

Annexure C
FACULTY OF SCIENCES
SYLLABUS
FOR
Master of Science (Mathematics) (FYIP)
(Semester: V -VI)
(Under Credit Based Continuous Evaluation Grading System)
(CBCEGS)

Session: 2025-26



The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR
(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Five Years Integrated Programme

(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Master of Science (Mathematics) (FYIP)

Semester-V

Session- 2025-26

Master of Science (Mathematics) (FYIP) Semester-V										
Course Code	Course Type	Course Title	Hours Per Week L-T-P	Credits L-T-P	Total Credit	Marks				Examination time in hours
						Total	Th	P	CA	
FMAL-5331	C	Number Theory	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-5332	C	Discrete Mathematics	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-5333	C	Linear Integral Equations	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-5334	C	Riemann Integration	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-5335	C	Metric Spaces	3-1-0	3-1-0	4	100	80	-	20	3
SECJ-5551	AC	*Job Readiness Course	0-0-4	0-0-2	2	50	-	40	10	-
Total					22	500				

Note:

*Credits/Grade points of these courses will not be included in SGPA/CGPA of Semester/Programme. Only grades will be provided.

C- Compulsory

AC- Audit Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Five Years Integrated Programme

(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Master of Science (Mathematics) (FYIP)

Semester-VI

Session- 2025-26

Master of Science (Mathematics) (FYIP) Semester-VI										
Course Code	Course Type	Course Title	Hours Per Week L-T-P	Credits L-T-P	Total Credit	Marks				Examination time in hours
						Total	Th	P	CA	
FMAL-6331	C	Complex Analysis	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-6332	C	Analytical Skills	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-6333	C	Numerical Analysis	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-6334	C	Special Functions	3-1-0	3-1-0	4	100	80	-	20	3
FMAL-6335	C	Differential Geometry	3-1-0	3-1-0	4	100	80	-	20	3
Total					20	500				

Note:

C- Compulsory

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025 -26

Course Title: Number Theory

Course Code: FMAL-5331

Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Find solutions of specified linear Diophantine equation and system of linear congruences.

CO 2: Apply Fermat's to prove relation involving prime numbers.

CO 3: Apply the Wilson's and Euler's theorem to solve numerical problems and explore properties of phi function in real world problems.

CO 4: Understand application of important arithmetic functions.

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025 -26

Course Title: Number Theory

Course Code: FMAL-5331

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory: 80

3 1 0

CA: 20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

The question paper must contain 30% of the article/theory from the syllabus.

Unit I

The Diophantine equation $ax + by = c$ and its solution, Basic properties of congruences, Complete and Reduced set of residues modulo n , Special divisibility tests.

Unit II

Polynomial congruences, Lagrange's theorem, Linear congruences, Chinese remainder theorem, The Fermat's theorem, Pseudo prime, Absolutely Pseudo prime.

Unit III

Wilson's theorem. Euler's Φ function, Euler's theorem, some properties of the Φ Function, Gauss theorem.

Unit IV

Number-Theoretic functions: The Sum and Number of divisors, The Mobius Inversion formula, The Greatest integer function for treating divisibility problems.

Text Book:

D. Burton, Elementary Number Theory, McGraw-Hill Education, Boston, Seventh edition, 2012 (Scope as in Chapters 2, 4-7).

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025 -26

Course Title: Discrete Mathematics

Course Code: FMAL-5332

Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Understand Boolean algebra , K-Map and application of Boolean Algebra to switching circuits.

CO 2: Understand the use of Graphs and Models.

CO 3: Understand the language of trees with various types of trees and methods of traversing trees.

CO 4: Have substantial experience to comprehend formal logical and write an argument using logical notation and determine if the argument is valid or not.

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025 -26

Course Title: Discrete Mathematics

Course Code: FMAL-5332

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Boolean Algebra – Boolean Algebra, Unary Operation, Binary Operation, Laws of Boolean Algebra, Principle of Duality, Boolean Function, Fundamental Product, Sum of Product form, Complete sum of Product form, Minterm, Disjunctive Normal form, Conjunctive Normal form, obtaining a Disjunctive Normal form, obtaining a Conjunctive Normal form, Karnaugh Map upto four variables, Applications of Boolean Algebra to Switching Circuits.

Unit II

Graph, Subgraph, Paths, Directed and Undirected graphs, Connected graphs, Weakly connected graphs, Regular and bipartite graphs, Weighted graphs, Euler path and graphs, Hamiltonian path and graphs, planar graphs.

Unit III

Chromatic number in graphs, shortest path in weighted graphs. Tree, directed tree, ordered tree, Binary tree, traversing binary tree, spanning tree, minimum spanning tree, Kruskal's algorithm to find minimum spanning tree.

Unit IV

Propositional Calculus – Basic Logic Operations, Statement, Proposition, Propositional Variables, Truth Table, Combination of Propositions, Laws of the Algebra of Proposition, Variations in Conditional Statement, Principle of Duality, Logical Implication, Logical Equivalence of Proposition, Tautologies, Contradiction, Contingency, Argument, Proof of Validity, Quantifiers, Existential Quantifier, Universal Quantifier, Negation of Quantified Propositions, Propositions with Multiple Quantifier.

Text Book:

S. B. Gupta and C. P. Gandhi, Discrete Structures, University Science Press, Second edition, 2010 (Scope as in Chapters: 10, 11, 12, 13).

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025 -26

Course Title: Linear Integral Equations

Course Code: FMAL-5333

Course Outcomes

On satisfying the requirements of this course, students will have the Knowledge of:

CO 1: Concept of Linear Integral equations and various kinds of Kernels, Volterra and Fredholm Integral equations of first and Second kind, reduction of initial value problem to a Volterra Integral equation and solution of Volterra Integral equation using method of Resolvent Kernel.

CO 2: Reduction of Boundary Value Problem to Fredholm Integral Equation and techniques to solve homogeneous and non-homogeneous Fredholm Integral equations.

CO 3: Laplace Transform and its basic properties and how to find solution of Volterra Integral Equations using Laplace Transform.

CO 4: Construction of Green's function and application of Green's function in finding the solution of Boundary Value Problem.

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025 -26

Course Title: Linear Integral Equations

Course Code: FMAL-5333

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Linear integral equations of the first and second kind of Fredholm and Volterra type, some basic identities, Types of kernels: Symmetric kernel, Separable kernel, Iterated kernel, resolvent kernel, Initial value problems reduced to Volterra integral equations, Solution of Volterra integral equation using: Resolvent kernel, Successive approximation.

Unit II

Boundary value problems reduced to Fredholm integral equations, Solution of Fredholm integral equations using separable kernel, resolvent kernel. Methods of successive approximation to solve Fredholm equations of second kind. Solution of Homogeneous Fredholm integral equation: Eigen values, eigen vectors.

Unit III

Integral transforms for solving integral equations: Basic properties of Laplace transforms, Solution of Abel's equation using Laplace transform, Application of Laplace transform to the Solution of Volterra integral equations with convolution type kernels.

Unit IV

Green's function, Basic four properties of the Green's function, Procedure for construction of the Green's function by using its basic four properties, Construction of Green's function for boundary value problems, Solution of boundary value problems using Green's function, reducing boundary value problems to an integral equation using Green's function.

Text Book:

M.D. Raisinghania, Integral Equations & Boundary Value Problems, S. Chand Co. Pvt. Ltd., New Delhi, First Edition, 2007 (Scope as in Chapters 1-6, 9, 11).

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025-26

Course Title: Riemann Integration

Course Code: FMAL-5334

Course outcomes

After passing this course, the students will be able to:

CO 1: To understand the concepts of Riemann sum, partitions, Upper and lower Riemann integrals, Refinement of partitions, Darboux's Theorem and Necessary and sufficient conditions for Integrability.

CO 2: To know and describe the Particular classes of Integrable functions, Properties of Integrable functions, Integrability of the sum, difference, product, quotient and modulus, First and second mean value theorems of integral calculus.

CO 3: Explain the concept of Improper Integrals and conditions for existence, Comparison test for convergence of improper integrals, Abel's Test and Dirichlet test for convergence.

CO 4: To distinguish between the absolute convergence and conditional convergence and find the relation between Beta and Gamma functions & their converging behaviour

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025-26

Course Title: Riemann Integration

Course Code: FMAL-5334

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Definition and Existence of the Riemann Integral, Partitions and Riemann (or Darboux) sums, Some properties of Darboux Sums, Upper and lower Riemann integrals, Refinement of partitions, Darboux's Theorem, Necessary and sufficient conditions for integrability.

Unit II

Particular classes of Integrable functions, Properties of integrable functions, Integrability of the sum, difference, product, quotient and modulus, The Fundamental theorem of integral calculus, First and Second mean value theorems of integral calculus.

Unit III

Improper Integrals and conditions for existence, Comparison test for convergence of improper integrals, Abel's Test and Dirichlet test for convergence.

Unit IV

Absolute convergence and conditional convergence of improper integrals, Beta and Gamma functions, Properties of Beta functions, Recurrence formulae for Gamma function, Relation between Beta and Gamma functions.

Text Book:

S. Narayan and M. D. Rai Singhania, Elements of Real Analysis, S. Chand & Co. Pvt. Ltd., New Delhi, Seventeenth Edition, 2016 (Scope as in chapters: 13, 16, 20).

Reference Books:

1. A. Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, Taylor & Francis Group, New York, First Edition, 2014 (Scope as in chapters: 6).
2. S. C. Malik and S. Arora, Mathematics Analysis, New Age International Publishers, New Delhi, Second Edition, 2005 (Scope as in chapters: 9,11).

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025-26

Course Title: Metric Spaces

Course Code: FMAL-5335

Course outcomes

After passing this course, the students will be able to:

CO1: Explain the fundamental concepts of Metric Spaces and their role in modern mathematics.

CO2: Understand the concept of compact sets , separated sets and state and prove Heine – Borel theorem

CO3: Demonstrate sequence in a metric space and give argument related to convergence.

CO4: Give argument related to continuity, completeness, compactness, connectedness in metric spaces.

Master of Science (Mathematics) (FYIP)

Semester–V

Session: 2025-26

Course Title: Metric Spaces

Course Code: FMAL-5335

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Metric on a set, Metric space, definitions and examples, open sets, interior and closure of a set, closed set, dense and nowhere dense sets, exterior, frontier and boundary points and their properties.

Unit II

Compact subsets of a metric space, elementary properties of compact sets, Heine-Borel theorem, separated sets, connected subsets of a metric space.

Unit III

Sequences in a metric space, Convergent Sequences, Cauchy Sequences, Complete Metric Spaces, Cantor's Intersection Theorem, Baire's Category Theorem.

Unit IV

Continuous Functions in a metric space, continuity and compactness, continuity and connectedness, discontinuities, monotonic functions, uniform continuity

Text Book:

S. Narayan and M. D.Raisinghania, Elements of Real Analysis, S. Chand & Company, New Delhi, 12th Edition, 2011 (Scope as in Chapter- 19)

Reference Books:

1.S. C.Malik and S. Arora, Mathematics Analysis, New Age International Publishers, New Delhi, 5th Edition, 2021 (Scope as in Chapter- 19)

2.W. Rudin, Principles of Mathematical Analysis, McGraw-Hill Education, New York, 3rd Edition, 1976 (Scope as in Chapters- 2, 3(3.1-3.12), 4)

SEMESTER-VI

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025 -26

Course Title: Complex Analysis

Course Code: FMAL-6331

Course outcomes

After passing this course, the students will be able to:

CO1: Justify the need for a complex number system and explain how it is related to other existing number system. Define a function of complex variable, limit, continuity and differentiability, Analytic functions, Conjugate function, Cauchy Riemann equations, Harmonic function and carry out basic mathematical operations with complex numbers.

CO2: State and prove Cauchy's theorem, Cauchy's integral formula, Cauchy's inequality, Poisson's integral formula, Morera's theorem and Liouville's theorem.

CO3: Define singularities of a function, know the different types of singularities and be able to determine the Residue at singularities of a function.

CO4: Learn The Fundamental Theorem of Algebra, The Argument principle, Rouché's theorem, Conformal transformations, Bilinear transformations, Critical points, Fixed points, and Problems on cross ratio and bilinear transformation.

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Complex Analysis

Course Code: FMAL-6331

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Functions of complex variables, Topology of real line and complex plane, limit, continuity and differentiability, Analytic functions, Conjugate function, Cauchy Riemann equations (Cartesian form), Harmonic function, Construction of analytic functions.

Unit II

Complex line integral, Cauchy's theorem, Cauchy's integral formula and its generalized form, Cauchy's inequality, Poisson's integral formula, Morera's theorem, Liouville's theorem.

Unit III

Taylor's theorem, Laurent's theorem, Zeros and Singularities of an analytic function, Residue at a pole and at infinity, Cauchy's Residue theorem.

Unit IV

The Fundamental Theorem of Algebra, The Argument principle, Rouché's theorem, Conformal transformations, Bilinear transformations, Critical points, Fixed points, The cross ratio, Problems on cross ratio and bilinear transformation.

Text Book:

S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, New Delhi, Second Edition, 1995 (Scope as in Chapters: 1-5).

Reference Books:

1. S. Narayan, Theory of Functions of a Complex Variable, S. Chand Co. Pvt. Ltd., New Delhi, Fourth Edition, 2009 (Scope as in Chapters: 3, 5, 7, 9, 11).

2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw-Hill Education, New York, Eighth Edition, 2004 (Scope as in Chapters: 1, 2, 4, 5, 6, 7, 9).

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Analytical Skills

Course Code: FMAL-6332

Course outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of sequence and series, clock problems, blood relationship.

CO 2: Demonstrate procedural fluency with real number arithmetic operations and use these operations to represent real world scenarios and to solve stated problems and demonstrate number sense and conversion between fractions, decimals and percentages.

CO 3: Use simple and compound interest to do business calculations such as value of money, maturity value, present value, future value and able to differentiate which math method should be used for different problems and understand the concept of mensuration.

CO 4: Analyse data being presented in the form of tables, Venn diagrams, pie charts.

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Analytical Skills

Course Code: FMAL-6332

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Sequence and Series: Analogies of Numbers and Alphabets, Completion of blank spaces following the pattern in A: b::C: d relationship, Odd thing out, Missing number in a sequence or a series.

Date, Time and Arrangement Problems: Calendar Problems, Clock Problems, Blood Relationship.

Unit II

Arithmetic Ability: Algebraic operations BODMAS, Fractions, Decimals Fractions, Divisibility rules, LCM & GCD (HCF), Elementary Algebra.

Quantitative Aptitude: Averages, Ratio and proportion, Problems on ages, Time and Work, Work and Wages, Pipes and Cisterns, Time and Distance, Trains, Streams.

Unit III

Mensuration: Measurement of Areas, Surface Areas and Volume.

Business Computations: Percentages, Profit & Loss, Partnership, Simple and Compound Interest.

Unit IV

Data Analysis: The data given in a Table, Graph, Bar Diagram, Pie Chart, Venn diagram or a Passage is to be analysed and the questions pertaining to the data are to be answered.

Reference Books:

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Co. Pvt. Ltd., New Delhi, Eighth Edition, 2017 (Scope as in Chapters:1-4, 6, 8, 11-14, 16-20, 22-23, 27-28, 35 (Section I) and Chapters 36-39 (Section II)).
2. R.V. Praveen, Quantitative Aptitude and Reasoning, PHI Learning Pvt. Ltd., Delhi, Third Edition, 2016 (Scope as in Chapters: 1, 4-8, 13-21, 23-29, 32, 34, 36, 39 (Part I) and Chapters 1,3,5 (Part II)).

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Numerical Analysis

Course Code: FMAL-6333

Course Outcomes

After passing this course, the students will be able to:

CO 1. Know how to find the roots of transcendental equations.

CO 2. Perform computation for solving a system of equations and understand its application in all branches of engineering.

CO 3. Learn how to interpolate the given set of values and understand the curve fitting for various polynomials. They will be able to compute numerical integration and differentiation, numerical solution of ordinary differential equations.

CO 4. Learn numerical solution of differential equations.

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Numerical Analysis

Course Code: FMAL-6333

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setter:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

The students can use only Non-Programmable & Non-Storage Type Calculator.

Unit I

Error generation, error propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Method of false position, Newton-Raphson method, Generalized Newton-Raphson method, Iteration method, Muller's method, Rate of convergence of these methods.

Unit II

Solution of linear system of equation: Direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative methods: Jacobi's method, Gauss Seidel method. Finite Differences: Forward, Backward, Central, Divided differences, shift operator, relationship between the operators and detection of errors by use of difference operator. Interpolation with divided difference, Newton's formula, Lagrangian method.

Unit III

Finite difference interpolation, Gauss formula, Stirling formula, Bessel's formula, Error Estimation, Extrapolation. Numerical differentiation: Method based on interpolation. Numerical Integration: Trapezoidal rule, Simpson's rule, Weddle rule, Romberg integration, Gaussian integration method, Gaussian legendre integration. Double numerical integration.

Unit IV

Numerical solution of ordinary differential equations, Initial value problem, Taylor's method, Euler's methods, Picard's method, Milne's method, Runge-Kutta method, Predictor- Corrector's method.

Text Book:

M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, Delhi, Fifth edition, 2007 (Scope as in Chapters 2-6).

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Special Functions

Course Code: FMAL-6334

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of Hyper geometric function, its integral form and Contiguity of Hyper geometric functions and solution of hyper geometric equation as a function of its parameters.

CO 2: Understand the concept of Bessel's Function and their properties like Recurrence Relations, Generating Function etc., modified Bessel Function and to recognize some of the Partial Differential Equations that can be solved by application of Bessel Functions.

CO 3: Understand the concept of Legendre's Function and their properties like Orthogonal Property, Recurrence Relations, Rodrigue's formula and Generating Function etc. and understand Hyper geometric forms of Legendre's function.

CO 4: Understand the concept of Hermite Polynomials, basic properties like Orthogonality, Rodrigue's formula etc. and its relation with 2^F_0 .

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Special Functions

Course Code: FMAL-6334

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Hypergeometric functions, The function $F(a,b,c,z)$, Integral form, Evaluation of $F(a,b,c,1)$, The contiguous function relations, The Hypergeometric differential equation, solution of hypergeometric equation, $F(a,b,c,z)$ as a function of its parameters, Relation between z and $1-z$, A quadratic transformation, A theorem due to Kummer.

Unit II

Bessel's functions of first and second kind, Bessel's differential equation, Recurrence relations, Generating functions, Bessel's integral, Modified Bessel functions, Neumann polynomials, Neumann series.

Unit III

Legendre's function $P_n(x)$, A generating function, Recurrence relation, Legendre differential equation, The Rodrigues formula, Bateman's generating function, Hypergeometric forms of $P_n(x)$ Laplace's first integral form, Orthogonality.

Unit IV

Hermite Polynomials, Recurrence relations, Rodrigues formula, Integrals, The Hermite polynomial as 2^F_0 , Orthogonality.

Text Book:

S. S Trivedi, Special functions, Pragati Prakashan, Meerut, XXI edition, 2021 (Scope as in chapters 3,4,5,6,7)

Reference Book:

M.D. Raisinghania, Ordinary and Partial Differential equations, S. Chand publication, New Delhi , 18th edition, 2013 (Scope as in chapters 9,10,11,12,14)

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Differential Geometry

Course Code: FMAL-6335

Course Outcomes

After passing this course, the students will be able to:

CO 1: Able to explain the concept of theory of space curve tangent, normal, binormal and rectifying plane.

CO 2: Able to understand contact between curves and surfaces, locus of centre of curvature, spherical curvature as well as calculate the curvature and torsion of curve

CO 3: Understand the concept of Spherical indicatrix, envelopes, and two fundamental forms,

CO 4: Understand tensor variables, metric tensor, contra-variant, covariant and mixed tensors & and able to apply tensors among mathematical tools for invariance and the reason why the tensor analysis is used and explain usefulness of the tensor analysis.

Master of Science (Mathematics) (FYIP)

Semester–VI

Session: 2025-26

Course Title: Differential Geometry

Course Code: FMAL-6335

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory:80

3 1 0

CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Curves in R^3 : A simple arc, curves and their parametric representation, arc length, contact of curves, tangent line, osculating plane, principal normal, binormal, normal plane, rectifying plane.

Unit II

Curvature and torsion, Serret-Frenet Formulae, Helics, Evolute and Involute of a parametric curve, Osculating circle and osculating sphere, spherical curves.

Unit III

Surfaces in R^3 : Implicit and Explicit forms of the equation of surface, two fundamental forms of a surface, Family of surfaces, Edge of regression, Envelops .

Unit IV

Einstein's summation convention, Transformations of coordinates, Tensor's law for transformation, contravariant, covariant and mixed Tensors, addition, outer product, contraction, inner product and quotient law of tensors, metric Tensor and Riemannian metric.

Text Book:

G.S Malik, Differential Geometry, Pragati Prakashan, Meerut , IX edition , 2013 (Scope as in chapters 1-10)

Reference Books:

1. D Somasundaram, Differential Geometry: A first Course, Alpha Science International Limited, New Delhi, 2005 (Scope as in chapters 1,2)

2. C.E Weather burn, Differential Geometry, Cambridge University Press, Cambridge (Scope as in chapters 1,2,3,4)