Pratap College Amalner

(Autonomous)

(Affiliated to Kavayitri Bahinabai Chaudhari North Maharashtra University Jalgaon)

SYLLABUS

for

First Year Bachelor of Science (F.Y.B.Sc.)
[Mathematics]

NEW EDUCATION POLICY

(Effective from 2023)

2023 - 2024

Teaching and Examination Scheme,

Bachelor of Science (Honors/ Research) Four Year
B.Sc. (Level 4.5) Sem-I (Mathematics)

Sr. No.	Course Category	Name of Paper		Total Credit	Hours/ Semester	Teaching Scheme (hrs/week)		Evaluation Scheme		
						Theory	Practical	Continuous Internal assessment (CA)	End Semester Evaluation (UA)	Duration of Examination (Hrs)
						T	P			
1	DSE	DSC_1	Matrix Algebra	2	30	2	-	40	60	2
		DSC-2	Calculus-I	2	30	2	-	40	60	2
		DSC-3	Practical	2	60	-	4	40	60	3
2	Minor	Min-1	Theory of Matrices	2	30	2	-	40	60	2
		Min-2	Practical	2	60	-	4	40	60	3
3	GE/OE	OE-1	Competitive Mathematics-I	2	30	2	-	40	60	2
4	VSEC	SEC-1	Set Theory and Logic	2	30	2	-	40	60	2
Total				14						

Bachelor of Science (Honors/ Research) Four Year
B.Sc. (Level 4.5) Sem-II (Mathematics)

Sr. No.	Course Category	Name of Paper		Total Credit	Hours/ Semester	Teaching Scheme (hrs/week)		Evaluation Scheme		
						Theory	Practical	Continuous Internal assessment (CA)	End Semester Evaluation (UA)	Duration of Examination (Hrs)
						T	P			
1	DSE	DSC_1	Theory of Numbers and Equations	2	30	2	-	40	60	2
		DSC-2	Calculus-II	2	30	2	-	40	60	2
		DSC-3	Practical	2	60	-	4	40	60	3
2	Minor	Min-1	Numerical Methods	2	30	2	-	40	60	2
		Min-2	Practical	2	60	-	4	40	60	3
3	GE/OE	OE-1	Competitive Mathematics-II	2	30	2	-	40	60	2
4	VSEC	SEC-1	Introduction to MATLAB	2	30	2	-	40	60	2
		SEC-2	Practical	2	60	-	4	40	60	3
Total				16						

DSE 1: Matrix Algebra

Course Description:

This course provides an elementary level knowledge of Rank and adjoint of matrix, Applications of matrices to system of linear equations, Eigen values and Eigen vectors of matrices, and the transformation of matrices.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective:

A primary need for the establishment of this course is to understand the basic knowledge and applications of matrices in various fields. So, the main objective is to teach mathematical approaches and models to grow mathematical skills, improve mathematical thinking and improve students' choice-making power.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

1) understand concepts on matrix operations and rank of the matrix.
2) understand use of matrix for solving the system of linear equations.
3) understand basic knowledge of the eigen values and eigen vectors.
4) apply Cayley-Hamilton theorem to find the inverse of the matrix.
5) know the matrix transformation and its applications in rotation, reflection, translation.

UNIT-1: Rank of Matrix: No. of Hours : 08

1.1. Elementary operations on matrices.
1.2. Adjoint of a matrix & Inverse of a matrix.
1.3. Existence & uniqueness theorem of inverse of a matrix.
1.4. Rank and normal form of a matrix, Reduction of a matrix to its normal form, Rank and product of two matrices.

UNIT-2: System of Linear Equations No. of Hours : 08

2.1. A homogeneous and non-homogeneous system of linear equations.
2.2. Consistency of system of linear equations.
2.3. Application of matrices to solve the system of linear equations.

UNIT-3: Eigen Values & Eigen Vectors No. of Hours: 07

3.1. Orthogonal Matrices and Properties of Orthogonal Matrices.
3.2. Characteristic equation, Eigen Values and Eigen Vectors of Matrices.
3.3. Cayley Hamilton theorem (statement only) and its use to find the inverse of a Matrix.

Unit-4. Orthogonal matrices and Quadratic forms No. of Period : 07

4.1. Quadratic forms: Matrix representation, Rank of a quadratic form.
4.2. Congruent matrices, Elementary congruent transformations, Diagonal form of a quadratic form,
4.3. Canonical forms, Jordan Canonical, triangular form

References:

1. Matrix and Linear Algebra, by K. B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi,2000.
2. Matrices, by Shanti Narayan
3. Matrices, Schaum's outline series

DSE 2: Calculus-I

Course Description:

This course provides fundamental knowledge of systems of real numbers, sequences, series, limits, and Indeterminate forms of limits.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective:

The basic need of this course is to understand the concepts and applications of calculus. Also, this course will improve the students' problem-solving and logical thinking abilities. By learning this course students can use the concepts of calculus to develop different mathematical models.

Learning Outcomes:

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

1) understand what are real numbers.
2) understand sequence and series and its applications.
3) know the Limit of function.
4) make the applications of limits to solving problems.
5) know the applications of calculus.

Unit 1. The Real Numbers & Real function **No. of Hours: 08**

1.1. Algebraic and order properties of R
1.2. Absolute Value and the Real Line
1.3. Completeness, infimum, and supremum in R
1.4. Archimedean property and its applications.

Unit 2. Sequences of Real Numbers **No. of Hours: 09**

2.1. Sequences and their Limits
2.2. Convergence and divergence of sequence
2.3. Monotone Sequences
2.4. Bounded Sequence
2.5. Subsequence and Bolzano - Weierstrass Theorem (Statement only).
2.6. Infinite series: definition, example, convergence (definition).

Unit 3. Limits **No. of Hours: 06**

3.1. Limits of Functions
3.2. Limit Theorem

Unit 4. Indeterminate form **No. of Hours: 07**

4.1 L-Hospital's rule.
4.2. Indeterminate forms

References:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002
2. Theory and Problems of Advanced Calculus, by Robert Wrede and Murray R. Spiegel, McGraw-Hill Company, New York, Second Edition, 2002
3. Differential Calculus, Shantinarayan, 7th Edition, S. Chand and Co. Publication

DSE 3: Practical Based on Matrix Algebra and Calculus-I

Course objectives:

1. To develop analytical and computational skills
2. To get hands on training for solving problems of Matrix Algebra and Calculus.

Learning outcomes:

After successful completion of this course, students are expected to:
Students will develop problem solving problems on Matrix Algebra and Calculus**.**

Section-I: Matrix Algebra Practical

Practical-1: Examples on unit -I of DSE-1
Practical-2: Examples on unit -II of DSE-1
Practical-3: Examples on unit -III of DSE-1
Practical-4: Examples on unit -IV of DSE-1

Section-II: Calculus-I Practical

Practical-5: Examples on unit -I of DSE-2
Practical-6: Examples on unit -II of DSE-2
Practical-7: Examples on unit -III of DSE-2
Practical-8: Examples on unit -IV of DSE-2

MIN 1: Theory of Matrices

Course Description:

This course provides an elementary level knowledge of the Rank and adjoint of matrices, Applications of matrices to the system of linear equations, Eigen values and Eigen vectors of matrices, and the transformation of matrices.

Prerequisite Course(s): 11 and 12 standard Mathematics.

General Objective:

A primary need for the establishment of this course is to understand the basic knowledge and applications of matrices in various fields. So, the main objective is to teach mathematical approaches and models to grow mathematical skills, improve mathematical thinking and improve students' choice-making power.

Learning Outcomes:

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

1) understand concepts on matrix operations and rank of the matrix.
2) understand the use of a matrix for solving the system of linear equations.
3) understand the basic knowledge of the eigen values and eigen vectors.
4) apply the Cayley-Hamilton theorem to find the inverse of the matrix.
5) know the matrix transformation and its applications in rotation, reflection, and translation.

UNIT-1: Rank of Matrix: **No. of Hours: 10**

1.1. Elementary operations on matrices.
1.2. Adjoint of a matrix & Inverse of a matrix.
1.3. Existence & uniqueness theorem of the inverse of a matrix.
1.4. Properties of the inverse of a matrix, Elementary matrices.
1.5. Rank and normal form of a matrix, Reduction of a matrix to its normal form, Rank and product of two matrices.

UNIT-2: System of Linear Equations **No. of Hours: 09**

2.1. A homogeneous and non-homogeneous system of linear equations.
2.2. Consistency of system of linear equations.
2.3. Application of matrices to solve the system of linear equations.

UNIT-3: Eigen Values & Eigen Vectors **No. of Hours: 07**

3.1. Orthogonal Matrices and Properties of Orthogonal Matrices.
3.2. Characteristic equation, Eigen Values, and Eigen Vectors of Matrices.
3.3. Cayley Hamilton theorem (statement only) and its use to find the inverse of a Matrix.

Unit-4. Orthogonal matrices **No. of Hours: 04**

4.1. Orthogonal matrices & Properties of orthogonal matrices.
4.3. Linear transformations.
4.5. Canonical forms, Jordan Canonical, triangular form

References:

1. Matrix and Linear Algebra, by K. B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi,2000.
2. Matrices, by Shanti Narayan
3. Matrices, Schaum's outline series

MIN 2: Practical Based on Theory of Matrices

Course objectives:

1. To develop analytical and computational skills
2. To get hands on training for solving problems of Matrix Algebra.

Learning outcomes:

After successful completion of this course, students are expected to:
Students will develop problem solving problems on Matrix Algebra**.**

Theory of Matrices Practical

Practical-1: Examples on unit -I of MIN-1
Practical-2: Examples on unit -I of MIN-1
Practical-3: Examples on unit -II of MIN-1
Practical-4: Examples on unit -II of MIN-1
Practical-5: Examples on unit -III of MIN-1
Practical-6: Examples on unit -III of MIN-1
Practical-7: Examples on unit -IV of MIN-1
Practical-8: Examples on unit -IV of MIN-1

OE/GE 1: Competitive Mathematics-I

Course Description:

The Competitive Mathematics course is designed to equip students with the necessary skills and strategies to excel in various competitive math competitions and examinations. Throughout the course, students will explore a wide range of mathematical concepts, including algebra, number theory, and geometry. Emphasis will be placed on developing problem-solving techniques, logical reasoning, and analytical thinking.

Prerequisite Course(s): Up to 10^{th} standard Mathematics.

General Objective:

The general objective of Competitive Mathematics is to equip students with the necessary skills, knowledge, and mindset to excel in math competitions, academic pursuits, and problem-solving endeavours. The course seeks to develop well-rounded individuals with strong problem-solving abilities, a solid mathematical foundation, and a competitive spirit.

Learning Outcomes:

1) Proficiency in Problem Solving.
2) Mastery of Mathematical Concepts.
3) Logical Reasoning and Critical Thinking.
4) Time Management and Efficiency.
5) Creative Problem Solving.
6) Competition Readiness.
7) The skills acquired in Competitive Mathematics extend beyond math Appreciation for Mathematics.

Unit-I: **No. Hours: 06**

1.1 Numbers and Basic Operations.
1.2 Fractions and Decimal Numbers.
1.3 HCF and LCM.

Unit-II: **No. Hours: 09**

2.1 Percentages,
2.2 Profit and Loss,
2.3 Simple and Compound Interest,
2.4 Ratio and Proportion.

Unit-III: **No. Hours: 10**

3.1 Distance and Directions,
3.2 Speed, Average,
3.3 Laws of Exponents,
3.4 Mensuration.

Unit-VI: **No. Hours: 05**

4.1 Time and Distance,
4.2 Time and Work

Reference:

Quantitative Aptitude for Competitive Examinations, by R. S Aggarwal, S Chand Publication.

SEC -1 Set Theory and logic (Period: 30 Clock hours)

Course Description:
This course is an elementary skill development course for S. Y. B.Sc. students.
Prerequisite Course(s): Secondary school level knowledge of elementary mathematics.
General Objective:
The general objectives are to acquire concepts of sets, relations, countable and uncountable sets; statements and truth values; concept of tautology, contradiction and quantifiers.
Learning Outcomes:
1) Uses of the language of set theory, designing issues in different subjects of mathematics
2) understand the issues associated with different types of finite and infinite sets via countable uncountable sets
3) knowledge of the concepts and methods of mathematical logic, set theory, relation calculus, and concepts concerning functions.
4) understanding the role of propositional and predicate calculus
5) able to provide the logical mathematical reasoning, formulate theorems and definitions

Unit-1: Sets and Subsets **No. of Hours : 9**

1.1 Finite Set and Infinite set
1.2 Equality of two Sets,
1.3 Null Set, Subset, Proper subset, Symmetric difference of two sets
1.4 Universal set, Power set, Disjoint sets,
1.5 Operation on sets: Union and Intersection
1.6 Venn diagram
1.7 Equivalent sets
1.8 Countable and uncountable sets

Unit-2: Relations and Functions **No. of Hours : 8**

1.1 Product of sets
1.2 Relations, Types of relations, Reflexive, Symmetric, Transitive relations and Equivalence relations
1.3 Function, Types of functions, One-one, Onto, Even, Odd and Inverse function
1.4 Composite functions

Unit-3: Algebra of Propositions **No. of Hours : 7**

2.1 Statements, Conjunction, Disjunction.
2.2 Negation, Conditional and Bi-Conditional statements, Propositions.
2.3 Truth table, Tautology and Contradiction.
2.4 Logical equivalence, Logical equivalent statements.

Unit-4: Quantifiers **No. of Hours : 6**

3.1 Propositional functions and Truth sets.
3.2 Universal quantifier, Existential quantifier.
3.3 Negation of proposition which contain quantifiers, Counter examples.

Reference book:

1. Set Theory and Related Topics by Schaum's outline Series (Chapter1, chapter 4, chapter 6: 6.2, 6.3, chapter 10)
2. R.R.Halmons, Naïve Set Theory, Springer, 1974

SEM-II

DSE 4: Theory of Numbers and Equations

Course Description: This course provides fundamental knowledge of Numbers, Congruence classes, and Theory of equations.
Prerequisite Course(s): 11 and 12 standard Mathematics.
General Objective: To study the Divisibility of numbers, Congruence relation, GCD, and LCM Roots of polynomial equations. Relations between roots and coefficients of polynomials of degree Roots of equations by using Cardon's method, biquadratic equations by Descarte's method, and roots of polynomial equations by Newton's method.
Learning Outcomes:
1) Student Can Find LCM & GCD of Many Numbers
2) Students understand the Application of Congruence
3) Students can find out the roots of any equation of degree less than or equal to five. The theory of equations is highly useful in various subjects like algebra, linear algebra, calculus, ordinary and partial differential equations, etc.

Unit 1. Divisibility of Integers: **No. of Hours: 10**

1.1. Numbers, The Well-ordering principle (statement only).
1.2. Principle of Mathematical Induction.
1.3. Divisibility of integers and theorems. Division algorithm.
1.4. GCD and LCM. Euclidean algorithm.
1.5. Fundamental Theorem of Arithmetic (Statement only)

Unit 2. Congruence classes **No. of Hours: 09**

2.1. Partition of a set. Equivalence relations. Equivalence classes.
2.2. Congruence relation (modulo n) and theorems.
2.3. Properties of residue classes, Composition tables.
2.4. Fermat's theorem, Euler's theorem (Statements and examples Only).

Unit 3. Theory of Equations-I: **No. of Hours: 06**

3.1. Relation between roots and coefficient of a general polynomial equation in one variable.
3.2. Relation between roots and coefficient of quadratic, cubic, and biquadratic equations.
3.3. Symmetric functions of roots.

Unit 4. Theory of Equations –II: **No. of Hours: 05**

4.1. Transformation of equations.
4.2. Descarte's rule of signs.
4.3. Cardon's method of solving cubic equations.

References:

1. Elementary Number Theory, by David M. Button, W. C. Brown publishers, Dubuquolowa 1989.
2. Higher Algebra, by H. S. Hall and S. R. Knight, H. M. Publications 1994.
3. Matrix and Linear Algebra, by K. B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.

DSE 5 : Calculus-II

Course Description:

This course provides fundamental knowledge of continuity, Differentiations, Mean value theorem, Rolle's theorem, Cauchy's Mean value theorem and Geometrical interpretations.

Prerequisite Course(s): 11^{th} and 12^{th} Mathematics & Calculus-I of F.Y.B.Sc Mathematics.

General Objective:

The basic need of this course is to understand the concepts and applications of calculus. Also, this course will improve problem solving and logical thinking abilities of the students. By learning this course students can use the concepts of calculus to develop different mathematical models.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

1) understand basic concepts on continuity.
2) understand use of differentiations in various theorems.
3) know the Mean value theorems and its applications.
4) make the applications of Taylor's, Maclaurin's theorem.
5) know the applications of calculus.

Unit 1. Continuous Functions **No. of Hours : 7**

1.1. Continuous Functions
1.2. Combinations of Continuous Functions
1.3. Continuous functions on intervals

Unit 2. Mean Value Theorems: **No. of Hours : 9**

2.1. Differentiability.
2.2. Rolle's Theorem.
2.3. Lagrange's Mean Value Theorem.
2.4. Cauchy's Mean Value Theorem.
2.5. Geometrical interpretation and applications.

Unit 3. Successive Differentiation: **No. of Hours : 7**

3.1. The nth derivative of some standard functions:
3.2. Leibnitz's theorem & Examples.

Unit 4. Applications of Calculus **No. of Hours : 7**

4.1. Taylor's theorem with Lagrange's form of remainder and related examples.
4.2. Maclaurin' theorem with Lagrange's form of remainder and related examples
4.3. Reduction Formulae

References :

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002
2. Theory and Problems of Advanced Calculus, by Robert Wrede and Murray R. Spiegel, McGraw-Hill Company, New York, Second Edition, 2002
3. Differential Calculus, Shantinarayan, 7th Edition, S. Chand and Co. Publication

DSE 6 : Practical Based on Theory of Numbers and Equations and Calculus-II

Course objectives:

1. To develop analytical and computational skills
2. To get hands on training for solving problems of Theory of Numbers and Equations and Calculus.

Learning outcomes:

After successful completion of this course, students are expected to:
Students will develop problem solving problems on Theory of Numbers and Equations and Calculus**.**

Section-I: Theory of Numbers and Equations Practical

Practical-1: Examples on unit -I of DSE-1
Practical-2: Examples on unit -II of DSE-1
Practical-3: Examples on unit -III of DSE-1
Practical-4: Examples on unit -IV of DSE-1

Section-II: Calculus-II Practical

Practical-5: Examples on unit -I of DSE-2
Practical-6: Examples on unit -II of DSE-2
Practical-7: Examples on unit -III of DSE-2
Practical-8: Examples on unit -IV of DSE-2

MIN 3: Numerical Methods

Course Description: This course provides fundamental knowledge of different methods of solution of equations, basics of interpolation and curve fitting for set of data Also it provides methods for solving differential equations.

Prerequisite Course(s):11th and 12^{th} standard Mathematics.

General Objective: The students will be able to understand the basic numerical analysis which is applicable to problems like finding zeroes of algebraic equations, interpolation, curve fitting, and solution of first-order differential equations. Students will also understand that when exact solutions are difficult to obtain, then approximate solutions can be obtained by using numerical methods.

Learning Outcomes: Students will be able to Learning Outcomes:

1) Understand basic concepts of methods of solutions of equations viz. bisection, iteration, Newton-Raphson methods and method of false position.
2) Understand methods of curve fitting viz. Newton's forward and backward difference formulae and Lagrange's interpolation formula.
3) Use of curve fitting such as least square, polynomials and exponential fittings for set of given data.
4) Use Taylor's series, Euler's method, Modified Euler's methods, RangeKutta methods for solving ordinary differential equations.

Unit-I Algebraic and Transcendental Equations **No. of Hours: 7**

1.1 The bisection method.
1.2 Regula – Falsi Method [Method of False position]
1.3 Newton Raphson method
1.4 Iteration method $x = \phi(x)$.

Unit-II Curve Fitting **No. of Hours: 7**

1.1 Method of least squares.
1.2 Fitting of straight line $y = a + bx$.
1.3 Fitting of curves $xy = k,\ y = ab^x,\ y = ae^{bx},\ y = ax^b$.
1.4 Fitting of second-degree parabola $y = a + bx + cx^2$.

Unit -III Finite Differences and Interpolation **No. of Hours: 10**

3.1 Finite forward and backward differences forward and backward, shift operators μ and δ operators, Inter relation between these operators.
3.2 Newtons forward and backward Interpolation formulae.
3.3 Lagrange's Interpolation formula for unequally spaces points.

Unit-IV Solution of ordinary differential equation of first order and first degree and Numerical Integration **No. of Hours : 6**

4.1 Euler's method and modified Euler's method.
4.2 Taylor's series method.
4.3 Fourth order Runge-Kutta method.
4.4 Trapezoidal rule
4.5 Simpson's $\frac{1}{3}$ rule and $\frac{3}{8}$ rule.

Reference Books :

1. Introductory Methods of Numerical Analysis, S. S. Shastry Prentice Hall India Learning Private Limited; Fifth edition, 2012.
2. Introduction of Numerical Analysis, Addison – Wesley, Carl-Erik Froberg, Second edition, 1979.
3. Numerical methods for scientific and engineering computation, M. K. Jain, S.R.K. lyengr and R. K. Jain, New Age International Publisher Pvt, Ltd.,1999.

MIN 4: Practical Based on Numerical Methods

Course objectives:

3. To develop analytical and computational skills
4. To get hands on training for solving problems of Numerical Methods.

Learning outcomes:

After successful completion of this course, students are expected to:
Students will develop problem solving problems on Numerical Methods**.**

Numerical Methods Practical

Practical-1: Examples on unit -I of MIN-3
Practical-2: Examples on unit -I of MIN-3
Practical-3: Examples on unit -II of MIN-3
Practical-4: Examples on unit -II of MIN-3
Practical-5: Examples on unit -III of MIN-3
Practical-6: Examples on unit -III of MIN-3
Practical-7: Examples on unit -IV of MIN-3
Practical-8: Examples on unit -IV of MIN-3

OE/GE 2: Competitive Mathematics-II

Course Description:

The Competitive Mathematics course is designed to equip students with the necessary skills and strategies to excel in various competitive math competitions and examinations. Throughout the course, students will explore a wide range of mathematical concepts, including algebra, number theory, and geometry. Emphasis will be placed on developing problem-solving techniques, logical reasoning, and analytical thinking.

Prerequisite Course(s): Up to 10^{th} standard Mathematics.

General Objective:

The general objective of Competitive Mathematics is to equip students with the necessary skills, knowledge, and mindset to excel in math competitions, academic pursuits, and problem-solving endeavours. The course seeks to develop well-rounded individuals with strong problem-solving abilities, a solid mathematical foundation, and a competitive spirit.

Learning Outcomes:

1) Proficiency in Problem Solving.
2) Mastery of Mathematical Concepts.
3) Logical Reasoning and Critical Thinking.
4) Time Management and Efficiency.
5) Creative Problem Solving.
6) Competition Readiness.
7) The skills acquired in Competitive Mathematics extend beyond math Appreciation for Mathematics.

Unit-I: **No. Hours: 08**

- 1.1 Progression.
- 1.2 Series.
- 1.3 Problems of Mathematical Signs.
- 1.4 Finding Position, Analogy.
- 1.5 Odd one out.

Unit-II: **No. Hours: 07**

- 2.1 Coding and Decoding.
- 2.2 Venn Diagram.
- 2.3 Family Relations.
- 2.4 Direction Problems.

Unit-III: **No. Hours: 08**

- 3.1 Time and Angles.
- 3.2 Time in a Clock and its Reflection.
- 3.3 Date, Calendar.

Unit-VI: **No. Hours: 07**

- 4.1 Train Problem.
- 4.2 Boats and Streams.
- 4.3 Problem on Age.
- 4.4 Square and square root.

Reference:

Quantitative Aptitude for Competitive Examinations, by R. S Aggarwal, S Chand Publication

SEC 2: Introduction to MATLAB

Course Description:

The course "Introduction to MATLAB" provides a comprehensive introduction to the MATLAB programming language and its applications. MATLAB is a powerful numerical computing environment widely used in various scientific, engineering, and mathematical fields. This course aims to equip students with the fundamental skills and knowledge required to effectively use MATLAB for data analysis, visualization, and algorithm development.

Prerequisite Course(s):

None. Basic knowledge of programming concepts and mathematics is helpful but not required.

General Objective:

The course "Introduction to MATLAB" is to provide students with a solid understanding of the MATLAB programming language and its applications. The course aims to equip students with the necessary skills and knowledge to utilize MATLAB as a powerful tool for data analysis, visualization, and algorithm development.

Learning Outcomes:

1) Gain Familiarity with MATLAB.
2) Understand MATLAB Syntax and Programming Constructs.
3) Apply MATLAB for Data Analysis.
4) Visualize Data and Generate Plots.
5) Develop MATLAB Programs.
6) Solve Mathematical Problems.

Unit-I: Introduction to MATLAB **No. of Hours: 04**

1.1 MATLAB environment and interface
1.2 Variables, data types, and basic operations
1.3 Using MATLAB as a Calculator
1.4 Working with arrays and Matrices
1.5 Displaying output and using basic formatting

Unit-II: MATLAB Programming Basics **No. of Hours: 05**

2.1 Writing and executing MATLAB scripts
2.2 Control flow statements (if-else, for loops, while loops)
2.3 Logical Operators and relational operators
2.4 Working with built-in functions

Unit-III: Data Manipulation in MATLAB **No. of Hours: 05**

3.1 Indexing and slicing arrays and matrices
3.2 Working with vectors and matrices operations
3.3 Basic input/output operations (reading from/writing to files)
3.4 Importing and exporting data from various file formats

Unit-IV: Data Visualization **No. of Hours: 05**

4.1 Plotting 2D graphs using MATLAB
4.2 Customizing plot appearance (labels, titles, colors, etc.)
4.3 Creating multiple plots and subplots

Unit-V: Numerical Computations in MATLAB **No. of Hours: 05**

5.1 Solving equations and systems of equations
5.2 Numerical Integration and differentiation
5.3 Optimization techniques
5.4 Curve fitting and interpolation

Unit-VI: MATLAB Applications in Mathematics **No. of Hours: 06**

6.1 Matrix operations (transpose, inverse, determinant, etc.)
6.2 Solving linear systems and matrix operations
6.3 Solving ordinary differential equations
6.4 Symbolic Computations and algebraic manipulations

References:

1. "MATLAB: A Practical Introduction to Programming and Problem Solving" by Stormy Attaway, 4th Edition, Butterworth Heinemann publication.
2. “Programming in MATLAB” by E V Krishnamurthy and S K Sen, East-West Publication.
3. MATLAB The Language of Technical Computing by The MathWorks, Inc.

SEC 3: Practical on MATLAB

Course objectives:

1. To develop analytical and computational skills
2. To get hands on training in solving problems of MATLAB.

Learning outcomes:

After successful completion of this course, students are expected to:

1. develop problem solving skills
2. develop computer programs for problems of MATLAB.

MATLAB Practical

Practical-1: Examples on unit -I of SEC-2
Practical-2: Examples on unit -II of SEC-2
Practical-3: Examples on unit -III of SEC-2
Practical-4: Examples on unit -IV of SEC-2
Practical-5: Examples on unit -V of SEC-2
Practical-6: Examples on unit -V of SEC-2
Practical-7: Examples on unit -VI of SEC-2
Practical-8: Examples on unit -VI of SEC-2