

Annexure B

FACULTY OF SCIENCES

SYLLABUS

FOR

Master of Science (Mathematics) (FYIP)

(Semester: I -IV)

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

Session: 2025-26



The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Master of Science (Mathematics)(FYIP)

Session: 2025-26

Programme Specific Outcomes

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

PSO1: Acquire a strong foundation in core areas of mathematics such as Algebra, Real and Complex Analysis, Topology, Differential Equations, and Mathematical Modelling.

PSO2: Develop the ability to think logically and critically, formulate and solve complex mathematical problems using appropriate techniques and tools.

PSO3: Apply mathematical concepts in research-oriented activities, undertake projects, and contribute to the advancement of knowledge in mathematics and allied disciplines.

PSO4: Gain hands-on experience in using computational software such as MATLAB, Python, and R for solving mathematical problems and analyzing data.

PSO5: Effectively communicate mathematical ideas, theories, and results through well-structured reports, presentations, and discussions suitable for academic and professional platforms.

PSO6: Demonstrate readiness for pursuing higher studies, qualifying competitive exams, and taking up careers in academics, research, data science, actuarial sciences, and the financial sector.

PSO7: Integrate mathematical knowledge with other disciplines such as physics, computer science, economics, and engineering to solve interdisciplinary problems.

PSO8: Demonstrate awareness of ethical issues, professional responsibilities, and the societal impact of mathematical modelling and data analysis.

PSO9: Cultivate a habit of continuous learning and updating mathematical knowledge and skills in response to emerging trends and technologies.

PSO10: Develop the ability to work effectively both independently and as part of a team, taking initiative and leadership roles in collaborative mathematical projects and research work.

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)

Semester-I

Session- 2025-26

Master of Science (Mathematics) (FYIP) Semester-I										
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-1421/ FMAL-1031/ FMAL-1431	C	¹ Punjabi (Compulsory)/ ² Basic Punjabi/ ³ Punjab History and Culture	2-0-0	2-0-0	2	50	35	-	15	3
FMAL-1102	AEC	Communicative English-I	2-0-0	2-0-0	2	50	35	-	15	3
FMAL-1333	DSC	Calculus	4-0-0	4-0-0	4	100	70	-	30	3
FMAL-1334	DSC	Theory of Equations	4-0-0	4-0-0	4	100	70	-	30	3
FMAL-1335 OR	C	⁴ Dynamics	4-0-0	4-0-0	4	100	70	-	30	3

FMAM-1395		OR ⁵ Mechanics - I	3-0-2	3-0-1	4	100	40	30	30	3+3
FMAP-1336	DSC	Calculus Laboratory	0-0-4	0-0-2	2	50	-	35	15	3
FMAM-1130	SEC	Programming Language - I	3-0-2	3-0-1	4	100	40	30	30	3+3
VACF-1491	VAC	*Foundation Course	2-0-0	2-0-0	2	50	35	-	15	1
Total					24					

C-Compulsory

AEC-Ability Enhancement Course

DSC-Discipline Specific Course

SEC-Skill Enhancement Course

VAC-Value Added Course

Note:¹Domicile / Non Domicile of Punjab students who have studied Punjabi till 8th/ 10th class will study Punjabi (compulsory)

^{2,3}The Non-Domicile of Punjab Students who have not studied Punjabi till 8th/10th class can choose either Basic Punjabi or Punjab History and Culture (PHC)

²Domicile of Punjab students who studied out of Punjab and did not study Punjabi till 8th / 10th class will have to study Basic Punjabi

²Domicile of Punjab students who have studied in Kendriya Vidyalaya of Punjab or any other school and due to any reason did not study Punjabi till 8th/10th class will have to study Basic Punjabi

⁴ Only those students can opt this course who have not studied Physics, Chemistry at +2 level.

⁵Only those students can opt this course who have studied Physics, Chemistry and Mathematics at +2 level.

* Marks of this paper will not be added in total marks. Grades will be provided.

Master of Science (Mathematics)(FYIP)

Semester–I

Session- 2025-26

Course Title: Calculus

Course Code: FMAL-1333

Course Outcomes

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

CO 1: Understand real number system, limit of a function, basic properties of limit, continuity, and classification of discontinuities & to apply it in real world problem.

CO 2: To Classify the difference between increasing and decreasing functions and understand the concept of Differentiability of functions and maxima & minima.

CO 3: Demonstrate Asymptotes, points of inflexion, multiple points on a curve & also to differentiate between concavity and convexity.

CO 4: To understand the concepts of Riemann sum, definite integrals and their properties, the fundamental theorem of calculus, applications to length of arc and area bounded between curves, Reduction Formulae & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

Master of Science (Mathematics)(FYIP)

Semester–I

Session-2025-26

Course Title: Calculus

Course Code: FMAL-1333

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA:30

L T P

4 0 0

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

Review of limit and continuity of a function of real variable, indeterminate forms, higher order derivatives, Leibnitz theorem and applications to problems of the type

$$e^{ax} \sin(bx + c), e^{ax} \cos(bx + c), (a + bx)^n \sin x, (a + bx)^n \cos x.$$

Unit II

Differentiability of functions of real variable, increasing and decreasing functions, maxima and minima, Taylor's and Maclaurin's theorem with various forms of remainders.

Unit III

Concave upward, Concave downward, Point of inflexion, Asymptotes, Horizontal and Vertical Asymptotes, asymptotes of the algebraic curves represented by homogeneous equation in two variables.

Unit IV

Anti derivative of function of real variable, Riemann sums, definite integrals and their properties, the fundamental theorem of calculus, applications to length of arc and area bounded between Cartesian curves, Reduction Formulae, illustration of Reduction Formulae of type $\int \sin^n x \, dx$, $\int \cos^n x \, dx$, $\int \tan^n x \, dx$, $\int \sec^n x \, dx$, $\int \sin^n x \cos^m x \, dx$

Text Book:

Thomas, G.B., and Finney, L.R., Calculus and Analytic Geometry, 9th Edition,

Addison Wesley, 1998, (Scope as in Ch.1-7, 9, 11).

Reference Books:

1. Apostol, T.M., Calculus, An Indian Adaptation, Wiley, 2022.
2. Anton, H., Bivens, I., and Davis, S., Calculus, 12th Ed. John Wiley and Sons (Asia)P. Ltd, Singa- pore, 2002. (Scope as in ch.0-3, 6, 10,12)
3. R. Courant and F. John. Introduction to Calculus and Analysis (Vol. 1), Springer, 1999. (Scope as in Ch.4)

Master of Science (Mathematics) (FYIP)

Semester-I

Session-2025-26

Course Title: Theory of Equations

Course Code: FMAL- 1334

Course Outcomes

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

CO 1: Understand the concept of Greatest Common Divisor, Unique Factorization of Polynomial over a field F

CO 2: To find the relations between the roots and coefficients of general equation in one variable, distinguish between solution of cubic equations and Bi-quadratic equations.

CO 3: Classify Symmetric functions, Solutions of reciprocal and binomial equations, and Algebraic solutions of the cubic and biquadratic Equations using Cardan's Method, Descarte's Method, Ferrari Method.

CO 4: Obtain homogeneous products, limits of the roots of equations and Separation of the roots of equations.

Master of Science (Mathematics) (FYIP)

Semester: I

Session: 2025-26

Course Title: Theory of Equations

Course Code: FMAL- 1334

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA: 30

L T P

4 0 0

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

General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, Euclid's Algorithm, Greatest Common Divisor, Unique Factorization of Polynomial over a field F of numbers (Statement Only), Fundamental Theorem of Algebra (Statement only), Roots and their Multiplicity.

Unit II

General properties of equations, Relationship between the roots and the coefficients, Fundamental theorem of symmetric polynomials (without proof), Evaluation of symmetric functions of roots, Rational roots of polynomials with integral coefficients, Descarte's rule of signs positive and negative rule.

Unit III

Symmetric functions, Applications of symmetric function of the roots, Transformation of equations, Solutions of reciprocal and binomial equations, Algebraic solutions of the cubic and biquadratic Equations using Cardan's Method, Descarte's Method, Ferrari Method.

Unit IV

Symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations, Separation of the roots of equations

Text Books:

1. Burnside, W.S. and Panton, A.W., The Theory of Equations, Dublin University Press, 1954.
2. MacDuffee, C.C., Theory of Equations, John Wiley & Sons Inc., 1954.

Reference Book:

1. Kishan, H., Theory of Equations, Atlantic Publications, 2022.

Master of Science (Mathematics)(FYIP)

Semester–I

Session-2025-26

Course Title: Dynamics

Course Code: FMAL -1335

Course Outcomes

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

CO 1: Demonstrate the basic relations between distance, time, velocity and acceleration, manage to solve the problems of Newton's Laws of Motion and the motion of particles connected by a string.

CO 2: Illustrate motion along a smooth inclined plane. Solve different types of problems with Variable Acceleration. Discuss Simple Harmonic Motion.

CO 3: Understand the concept of projectile, oscillating system.

CO 4: Define Work, Power and Energy and explain their relationship. Use measurement tools to apply the concepts of Work and power to solve real life problems. Identify the different types of energy.

Master of Science (Mathematics)(FYIP)

Semester-I

Session-2025-26

Course Title: Dynamics

Course Code: FMAL -1335

Examination Time: 3 Hours

Max. Marks: 100

L T P

Theory: 70

4 0 0

CA: 30

Instructions for the Paper Setter: 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. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

Rectilinear motion in a straight line with uniform acceleration, Newton's laws of motion. Motion of two particles connected by a string.

Unit-II

Motion along a smooth inclined plane. Variable acceleration. Simple Harmonic Motion.

Unit-III

Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles. Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum.

Unit-IV

Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.

Text Book:

R. Kumar, Fundamentals of Dynamics, Pardeep Publications, Jalandhar city, second edition, 2004

Reference Books:

1.F. Chorlton, Text Book of Dynamics, CBS Publishers, New Delhi, second edition, 2004 (Scope in chapters 3,8).

2. S.R. Gupta, Elementary Analytical Dynamics, Sultan Chand and Company, New Delhi, Fourteen Edition, 1983(Scope in chapters 1,2,3)

Master of Science (Mathematics)(FYIP)

Semester–I

Session-2025-26

Course Title: Calculus Laboratory

Course Code: FMAP-1336

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA:15

L T P

0 0 2

Practical (Using any Software)

1. Plotting the graphs of elementary functions: $e^{ax+b} \sin(bx + c)$, $\log(ax + b)$, $1/(ax+b)$, $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of the polynomial of degree 4 and 5
3. Obtaining surfaces of revolution of curves and their area.
4. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, hyperbolic paraboloid using Cartesian coordinates.
5. Matrix operations (addition, multiplication, inverse, transpose), eigenvalues and eigenvectors.

Text Book:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998. (Scope as in Ch.1-7,9,11)

Reference Books:

1. Anton, H., Bivens, I., and Davis, S., Calculus, 12th Ed. John Wiley and Sons (Asia) P. Ltd, Singapore, 2002. (Scope as in Ch.0-3,6,10,12)
2. Courant, R. and John, F., Introduction to Calculus and Analysis (Vol I), Springer, 1999. (Scopes in Ch.4)

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)

Semester-II

Session- 2025-26

Master of Science (Mathematics) (FYIP) Semester-II										
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-2421/ FMAL-2031/ FMAL-2431	C	¹ Punjabi (Compulsory)/ ² Basic Punjabi/ ³ Punjab History and Culture	2-0-0	2-0-0	2	50	35	-	15	3
FMAL-2102	AEC	Communicative English-II	2-0-0	2-0-0	2	50	35	-	15	3
FMAL-2333	DSC	Sequences and Series	4-0-0	4-0-0	4	100	70	-	30	3
FMAL-2334	DSC	Algebra	4-0-0	4-0-0	4	100	70	-	30	3
FMAM	C	Object Oriented	3-0-2	3-0-1	4	100	40	30	30	3+3

2135		Programming C++								
FMAL- 2330	SEC	Statistical Analysis Using Spreadsheet	1-0-0	1-0-0	1	50	35	-	15	3
FMAP- 2330	SEC	Statistical Analysis Using Spreadsheet Laboratory	0-0-4	0-0-2	2	50	-	35	15	3
VACD- 2161	VAC	* Drug Abuse: Problem, Management and Prevention (Compulsory)	2-0-0	2-0-0	2	50	35	-	15	3
Total					21					

C-Compulsory

AEC-Ability Enhancement Course

DSC-Discipline Specific Course

SEC-Skill Enhancement Course

VAC-Value Added Course

Note:

¹Domicile / Non Domicile of Punjab students who have studied Punjabi till 8th/ 10th class will study Punjabi (compulsory)

^{2,3}The Non-Domicile of Punjab Students who have not studied Punjabi till 8th/10th class can choose either Basic Punjabi or Punjab History and Culture (PHC)

²Domicile of Punjab students who studied out of Punjab and did not study Punjabi till 8th / 10th class will have to study Basic Punjabi

²Domicile of Punjab students who have studied in Kendriya Vidyalaya of Punjab or any other school and due to any reason did not study Punjabi till 8th/10th class will have to study Basic Punjabi

* Marks of these papers will not be added in total marks. Grades will be provided.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Sequences and Series

Course Code: FMAL-2333

Course Outcomes

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

CO 1: Demonstrate an understanding of sequences and series and their convergence, Cauchy criterion, sub sequence and algebra of limit of sequences.

CO 2: Know and describe the behaviour of Infinite series using various tests like comparison test, Cauchy Integral test. Ratio test, Raabe's test.

CO 3: Distinguish between the absolute convergence and conditional convergence.

CO 4: Manage to solve the problem related to Fourier series expansion, Fourier series for even and odd functions and half range series.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Sequences and Series

Course Code: FMAL-2333

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA: 30

L T P

4 0 0

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

Sequence, sub sequence, bounded sequences, monotone sequences, convergence, Cauchy criterion, algebra of limit of sequences (proofs with ϵ -N rigor), Sandwich Theorem.

Unit II

Infinite series, Sequences of partial sums, convergence and divergence of series, series of non-negative terms, comparison test, Limit Comparison test, Cauchy's nth root test, Cauchy's Condensation test, Cauchy's Integral test. Ratio test, Raabe's test (all tests with proofs).

Unit III

Logarithmic test and Gauss test, Alternating series, Leibnitz Test, absolute and conditional convergence, Convergence of Power Series, Taylor Series.

Unit IV

Periodic functions, trigonometric series, Fourier series expansion, Fourier series for even and odd functions, half range series.

Text Book:

George B. Thomas and Ross L. Finney, Calculus and Analytic Geometry, Pearson publication, 9th Edition, 1998.

Reference Books:

1. S. C. Malik and S. Arora, Mathematical Analysis, New Age International Publishers, New Delhi, 2nd Edition, 2005.
2. Sudhir R. Ghorpade and B.V. Limaye, A course in calculus and real analysis, Springer, 2006.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Algebra

Course Code: FMAL-2334

Course Outcomes

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

CO 1: Understand the concept of Groups, Rings, Fields and Vector space with examples.

CO2: Understand the concepts of Linearly independent and dependent vectors, linear span, subspace generated by a subset, basis and dimension.

CO3: Understand matrix representation of a linear transformation and to determine Linear transformations, null space and range space of a linear transformation

CO 4: Obtain Eigen values, Eigen vectors and to solve the System of linear equations over a field.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Algebra

Course Code: FMAL-2334

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA: 30

L T P

4 0 0

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

Definition of Group, Ring and Fields with examples. Definition of a vector space, subspaces with examples. Direct sum of subspaces

Unit-II

Linearly independent and dependent vectors, linear span, subspace generated by a subset, basis and dimension.

Unit-III

Linear transformations, null space and range space of a linear transformation, rank and nullity of a linear transformation, matrix representation of a linear transformation.

Unit-IV

Elementary matrix operations and Elementary matrices, Row rank and Column rank of a matrix and their equality, System of linear equations over a field, Characteristic polynomial of a matrix, Cayley-Hamilton Theorem, Eigen values and Eigen vectors.

Text Book:

S. Axler, Linear Algebra Done Right, Springer, Second edition, 1997.

Reference Books:

1. S. H. Friedberg, A.J. Insel and L.E. Spence., Linear Algebra, PHI Learning Pvt. Ltd, New Jersey, 1979
2. V. Sahai and V. Bist., Linear Algebra, Narosa Publishing House Pvt. Ltd, Delhi, 2013
3. Andreescu, T. and Andrica, D. ,Complex Numbers from A to Z, Birkhauser,2006.

Master of Science (Mathematics) (FYIP)

Semester-II

Session-2025-26

Course Title: Statistical Analysis Using Spreadsheet

Course Code: FMAL-2330

Course outcomes:

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

CO:1 introduce the meaning of statistics, Collection, presentation and interpretation of data with the help of excel.

CO:2 To Enhance the knowledge of Measures of dispersion, Skewness and Bowley's coefficient of skewness and Kurtosis.

CO:3 To comprehend the concept of Correlation and its methods with rank correlation coefficient.

CO:4 To understand the concept of Linear Regression, regression Y on X, regression X on Y, Regression Coefficient, Difference between regression and Correlation, and calculation of these using MS excel.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Statistical Analysis Using Spreadsheet

Course Code: FMAL-2330

Examination Time: 3 Hours

Max. Marks: 50

Theory: 35

CA: 15

L T P

1 0 0

Instructions for Paper Setters:

Eight questions of equal marks (7 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 to statistics, functions of statistics, collection of data, presentation of data, tabulation of data, charting of data, introduction to excel/spss, graphs in excel, measures of central tendency-, mean, median - meaning and computation, mode- meaning and computation, weighted average mean, geometric mean and harmonic mean.

Unit II

Measures of dispersion, types of dispersion- range, quartile deviation, mean deviation, standard deviation, co-efficient of variation. Skewness- Karl Pearson co-efficient of skewness, Bowley's co-efficient of skewness and Kurtosis.

Unit III

Correlation, Types of correlation, positive, negative, linear. methods of correlations – Karl Pearson's Co-efficient of correlation, rank correlation coefficient.

Unit IV

Regression analysis- Linear Regression, regression Y on X, regression X on Y, Regression Coefficient, Relations between regression coefficients and correlation coefficients, Difference between regression and Correlation, Calculation of these using MS excel.

Reference Books:-

1. SC Gupta, Fundamentals of Mathematical Statistics, Himalaya Publication.
2. Data Analysis with Microsoft Excel by K. Berk, Partrick Carey.

Master of Science (Mathematics)(FYIP)

Semester–II

Session-2025-26

Course Title: Statistical Analysis Using Spreadsheet Laboratory

Course Code: FMAP-2330

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA: 15

L T P

0 0 2

List of Practicals (using excel)

1. Introduction of basics of excel and functions such as 'sum', 'count', 'countif', 'max', 'min', 'sort' etc.
2. To prepare result from the data on marks and number of credits in a given number of courses of a class based on total marks, marks obtained, percentage of marks obtained, grades, and determine SGPA for each student.
3. Create frequency distribution table; plot histogram, bar chart, pie chart, etc.
4. Plotting two dimensional graphs.
5. To find measures of central tendency for a given data.
6. To find measures of dispersion for a given data.
7. To find measures of skewness and kurtosis for a given data.
8. To find Karl Pearson Coefficient of correlation and rank correlation coefficient for a givendata.
9. To find regression coefficient for bivariate data and plotting regression lines.

Reference Books:-

1. S. C. Gupta, Fundamentals of Mathematical Statistics, Himalaya Publication.
2. K. Berk, Partrick Carey, Data Analysis with Microsoft Excel.

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Scheme and Curriculum of Examinations of Five Years Integrated Programme

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Master of Science (Mathematics) (FYIP)

Semester-III

Session- 2025-26

Master of Science (Mathematics) (FYIP) Semester-III										
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-3331	DSC	Theory of Real Functions	4-0-0	4-0-0	4	100	70	-	30	3
FMAL – 3332	DSC	Applied Differential Equations	4-0-0	4-0-0	4	100	70	-	30	3
FMAL-3333	MDC	Logic and Reasoning	4-0-0	4-0-0	4	100	70	-	30	3
FMAM-3334	C	Basics of Python Programming	3-0-2	3-0-1	4	100	40	30	30	3+3

FMAP- 3335	DSC	Applied Differential Equations Laboratory	0-0-4	0-0-2	2	50	-	35	15	3
FMAL- 3336	SEC	Graph Theory	4-0-0	4-0-0	4	100	70	-	30	3
VACE- 3221	VAC	*Environmental Studies (Compulsory)	2-0-0	2-0-0	2	50	35	-	15	1
Total					24					

C-Compulsory

VAC-Value Added Courses

SEC-Skill Enhancement Courses

DSC-Discipline Specific Courses

MDC-Multi Disciplinary Courses

* Marks of this paper will not be added in total marks. Grades will be provided.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Theory of Real Functions

Course Code: FMAL-3331

Course Outcomes

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

CO 1: Understand real number system, limit of a function, basic properties of limit, continuity, and classification of discontinuities & to apply it in real world problem.

CO 2: To understand the concept of Differentiability of functions and Uniform Continuity.

CO 3: Demonstrate Relative extrema, Mean Value Theorem and its Applications to inequalities.

CO 4: To understand the concepts of Taylor's theorem & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Theory of Real Functions

Course Code: FMAL-3331

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA:30

L T P

4 0 0

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

Limit of a function (ϵ - δ approach), Algebra of limit, One sided limits, Infinite limits and limits at infinity, Continuous functions, discontinuity criterion, Composition of continuous functions.

Unit II

Continuous functions on an interval, Bolzano's Intermediate Value Theorem, Uniform Continuity, Differentiability of a function at a point and in an interval, Algebra of differentiable functions, Chain Rule.

Unit III

Concavity and convexity, points of inflexion, Rolle's theorem, Mean Value Theorem and its Applications to inequalities, Cauchy Mean Value Theorem, L'Hospital's Rule.

Unit IV

Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, Application of Taylor's theorem, Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions.

Text Book:

Bartle, R. G. and Sherbert, D. R., Introduction to Real Analysis, 3rd Ed., John Wiley and Sons(Asia) Pvt. Ltd., Singapore, 2002.

Reference Books:

1. Rudin, W., Principles of Mathematical Analysis, 3rd edition. McGraw Hill, 1976.
2. Apostol, T. M., Mathematical Analysis, 2nd Edition, Narosa Publishing House, Reprint 2002.
3. Ghorpade, S. R. and Limaye, B. V., A Course in Calculus and Real Analysis, Springer, 2006.
4. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
5. Ross, K.A., Elementary Analysis: The theory of Calculus, Springer 2004.

Master of Science (Mathematics)(FYIP)

Semester–III

Session-2025-26

Course Title: Applied Differential Equations

Course Code: FMAL-3332

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

CO1: Identify differential equation, its order and degree, exact differential equations and special rules to find integrating factors.

CO2: Apply the Decay model to solve real life problem and analyze the dynamics of pollutant accumulation in a lake using differential equations.

CO 3: Demonstrate the concept of Linear homogeneous and non-homogeneous equations with constant coefficients, The Cauchy Euler Equations, Method of variation of parameters.

CO 4: Analyze the System of ordinary differential equations, Power Series, convergence of power series and Radius of convergence.

Master of Science (Mathematics)(FYIP)

Semester–III

Session-2025-26

Course Title: Applied Differential Equations

Course Code: FMAL-3332

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

L T P

CA:30

4 0 0

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

Classification of Differential Equations, their origin and application, solutions, initial value problems, boundary value Problem and existence of Solutions. Exact differential equations and integrating factors, sep- arable equations and equations reducible to this form, linear equation and Bernoulli equations, special inte- grating factors and transformations.

Unit II

Orthogonal and oblique trajectories. Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), exponential growth of population, limited growth of population, drug assimilation into the blood (case of a single cold pill)

Unit III

General solution of homogeneous equation of second order, principle of superposition for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations with constant coefficients, The Cauchy Euler Equations, Method of variation of parameters.

Unit IV

Power Series solution about an ordinary point, solutions about singular points, the method of Frobenius, Bessel equation and Bessel function and their recurrence relations.

Text Book:

S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Reference Books:

1. Barnes, B., and Fulford, G. R., Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. Edwards, C.H. and Penny, D.E., Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.
3. Abell, M.L., Braselton, J. P., Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
4. Boyce, W.E., and DiPrima, R.C., Elementary differential equations and boundary value problems, John Wiley & Sons, 8th edition, 2005.

Master of Science (Mathematics) (FYIP)

Semester-III

Session:2025-26

Course Title: Logic and Reasoning

Course Code: FMAL-3333

Course Outcomes:

After passing this course, the students will able to:

CO1.Understand and apply concepts of verbal reasoning including classification, analogy, and series.

CO2. Develop skills to solve puzzles and apply mathematical logic in reasoning problems.

CO3. Analyze and interpret non-verbal reasoning problems through visualization and logic pattern identification.

CO4. Develop problem solving skills in visual-spatial reasoning through figure manipulation and recognition.

Master of Mathematics (FYIP)
Semester-III
Session: 2025-26
Course Title: Logic and Reasoning
Course Code: FMAL-3333

Examination Time: 3 Hours

Maximum Marks: 100

L T P

Theory: 70

4 0 0

CA: 30

Instruction for the Paper Setters:

Eighth 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 sections.

Unit – I

Verbal Reasoning: Series Completion, Number and Alphabet analogy, Missing number in a sequence or a series, Classification, Coding and Decoding, Blood Relationship.

Unit-II

Puzzle test, Direction Sense test, Logical Venn Diagram, Mathematical operations, Arithmetical Reasoning, Inserting the missing character, Logic

Unit-III

Non-Verbal Reasoning: Series, Analogy, Classification, Analytical reasoning, Mirror Images, Water Images, Spotting out of the embedded figures. Vocabulary: Antonym, synonym, phrases

Unit-IV

Non-Verbal Reasoning: Completion of Incomplete pattern, Figure Matrix, Paper Folding, Rule Detection, Grouping of identical Figures, Cubes and dice, Construction of squares and triangles.

Text-Book:

R.S Aggarwal, A Modern approach to Verbal and Non-Verbal Reasoning, S. Chand and Co. Pvt. Ltd, New Delhi, Eighth Edition, 2018

Reference Books:

1. M.K Pandey, Analytical reasoning, BSC Publishing Co. Pvt. Ltd., 2024 Edition.
2. Mishra & Kumar, Multidimensional Reasoning, Arihant Publication, Latest Edition 2024.
3. Course in Mental Abilities and Quantitative Aptitude for Competitive Examinations by Edgar Thorpe, Tata McGraw Hill Pub. Co. Ltd. New Delhi.

Master of Science (Mathematics) (FYIP)
Semester–III
Session-2025-26
Course Title: Basics of Python Programming
Course Code: FMAM-3334

Course Outcomes:

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

CO1: Comprehend basics of Python programming like operators, data types, etc.

CO2: Apply various control statements of Python Programming Language for designing solutions to different real world problems.

CO3: Implement various built-in and user defined function, packages and modules to solve mathematical problems.

CO4: Apply different matrix operations and perform file manipulations.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Basics of Python Programming

Course Code: FMAM-3334

Examination Time: (3+3) Hours

Max. Marks: 100

Practical-30

Theory: 40

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

Introduction to python: Features of Python, How to Run Python, Identifiers, Reserved Keywords, Variables, Comments in Python, Indentation in Python, Multi-Line Statements, Multiple Statement Group (Suite), Quotes in Python, Input, Output and Import Functions, Operators, Data Types and Operations: Numbers, String, Lists, Tuple, Set, Dictionary, Mutable and Immutable Objects, Data Type Conversions

Unit II

Flow Control: Decision Making, Loops, Nested Loops, Control Statements, Types of Loops. Functions: Function Defining in Python, Function Calling, Function Arguments, Anonymous (Lambda) Functions, Recursive Functions, Function with more than one return value.

Math Module: Constants, Arithmetic functions, Power functions, Logarithmic functions

Unit III

Modules and Packages: Built-in modules, Creating Modules, Import Statement, Locating Modules, Namespaces and scope, The dir() function, The reload() function, Packages in Python, Date and Time Module. Math Module: Trigonometric and Angular functions.

Unit IV

File Handling: Opening a File, Closing a File, Writing to a File, Reading from a File, File Methods, Renaming a File, Deleting a File, Directories in Python. Math Module: Matrix operations (Multiplication, Addition, matrix multiplication, inverse, determinant, adjoint, Eigenvalues).

References Books:

1. Jeeva Jose, P. Solan Lal, Introduction to Computing and Problem Solving with Python, Publisher of Science, Technology and Engineering Books, 2022
2. John V. Guttag, Introduction to Computation and Programming Using Python, PHI Learning Pvt. Limited Second Edition, 2016.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Applied Differential Equations Laboratory

Course Code: FMAP-3335

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA:15

L T P

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List of Practicals (using any software)

1. Plotting solution of first order differential equation.
2. Plotting of solution of family of second order differential equation.
3. Solution of system of ordinary differential equations, numerically using Runge-Kutta method.
4. Growth & Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Limited growth of population (with and without harvesting).

Reference Books:

1. Barnes, B., and Fulford, G. R., Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. Edwards, C.H. and Penny, D.E., Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.
3. Abell, M.L., Braselton, J. P., Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
4. Boyce, W.E., and DiPrima, R.C., Elementary differential equations and boundary value problems, John Wiley & Sons, 8th edition, 2005.
5. Ross, S. L., Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Graph Theory

Course Code: FMAL-3336

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

CO1: Achieve command of the fundamental definitions and concepts of graph theory.

CO2: Develop a graph theoretical model for real life situations.

CO3: Understand the structures, applications, and algorithms related to tree data structures.

CO4: Evaluate or synthesize any real world applications using graph theory based on directed or undirected graphs in networks.

Master of Science (Mathematics) (FYIP)

Semester–III

Session-2025-26

Course Title: Graph Theory

Course Code: FMAL-3336

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA:30

L T P

4 0 0

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

Graph and its terminology: vertex, edge, types of vertex and edges, incidence matrix and diagram of a graph, order and size of graph, null graph, isomorphic graph, homeomorphic graph, finite and infinite graph, subgraphs and its types, Complement of a graph, Dual graphs, complete graph, regular graph, bipartite, weighted graph, planar graph

Unit II

Walk, path and its length, Cycle and its length, connected and disconnected graph, Shortest path in weighted graph, Eulerian paths and circuits, Hamiltonian paths and circuits

Unit III

Tree, distance and centers in a tree, rooted tree, binary tree, spanning tree, minimum spanning tree in a weighted graph, Kruskal's algorithm, Prim's algorithm

Unit IV

Graph coloring, vertex coloring, chromatic polynomial, chromatic number, algebraic operations in graph, Directed graph, out degree and in degree of a vertex, matrix and diagrammatic representation of directed graph

Text Book:

Gupta, S.B. and Gandhi, C.P. , Discrete Structures, 4th edition, University Science Press, New Delhi. India.

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-IV

Session- 2025-26

Master of Science (Mathematics) (FYIP) Semester-IV										
Course Code	Course type	Course Title	Hours Per Week L-T-P	Credits L-T-P	Total Credits	Max. Marks				Examination time in hours
						To	Th	P	CA	
FMAL-4331	DSC	Number Theory	4-0-0	4-0-0	4	10	70	-	30	3
FMAL-4332	DSC	Numerical Analysis	4-0-0	4-0-0	4	10	70	-	30	3
FMAL-4333	MDC	Quantitative Aptitude for Banking	4-0-0	4-0-0	4	10	70	-	30	3
FMAM-4134	C	Statistical Computing Using R Programming	3-0-2	3-0-1	4	10	40	30	30	3+3
FMAP-4335	DSC	Numerical Analysis Laboratory	0-0-4	0-0-2	2	50	-	35	15	3
FMAM-4336	SEC	Statistical Methods	3-0-2	3-0-1	4	10	40	30	30	3+3
VACE-	VAC	*Gender Sensitization	2-0-0	2-0-0	2	50	35	-	15	1

4221										
Total					24					

C-Compulsory

VAC-Value Added Courses

SEC-Skill Enhancement Courses

DSC-Discipline Specific Courses

MDC-Multi Disciplinary Courses

* Marks of these papers will not be added in total marks. Grades will be provided

Master of Science (Mathematics) (FYIP)

Semester–IV

Session-2025-26

Course Title: Number Theory

Course Code: FMAL-4331

Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Understand congruences and solve system of linear congruences.

CO 2: Understand concepts and applications of Number theoretic functions.

CO 3: Understand the existence of primitive roots for all integers

CO 4: Identify representation for an integer as sum of squares

Master of Science (Mathematics) (FYIP)

Semester–IV

Session-2025-26

Course Title: Number Theory

Course Code: FMAL-4331

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA:30

L T P

4 0 0

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

Basic properties of congruences, linear congruences and its properties, simultaneous linear congruences, Chinese Remainder Theorem, Fermat's Little theorem, Wilson's theorem and its applications.

Unit II

Number theoretic functions, number of divisors and sum of divisors of a natural number, multiplicative functions, the Mobius function, the Mobius Inversion formula, Euler's phi-function and its properties, Euler's theorem.

Unit III

Order of an integer modulo n , primitive roots for primes, Composite numbers having primitive roots, Theory of Indices and its properties, Table of Indices, Quadratic residues modulo primes, Euler's criterion.

Unit IV

The Legendre symbol and its properties, Gauss Lemma, Quadratic reciprocity law, Jacobi Symbol, and its properties, Pythagorean triplet, the Diophantine equations: $x^2 + y^2 = z^2$, $x^4 + y^4 = z^2$, $x^4 + y^4 = z^4$.

Text Books:

1. Burton, D.M., Elementary Number Theory, 6th Ed., Tata McGraw-Hill, Indian reprint, 2007.
2. Niven, I., Zuckerman, H.S. and Montgomery, H.L., An introduction to the theory of numbers, 5th edition, oxford university press, oxford, 1991.

Master of Science (Mathematics) (FYIP)

Semester–IV

Session-2025-26

Course Title: Numerical Analysis

Course Code: FMAL-4332

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

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

CO 2. Perform computation for solving a system of equations.

CO 3. Learn how to interpolate the given set of values.

CO 4. Learn numerical solution of differential equations & compute numerical integration and differentiation, numerical solution of ordinary differential equations.

Master of Science (Mathematics) (FYIP)

Semester-IV

Session-2025-26

Course Title: Numerical Analysis

Course Code: FMAL-4332

Examination Time: 3 Hours

Max. Marks: 100

Theory: 70

CA:30

L T P

4 0 0

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

Errors: Relative, absolute, round off, truncation, Transcendental and polynomial Equations: Bisection Method, R e g u l a - F a l s i M e t h o d , Secant Method, Newton's Method, Rate of convergence of these methods, Newton's method for multiple roots.

Unit II

System of linear algebraic equations: Gaussian Elimination, Gauss Jordan, LU decomposition method , Jacobi method, Gauss-Seidel Method.

Unit III

Interpolation: Finite Difference Operators, Newton Forward and backward difference interpolation, La-grange's Method, Newton's Divided Difference Formula.

Unit IV

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 rd Rule, Simpson's 3/8 th Rule, Ordinary differential Equations: Picard's Method, Taylor's series method, Euler's Method, modified Euler's method, Runge-Kutta Methods of all orders.

Text Book:

Jain, M.K., Iyengar, SRK and Jain, R. K., Numerical methods for Scientific and Engineering Computation, New age International, 2007.

Reference Books:

1. Sastry, S. S., Introductory Methods of Numerical Analysis, Prentice Hall of India, 2012.
2. Bradie, B., A friendly introduction to Numerical Analysis, Pearson Education, 2007.

Master of Science (Mathematics)(FYIP)

Semester-IV

Session:2025-26

Course Title: Quantitative Aptitude for Banking

Course Code: FMAL-4333

Course Outcomes:

After passing this course , the students will able to :

CO1 : Understand and solve the problems based on number system, algebraic expression and arithmetic operations with speed and accuracy

CO2: Apply arithmetic principles to practical business and daily life problems involving percentages, ratios and equation.

CO3: Analyze and compute time-based problems and financial calculations involving interest and mixture concepts.

CO4: Solve logical and data interpretation problems and develop skills in handling quantitative reasoning questions.

Master of Mathematics (FYIP)
Semester-IV
Session: 2025-26
Course Title: Quantitative Aptitude for Banking
Course Code: FMAL-4333

Examination Time: 3 Hours

Maximum Marks: 100

L T P

Theory: 70

4 0 0

CA: 30

Instruction for the Paper Setters:

Eighth 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

Number system, H.C.F and L.C.M of Numbers , Decimal fractions, Simplification, squares and Cube roots , Average , Problem on numbers, Problem on ages, Surds and Indices, Logarithms

Unit-II

Percentage, Profit and loss , Ratio and proportion, Partnership , Chain Rule, Pipes and Cisterns Quadratic Equation, , Height and Distance

Unit-III

Time and work, Time and Distances, Boats and Streams, Problem on Trains, Alligation or Mixtures, Simple interest , Compound Interest , Stock and Share

Unit-IV

Calendar Problem, Clock problem, True Discount, Banker's Discount, Data interpretation.

Text Book:

R.S Aggarwal, Quantitative Aptitude for Competitive Examination, S.Chand Co. Pvt. Ltd, New Delhi, Eighth Edition, 2017

Reference Books:

1. Arun Sharma , How to prepare for Quantitative aptitude for CAT McGraw Hill Education, 10th edition (2023).

2. Sarvesh K. Verma, Quantitative Aptitude Quantum CAT , Arihant Publications,latest edition 2024.
3. Course in Mental Abilities and Quantitative Aptitude for Competitive Examinations by Edgar Thorpe, Tata McGraw Hill Pub. Co. Ltd. New Delhi.

Master of Science (Mathematics) (FYIP)

Semester–IV

Session-2025-26

Course Title: Statistical Computing Using R Programming

Course Code: FMAM-4334

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-2025-26

Course Title: Statistical Computing Using R Programming

Course Code: FMAM-4334

Examination Time (3+3) Hours

Max. Marks: 100

Theory: 40

Practical: 30

CA:30

L T P

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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 Golemund, 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–IV

Session-2025-26

Course Title: Numerical Analysis Laboratory

Course Code: FMAP-4335

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA:15

L T P

0 0 2

Practical (Using any Software)

List of Practical's (using any software)

1. Calculate the sum $1/1+1/2+1/3+1/4+ \dots +1/N$.
2. To find the absolute value of an integer.
3. Bisection Method.
4. Newton Raphson Method.
5. Secant Method.
6. Regula Falsi Method.
7. LU decomposition Method.
8. Jacobi Method.
9. Gauss Seidel Method.
10. Lagrange Interpolation or Newton Interpolation.
11. Simpson's rules.
12. Euler's Method
13. Runge-Kutta Method

Text Book:

Jain, M.K., Iyengar, S. R. K., and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.

Reference Books:

1. Jain, C., Advanced Programming in SCILAB, Alpha Science International, Oxford, UK, 2020.
2. Campbell, S.L., Chancellor, J.P., Nikoukhah, R. Modeling and Simulation in Scilab/Scios, Springer, 2006.
3. Bradie, B., A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
4. Gerald, C. F. and Wheatley, P. O., Applied Numerical Analysis, Pearson Education, India, 2008.
5. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.

Master of Science (Mathematics) (FYIP)

Semester–IV

Session-2025-26

Course Title: Statistical Methods

Course Code: FMAM-4336

Course Outcomes

CO1: Explain the scope, applications, and limitations of statistics, and distinguish between population and sample. To Compute and interpret measures of central tendency, dispersion, skewness, and kurtosis, including the use of box-and-whisker plots.

CO2: Analyze relationships between two attributes using 2×2 tables to assess consistency, independence, and association and Apply the principles of least squares to perform simple linear regression and fit polynomial and exponential curves; interpret residual plots.

CO3: Convert fixed base index numbers to chain base and vice versa, and evaluate errors in index numbers using appropriate tests. To Construct various types of index numbers (Laspeyre's, Paasche's, Edgeworth-Marshall, Fisher's Ideal) and understand the concepts of weighted and unweighted index numbers.

CO4: Decompose time series data into components and determine trends using graphical, mathematical, and moving average methods. Measure seasonal variations using ratio-to-moving-average and ratio-to-trend methods.

Master of Science (Mathematics) (FYIP)

Semester-IV

Session-2025-26

Course Title: Statistical Methods

Course Code: FMAM-4336

Examination Time: (3+3) Hours

Max. Marks: 100

Practical-30

Theory: 40

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

Descriptive Statistics: Definition and scope of Statistics, limitations of statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Collection and tabulation of data. Diagrammatic representation of frequency distribution: histogram, frequency polygon, frequency curve, ogives, stem and leaf plot, pie chart. Measures of central tendency, dispersion, box and whisker plot, skewness and kurtosis.

Unit II

Data on two attributes, consistency, independence, and association of attributes in 2x2 tables. Linear regression: Simple linear regression, principle of least squares and fitting of polynomials and exponential curves, residual plots. Correlation: scatter diagram, Karl Pearson's and rank correlation, Partial and multiple correlation (3 variables only)

Unit III

Index Numbers: Definition, construction of index numbers and problems, weighed and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's Ideal Index numbers. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Errors in Index numbers and tests to measure errors in index numbers. Cost of living index numbers. Uses and limitations of index numbers.

Unit IV

Time Series: Introduction and components of time series. Trend determination: by graphical methods, mathematical curve fitting and by moving average methods. Measurement of seasonal variations: ratio to moving average method, ratio to trend method. Auto regression series: first and second order auto-regression. Introduction to auto correlation and Correlogram.

Text Books Recommended:

Goon A.M., Gupta M.K. and Dasgupta B., Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.

Gupta, S. C. and Kapoor, V.K., Fundamentals of Mathematical Statistics, 4th Edition (Reprint), Sultan Chand & Sons, 2008.

Reference Book Recommended:

Gupta, S. C. and Kapoor, V.K., Fundamentals of Applied Statistics, Sultan Chand & Sons, 2008.