FACULTY OF SCIENCES

SYLLABUS

Master of Science (Mathematics) (FYIP)

(Semester: VII -VIII)

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

Session: 2026-27

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-VII
Session- 2026-27

Master of Science (Mathematics) (FYIP) Semester-VII										
Course Code	Course Type	Course Title	Hours Per Week L-T-P	Credits L-T-P	Total Credits	Max. Marks				Examination Time in Hours
						Total	TH	P	CA	
FMAL-7331	DSC	Algebra-I	4-1-0	4-1-0	5	100	80	-	20	3
FMAL-7332	DSC	Mathematical Programming-I	4-1-0	4-1-0	5	100	80	-	20	3
FMAL-7333	DSC	Real Analysis	4-1-0	4-1-0	5	100	80	-	20	3
FMAL-7134	C	Machine Learning	4-0-0	4-0-0	4	100	80	-	20	3
FMAM-7335	DSC	Technical Writing and Latex	3-0-2	3-0-1	4	100	50	30	20	3+3
Total					23					

C-Compulsory
DSC-Discipline Specific Courses

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-VIII
Session- 2026-27

Master of Science (Mathematics) (FYIP) Semester-VIII										
Course Code	Course Type	Course Title	Hours Per Week L-T-P	Credits L-T-P	Total Credits	Max. Marks				Examination Time in Hours
						Total	TH	P	CA	
FMAL-8331	DSC	Algebra-II	4-1-0	4-1-0	5	100	80	-	20	3
FMAL-8332	DSC	Mathematical Programming-II	4-1-0	4-1-0	5	100	80	-	20	3
FMAL-8333	DSC	History of Mathematics in India	4-0-0	4-0-0	4	100	80	-	20	3
FMAL-8134	C	Data and File Structures	4-0-0	4-0-0	4	100	80	-	20	3
FMAD-8335	C	Project	0-0-12	0-0-6	6	100	-	80	20	3
FMAL-8406	C	Universal Human Values-II: Understanding Harmony	3-0-0	3-0-0	3	100	-	80	20	3
Total					27					

C-Compulsory
DSC-Discipline Specific Courses

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Algebra-I
Course Code: FMAL-7331
Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Understand the importance of the algebraic properties with regard to working with various number systems, explain the significance of the notion of a normal subgroup, quotient group, and cyclic group.

CO 2: Know and recognize the concepts of homomorphism, isomorphism and automorphism and understand permutation group.

CO 3: Describe the structure of finite abelian group using Sylow's theorems.

CO 4: State the definitions Direct Products: External and Internal, its applications; Semi direct Products, Recognition Theorems on semi direct products.

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Algebra-I
Course Code: FMAL-7331

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 80

4 1 0 | CA:20

Instructions for 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

Groups: Definition & examples, Subgroups, Normal subgroups and Quotient Groups, Lagrange's Theorem, Generating sets, Cyclic Groups.

Unit II

The Commutator subgroups, Homomorphism, Isomorphism Theorems, Automorphisms, inner Automorphisms, Permutation groups, the alternating groups, Simplicity of A_n, $n \geq 5$, Cayley's theorem.

Unit III

Structure of finite Abelian groups. Conjugate elements, class equation with applications, Cauchy's Theorem, Sylow's Theorems and their simple applications, Composition Series, and Jordan Holder Theorem, Solvable Groups.

Unit IV

Direct Products: External and Internal. Fundamental theorem of finite Abelian groups and its applications; Semi direct Products, Recognition Theorems on semi direct products.

Text Book:

Fraleigh, J.B, An Introduction to Abstract Algebra, Pearson Education Publication Ltd., 2008.

Reference Books:

1 Herstein,I.N.,TopicsinAlgebra,WilleyEastern PublicationLtd.,1975.
2. Singh,S.and Zameeruddin,Q.,ModernAlgebra,Vikas PublicationPvt.Ltd.,2006.
3. Artin,M.,Algebra,Pearson India,2015.

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Mathematical Programming-I
Course Code: FMAL-7332
Course Outcomes

After the successful completion of this course, students will be able to:

CO 1: Formulate and solve linear programming problems using the simplex method and artificial variable techniques.

CO 2: Analyze and solve dual problems, transportation problems, and apply the MODI method for optimal solutions.

CO 3: Model and solve assignment and traveling salesman problems; apply game theory to two-person zero-sum games.

CO 4: Apply integer and dynamic programming techniques to solve optimization problems, including branch-and-bound and Gomory methods.

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Mathematical Programming-I
Course Code: FMAL-7332

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 80

4 1 0 | CA:20

Instructions for 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 linear programming problem, properties of a solution to the linear programming problem, generating extreme point solution, simplex computational procedure, development of minimum feasible solution, the artificial basis techniques, a first feasible solution using slack variables, two phase and Big-M method with artificial variables.

Unit II

General Primal-Dual pair, formulating a dual problem, primal-dual pair in matrix form, Duality theorems, complementary slackness theorem, duality and simplex method, economic interpretation of duality, dual simplex method. General transportation problem, transportation table, duality in transportation problem, loops in transportation tables, LP formulation, solution of transportation problem, test for optimality, degeneracy, transportation algorithm (MODI method), time minimization transportation problem.

Unit III

Mathematical formulation of assignment problem, assignment method, typical assignment problem, the traveling salesman problem. Game Theory: Two-person zero-sum games, maximin-minimax principle, games without saddle points (Mixed strategies), graphical solution of 2 * n and m * 2 games, dominance property, arithmetic method of n * n games, general solution of m * n rectangular games.

Unit IV

Integer Programming: Gomory's all I.P.P. method, constructions of Gomory's constraints, Fractional cut method-all integer and mixed integer, Branch-and-Bound method, applications of integer programming. Dynamic Programming: The recursive equation approach, characteristics of dynamic programming, dynamic programming algorithm, solution of-Discrete D.P.P., some applications, solution of L.P.P. by Dynamic Programming.

Reference Books:

1. Gass, S. L. Linear Programming (Methods & Applications), John Wiley & Sons, 2014
2. Hadley, G. Linear Programming, addison Publisher, 1963.
3. Kambo, N.S. Mathematical Programming Technique Affiliated East West Press Pvt. Ltd. 2008.

4. Swaroop, K., Gupta, P. K., Manmohan. Operations Research, S. Chand & Sons.
5. Panneerselvam, R. Operations Research, PHI Publications, 2016

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Real Analysis
Course Code: FMAL-7333
Course outcomes

After the completion of this course, students should be able to

CO 1: Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts of interior points, interior and closure, open set, closed set, derived set, closure of a set and compact set.

CO 2: Give argument related to Separated sets, connected sets, components, Convergence and completeness in metric spaces.

CO 3: Understand and derive proofs of mathematical theorems related to limit and continuity, continuity and compactness, continuity and connectedness and uniform continuity.

CO 4: Differentiate between sequence and series of functions and able to solve problems related to uniform convergence and differentiation and use the polynomials to approximate a function.

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Real Analysis
Course Code: FMAL-7333

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 80

4 1 0 | CA:20

Instructions for 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

Set Theory: Finite, countable and uncountable sets. Metric spaces; open balls, closed balls, open and closed sets, Neighborhood, limit points, interior points, interior and closure, k- cells, compactness of k-cells, Compact subsets of Euclidean space Rk,Perfect sets, The Cantor set.

Unit II

Separated sets, connected sets in a metric space, Connected subsets of real line, Components, Sequences in Metric Spaces: Convergent sequences (in Metric Spaces), subsequences, Cauchy sequences, Complete metric spaces, Cantor's Intersection Theorem.

Unit III

Baire's theorem, Banach contraction principle, Continuity: Limits of functions (in metric spaces) Continuous functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic functions, Uniform Continuity.

Unit IV

Sequences and Series of functions: Discussion of main problem, Uniform Convergence, Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous families of functions, Arzela's Theorem, Weierstrass Approximation theorem.

Text Book:

Rudin, W., Principles of Mathematical Analysis (3rd Edition), Mc Graw-Hill Ltd Ch.2,Ch.3, (3.1-3.12), Ch.4, Ch.6, (6.1-6.22), 2017.

Reference Books:

1. Simmons, G.F., Introduction to Topology and Modern Analysis, McGraw-Hill Ltd (App.1), pp 337-338, Ch.2 (9-13), 1963.
2. Narayan, S.,A course of Mathematical Analysis,S.ChandPublicationsLtd,2005.
3. Apostol, T.M., Mathematical Analysis 2nd Edition7.18(Th.7.30&7.31), Narosa Publication, 2002.
4. Malik, S.C. and Arora, S., Mathematical Analysis, New Age International Publisher, 2017.

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Machine Learning
Course Code: FMAL-7134
Course Outcomes

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Machine Learning
Course Code: FMAL-7134

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 80

4 0 0 | CA:20

Instructions for 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

Introduction: The Machine learning landscape: What is Machine Learning (ML), Why Machine Learning, Type of ML Systems, Main challenges of machine learning, Confusion Matrix, testing and validating. Applications of Machine Learning Applying Machine Learning to a project- Step through the machine learning workflow using an example. Working with real data, get data and prepare for machine learningby pre- processing data, deriving features, and training and refining models, fine tune the model, ready the solution for production. Probability and classification, Bayes optimal decisions, Naive Bayes and Gaussian class- conditional distribution.

Unit II

Linear regression; SSE; gradient descent; normal equations; features, Overfitting and underfitting. Classification problems; decision boundaries; nearest neighbour methods Supervised Learning: Linear classifiers, Bayes' Rule and Naive Bayes Model, Training a binary classifier, performance measures, multiclass classification, error analysis, multilabel classification, multioutput classification. Training Models: gradient descent, Polynomial regression, learning curves, regularized linear models, Logistic regression, Linear SVM classification, Non-linear SVM classification, SVM regression.

Unit III

Decision tree, Ensemble methods: Bagging, random forests, boosting, practical examples; the curse of dimensionality, dimensionality reduction, principal components analysis Unsupervised learning: clustering and clustering algorithms; Using clustering for image segmentation, for pre-processing, semi-supervised learning, DBSCAN; Gaussian Mixtures– anomaly detection, selecting number of clusters, Bayesian Gaussian mixture models, novelty detections algorithms.

Unit IV

Reinforcement learning and adaptive models, the model-based reinforcement learning paradigm, Explore Q-learning and SARSA.

Reference Books:

1. Alpaydin, E., Introduction to Machine Learning, Second Edition.
2. Geron,A., Hands on Machine Learning with Scikit Learn, Keras& Tensor Flow, O'Reilly

3. Marsland, S., Machine Learning: An Algorithmic Perspective
4. Bishop, C.M., Pattern Recognition and Machine Learning
5. Mitchell, T., Machine Learning 6. Raschka, S., Python Machine Learning, PACKT Publishing

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Technical Writing and Latex
Course Code: FMAM-7335
Course Outcomes

Upon completion of this course, students should be able to:

CO1: Students will be able to install and use Latex to create basic documents, including writing mathematical symbols, managing spacing, and formatting text structure.

CO2: Students will be able to design structured documents using title pages, sections, headers/footers, and generate tables of contents with proper labeling and referencing.

CO3: Students will be able to format documents using font styles, colors, lists, and insert tables and figures effectively in Latex.

CO4: Students will be able to typeset mathematical equations and symbols and manage bibliographies and citations in Latex documents.

Master of Science (Mathematics) (FYIP)
Semester–VII
Session-2026-27
Course Title: Technical Writing and Latex
Course Code: FMAM-7335

Examination Time: (3+3) Hours | Max. Marks: 100
Practical-30
Theory: 50
L T P | CA: 20
3 0 1

Instructions for the Paper Setters: Eight questions of equal marks (10 Marks each) are to be set, two in each of the four Sections (A-D). 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

Installation of the software Latex, Introduction to Latex, mathematical symbols, commands for writing mathematical symbols, spacing, Line breaking and page breaking, practical work on these topics.

Unit II

Title pages, Header and Footer, Text formatting, Essentials, troubleshooting, creating a title, sections, labelling, table of contents, practical work on these topics.

Unit III

Font effects, coloured text, font sizes, lists, comments and spacing, special characters, Practical for inserting tables and figures, practical work on these topics.

Unit IV

Inserting equations, mathematical symbols, inserting a bibliography, citing references, practical work on these topics.

Text Book:
Kopka, H., Daly, P.W., Guide to Latex, Addison-Wesley Professional, 4th Edition, 2003.

List of Practicals using Latex

1. Introduction to Latex, preparing and running a .tex file.

2. Inserting tables and figures.

3. Inserting line breaks, Foote notes.

4. Font Effects, Font sizes.

5. Write A Paragraph Containing Different colored text.

6. Use of special symbols like %, &,#,€,$ etc.

7. Mathematical symbols.

8. Write a mathematical text containing equations with equation numbers and unnumbered equations, and system of equations, arrays, matrices.

9. Preparing a bibliography using BibTeX

SEMESTER-VIII

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Algebra-II
Course Code: FMAL-8331
Course Outcomes

After the successful completion of this course, students will be able to:

CO 1: State the definitions of ring, subring, ideal, ring homomorphism.

CO 2: State definitions of important classes of rings associated with factorization: Unique Factorization Domain, Principal Ideal Domain, and Euclidean Domains. Show that a given ring falls into one of these classes (or not). Relate these classes of rings to each other.

CO 3: Explain the notion of an extension of a field. State the definitions and examples of algebraic extension, finite extension, simple extension, separable extensions, splitting field and Galois extension. Identify in specific examples whether an extension satisfies one of these properties.

CO 4: Describe Galois field. Relate the concept of solvability by radicals to Galois groups and State the definition of constructible point, line and number. Relate constructability to field extension degrees.

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Algebra-II
Course Code: FMAL-8331

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 80

4 1 0 | CA:20

Instructions for 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

Rings, Subrings, Ideals, Factor Rings, Homomorphism, Integral Domains. Maximal and prime ideals.

Unit II

The field of Quotients of an integral domain. Principal Ideal domains, Euclidean Rings. The ring of Gaussian Integers, Unique Factorization domains, Polynomial Rings, Gauss's theorem and irreducibility of a polynomial.

Unit III

Extension Fields: Finite and Infinite, Simple and Algebraic Extensions, Splitting fields: Existence and uniqueness theorem.

Unit IV

Separable and inseparable extensions, perfect fields, finite fields, Existence of GF(p^n), construction with straight edge ruler and compass.

Text Books:

1. Herstein, I.N. Topics in Algebra, Willey Eastern1975.
2. Fraleigh, J.B. An Introduction to Abstract Algebra, Pearson Education Publication Ltd., 2008.

Reference Books:

1. Singh, S. and Zameeruddin, Q. Modern Algebra, Vikas Publication Pvt. Ltd., 2006.
2. Bhattacharya, P.B., Jain, S.K., and Nagpal, S. R. Basic Abstract Algebra, Ch-14 (Sec.1-5), 1994.

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Mathematical Programming-II
Course Code: FMAL-8332
Course Outcomes

After the successful completion of this course, students will be able to:

CO 1: Understand and analyze basic queueing models, including M/M/1 and generalized birth-death processes.

CO 2: Apply multi-server queueing models and solve deterministic inventory control problems including EOQ and price break models.

CO 3: Formulate and solve replacement problems for deteriorating and failed equipment, including manpower planning.

CO 4: Develop and implement simulation models using Monte Carlo methods for systems like inventory, queues, and job sequencing

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Mathematical Programming-II
Course Code: FMAL-8332

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 80
4 1 0 | CA:20

Instructions for 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

Queueing Theory: Introduction, Queueing System, elements of queueing system, distributions of arrivals, inter arrivals, departure and service times. Classification of queueing models, single service queueing model with infinite capacity (M/M/1): (∞ /FIFO), Queueing Models: (M/M/1): (M/M/1): (N/FIFO), Generalized Model: Birth-Death Process.

Unit II

(M/M/C): (∞/FIFO), (M/M/C) (N/FIFO), (M/M/R) (KIGD), Power supply model., Inventory Control: The inventory decisions, costs associated with inventories, factors affecting Inventory control, economic order quantity (EOQ), Deterministic inventory problems with no shortage and with shortages, EOQ problems with price breaks, Multi item deterministic problems

Unit III

Replacement Problems: Replacement of equipment/Asset that deteriorates gradually, replacement of equipment that fails suddenly, recruitment and promotion problem, equipment renewal problem.

Unit IV

Need of simulation, methodology of simulation. Simulation models, event- type simulation, generation of random numbers, Monte-Carlo simulation, simulation of inventory problems, queueing systems, maintenance problem, job sequencing.

Text Book:
Kambo, N.S. Mathematical Programming Technique Affiliated East West Press Pvt. Ltd. 2008.

Reference Books:
1. Hadley, G. Linear Programming, addison Publisher, 1963.
2. Panneerselvam, R. Operations Research, PHI Publications, 2016

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: History of Mathematics in India
Course Code: FMAM-8333
Course Outcomes

After the successful completion of this course, students will be able to:

CO1: Demonstrate understanding of the geometric, mensurational, and trigonometric contributions of ancient Indian mathematicians, particularly those found in the Shulbasutras and later classical texts.

CO2: Examine arithmetic, combinatorial, and recreational mathematical techniques in Indian mathematics, including number properties, series identities, Virahanka sequence, Kaprekar numbers, and magic squares.

CO3: Analyze classical Indian algebraic methods for linear, quadratic, higher degree, and indeterminate equations, with special emphasis on Kuttaka and Chakravala methods.

CO4: Appreciate the Kerala School's contributions to infinite series, trigonometric expansions, and early ideas of differential and integral calculus.

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: History of Mathematics in India
Course Code: FMAM-8333

Examination Time: 3 Hrs

LTP
4 0 0

Max. Marks: 100
Theory: 80
CA: 20

Instructions for the paper setters/examiners:
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

Geometry in Shulbasutras [Ref. 2, Chapter-II]: Theorem of the square of the diagonal (Baudhayan, and Katyayan), Construction of geometrical figures in Shulbasutras (Squares, rectangles, trapezia, isosceles triangle equal in area to the given square and vice versa, rhombus of given area), Area preserving transformations of figures (Squaring the circle and circling the square, Rectangle to square and converse, rectangle or square into trapezium, trapezium into equivalent rectangle, rhombus into rectangle), Construction by the combination and subtraction of areas. The radius of Khavrita; hypotenuse of the right-angled triangle formed by Gnomon of shadow, Geometric proof of the sum of first n odd numbers. Brhamgupt's formula of a cyclic quadrilateral with Heron’s formula as the special case. Proof of the relation between the Area and the Circumference of the circle by Neelkanth Somya ji, by the summation of Infinitesimals. Area and volume (Tetrahedron, Frustum, Cone, Pyramid, Sphere) problems by Araybhatt-I, Brahmagupt, and Bhaskar-II. The surface area and the volume of the sphere with early integration attempt in Yukti Bhasa. [Ref. 1, Ref. 2, Chapter V, VIII.] Origin of the term sine and cosine from Jya and Kotijya. Methods of constructing sine (Jya) by forming triangles and quadrilaterals in the quadrant of a circle. Yukti Bhasha proof of trigonometric identities. [Ref. 1, Ref. 2 Chapter V.]

Unit II

Mathematical Analysis of the methods developed by Bharti Krishna Tirtha: Divisibilty, squares and square roots, cubes and cube roots, and their theoretical proofs [Ref. 3, Chapter II]. Comparison of the methods developed for same by Aryabhatta, Sridhara, and Bhaskara-II. Varsankalita of Narayan Pandit (Sum of sums of natural numbers, sum of sums of terms in A.P., and extensions of Virahaṅka sequence, the so-called Fibonacci sequence, Representation of any number as a sum of Virahaṅka numbers, Super Golden ratio). Some identities related to the sum of series given by Sridhar, Mahavir, Thakkar Pheru, and Narayan Pandit with reference to Patiganit, Ganitasarasangraha, Ganitasarakaumudi, and Ganit Kaumudi. Kaprekar constant and convergence to Kaprekar constant, Kaprekar’s swayambhu number, and their properties, Kaprekar’s Harshad and Demlo numbers, Extension of Kaprekar’s numbers to polynomials and other bases. Bhadraganit: Construction of magic squares, Pandiagonal magic squares, Sarvatobhadra of Varahamihira, Alpashruti, and Turgagati methods of Narayana Pandita. Classifications for magic squares with reference to Ganitasarasakaumudi of Thakkar Pheru (Even, odd, and evenly odd magic squares), and their construction.

Unit III

Linear equations in one variable, rules of false position, Bhaskar's method of operations with optional numbers. Aryabhatt's & Brahmgupt's method of division of differences. Linear equations with several unknowns (rules of Brahmagupt, Mahavir, and Bhaskar). [Ref. 1. Vol-II, Chapter. 7] Quadratic equations (rules of Aryabhtt-I, Brahmagupt, Aryabhatt-II, Sridhar, Mahavir, Sripati, and Bhaskar-II). Solutions of equations of higher degrees and simultaneous quadratic equations by Bhaskar and Mahavir. One linear equation with more than two unknowns, Simultaneous Indeterminate equations of the first degree. Pulverisation (Kuttak) method. Solution of Brahmgupt-Bhaskar equation (The so-called Pell's equation) of the type Nx2± c=y2. Bhavana lemmas of Brahmagupt. Chakraval method of Bhaskar-II, Continued Fractions. [Ref. 3, Chapter-III], Single Indeterminate equations of higher degrees.

Unit IV

Madhav's infinite series for inverse tangent and π/4 (The so called Gregory-Leibnitz series). Madhav's infinite series for sine and cosine. Proof by Neelkanth Somyaji in Yukti-Bhasha and early attempts of integral Calculus with reference to the Kerala School of Mathematics. Rapidly converging series, Madhav's formulae for remainder terms.

Text Books:

1. Datta, B., & Singh, A. N. History of Hindu Mathematics: A Source Book, Vol-I, II, Gyan Prakashan, 2021. (First Published 1938, Lahore).
2. A. Saraswati, T. A. Geometry in Ancient and Medieval India: Motilal Banarsidass Publishers Private Limited, 2017. (First Edition 1979).
3. Bhanu Murthy, T. S. A modern Introduction to Ancient Indian Mathematics, New Age International Publishers, 2009 (First Edition 1992).
4. Parameshwaran, S. The Golden Age of Indian Mathematics, Swadeshi Science Movement, Kerala, 1998.
5. SaKHYa. Ganitasarakaumudi The Moonlight of the Essence of Mathematics by Thakkura Pheru, MANOHOR. 2009.

Reference Books:

1. Hayashi, T. Indian Mathematics.
2. Plofker, K. Mathematics in India.
3. Joseph, G. G. The Crest of the Peacock: Non-European Roots of Mathematics.
4. Sarma, K. V. &Ramasubramanian, K. Ganita-Yukti-Bhasha of Jyesthadeva.
5. Introduction to Indian Knowledge system, Concepts and Applications.**
6. Kamble, B. The Imperishable seed, Garuda Prakashan Pvt. Ltd., 2022.
7. Clark, W. E. The Aryabhatiya of Aryabhata, An ancient Indian work on Mathematics and Astronomy, D. K. Printworld, 2018 (First Published 1930)

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Data and File Structures
Course Code: FMAL-8134
Course Outcomes

After the successful completion of this course, students will be able to:

CO1: Students will be able to analyze fundamental data structures (arrays, linked lists) and evaluate algorithm complexity using Big-O notation and time–space trade-offs.

CO2: Students will be able to implement and apply linear and hierarchical data structures such as stacks, queues, and trees to solve computational problems.

CO3: Students will be able to design and apply algorithms including greedy methods, graph algorithms, and heap operations for optimization and problem-solving.

CO4: Students will be able to implement searching and sorting techniques, utilize hashing methods, and analyze file organization strategies for efficient data management.

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Data and File Structures
Course Code: FMAL-8134

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 80

4 0 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 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

Preliminaries: Various data structures, common operations on data structures, algorithm complexity, big O notation, time–space trade off between algorithms. Arrays: Arrays defined, representing arrays in memory, various operations on linear arrays, Multi dimensional arrays, Records. Linked Lists: Types of linked lists, representing linked lists in memory, advantage of using linked lists over arrays, various operation on linked lists

Unit II

Stacks: Description of stack structure, implementation of stack using arrays and linked lists. Applications of stacks– converting arithmetic expression from infix notation to polish and their subsequent evaluation, quicksort technique to sort an array, parenthesis checker. Queues: Description of queue structure, implementation of queue using arrays and linked lists, description of priorities queues. Applications of queues– Operating system simulations Trees: Description of tree structure and its terminology, binary search tree, implementing binary search tree using linked lists, various operations on binary search trees, AVL Trees, Threaded Binary Trees, B Trees, B+ trees.

Unit III

Greedy Method: Knapsack Problem, Prim's and Kuruskal's Algorithm to find MSTs. Heaps: Description of heap structure, implementing heaps using arrays, various operations on heaps, Applications of heaps– heapsort technique to sort an array, implementation of priority queues. Graphs: Description of graph structure, implementing graphs in memory using adjacency matrix or adjacency lists, various graphs traversing algorithms, finding shortest path between two nodes, Dijkastra’s shortest path algorithm., finding biconnected component, strongly connected component and finding cycles in the graphs.

Unit IV

Searching and Sorting: Sorting Types, External and Internal sort Linear Search, Binary search, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Shell Sort, Quick sort, Radix Sort. Hash Tables: Direct address tables, hash tables, collision resolution by chaining, hash functions, open addressing– linear probing, quadratic probing, double hashing. Files: Operations on files, Types of files, File Organizations: Sequential files, Indexed Sequential file, Directed files and multi–key files, File performance criteria and terms.

Reference Books:

1. Lipschutz, S., Theory and Problems of Data Structures, Schaum Outline Series, McGraw–Hill Book Company. Third Edition

2. Esakov, J., Data Structures– An Advanced Approach Using C, Tom Weiss, Prentice– Hall International, Inc. 2007
3.Trembley and Sorenson: An Introduction to Data Structures with Application, Tata–McGraw Hill Company, Delhi. 2003
4.Tanenbaum: Data Structures and C. Second Edition

Master of Science (Mathematics) (FYIP)

Semester–VIII

Session-2026-27

Course Title: Project

Course Code: FMAD-8335

Course Outcomes

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

CO 1: To understand the basic framework of research process.

CO 2: To understand the primary characteristics of research and to identify various sources of information for literature review and data collection.

CO 3: To learn how to design a project and will be accustomed to work independently and confidently.

CO 4: To understand the formulation of Mathematical Problem based on real time applications

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Project
Course Code: FMAD-8335

The students will do project work primarily focusing on educational research for the resurgence of quality education as a whole through research practices.

To monitor the progression of the students, CP-I, MST, CP-II will be conducted accordingly. In end semester examination, students will be evaluated on the basis of viva-voce and project report as per examination policy of Kanya Maha Vidyalaya.

Master of Science (Mathematics) (FYIP)
Semester–VIII
Session-2026-27
Course Title: Universal Human Values-II: Understanding Harmony
Course Code: FMAL-8406

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 80
3 0 0 | CA: 20

Instructions for 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

Development of Holistic Perspective through Universal Human Values a) Recapitulation from universal human values and its implications for holistic development. Self Exploration- Meaning, Content, Process (Natural Acceptance and Experiential validation). b) Human Aspirations- Concept, Requirements (Right understanding, relationship- and physical facility) and methods for fulfilment of aspirations, Critical appraisal of human aspirations to achieve happiness and prosperity.

Unit II

Harmony in Human Beings and Human-Human Relationship a) Human being as a co-existence of self and body: Characteristics of self, needs of self and body, Body as an instrument of self, Harmony of self with body: Sanyam and Health, Programs to ensure Sanyam & Health. b) Human-Human Relationship: Universal Values in Human-Human relationship, Programmes for ful filment of values, Trust & Intention, Respect & Differentiation, Harmony in society: Undivided So ciety, Universal order, family to world family for Achieving comprehensive human goals (Resolu tion, Prosperity, fearlessness & Co-existence).

Unit III

Harmony in Nature and Existence a) Understanding harmony in the Nature, Holistic perception of harmony at all levels of existence. Film on home to be used for balance / imbalance in nature. b) Importance of Yoga in daily life; Ashtang Yoga (Eight stages of Yoga) and benefits of Asanas,
Pra nayama and Concentration.

Unit IV

Harmony on Professional Ethics a) Natural acceptance of human values, Humanistic Education, Humanistic Constitution, Humanistic Universal order and Ethical Human Conduct. b) Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order, identify the scope and characteristics of people friendly and eco-friendly production systems, identify and develop appropriate technologies and management patterns for above production systems.

Reference Books:
1. Andrews, C. (2006). Slow is Beautiful: New Vision of Community, Leisure and Joie De Vivre. New Society Publishers Paperback in English.
2. Azad, M.A.K. (1988). India Wins Freedom. Madras: Orient Longman Limited.
3. Dharampal. (2003). Rediscovering India. New Delhi: Society for Integrated Development of Hima layas.

4. Gandhi, M.K. (1921). Hind Swaraj or Indian Home Rule. Madras: Navajivan Publishing House.
5. Gandhi, & Desai, M. H. (1993). An autobiography: the story of my experiments with truth. American ed. Boston, Beacon Press.
6. Kumarappa, J.C. (1984). Economy of Permanence. Sarva-Seva-Sangh-Prakashan: Rajghat, Varanasi.
7. Leonard, A. (2007). The story of stuff. Widescreen format. [Berkeley, Calif.], Free Range Studios.
8. Nagraj, A. (1999). Jeevan Vidya: EkParichaya, Jeevan Vidya Prakashan, Amarkantak. Ajab Distrib uter.
9. Rolland, R. (1930). Mahatma Gandhi. London: George Allen & Unwin Ltd. Museum Street.
10. Rolland, R. (1961).The Life of Vivekananda and the Universal Gospel. Utter Pradesh: Swami Vireswarananda.