaboration.

PO3: Aware of the central role of mathematics in society, its central parts of history and evolution,

PO4: With a Master's degree in Mathematics students are qualified to work in a variety of interesting jobs and sectors. Some of the sectors where student's competence is needed include, among others, research and teaching, both in the public and private sector.

PO5: With a Master's degree in Mathematics students can choose to do PhD in mathematics. After the degree it is also possible to take Education degree, which allows you to teach at secondary level schools (provided you also have teaching competence). There is a high demand for teachers with competence in mathematics in the secondary school and Pre-University colleges, and the demand will continue to rise in the years to follow.

Course Outcomes (COs):

I Semester

Course: MSM-HC 1.1: Algebra-I

After completion of this course students will be able to

CO	Statement
CO1	Understand the importance of algebraic properties with regard to working within various number systems.

CO2	Explore the properties of groups, subgroups, symmetric groups, permutation groups, cyclic groups and quotient groups.
CO3	Understand Sylow's theorem, solvability of S_n and its applications.
CO4	Understand the importance of Cauchy's theorem for finite groups

Course: MSM-HC 1.2: REAL ANALYSIS-I

After completion of this course students will be able to

CO	**Statement**
CO1	Apply mathematical concepts involving of sets and their cardinalities.
CO2	Define and recognize the basic properties of the field of real numbers.
CO3	Ability to apply the theorem in a correct mathematical way.
CO4	Define and recognize the limit, continuity and differentiability of real functions.

Course: MSM-HC 1.3: TOPOLOGY – I

After completion of this course students will be able to

CO	**Statement**
CO1	Ability to understand the basic characteristics to topological spaces, open bases and open sub bases, convergence of sequences in topological spaces.
CO2	Separated sets, connected and disconnected spaces, topological property of connected spaces, locally connected space, separation axioms of the topological space.
CO3	The cover, open cover and finite sub cover, finite intersection property, compactness, Heine-Borel theorem.
CO4	Metric space and geometrical interpretation, Nets and filters.

Course: MSM-HC 1.4: COMPLEX ANALYSIS

After completion of this course students will be able to

CO	**Statement**

CO1	Represent complex numbers algebraically and geometrically.
CO2	Evaluate complex contour integrals and apply the Cauchy integral theorem in its various versions and Cauchy integral formula.
CO3	Students realize calculus of residues as one of the power tools in solving some problems, like improper and definite integrals effortlessly.
CO4	Understands the concepts of Rational Functions, Singularities, Poles, Classification of Singularities.

Course: MSM-HC 1.5: ORDINARY DIFFERENTIAL EQUATIONS

After completion of this course students will be able to

CO	**Statement**
CO1	Find the solutions of differential equation with initial and boundary conditions.
CO2	Solving higher order ordinary differential equations using various methods.
CO3	Students will understand concept of linear differential equation, Fundamental set Wronskian.
CO4	Students will be able to find the series solutions of standard differential equations.

Course: MSM-SC 1.6: (a) DISCRETE MATHEMATICS

After completion of this course students will be able to

CO	**Statement**
CO1	Construct mathematical arguments using logical connectives and quantifiers.
CO2	Validate the correctness of an argument using logical connectives and quantifiers.
CO3	Learn how to work with some of the discrete structures which include sets, relations, functions, graphs and recurrence relations.
CO4	Understands the concepts of Trees, Spanning Trees, centers and centroids, connectivity, edge connectivity.

Course: MSM-SC 1.6(b): FUNCTIONS OF SEVERAL VARIABLES

After completion of this course students will be able to

CO	Statement
CO1	Apply mathematical concepts to construct the open, compact subsets etc. in the Euclidean space.
CO2	Write clear and precise proofs for some important theorems of vector valued functions.
CO3	Ability to do analysis of Riemann–Stieltjes integrable functions.
CO4	Application of Green, Gauss and Stokes theorems.

Course: MSM- C Lab-I

After completion of this course students will be able to

CO	Statement
CO1	Recollect various programming constructs and to develop C programs.
CO2	Develop the skills of solving problems using C programming.
CO3	Choose the right data representation formats based on the requirements of the problem.
CO4	Implement different Operations on arrays, functions, pointers, structures, unions and files.

II Semester

Course: MSM-HC 2.1 ALGEBRA-II

After completion of this course students will be able to

CO	Statement
CO1	Explore the properties of rings, sub rings, ideals and Integral domain.
CO2	Understand the concepts of homomorphism and isomorphism between rings.
CO3	Understand Euclidean rings and their properties.
CO4	Provide information on Fields and Splitting field of polynomial.

Course: MSM-HC 2.2: REAL ANALYSIS – II

After completion of this course students will be able to

CO	Statement
CO1	Ability to construct counterexamples for various concepts in the context of sequence and series of functions.
CO2	Describe the properties involving of basic difference between series of functions and power series.
CO3	Write clear and precise proofs for Bolzano-Weirstrass, Heine-Borel, theorems etc.
CO4	Application of integration of functions in the Euclidean spaces.

Course: MSM-HC 2.3: NUMERICAL ANALYSIS-I

After completion of this course students will be able to

CO	Statement
CO1	Understanding the theoretical and practical aspects of the use of numerical methods.
CO2	Develops the skills of implementing numerical methods for a variety of multidisciplinary applications.
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations
CO4	Understand the concepts of eigen values and eigenvectors of a matrix by Jocobi's method.

Course : MSM-HC 2.4: PARTIAL DIFFERENTIAL EQUATIONS

After completion of this course students will be able to

CO	Statement
CO1	Classify partial differential equations and transform into canonical form.
CO2	Solve linear partial differential equations of both first and second order.
CO3	Students will be focused on initial boundary value problem for homogeneous and non-homogeneous PDE.
CO4	Students will be focused on boundary value problem by Dirichlet and Neumann

	problem.

Course: MSM-SC 2.5(a) : DIFFERENTIAL GEOMETRY

After completion of this course students will be able to

CO	**Statement**
CO1	Able to understand the fundamental theorem for plane curves.
CO2	Define and understand space curves with the help of examples.
CO3	Able to compute the curvature and torsion of space curves.
CO4	Develops the skills needed for employability.

Course: MSM-SC 2.5(b) CLASSICAL MECHANICS

After completion of this course students will be able to

CO	**Statement**
CO1	Ability to understand the tensor algebra and tensor calculus which has numerous applications in mechanics.
CO2	The continuum hypothesis, description of motions, various types of deformations, stresses and strains and their interrelation.
CO3	Fundamental physical conservative laws and their governing equations.
CO4	Mathematical modeling of various solid and fluid mechanics problems arising in natural and technological systems.

Course: MSM-SC 2.5(C): FUZZY SETS AND FUZZY SYSTEM

After completion of this course students will be able to

CO	**Statement**
CO1	Understand basic knowledge of the fuzzy sets, operations and their properties.
CO2	Understand the fundamental concepts of fuzzy functions and fuzzy logic.
CO3	Be able to distinguish between the crisp set and fuzzy set concepts through the learned difference between the crisp set characteristic function and the fuzzy set

	membership function.
CO4	Analyze the fuzzy relations, projection and binary fuzzy relations along with its applications.

Course: MSM 2.6: Matlab-I

After completion of this course students will be able to

CO	**Statement**
CO1	Able to use Matlab for interactive computations.
CO2	Familiar with memory and file management in Matlab.
CO3	Develops the skill to generate plots and export this for use in reports and presentations
CO4	Able to program scripts and functions using the Matlab development environment.

Course: MSM-2.7 OEC (1) COMMERCIAL MATHEMATICS

After completion of this course students will be able to

CO	**Statement**
CO1	Understand the basic concepts of general mental ability and logical reasoning skills.
CO2	Able to solve arithmetical problems like simplifications, average, percentage, probability, profit loss, simple interest, GCD and LCM etc.
CO3	Enhances the problem solving skills.
CO4	Improves the basic mathematical skills and to help students who are preparing for any type of competitive examinations.

Course: MSM-2.7 OEC (2) :MATHEMATICAL STATISTICS

After completion of this course students will be able to

CO	**Statement**
CO1	Understand the relationship among the measures using examples.

CO2	Finding Measures of central tendency and dispersions of some problems.
CO3	Able to define and distinguish between Correlation and regression.
CO4	Analyze the correlated data and fit the linear regression models.

Course: MSM MSM-2.7 OEC (3):MATHEMATICAL FINANCE

After completion of this course students will be able to

CO	**Statement**
CO1	The students would have a clear perception of the power of mathematical ideas and tools and would be able to demonstrate the application of mathematics to problems drawn from industry and financial services.
CO2	Predict various types of returns and risks in investments and take necessary protective measures for minimizing the risk.
CO3	Develop ability to understand, analyze and solve problems in bonds, finance and insurance.
CO4	Build skills for computation of premium of life insurance and claims for general insurance using probability distributions.

III Semester

Course: MSM-HC 3.1: TOPOLOGY-II

After completion of this course students will be able to

CO	**Statement**
CO1	Able to state and prove Urysohn's lemma and Tietze's Extension theorem.
CO2	Distinguish between T_3, T_4 and T_5 spaces.
CO3	Able to describe the properties of T_3, T_4 and T_5 spaces.
CO4	Gains the knowledge on separation axioms, countability axioms.

Course: MSM-HC 3.2: FUNCTIONAL ANALYSIS

After completion of this course students will be able to

CO	Statement
CO1	To study certain topological-algebraical structures and the methods by which the knowledge of these methods can be applied to analytic problems.
CO2	The student will be in a position to take up advance courses in analysis.
CO3	The student will be able to apply the concepts and theorems for studying numerical analysis, design maturity, the evolution of the design and the complexity of the mission, etc.
CO4	Able to define linear operators, self adjoint, isometric and unitary operators on Hilbert spaces.

Course: MSM-HC 3.3: LINEAR ALGEBRA

After completion of this course students will be able to

CO	Statement
CO1	Write clear and precise proofs for theorems needed to construct bases for vector spaces.
CO2	Ability to implement the Gram-Schmidt procedure to construct orthogonal basis.
CO3	Gaining of knowledge between matrices and linear transformations.
CO4	Determination of Jordan form for given a matrix.

Course: MSM-HC 3.4: FLUID MECHANICS-I

After completion of this course students will be able to

CO	Statement
CO1	Ability to understand the fluid characteristics and flow behaviors.
CO2	Description of motion and fundamental physical laws in fluid mechanics and their representing equations.
CO3	Bernoulli's equation and its applications.
CO4	Stream function, sources and sinks and their image with respect to various geometries.

Course: MSM-SC 3.5(a): NUMERICAL ANALYSIS-II

After completion of this course students will be able to

CO	**Statement**
CO1	Understand and apply Newton-Cotes integration methods to evaluate the integral of the functions.
CO2	Find the Solution of boundary value problems by the method of undetermined coefficients, Finite difference methods, Shooting Method.
CO3	Find the numerical Solution of Laplace equation by Jacobi, Gauss Seidel and SOR Methods, ADI Method.
CO4	Able to find the Parabolic Solution of heat equation by Schmidt and Crank-Nicolson Methods, solution of wave equation using Finite difference method

Course: MSM-SC 3.5(b): OPERATIONS RESEARCH

After completion of this course students will be able to

CO	**Statement**
CO1	Able to analyze the optimization methods and algorithms developed for solving various types of optimization problems and to formulate optimization problems.
CO2	Understand and apply the concept of optimality criteria for various types of optimization problems.
CO3	Solve various constrained and unconstrained problems in single variable as well as multivariable.
CO4	Develop and promote research interest in applying optimization techniques in problems

Course: MSM-SC 3. 5(C) - NUMBER THEORY

After completion of this course students will be able to

CO	**Statement**
CO1	Able to solve systems of linear congruences.

CO2	Find integral solutions to specified linear Diophantine equations.
CO3	Understand and apply The Law of Quadratic Reciprocity.
CO4	Apply Euler-Fermat's Theorem to prove relations involving prime numbers.

Course: MSM 3.6: C Lab-I

After completion of this course students will be able to

CO	**Statement**
CO1	Recollect various programming constructs and to develop C programs.
CO2	Develop the skills of solving problems using C programming.
CO3	Choose the right data representation formats based on the requirements of the problem.
CO4	Implement different Operations on arrays, functions, pointers, structures, unions and files.

Course: MSM-3.7 OEC (1): MATHEMATICAL PHYSICS

After completion of this course students will be able to

CO	**Statement**
CO1	Understand vector calculus in three dimensions and derive gauss theorem, stokes theorem and green's theorem.
CO2	Derive curvilinear co-ordinates and differential operators in cylindrical and spherical coordinates.
CO3	Understand Newtonian, Lagrangian and Hamiltonian mechanics.
CO4	Compare Maxwell-Boltzmann, Bose-Einstein and Fermidira stastistics and derive its outcomes

Course: MSM-3.7 OEC (2) QUANTITATIVE TECHNIQUES

After completion of this course students will be able to

CO	**Statement**

CO1	Understand the basic mathematical concept like models, constants, variables and graphical representation of functions and its applications.
CO2	Finding optimal or near optimal solutions to complex decision making problems.
CO3	Solving LP by using graphical and simplex methods.
CO4	Compute the probabilities of composite events using the basic rules of probability.

Course: MSM-3.7 OEC (3) - MATHEMATICAL BIOLOGY

After completion of this course students will be able to

CO	**Statement**
CO1	Develop the ability to explain mathematical results in language understandable by biologists.
CO2	Have an enhanced knowledge and understanding of mathematical modeling and stastical methods in the analysis of biological systems.
CO3	Formulate discrete and differential equation models that represent in a range of biological problems, including, identifying assumptions that are appropriate for the problem to be solved.
CO4	Understands how mathematics, statistics, and computing can be used in integrated way to analyze biological systems.

IV Semester

Course: MSM-HC 4.1:MEASURE THEORY

After completion of this course student should be able to

CO	**Statement**
CO1	Differentiate and Integrate Complex functions.
CO2	Compute sequence and series of functions.
CO3	Apply techniques of measurable functions in varies fields.
CO4	To state some of the classical theorems in of Advanced Real Analysis.

Course: MSM-HC 4.2: MATHEMATICAL METHODS

After completion of this course student should be able to

CO	Statement
CO1	Know different integral equations and methods of solving them.
CO2	Understanding Hilbert Schmidt theory.
CO3	Know functional and the construction of Euler's equation.
CO4	Applications of Fourier, Laplace, Z and Mellin transform to solve the various physical problems.

Course: MSM-SC 4.3(a): FLUID MECHANICS –II

After completion of this course student should be able to

CO	Statement
CO1	Able to derive equation of continuity in Cartesian, polar and spherical forms.
CO2	Able to derive Navier-Stoke equation, energy equation and apply them to solve the problems.
CO3	Understand the Principles of similarity, Buckingham's pi-theorem & its Applications.
CO4	Analyze simple fluid flow problems (flow between parallel plates, flow through pipes etc.) with Navier Stokes's equation of motion.

Course: MSM-SC 4.3(b): GRAPH THEORY

After completion of this course student should be able to

CO	Statement
CO1	Cover a variety of different problems in Graph Theory.
CO2	Come across a number of theorems and proofs.
CO3	Applications to real life problems.
CO4	Introduction to advance topics in graph theory and algorithms in graph theory.

Course: MSM-SC 4.3(C): WAVELETS

After completion of this course student should be able to

CO	**Statement**
CO1	Ability to compute the fast Fourier transform of a vector. Detection of frequencies.
CO2	Compute wavelet transform for discrete signals.
CO3	Compute wavelet transform for discrete signals on the set of integers.
CO4	MRA for functions.

Course: MSM-SC 4.3 (d): MAGNETOHYDRODYNAMICS

After completion of this course student should be able to

CO	**Statement**
CO1	Ability to understand the various laws of electromagnetism and their consequences.
CO2	Electromagnetic waves and its effects on the flow system.
CO3	Force field magnetic field and its significances.
CO4	Modeling of hydromagnetic flows in a channel appearing is various biosciences, engineering and technological systems.

Course: MSM-SC 4.3 (e)- BANACH ALGEBRA

After completion of this course student should be able to

CO	**Statement**
CO1	Since students attending the course had different background, course had to give full proofs for every statement and explains many details from measure theory and functional analysis as well as the theory of algebras.
CO2	Learn the skills helpful to study spectral analysis.
CO3	It's the formal setting for understanding properties and spectra of operators on a Hilbert space, and therefore for understanding results about differential equation.
CO4	Banach algebras have specific beautiful applications in the theory of Fourier analysis.

COURSE: MSM 4.4 PROJECT

Course Outcomes (CO): After completion of the project student should able to

CO	**Statement**
CO1	Conduct literature survey on specified area of research.
CO2	Define or state the research problem.
CO3	Analyse experimental observations by scientific methods.
CO4	Communicate (oral and written) the results of investigation.

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