Course Outcomes of Mathematics

Semester I

Name of the Course: Calculus

Course Code B23-MAT-101

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Gain knowledge of the concepts and theory of limit, continuity and differentiability of functions. Attain skills of calculating the limit of functions and examining the continuity and differentiability of different types of functions, and perform successive differentiation of functions. To apply the procedural knowledge to obtain the series expansions of functions which find multidisciplinary applications.

2. Understand concepts of asymptotes and curvature, the geometrical meaning of these terms and to have procedural knowledge to solve related problems.

3. Determine singular points of a curve and classify them. Understand the concept of rectification of curves and derive the reduction formulae.

4. Have theoretical knowledge and practical skills to evaluate the area bounded by the curves, and volume and surface area of solids formed by revolution of curves.

5. Attain cognitive and technical skills required for solving different problems of calculus associated with tracing of curves, determination of curvature, and rectification of curves, volume and surface area of solids of revolution. Have technical and practical skills of solving calculus problems related to differentiation and integration of functions by using MAXIMA software.Semester I

Name of the Course: Advanced Calculus Course

Code B23-MAT-102

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Have theoretical knowledge about various mean value theorems and their geometrical interpretations.

2. Learn conceptual variations while advancing from dealing with functions of one variable to several variables in calculus and discuss limit and continuity of such functions. Have deeper understanding of Euler's theorem and Taylor's theorem and practice to attain skill in multidisciplinary contexts.

3. Know about differentiability of real valued functions of two variables and understand Young's, theorem Schwarz's theorem and implicit function theorem. Determine maxima and minima of functions of two variables, learn Lagrange's method of undetermined multipliers and exploit this procedural knowledge for various realistic optimization problems.

4. Understand and acquire theoretical knowledge about Jacobians, Beta and Gamma functions, with acquisition of skill to analyse various methods of integration and evaluate double and triple integrals which find application in the determination of areas and volumes.

5. Attain cognitive skills required for solving problems associated with continuity, differentiability of functions of several variables and applications of double and triple integrals. Have technical and practical skills of solving problems related to plotting of curves in two and three dimensions and evaluating double and triple integrals by using built in functions of MAXIMA software.

Semester II

Name of the Course: Algebra and Number Theory

Course Code : B23-MAT-201

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Gain knowledge of the concepts of symmetric, skew-symmetric, Hermitian, skew-Hermitian, Orthogonal and Unitary matrices, Linear dependence and independence of rows and columns of a matrix. Have knowledge of procedure and cognitive skills used in calculating rank of a matrix, eigen values, characteristic equation, minimal polynomial of a matrix and technical skills used in solving problems based on Cayley- Hamilton theorem.

2. Have knowledge of the concepts used in solving problems based on relations between the roots and coefficients of general polynomial equation in one variable, solutions of polynomial equations having conditions on roots, common roots and multiple roots. Understand Descarte's rule of signs and learn cognitive and technical skills required in assessing nature of the roots of an equation and solving problems based on these.

3. Have deeper and procedural knowledge required for solving cubic and biquadratic equations used in Mathematics as well as many other learning fields of study. To understand the basic concepts of number theory and their applications in problem solving and life- long learning.

4. Have knowledge of concepts, facts, principles and theories of Linear Congruences, Fermat's theorem, Euler's theorem, Wilson's theorem and its converse, Chinese Remainder theorem. Attain cognitive skills used in solving linear Diophantine equations in two variables.

5. Attain cognitive and technical skills required to formulate and solve practical problems involving rank of a matrix, inverse of a matrix, Cardon's method, Ferrari's method, Descarte's method, Cayley-Hamilton

theorem, Euler's theorem and Chinese Remainder theorem. Have technical and practical skills required for solving algebraic equations, finding inverse and eigen values of matrices by using built in functions of MAXIMA software.

Name of the Course : PROGRAMMING IN C

Course Code : B23-MAT-202

Course Learning Outcomes (CLOs):

After completing this course, the learner will be able to:

1. Gain the knowledge and understanding of the concepts of C programming language. Learn elements of C, data types, constants and variables, operations and operators, statements and expressions. Attain the skills to write C programs.

2. Have the conceptual knowledge of Input/ Output functions in C, decision making statements in C. Acquire the technical skills to develop C programs for practical problems.

3. Gain the knowledge of loops and arrays, their types, characteristics and structures. Attain the skills to write C programs with loops and arrays for solving mathematical and realistic problems.

4. Have the procedural knowledge required for performing skilled task associated with C language. Learn strings of characters, their declaration, input/output, operations on strings and functions which handle strings. Acquire knowledge of the concepts of user defined functions in C. Attain the skills to write codes in C using functions.

5. Attain cognitive and technical skills for solving problems with the C programming language. Have hands-on experience to run and debug programs in C for different mathematical and other practical problems of daily or scientific use.

Semester III

Name of the Course : Differential Equations-1

Course Code B23-MAT-301

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Gain knowledge of the basic concepts of ordinary differential equations and learn various techniques of finding exact solutions of certain solvable first order differential equations.

2. Have procedural knowledge and cognitive and technical skills of solving homogeneous and nonhomogeneous second order linear ordinary differential equations with constant coefficients and with variable coefficients.

3. Gain knowledge of theory of total differential equations and basic concepts of partial differential equations. To learn methods and techniques for solving linear PDEs of first order and to acquire technical skills for accomplishing assigned tasks relating to formulation and solution of PDEs in broad multidisciplinary contexts.

4. Have knowledge of concepts and theories of second order PDEs and to apply theory of PDEs to determine integral surfaces through a given curve and to find orthogonal surfaces. To understand compatible systems and to learn cognitive and technical skills required for selecting and using relevant Charpit method, Jacobi method methods to assess the appropriateness of approaches for solving PDEs.
5. To attain cognitive and technical skills required for selecting and using relevant methods and techniques to assess the appropriateness of approaches to solving problems associated with the differential equations. To attain technical skill of solving differential equations by using built in functions of MAXIMA software.

Name of the Course : Groups and rings

Course Code: B23-MAT-302

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Gain theoretical knowledge of the concept of a group, subgroup, abelian group, cyclic group, normal group, quotient group and have understanding of the results based on these concepts.

2. Have knowledge and understanding of the theory of group homomorphisms, group isomorphisms and group automorphisms. Learn about the permutation groups, permutations, centre of a group and theorems based on these concepts.

3. Gain the deeper knowledge of the concepts of a ring, subring, ideal, integral domain, field of quotient and understanding of the results based on these concepts.

4. Know about Euclidean rings, Polynomial rings and Unique factorization domain.

5. Attain the deeper knowledge and understanding of groups and rings, their underlying principles and theories, by solving some problems based on them.

Semester IV

Name of the Course: Analytical Geometry & Vector Calculus

Course Code B23-MAT-401

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Gain knowledge of the concept of different conic sections, their classification and properties. Understand various terms related to conic sections and gain skills to use them in problem solving.

2. Have knowledge of general form of equation of a sphere and attain procedural knowledge required for solving problems related to intersection of spheres, tangent plane and line, orthogonality, length of tangent and co-axial system of spheres. Learn about equations of cones and apply knowledge for problem solving.

3. Have deeper knowledge and understanding of cylinder, enveloping cylinder, concepts of conicoids, tangent plane, director sphere, normal, envelope and to make further use thereof.

4. Understand and solve problems related to scalar and vector product of vectors, vector differentiation, directional derivatives, gradient, divergence and curl operators. Have deeper understanding of line, surface and volume integrals, their evaluation, proof of Gauss Divergence, Green's and Stoke's theorems and gain theoretical and technical knowledge in computing different surface flux integrals, volume integrals and line integrals used in other disciplines also.

5. Attain cognitive and technical skills required for solving practical problems related to assessing nature of conicoid, their characteristics. Learn skills to formulate and solve real life practical problems on sphere, cone and cylinder; to generate solutions of practical problems involving complex line, surface and volume integral using Gauss Divergence theorem, Stoke's theorem, Green's theorem in a very easy manner.

Name of the Course : Linear Algebra

Course Code : B23-MAT-402

Course Learning Outcomes(CLOs):

After completing this course, the learner will be able to:

1. Have comprehensive knowledge and understanding of the concepts of vector space, subspace, linear span, linearly independence, basis, dimension and quotient space.

2. Gain the procedural knowledge required to find the null space, range space, rank, nullity of linear transformation. Understand the proof of rank-nullity theorem and change of basis concept.

3. Have deeper knowledge of the concept of algebra of linear transformations, dual spaces and bi-dual spaces. Find the eigen values, eigen vectors and minimal polynomials of linear transformations.

4. Gain the theoretical knowledge and understanding of inner product space, Gram Schmidt orthogonalization process and Bessel's inequality. Attain the cognitive skills to apply the learnt concepts to solve mathematical problems

5. Attain cognitive and technical skills required for performing and accomplishing complex tasks related to problems of linear algebra. Have technical and practical skills required to solve problems related to linear algebra using built in functions of MAXIMA and other FOSS software.