NATIONAL EDUCATION POLICY-2020

Common Minimum Syllabus for all Uttarakhand

State Universities and Colleges

Syllabus Proposed
2023-24

Sri Dev Suman Uttarakhand University
Badshahithol, Tehri (Garhwal)

पाठ्यक्रम निर्माण समिति, उत्तराखण्ड
Curriculum Design Committee, Uttarakhand

क्र0 सं0	नाम एवं पद	
1	**प्रो0 एन0 के0 जोशी** कुलपति, श्रीदेव सुमन उत्तराखण्ड विश्वविद्यालय, टिहरी	**अध्यक्ष**
2	कुलपति, कुमाऊँ विश्वविद्यालय, नैनीताल	**सदस्य**
3	**प्रो0 जगत सिंह बिष्ट** कुलपति, सोबन सिंह जीना विश्वविद्यालय, अल्मोड़ा	**सदस्य**
4	**प्रो0 सुरेखा डंगवाल** कुलपति, दून विश्वविद्यालय, देहरादून	**सदस्य**
5	**प्रो0 ओ0 पी0 एस0 नेगी** कुलपति, उत्तराखण्ड मुक्त विश्वविद्यालय, हल्द्वानी	**सदस्य**
6	**प्रो. एम0 एस0 एम0 रावत** सलाहकार–रूसा, रूसा निदेशालय, देहरादून	**सदस्य**
7	**प्रो0 के0 डी0 पुरोहित** सलाहकार–रूसा, रूसा निदेशालय, देहरादून	**सदस्य**

NATIONAL EDUCATION POLICY-2020

Syllabus for Professional Course

Diploma

in

Mathematics and Scientific Computing

Sridev Suman Uttarakhand University

Badshahithaul (Tehri Garhwal) Uttarakhand -249199

(State University of Uttarakhand)

2023

Professional Course

Diploma

in

“Mathematics and Scientific Computing”

Course designed by:

S.No.	Name	Designation	Affiliation
1.	Prof. Anita Tomar	Professor and Head	Department of Mathematics Pt. L. M. S. Campus, Sridev Suman Uttarakhand University Campus, Rishikesh
2.	Dr. Gaurav Varshney	Associate Professor	Department of Mathematics Pt. L. M. S. Campus, Sridev Suman Uttarakhand University Campus, Rishikesh
3.	Dr. Deepak Singh	Assistant Professor	Department of Mathematics, B.L.J. Govt. (P.G.) College Purola, Uttarkashi

Course Description

S.No.	Course Code	Course	Semester	Course Type	Credit
1	DMSC001	Matrix Algebra and Differential Calculus	First	Major	6
2	DMSC002	Programming in Python- I	First	Major	4+2*
3	DMSC003	Integral Calculus and Vector Calculus	Second	Major	6
4	DMSC004	Programming in Python- II	Second	Major	4+2*
5	DMSC005	Differential Equations and Laplace Transform	Third	Major	6
6	DMSC006	Introduction to Machine Learning using Python	Third	Major	4+2*
7	DMSC007	Probability and Statistics	Fourth	Major	6
8	DMSC008	Introduction to Artificial Intelligence using Python	Fourth	Major	4+2*
9	DMSC009	Methods of Scientific Writing: LaTeX	First/Second	Minor	4
10	DMSC010	Visualizing Data with MATLAB: Techniques and Strategies	Third/Fourth	Minor	4

*(4+2) Credits represent 4 credits for theory courses and 2 credits for project work.

Credit Evaluation

Semester	Course	Credits
First	Major-1 (DMSC001)	6
	Major-2 (DMSC002)	4+2
	Major Elective	6
	Minor Elective* (DMSC009)	4
	Skill/Vocational enhancement	3
	Co-Curricular#	Qualifying Paper
Second	Major-1 (DMSC003)	6
	Major-2 (DMSC004)	4+2
	Major Elective	6
	Skill/Vocational enhancement	3
	Co-Curricular#	Qualifying Paper
Second	Major-1 (DMSC005)	6
	Major-2 (DMSC006)	4+2
	Major Elective	6
	Minor Elective** (DMSC010)	4
	Skill/Vocational enhancement	3
	Co-Curricular#	Qualifying Paper
Second	Major-1 (DMSC007)	6
	Major-2 (DMSC008)	4+2
	Major Elective	6
	Skill/Vocational enhancement	3
	Co-Curricular#	Qualifying Paper
Total Credits		**92**

*Students can opt for the minor elective course (DMSC009) in the **First or Second** Semester.

Students can opt for the minor elective course (DMSC010) in the **Third or Fourth Semester.

Co-Curricular courses are qualifying papers, and students must score a minimum of 40% to pass the examination.

Course Guidelines

A **Diploma** in *Mathematics and Scientific Computing* will be given after completing 02 years (92 Credits).
To obtain a diploma the candidate will study:

- **3 Major** courses (2 Core and 1 Elective) in each semester.
- **1 Minor** course each year.
- **1 Vocational /Skill enhancement** course in each semester.
- **1 Co-curricular** course in each semester (Qualifying).

Examination Pattern:

1. The students will be required to take both internal and external examinations for their Major, Minor, Vocational/Skill and Co-Curricular courses. The external examination will carry a weightage of 75 marks while the internal examination will carry a weightage of 25 marks.
2. Passing marks for Major, Minor and Vocational/Skill enhancement courses will be 33 %.
3. To pass/qualify a course, a student must score a minimum of 33% marks in the external examination (i.e., 25 marks out of 75). In addition to this, the student must secure a total of at least 33 marks, considering both internal and external examination marks.
4. There are no minimum passing marks in the internal examination.
   (i.e., Even if a student gets *0 marks in internal examination* but gets minimum passing marks (33%) in total (out of *100 =25 internal +75 external*), then candidate is considered pass/qualified).
5. Passing marks for Co-Curricular subjects will be 40%.
6. There will be ***no grace marks***.

How is the Diploma in Mathematics and Scientific Computing Course Beneficial?

Mathematics and computer science are closely related fields. Problems in computer science are often formalized and solved with mathematical methods. Many significant problems currently faced by computer scientists may be solved by researchers skilled in algebra, analysis, combinatorics, logic and/or probability theory, as well as computer science. The purpose of this program is to allow students to study a combination of these mathematical areas and potential areas of application in computer science. After completing the Diploma

- candidates can pursue advanced degree programs in their respective fields.
- they can pursue diverse career opportunities in fields such as Accounting and Business Services, Banking, Investing, Finance Sectors, IT Firms, Quantitative Specialist, Staff Systems Analyst (Computational), Business Analyst, Equity Quant Analyst, Economics Demography, Data Warehouse, government, and public administration.

Syllabus

DMSC001

Course Title: **Matrix Algebra and Differential Calculus** **Credits:** **6**

Objective: The objective of this course is to introduce students to the fundamental concepts of matrix algebra and differential calculus, and their applications in mathematical modeling and problem-solving. The course will cover the basic properties of matrices and determinants, eigenvalues and eigenvectors, and differential calculus including limits, derivatives, and integrals. Students will learn how to apply these concepts to solve mathematical problems.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the fundamental concepts of matrix algebra and differential calculus.
- Solve systems of linear equations using matrix algebra.
- Find eigenvalues and eigenvectors of matrices.
- Apply differential calculus to find limits, derivatives, and various other applications.

Unit	Contents	No. of Lectures
1	**Unit 1: Matrices and Determinants** • Matrices, vectors, elementary operations on matrices • Properties of determinants and their applications • Inverse of a matrix and its properties • Rank of a matrix and its calculation • Solving linear simultaneous equations using matrix algebra	**20**
2	**Unit 2: Eigenvalues and Eigenvectors** • Eigenvalues and eigenvectors of a matrix • Characteristic equation and diagonalization of matrices • Cayley-Hamilton theorem and its proof • Applications of eigenvalues and eigenvectors in linear algebra	**25**
3	**Unit 3: Limits, Continuity, and Differentiability** • Limits of functions, algebra of limits, and basic theorems on limits • Continuity of functions and basic theorems on continuity • Differentiability of functions and theorems on differentiability • Rolle's theorem, Mean value theorem • Taylor's theorem and its applications	**20**
4	**Unit 4: Partial Differentiation and Optimization** • Partial differentiation and its geometrical interpretation • Chain rule and implicit function theorem • Tangent plane, normal line, and gradient of a function • Jacobian matrix and its applications in change of variables • Maxima and minima of functions of two variables, constrained optimization, and Lagrange multipliers	**25**

Reference Books:

1. “Advanced Engineering Mathematics” R.K. Jain and S.R.K. Iyenger
2. “Schaum's Outline of Matrix Operations” by Richard Bronson.
3. "Differential and Integral Calculus" by N. Piskunov
4. "Advanced Calculus" by P. Jain and Iyengar

DMSC002

Course Title: Programming in Python- I | **Credits: 4 + 2**

Objective: The objective of this course is to provide students with a strong foundation in computer programming using Python. Students will learn how to write programs to solve mathematical problems, and how to use Python to visualize mathematical concepts. The course will also introduce students to data structures and algorithms commonly used in computer science.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the basic principles of programming in Python.
- Write Python programs to solve mathematical problems.
- Understand and implement common data structures and algorithms.
- Use Python to visualize mathematical concepts.
- Use Python to solve real-world problems.

Unit	Contents	No. of Lectures
1	**Unit 1: Introduction to Python Programming** • Overview of computer programming concepts • Introduction to the Python programming language • Data types, variables, operators, and expressions • Input/output operations in Python • Introduction to Jupyter Notebook	**13**
2	**Unit 2: Flow Control and Functions in Python** • Conditional statements and loops in Python • Functions and procedures in Python • Recursion • Exception handling in Python	**15**
3	**Unit 3: Data Structures and Algorithms** • Introduction to data structures • Lists, arrays, and tuples • Stacks, queues, and trees • Sorting and searching algorithms	**16**
4	**Unit 4: Visualization with Python** • Introduction to matplotlib • Scatterplots, line plots, and histograms • 3D plotting and animation • Applications to mathematical visualization	**16**
5	**Project Work (2 Credit):** It is mandatory for the students to undertake a project assigned by the course instructor	**30**

Reference Books:

1. "Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes
2. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" by Al Sweigart
3. "Python Programming: An Introduction to Computer Science" by John Zelle
4. "Introduction to Computing and Programming in Python" by Mark J. Guzdial and Barbara Ericson

DMSC003 Course Title: Integral Calculus and Vector Calculus **Credits: 6**

Objective: To provide a solid foundation in the concepts and techniques of integral calculus and vector calculus. To develop the ability to use integration and differentiation techniques to solve problems in mathematics, physics and engineering. To introduce students to the concepts of vectors and their applications in mathematical and physical problems. To equip students with the knowledge of vector calculus and its applications in various fields.

Course Outcome: Upon completion of the course, students will be able to:

- Apply techniques of integration to solve mathematical problems.
- Analyze vector fields and calculate their properties.
- Calculate line and surface integrals using vector calculus.
- Use Green's, Gauss' and Stoke's theorems to solve problems.
- Apply integration and vector calculus techniques to solve problems in physics and engineering.

Unit	Contents	No. of Lectures
1	**Unit 1: Multiple Integrals** • Properties of Definite Integrals • Double and triple integrals • Change of order of integration • Change of variables • Applications of multiple integrals	25
2	**Unit 2: Special Functions and Applications** • Beta and Gamma functions • Dirichlet's integral • Applications of multiple integrals such as surface area and volumes	20
3	**Unit 3: Vector Calculus Basics** • Vector functions of one variable • Differentiation of vectors • Gradient of a scalar function and its physical interpretation • Divergence of a vector field and its physical interpretation • Curl of a vector field and its physical interpretation • Identities involving gradient, divergence, and curl	20
4	**Unit 4: Line and Surface Integrals** • Line integrals and their applications • Surface integrals and their applications • Green’s theorem and its applications • Gauss’ theorem and its applications • Stoke’s theorem and its applications	25

Reference Books:

1. "Calculus and Analytic Geometry" by George B. Thomas, Maurice D. Weir, and Joel Hass
2. "Differential and Integral Calculus" by N. Piskunov
3. “Schaum's Outline of Vector Analysis” by Murray Spiegel, Seymour Lipschutz
4. Advanced Calculus" by P. Jain and Iyengar

DMSC004

Course Title: Programming in Python- II | **Credits: 4+2**

Objective: The objective of this course is to provide students with a strong foundation in computer programming using Python. Students will learn how to write programs to solve mathematical problems, and how to use Python to visualize mathematical concepts. The course will also introduce students to data structures and algorithms commonly used in computer science.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the basic principles of programming in Python.
- Write Python programs to solve mathematical problems.
- Understand and implement common data structures and algorithms.
- Use Python to visualize mathematical concepts.
- Use Python to solve real-world problems.

Unit	Contents	No. of Lectures
1	**Unit 1: Advanced Python Programming** • Object-oriented programming • Exception handling • File I/O	13
2	**Unit 2: Numerical Computing with Python** • Linear algebra and matrix computations • Introduction to NumPy and SciPy • Numerical optimization • Applications to mathematical modeling	15
3	**Unit 3: Probability and Statistics with Python** • Introduction to probability distributions • Statistical inference and hypothesis testing • Regression analysis • Applications to data analysis	16
4	**Unit 4: Machine Learning with Python** • Introduction to scikit-learn • Classification and clustering algorithms • Model selection and evaluation	16
5	**Project Work (2 Credit):** It is mandatory for the students to undertake a project assigned by the course instructor	30

Reference Books:

5. "Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes
6. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" by Al Sweigart
7. "Python Programming: An Introduction to Computer Science" by John Zelle
8. "Introduction to Computing and Programming in Python" by Mark J. Guzdial and Barbara Ericson

DMSC005

Course Title: Differential Equations and Laplace Transform | **Credits: 6**

Objective: To provide a thorough understanding of ordinary and partial differential equations. To develop the ability to solve linear differential equations with constant coefficients. To introduce students to the methods of variation of parameters and series solutions for solving differential equations. To equip students with the knowledge of first and second-order partial differential equations and their solutions.

Course Outcome: Upon completion of the course, students will be able to:

- Solve linear differential equations with constant coefficients.
- Solve second-order differential equations by changing dependent and independent variables.
- Use variation of parameters to solve differential equations.
- Solve first-order partial differential equations using Lagrange's equation and the four standard forms of non-linear first-order equations.
- Understand the basic concepts of Laplace transforms and their properties.
- Use Laplace transforms to solve differential equations and initial value problems.

Unit	Contents	No. of Lectures
1	**Unit 1: Introduction to Differential Equations** • Definition and types of differential equations • Order and degree of differential equations • Formation of differential equations • General and particular solutions	**25**
2	**Unit 2: Ordinary Differential Equations** • Linear differential equations with constant coefficients • Cauchy-Euler equations • Method of variation of parameters • Introduction to series solution method	**25**
3	**Unit 3: Partial Differential Equations** • Formation of first and second-order partial differential equations • Solution of first-order partial differential equations using Lagrange's equation • Solution of second-order partial differential equations • Classification of second-order partial differential equations • Method of separation of variables	**20**
5	**Unit 4: Laplace Transform** • Introduction to Laplace transform • Laplace transforms of standard functions, Shifting theorems • Laplace transform of derivatives and integrals • Convolution theorem, Initial and final value theorem • Laplace transform of periodic functions, error functions, Heaviside unit step function and Dirac delta function	**25**

Reference Books:

1. "Elementary Differential Equations and Boundary Value Problems" by William E. Boyce and Richard C. DiPrima
2. "Differential Equations with Boundary Value Problems: Computing and Modeling" by Dennis G. Zill and Warren S. Wright
3. "Advanced Engineering Mathematics" by Erwin Kreyszig
4. "Laplace Transforms and Applications" by Joel L. Schiff

DMSC006

Course Title: Introduction to Machine Learning using Python | **Credits: 4+2**

Objective: The objective of this course is to introduce students to the basic concepts of machine learning and how to implement them using Python. The course will cover the fundamental concepts of machine learning such as supervised and unsupervised learning, data preprocessing, feature selection, model selection, and evaluation. Students will learn how to use Python libraries such as scikit-learn, pandas, and matplotlib to implement machine learning algorithms.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the basic concepts of machine learning and its applications in various fields.
- Implement machine learning algorithms using Python libraries.
- Analyze and preprocess data for machine learning tasks.
- Perform model selection, training, and evaluation.
- Develop a deep understanding of popular machine learning algorithms such as decision trees, neural networks, and support vector machines.

Course Prerequisites: Students should have prior knowledge of Python programming language.

Unit	Contents	No. of Lectures
1	**Unit 1: Introduction to Machine Learning** • Definition and types of machine learning • Applications of machine learning • Data types and preprocessing	**13**
2	**Unit 2: Supervised Learning** • Linear regression and its extensions • Logistic regression • Decision trees and random forests • k-Nearest Neighbors (k-NN)	**15**
3	**Unit 3: Unsupervised Learning** • k-means clustering • Hierarchical clustering • Principal Component Analysis (PCA) • Association Rule Mining	**16**
4	**Unit 4: Deep Learning** • Introduction to neural networks • Convolutional Neural Networks (CNN) • Recurrent Neural Networks (RNN) • Autoencoders and Generative Adversarial Networks (GANs)	**16**
5	**Project Work (2 Credit):** It is mandatory for the students to undertake a project assigned by the course instructor	**30**

Reference Books:

1. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Aurélien Géron
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller and Sarah Guido
4. "Machine Learning in Python: Essential Techniques for Predictive Analysis" by Michael Bowles

DMSC007 Course Title: Probability and Statistics **Credits: 6**

Objective: To introduce students to the concepts of probability and random variables. To develop the ability to calculate moments and moment generating functions for probability distributions. To familiarize students with commonly used probability distributions and their properties. To introduce the concept of bivariate random variables and their distributions. To provide an understanding of the law of large numbers, central limit theorem, correlation, and regression analysis. To introduce students to hypothesis testing and statistical inference.

Course Outcome: Upon completion of the course, students will be able to:

- Calculate probabilities for events using probability distributions.
- Determine the mean, variance, and other moments of probability distributions.
- Apply different probability distributions to model real-life problems.
- Analyze bivariate random variables and their distributions.
- Understand the law of large numbers, central limit theorem, correlation, and regression analysis.
- Estimate population parameters using maximum likelihood estimation and interval estimation.
- Conduct hypothesis tests and make statistical inferences about population parameters.

Unit	Contents	No. of Lectures
1	**Unit 1: Probability** • Introduction to probability theory • Random variables and distribution functions • Moments and moment generating functions	**20**
2	**Unit 2: Probability Distributions** • Discrete distributions: binomial, Poisson, negative binomial, geometric • Continuous distributions: uniform, exponential, gamma, beta, normal, lognormal • Properties and applications of probability distributions	**25**
3	**Unit 3: Bivariate Random Variables** • Joint, marginal, and conditional distributions • Statistical independence and product moment • Applications of bivariate random variables	**20**
	Unit 4: Statistical Inference • Random sample and sampling distribution • Law of large numbers and central limit theorem • Correlation and regression analysis • Maximum likelihood estimation and interval estimation • Hypothesis testing and statistical inference	

1. "Introduction to Probability" by Joseph K. Blitzstein and Jessica Hwang
2. "Probability and Statistics for Engineers and Scientists" by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying Ye
3. "All of Statistics: A Concise Course in Statistical Inference" by Larry Wasserman
4. "Statistical Inference" by George Casella and Roger L. Berger

DMSC008	
Course Title: Introduction to Artificial Intelligence using Python	**Credits: 4+2**

Objective: The objective of this course is to introduce students to the basic concepts and techniques used in artificial intelligence (AI) and machine learning (ML) using Python. The course will cover the basics of Python programming, data manipulation, and visualization, as well as various AI and ML algorithms. Students will learn how to implement these algorithms using Python and apply them to real-world problems.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the basic concepts and techniques used in artificial intelligence and machine learning.
- Write Python programs to manipulate and visualize data.
- Implement various AI and ML algorithms using Python.
- Apply these algorithms to real-world problems and analyze the results.

Course Prerequisites: Students should have prior knowledge of Python programming language.

Unit	Contents	5. o. of
1	**Unit 1: Introduction to Artificial Intelligence** • Overview of Artificial Intelligence and its applications • Basic concepts of machine learning and deep learning • Types of machine learning algorithms • Supervised and unsupervised learning	6.
2	**Unit 2: Python for Artificial Intelligence** • Working with arrays and matrices in Python • Data visualization using Python	14
3	**Unit 3: Machine Learning Algorithms** • Linear regression and logistic regression • Decision trees and random forests • Support vector machines • Neural networks and deep learning	16
4	**Unit 4: Applications of AI** • Image and speech recognition • Natural Language Processing • Reinforcement Learning • Case studies in AI	16
5	**Project Work (2 Credit):** It is mandatory for the students to undertake a project assigned by the course instructor	30

Reference Books:

1. "Artificial Intelligence with Python" by Prateek Joshi
2. "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2" by Sebastian Raschka and Vahid Mirjalili
3. "Hands-On Artificial Intelligence with TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Amir Ziai and Anish Shrestha
4. "Python Artificial Intelligence Projects for Beginners: Get up and running with Artificial Intelligence using 8 smart and exciting AI projects" by Joshua Eckroth

DMSC009

Course Title: Methods of Scientific Writing: LaTeX | **Credits: 4**

Objective: The objective of this course is to provide students with the knowledge and skills required to write scientific documents using LaTeX. Students will learn the basics of LaTeX programming and document formatting, including tables, figures, and equations. The course will also cover advanced topics such as bibliography management, creating presentations, and using templates.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the basic concepts of LaTeX typesetting system and document formatting.
- Use LaTeX to prepare scientific papers, reports, and presentations.
- Apply formatting and typography techniques to enhance the visual appeal of documents.
- Use LaTeX to typeset mathematical equations, figures, and tables.

Unit	Contents	No. of Lectures
1	**Introduction to LaTeX** • Introduction to LaTeX and its advantages • Basic LaTeX commands • Document structure and formatting	10
2	**Tables, Figures, and Equations** • Creating tables using LaTeX • Inserting figures in LaTeX • Creating equations and formulas using LaTeX • Mathematical typesetting in LaTeX	15
3	**Bibliography Management** • Creating bibliographies and references using LaTeX • Managing citations using BibTeX • Formatting bibliographies and references	15
4	**Advanced LaTeX Topics** • Creating presentations using LaTeX • Using templates to create documents efficiently • Customizing document formatting and styles • Debugging LaTeX errors	20
5	**Project Work:** It is mandatory for the students to undertake a project assigned by the course instructor	

Reference Books:

1. "Latex For Beginners" by *Murugan Swaminathan* (2022).
2. "LATEX - A Beginner Guide to Professional Documentation" by *S. Swapna Kumar* (2019).
3. "A Beginners Guide to Latex" by *Chetan Shirore* (2015).
4. "LaTeX for Complete Novices" by *Nicola L. C. Talbot* (2012)

DMSC010

Course Title: Visualizing Data with MATLAB: Techniques and Strategies | **Credits: 4**

Objective: The objective of this course is to provide students with an understanding of the techniques and strategies for visualizing data using MATLAB. The course will introduce students to the basic concepts of data visualization and the tools and techniques available in MATLAB. Students will learn how to create effective visualizations and how to use MATLAB to analyze and interpret data.

Course Outcome: Upon completion of the course, students will be able to:

- Understand the basic concepts of data visualization.
- Develop effective visualization strategies and techniques.
- Use MATLAB to create and analyze data visualizations.
- Interpret and communicate complex data using effective visualizations.

Unit	Contents	No. of Lectures
1	**Unit 1: Introduction to Data Visualization** • Overview of data visualization and its importance • Basic concepts of data visualization • Types of data and visualization techniques • Data visualization tools and software	**10**
2	**Unit 2: Introduction to MATLAB** • Introduction to MATLAB environment and tools • MATLAB programming basics • Data structures in MATLAB • Plotting functions and tools in MATLAB	**15**
3	**Unit 3: Advanced Data Visualization Techniques** • 2D and 3D plotting techniques in MATLAB • Visualization of large datasets • Customizing plots and graphics • Animation and interactive visualization	**15**
4	**Unit 4: Applications of Data Visualization** • Visualization of scientific data • Visualization of financial data • Data visualization for machine learning and artificial intelligence • Case studies in data visualization	**20**
5	**Project Work:** It is mandatory for the students to undertake a project assigned by the course instructor	

Reference Books:

1. MATLAB: A Practical Introduction to Programming and Problem Solving (5th edition) by Stormy Attaway
2. Learning MATLAB by Tobin A. Driscoll and Richard J. Braun
3. MATLAB for Engineers (5th edition) by Holly Moore
4. MATLAB Programming for Engineers (6th edition) by Stephen J. Chapman