Department of Mathematics

BA/B.Sc

Mathematics Syllabus

Semester I

CML 106

Core Course-I ALGEBRA

(Credits: 04; 60 Hrs (4Hrs /week)

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are required to attempt five questions in all, selecting one question from each Unit and Question no. 1 is compulsory wherein student is required to attempt 8 parts.

Unit-I

Matrices, Symmetric, Skew-Symmetric, Hermitian and Skew-Hermitianmatrics. Rank of a matrix. Linear dependence and independence of rows and columns of matrices.Row Equivalent matrices and column equivalent Matrices, Reduction to a Row and Column Mtrices, Normal form of a Matrix, Row rank and column rank of a matrix. Eigen values, eigen vectors and the characteristic equations of a matrix.

Unit-II

Minimal polynomial of a matrix.Cayley Hamilton theorem.Applications of matrices to a system of linear(both homogeneous and non-homogenous) equations. Theorems of consistency of a system of linear equations.Unitary and Orthogonal Matrices, Bilinear Form and Quadratic Form.

Unit-III

Discarte' Rule of Signs, 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. Transformation of equations into equations with roots multiplied by a given number, Equation with Reciprocal Roots, Roots Diminished by a given number.

Unit-IV

Solutions of cubic equations by Cardan's method, Discarte' Method and Ferarri Method.Biquadratic equations and their solutions. DeMoivre's theorem. Its applications in solutions of polynomials equations, Finding the nth root of a number.

CML 107

Core Course -II CALCULUS

(Credits: 04; 60 Hrs (4Hrs /week)

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are required to attempt five questions in all, selecting one question from each Unit and Question no. 1 is compulsory wherein student is required to attempt 8 parts.

Unit-I

Limit, continuity (definition), Types of Discontinuties and differentiability of functions.Successive differentiation of functions in imlicit, explicit and parametric form.Lebnitz theorem.Some general theorems on differentiable functions and expansions. Taylor's theorem with Langrange's form and Cauchy' form of remainder after 'n' terms.Maclaurinform and Infinite Series.

Unit-II

Asymptotes parallel to coordinate axis and Oblique Assymptotes in Cartesian and Polar form.Singular points.Points of inflexion. Multiple points. Cusps,nodes & conjugate points.Tracing of curves in Cartesian, parametric and polar co-ordinates, particularly, Asteroid, Cycloid and Cardoid. Curvature (radius of curvature for Cartesian curve, parametric curves, polar curves, pedal curves).

Unit-III

Reduction formulae. Rectification, length of cuves in Cartesian, parametric and polar curves particularly Asteroid, Cycloid and Cardoid., intrinsic equations of curve.

Unit-IV

Quardrature (area)Sectorial area. Area bounded by closed curves in Cartesian, parametric form and polar form. Volumes and surfaces of solids of revolution about x-axis and about any line.

CMP 110

PRACTICAL-I Mathematics Lab– I

(Credits: 1.5; 45 Hrs (3Hrs /week)

Marks for Major Test (External): 50

Time: 3 Hours

Part A:

Introduction to Programming in C Data types, Operators andexpressions, Input / outputs functions. Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops-for, while, do while; Switch Statement & Case control structures.

Part B:

Following Program should be done as Practical:-

1. Program to interchange the value of two variables.
2. Program to calculate compound interest.
3. Program for testing a leap year.
4. Program to find greatest of three numbers.
5. Program to calculate Gross salary of an employee.
6. Program to prepare electricity Bill.
7. Program to find roots of a quadratic equation.
8. Program to provide output of a given function.
9. Program to display table of an input number
10. Program to find reverse of a number
11. Program to generate Fibonacci series.
12. Program to check whether number is prime or not.
13. Program to generate first n prime numbers.
14. Program to check a number is Armstrong or not.
15. Program to convert a number to its binary equivalent.

Semester II

Core Course – III
VECTOR CALCULUS AND GEOMETRY
(Credits: 04; 60 Hrs (4Hrs /week)

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are required to attempt five questions in all, selecting one question from each Unit and Question no. 1 is compulsory wherein student is required to attempt 8 parts.

Unit – I

Scalar and vector product of three vectors, product of four vectors.Reciprocal vectors. Vector differentiation Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives.Gradient of a scalar point function, geometrical interpretation of grad .Divergence and curl of vector point function.

Unit – II

Gradient, divergence and curl of sums and product and their related vector identities.Laplacian operator.Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Unit – III

Vector integration: Indefinite Integral, Definite Integral,Standard results of Integration.Line integral, Surface integral, Volume integral. Gauss Divergence Theorem, Divergence Theorem in Cartesian Co-ordinates, Green Theorem, Stoke's Theorem(Relation between line Integral and Surface Integral). Stoke's Theorem in Cartesian form. Green's Theorem in Plane as special case of Stoke's Theorem, problems based on these theorems.

Unit -IV

Geometry:General equation of second degree. Tracing of conics.Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic.Polar equation of a conic, tangent and normal to the conic.Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, Cones. Right circular cone.Cylinder: Right circular cylinder.

CML 207

Core Course – IV

ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

(Credits: 04; 60 Hrs (4Hrs /week)

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

The examiner is requested to set nine questions in all, selecting two questions from each Unit. Question no. 1 is compulsory and is based on entire syllabus consisting of eight to ten short answer type questions each of 2 marks. Candidates are required to attempt five questions in all, selecting one question from each Unit and Question no. 1 is compulsory wherein student is required to attempt 8 parts.

Unit – I

Geometrical meaning of a differential equation.Exact differential equations, integrating factors. First order higher degree equations solvable for x,y,p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form.Singular solutions.

Unit – II

Orthogonal trajectories: in Cartesian coordinates and Polar coordinates. Self orthogonal family of curves.Linear differential equations with constant coefficients.Homogeneous linear ordinary differential equations. Equations reducible to homogeneous.

Unit – III

Linear differential equations of second order.Reduction to normal form.Transformation of the equation by changing the dependent variable/ the independent variable.Solution by operators of non-homogeneous linear differential equations.Reduction of order of a differential equation.Method of variations of parameters.Ordinary simultaneous differential equations.Solution of simultaneous differential equations.

Unit – IV

Laplace Transforms –Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives,solution of ordinary differential equations using Laplace transform.

CMP 210

PRACTIAL-II : Mathematics Lab – II

(Credits: 1.5; 45 Hrs (3Hrs /week)))

Marks for Major Test (External): 50

Time: 3 Hours

Part A:

Introduction to Programming in C Strings: Character data type, Standard string handling functions, arithmetic operations on characters. Structures: definition, using structures, use of structures in arrays and arrays in structures, Functions.

Part B:

Following Program should be done as Practical:-

16. Program to add two matrices.
17. Program to multiply two matrices.
18. Program to find the inverse of a matrix.
19. Program to find transpose of a matrix.
20. Program to find the sum of a series.
21. Program to sort an entire array using bubble short.
22. Program to find trace of 3X3 Matrix.
23. Program to find largest of three numbers using function.
24. Program to find factorial of a number using recursion.
25. Program to generate n Fibonacci terms using recursion.
26. Program to count number of vowels and consonants in a given sentence.
27. Program to print a salary chart for employee of a company.

Semester III

CML 306:
Advanced Calculus
(Credits: 04; 60 Hrs (4Hrs /week)

Marks (Theory): 80
Marks (Total): 100
Marks (Internal Assessment): 20
Time: 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section – I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

Section – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Section – III

Differentiability of real valued functions of two variables. Schwarz and Young's theorems. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Section – IV

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

CML 307:
Numerical Analysis

Marks (Theory): 80
Marks (Total): 100 Marks
(Internal Assessment): 20
Time: 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section – I

Finite Difference operators and their relations, difference table, finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: derivations of Newton's forward and Newton's backward interpolation formulae and their applications, Interpolation with unequal intervals: derivations of Newton's divided difference & Lagrange's Interpolation formulae and their applications.

Section – II

Central Difference interpolation formulae: derivations of Gauss's forward and Gauss's backward interpolation formulae, Sterling,Bessel formulae and their applications. Numerical Differentiation: Relation between difference operator and derivative operator, Derivative of a function using interpolation formulae (as studied in Sections – I & II). Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one- third rule and Simpson's three-eighth rule, Chebychev formula, Gauss Quadrature formula.

Section – III

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method, Newton's iterative method for finding pth root of a number. Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Section – IV

Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method. Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Milne-Simpson's method

CMP 310:

Mathematics Lab-III

Marks (Total): 100
Time: 3 Hrs

Write down and execute the following programs using C-Programming Language

1. To interpolate the data using Newton's forward interpolation formula

2. To interpolate the data using Newton's backward interpolation formula

3. To interpolate the data using Gauss's forward interpolation formula

4. To interpolate the data using Gauss's backward interpolation formula

5. To interpolate the data using Lagrange's interpolation formula

6. To find the roots of algebraic and transcendental equations using Bisection method.

7. To find the roots of algebraic and transcendental equations using Regula-Falsi method.

8. To find the roots of algebraic and transcendental equations using Secant method.

9. To find the roots of algebraic and transcendental equations using Newton-Raphson's method.
10. To solve the system of linear equations using Gauss -elimination method.

11. To solve the system of linear equations using Gauss -Seidal iteration method.

12. To solve the system of linear equation using Gauss –jordan method.

13. To find the largest eigen value of a matrix by Power -method.

14. To integrate numerically using Trapezoidal rule.

15. To integrate numerically using Simpson's one- third rule.

16. To integrate numerically using Simpson's three-eighth rule.

17. To find numerical solution of ordinary differential equations by Euler's method/ Modified Euler's method.

18. To find numerical solution of ordinary differential equations by Runge -Kutta method.

Semester IV

CML 406:

Partial Differential Equations & Special Functions

Marks (Theory): 80
Marks(Total) : 100
Marks (Internal Assessment) : 20
Time : 3Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section – I

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

Section – II

Linear partial differential equations of second and higher orders, Linear and non-linear homogeneous and non-homogeneous equations with constant coefficients, Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary functions and particular integrals, Equations reducible to linear equations with constant coefficients. Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Section – III

Classification of linear partial differential equations of second order, hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order, Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation.

Section – IV

Series solution of differential equations – Power series method. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions. Legendre differential equation and its solution: Legendre function and its properties-Recurrence Relations and generating functions. Orthogonality of Legendre polynomial. Rodrigues' Formula for Legendre Polynomial.

CML-407
Mechanics-I

Theory: 80 Marks
(Total): 100
Marks (Internal Assessment): 20
Time: 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section -I

Forces in two dimension (co-planner), triangle law and polygon law of forces, Lami's theorem, resultant of concurrent and coplanar forces, conditions of equilibrium of concurrent forces. Parallel forces: like parallel and unequal unlike parallel forces, resultant and centre of parallel forces; Moments and Couples.

Section -II

Forces in three dimensions, Poinsot'scentral axis, conditions for the reduction of a general system of forces in space to a single force, equations of central axis, Wrenches: Definition and basic laws, resultant wrench of two wrenches, locus of the central axis of two wrenches; Null lines and null planes.

Section –III

Velocity and acceleration along a plane curve, component of velocity and acceleration in radial, transverse, tangential and normal directions, Relative velocity and acceleration.Simple harmonic motion (SHM).

Section- IV

Newton's laws of motion, Central Orbits, differential equations of Central Orbits in polar form and in pedal form, areal velocity, elliptic, hyperbolic and parabolic orbit, velocity in a circle, apse and apsidal distances: definition and laws, velocity from infinity, Kepler's laws of planetary motion, equivalence of Kepler's laws of planetary motion and Newton's law of gravitation, motion under the inverse square law.

Semester V

CML-506 (i):

Groups and Rings

Marks (Theory): 80

Marks (Total) : 100

Marks (Internal Assessment) : 20

Time : 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section – I

Definition of a group. Examples of abelian and nonabelian groups. The group Zn of integers under addition modulo n and the group of (n) of units under multiplication modulo n. Generator of a group. Cyclic groups. Permutations groups. Alternating groups, Cayley's theorem. Subgroups and Subgroup criteria. Cosets, Left and right cosets, properties of cosets.

Section – II

Index of a sub-group. Coset decomposition, Lagrange's theorem on groups and its consequences, Normal subgroups, Quotient groups, Homomorphisms, isomorphisms, automorphisms on group. Center of a group and class equation of a group and derived group of a group.

Section – III

Introduction to Rings, Subrings, Integral domains and Fields, Characteristics of a ring. Ring homomorphisms, Theorems on Ring homomorphisms. Ideals (Principle, Prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

Section – IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion of irreducibility of polynomials over the field of rational numbers. Polynomial rings over commutative rings. Principal ideal domain, Unique factorization domain.

CML-507 (i):

Sequence and Series

Marks (Theory): 80

Marks (Total): 100

Marks: Internal Assessment (20)

Time: 3 Hours

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

SECTION-I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Sequence: Real sequences and their convergence, theorem on limits of sequence, bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, subsequences, subsequential limits.

SECTION-II

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series. D-Alembert's ratio test, Raabe's test, Logarithmic test, De Morgan and Bertrand's test, Cauchy's nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test. Alternating series: Leibnitz's test, absolute and conditional convergence. Arbitrary series: Abel's lemma, Abel's test, Dirichlet's test.

SECTION-III

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Coefficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions, Half range series, Change of Intervals.

SECTION-IV

Riemann integral: Definition and examples. Darboux's Theorem and condition of existence of Riemann's integral. Integrabililty of continuous, monotonic functions and discontinuous functions. Properties of integrable functions. Continuity and differentiability of integrable functions. Primitive. The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

CML-508(i):

Number Theory & Trigonometry

Marks (Theory): 80

Marks(Total) : 100

Marks (Internal Assessment) : 20

Time : 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section-I

Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

Section-II

Number theoretic functions, sum and number of divisors, totally multiplicative functions, the Möbius inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

Section-III

Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli.

Section-IV

Exponential, Logarithmic, Circular functions; sin(nx), cos(nx), tan(nx), sinn x , cosn x, tann x, hyperbolic and inverse hyperbolic functions - simple problems. Gregory's series, Summation of Trigonometric series, Trigonometric expansions of sine and cosine as infinite products (without proof).

Semester VI

CML-605 (i):

Linear Algebra

Marks (Theory): 80

Marks(Total) : 100

Marks (Internal Assessment) : 20

Time : 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Section – II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

Section – III

Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

Section – IV

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, GramSchmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations. Books Recommended: 1. I.N. Herstein,: Topics in Algebra, Wiley East

CML-606(i)

Mechanics-II

Theory: 80

Marks (Total): 100

Marks (Internal Assessment): 20

Time: 3 Hrs

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

Section - I

Analytical conditions of equilibrium of co-planar forces: Equilibrium of three forces, conditions of equilibrium, trigonometric theorem's, conditions of equilibrium of co-planar forces (First, Second and Third form); Friction: Definition of friction and basic laws, problems based on equilibrium of rods and ladders; Centre of gravity: Basic concepts and definitions, centre of gravity of a uniform rod, a thin uniform lamina in the form of a parallelogram, a thin uniform triangular lamina, three uniform rods forming a triangle, a uniform quadrilateral lamina, lamina in the form of a trapezium, centre of gravity of a body by integration.

Section - II

Motion of a particle attached to an elastic string, Hooke's law, motion of horizontal and vertical elastic strings, Definition of work, Power and Energy, work done by a variable force, work done in stretching an elastic string, principle of work and energy, conservative system of forces, principle of conservation of energy, impulse of a constant force and a variable force.

Section - III

Motion of a particle on smooth curves, motion on the outside and inside of a smooth vertical circle, cycloidal motion, motion on a rough curve under gravity.

Section - IV

Projectile motion of a particle in a plane, velocity at any point of the trajectory, directions of projection for a particle, range and time of flight on an inclined plane, directions of projection for a given velocity and a given range; range and time of fight down an inclined plane.

CML-607 (i):

Real and Complex Analysis

Marks (Theory): 80

Marks (Total): 100

Marks: Internal Assessment (20)

Time : 3 Hours

Note: Attempt five questions in all. The question paper will consist of four sections. Question No. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. Each of the four sections (I-IV) will contain two questions and the students are required to attempt one question from each section. All questions carry equal marks.

SECTION-I

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem.

SECTION-II

Baire's category theorem, Contraction Principle, continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass Property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness.

SECTION-III

Improper integrals and their convergence, comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, differentiability and integrability of an integral of a function of a parameter.

SECTION-IV

Topology of complex numbers: Trigonometric, exponential, logarithmic and hyperbolic trigonometric functions. Extended complex plane, Stereographic projection of complex numbers. Continuity and differentiability of complex functions. Analytic functions, Cauchy-Riemann equations, harmonic conjugates, harmonic functions. Construction of analytic functions: direct method and Milne-Thomson method.

CMS-608(i):

Solid Geometry

Marks (Theory): 50

Marks(Total) : 100

Marks (Internal Assessment) : 50

Time : 2 Hrs

Note: The examiner is requested to set five questions in all, selecting two questions from each UNIT and one compulsory question (Question No.1 based on entire syllabus will consist of five short answer type questions each of two marks). The candidate is required to attempt three questions in all selecting one from each UNIT and the compulsory Question No.1. All questions carry equal marks.

UNIT-I

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

UNIT-II

Paraboloids: Circular section, Plane sections of conicoids. Generating lines. Confocal conicoid. Reduction of second degree equations.