SYLLABUS

For

MASTER OF SCIENCE (MATHEMATICS) (FYIP)

SEMESTER–I, II, IV, V, VI, VII, VIII

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 Year Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Mathematics) (FYIP)
Session- 2026-27

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER I										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAM-1130	Programming Language - I	SEC	3-0-2	3-0-1	4	100	40	30	30	3+3

SEC-Skill Enhancement Course

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER II										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAM-2135	Object Oriented Programming C++	C	3-0-2	3-0-1	4	100	40	30	30	3+3

C – Compulsory

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER IV										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAM-4134	Statistical Computing Using R Programming	C	3-0-2	3-0-1	4	100	40	30	30	3+3

C – Compulsory

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER V										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAL-5134	Machine Learning	C	4-0-0	4-0-0	4	100	70	-	30	3

C – Compulsory

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER VI										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAL-6134	Data & File Structures	C	4-0-0	4-0-0	4	100	70	-	30	3

C – Compulsory

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER VII										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAL-7134	Machine Learning	C	4-0-0	4-0-0	4	100	80	-	20	3

C – Compulsory

MASTER OF SCIENCE (MATHEMATICS) (FYIP) SEMESTER VIII										
Course Code	**Course Title**	**Course Type**	**Hours per week**	**Credit**		**Marks**				**Examination Time (in Hours)**
			L-T-P	**L-T-P**	**Total**	**Total**	**Ext.**		**CA**	
							L	**P**		
FMAL-8134	Data & File Structures	C	4-0-0	4-0-0	4	100	80	-	20	3

C - Compulsory

Master of Science (Mathematics) (FYIP)

Semester–I
Session-2026-27
Course Title: Programming Language - I
Course Code: FMAM- 1130

Course Outcomes:

After passing course the student will be able to:

CO1: Articulate various kind of software and hardware used in computers.

CO2: Work with different set of operations in C programming.

CO3: Apply various control statements of C Programming Language for designing solutions to different real world problems.

CO4: Implement single and multidimensional arrays for representing complex data collections

Master of Science (Mathematics)(FYIP)
Semester–I
Session-2026-27
Course Title: Programming Language - I
Course Code: FMAM- 1130

Examination Time: (3+3) Hours | Max. Marks: 100
Practical-30
Theory: 40
CA: 30

L T P
3 0 1

Instructions for the Paper Setters: Eight questions of equal marks (8 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

Introduction to Computer Programming, Program Development life cycle, algorithms, flow chart, decision table & pseudo code.

Unit II

Introduction to C language, data types, Operators and Expression, Input/output Functions, Structured programming elements, Control statements: Branching, Jumping, Looping Arrays.

Unit III

Pointers, Functions: Inbuilt Functions, User defined Functions, Recursion, Storage Classes in C, dynamic memory management.

Unit IV

Strings, Structure and union, Reference variables, basics of searching and sorting techniques, file handling in C

References / Textbooks:

1. E. Balagurusamy, Programming in ANSI C, Tata McGraw-Hill (2002), 5th edition.
2. Stephen G. Kochan, Programming in C, Pearson Education (2015), 4th edition.
3. R.S. Salari, Application Programming in C, Khanna Book Publishing (2012), 4thedition.
4. Anshuman Sharma, Learn programming in C, Lakhanpal Publishers (2016), 7thedition.

Master of Science (Mathematics)(FYIP)
Semester–II
Session-2026-27
Course Title: Object Oriented Programming C++
Course Code: FMAM-2135

Course Outcomes:

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

CO1: Comprehend the concepts of Object-Oriented Programming Paradigm.

CO2: Identify the use of access specifiers and different types of constructors in class.

CO3: Apply function and operator overloading.

CO4: Comprehend different types of inheritance and polymorphism.

Master of Science (Mathematics)(FYIP)
Semester–II
Session-2026-27
Course Title: Object Oriented Programming C++
Course Code: FMAM-2135

Examination Time: 3 Hours | Max. Marks: 100
Practical-30
Theory: 40
CA: 30

L T P
3 0 1

Instructions for the Paper Setters:

Eight questions of equal marks (8 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

GettingStarted:Introduction.AbriefhistoryofC++,Variable,Constant,Expression,Statements,Comments and keywordsofC++.

Operator: Arithmetic, Relational, Logical, Assignment, Increment/Decrement, Conditional, Precedence of Operators.Datatype, Type conversion, library function.

Input/OutputStatements: Inputting using c in and outputting using c out statements, Preprocessor directives.

Basic Program construction: A complete C++ program: invoking Turbo C++, naming your program, using the editor, saving your program, compiling and linking, running the program Errors: Compiler, linker andruntime.

Other IDE features: Compiling and linking, shortcut exiting from IDE, examining files, opening an existingfile, DOSshell.

Unit II

Programming Paradigms: Introduction to the object oriented approach towards programming by discussing Traditional, Structured Programming methodology.

Objects & Classes: Object Definition, Instance, Encapsulation, Data Hiding, Abstraction, Inheritance, Messages, Method, Polymorphism, Classes.

Object Oriented Programming using C++: Characteristics of OOP, Overview of C++, Objects and Classes, Member functions and data, private & public, constructor & destructor, Constructor Overloading, Types of Constructors.

Unit III

Operator Overloading: Overloading unary operators, Overloading binary operators, Data conversion, Pit-fallsoperator overloadingandconversion.

Function Overloading: Function Overloading, Default Arguments, Ambiguity in Function Overloading.

Unit IV

Inheritance: Concept of inheritance, Base & derived classes, Access Specifiers, Class Hierarchies, Types of Inheritance with examples.

Polymorphism: Virtual functions, friend functions, static function, this pointer, polymorphism, Types of Polymorphism with examples, Templates

References / Textbooks:

1. Herbertt Schildt, C++: The Complete Reference, Tata McGraw-Hill Education India, 4th Edition.
2. Bjarne Stroustrup, The C++ Programming Language, Addison – Wesley Professional (2013), 4th Edition
3. G.S. Baluja, C++ Program Design (w/CD), Khanna Book Publishing Company (2015), 2nd edition.
4. Stanley Lippman, Josee Lajoie, Barbara Moo, C++ Primer, Addison-Wesley Professional (2012), 5th edition.
5. Richard Johnsonbaugh and Martin Kalin, Object Oriented Programming in C++, Pearson Education (1999), 2nd Edition

Master of Science (Mathematics) (FYIP)
Semester–IV
Session-2026-27
Course Title: Statistical Computing Using R Programming
Course Code: FMAM-4134

Course Outcomes:

After passing this course the student will be able to:

CO1: Comprehend basics of Statistical Computing and managing data structures like vector, matrix, etc.

CO2: Create, operate and manage lists and data frames.

CO3: Apply control and I/O statements for generating outputs.

CO4: Simulate various descriptive and analytical algorithms using R language along with their visualization.

Master of Science (Mathematics) (FYIP)
Semester–IV
Session-2026-27
Course Title: Statistical Computing Using R Programming
Course Code: FMAM-4134

Examination Time (3+3) Hours | Max. Marks: 100
Theory: 40
Practical: 30
CA: 30

L T P
3 0 1

Instructions for Paper Setters:

Eight questions of equal marks (8 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

Data Statistics: Sampling, Cumulative statistics, Statistics for Data frames, matrix objects and lists.

Introduction to R, Help functions in R, Vectors, Common Vector Operations, Using all and any function, subletting of vector. Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, lists, Creating lists, general list operations, Accessing list components and values, applying functions to lists, recursive lists

Unit II

Creating Data Frames – Matrix-like operations in frames , Merging Data Frames, Applying functions to Data frames, Factors and Tables , factors and levels , Common functions used with factors , string operations

Unit III

Input/ Ouput: scan() , readline() Function, Printing to the Screen Reading and writing CSV and text file. Control statements: Loops, Looping Over Nonvector, Sets, if-else , writing user defined function, scope of the variable, R script file

Unit IV

Graphics in R: Graph Syntax ((title, xlabel, ylabel, pch, lty, col.), Simple graphics (Bar, Multiple Bar, Histogram, Pie, Box-Plot, Scatter plot, qqplot), Low-level and High-Level plot functions, par() command to generate multiple plots.

Note:

Practical: Based on simple mathematical problems and based on syllabus of Statistical Methods for descriptive Statistics.

References Books:

1. Andrie de Vries and Joris Meys, R Programming for Dummies, Wiley (2016), 2nd Edition.
2. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (2017), 1st Edition.
3. Sandip Rakhsit, Statistics with R Programming, McGraw Hill Education (2018), 1st Edition.
4. Garrett Grolemund, Hands on Programming with R, O'Reilly (2014), 1st Edition
5. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley (2013)
6. Tilman M. Davies, The Book of R: A first Course in Programming and Statistics, No Strach Press (2016), 1st Edition

Master of Science (Mathematics) (FYIP)
Semester–V
Session-2026-27
Course Title: Machine Learning
Course Code: FMAL-5134

Examination Time: 3 Hours Max. Marks: 100

L T P Theory: 70
4 0 0 CA:30

Instructions for Paper Setters:
Eight questions of equal marks (14 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–VI
Session: 2026-27
Course Title: Data & File Structures
Course Code: FMAL-6134

Examination Time: 3Hours | Max. Marks: 100

Theory: 70
CA: 30

L T P
4 0 0

Instructions for the Paper Setters: Eight questions of equal marks (14 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–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–VIII
Session-2026-27
Course Title: Data & File Structures
Course Code: FMAL-8134

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

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.

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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