Nirmala Memorial Foundation College of Commerce and Science

(Autonomous)

Re-accredited by NAAC with B++, ISO 9001-2015 Certified, Recognised under section 2(f) & 12(B) of the UGC Act 1956

Permanently Affiliated to the University of Mumbai,

Syllabus

Bachelor of Science in Artificial Intelligence & Machine Learning

(B.Sc. AI & ML)

(Semester I and II)

(Programme Code: UGAIML04)

As Per New Education Policy (NEP) 2020

(To be implemented from the Academic Year 2026-2027)

*Approved in the Academic Council Meeting held on **7 th October 2025***

INTRODUCTION OF THE PROGRAMME

1. Introduction

In the age of Artificial Intelligence (AI) and Data-Driven Technologies, the influence of intelligent computing systems on society is profound and transformative. From healthcare to finance, transportation to entertainment, AI and Machine Learning (ML) have become the driving forces of innovation, reshaping industries and redefining human-computer interactions.

The B.Sc. in Artificial Intelligence and Machine Learning program is designed to prepare students for this rapidly evolving technological landscape. The curriculum integrates core foundations of computer science with specialized knowledge in AI and ML, enabling students to gain both breadth and depth of expertise.

Aligned with the National Education Policy (NEP) 2020, this program emphasizes not just technical proficiency but also adaptability, critical thinking, and problem-solving skills. Students will engage with concepts of programming, mathematics for AI, data structures, algorithms, databases, computer networks, and software engineering, while progressively advancing into machine learning, deep learning, natural language processing, computer vision, robotics, reinforcement learning, explainable AI, and AI ethics.

Key Philosophy of the Program:

Form Strong Foundations: Build a deep understanding of computational, mathematical, and statistical principles that drive AI and ML.

Nurture Innovation & Research: Encourage problem-solving, creativity, and research in AI applications across diverse domains.

Bridge Theory with Practice: Provide extensive lab work, projects, and industry-linked activities to strengthen real-world AI & ML skills.

Prepare for Industry & Academia: Equip students to thrive in industry roles or pursue higher studies and research in AI, ML, and Data Science.

This program not only prepares students for cutting-edge careers in AI & ML but also fosters a mindset of lifelong learning, innovation, and ethical responsibility in deploying intelligent systems. Graduates will be well-positioned to pursue roles in software development, data science, AI engineering, business intelligence, research, and entrepreneurship.

2. Aims and Objectives

Understanding and Knowledge Base: Develop a comprehensive knowledge of AI principles, machine learning algorithms, data-driven modeling, and applications of AI across industries.

Analytical Abilities and Problem Solving: Strengthen mathematical reasoning, analytical thinking, and computational approaches to solve real-world problems using AI techniques.

Training in Emerging Technologies: Provide exposure to modern AI frameworks, deep learning libraries, big data platforms, cloud-based AI services, and ethical considerations in AI deployment.

Preparation for Post-Graduate Studies & Research: Enable students to pursue advanced studies (M.Sc., M.Tech., MBA in AI/Analytics, or research programs) in AI, ML, or interdisciplinary fields.

Professional Skillset Development: Equip students with programming, data handling, visualization, and modeling skills necessary for careers in AI-driven industries.

Independent and Collaborative Work: Foster teamwork, leadership, and effective communication, enabling students to work both independently and collaboratively in AI project development.

PROGRAM OUTCOME

At the end of three-year B.Sc. AI & ML, the students will be able:

- Demonstrate understanding of mathematical, statistical, and computational foundations of Artificial Intelligence and Machine Learning.
- Design and implement AI/ML models to solve real-world problems in domains such as healthcare, finance, education, and smart systems.
- Apply data preprocessing, visualization, and exploratory data analysis techniques for effective decision-making.
- Utilize modern AI & ML libraries, tools, and frameworks such as TensorFlow, PyTorch, Keras, Scikit-learn, and OpenCV for building intelligent systems.
- Develop and deploy AI-driven applications in areas such as Natural Language Processing, Computer Vision, Robotics, and Predictive Analytics.
- Recognize the ethical, social, and legal implications of AI, ensuring fairness, transparency, and accountability in intelligent systems.
- Work effectively in teams, manage projects, and communicate findings clearly in both technical and non-technical contexts.
- Engage in continuous learning, keeping pace with advancements in AI, ML, Data Science, and related technologies.
- Exhibit professional competence and readiness for careers in AI engineering, data science, business analytics, or entrepreneurial ventures.
- Pursue higher studies and research in Artificial Intelligence, Machine Learning, Data Science, or interdisciplinary areas of computing.

ELIGIBILITY CRITERIA FOR ADMISSION

The eligibility for admission to the B.Sc. Artificial Intelligence and Machine Learning (AI & ML) programme shall be as per the rules and regulations laid down by the University of Mumbai.

1. **Duration of the Programme**

    - The B.Sc. AI & ML programme shall be a Three-Year Degree Course, conducted in six semesters, in accordance with the Choice Based Credit System (CBCS) and National Education Policy (NEP) 2020 framework.

2. **Eligibility for Admission**

    - A candidate for being eligible for admission to the B.Sc. AI & ML degree programme shall have passed the Higher Secondary School Certificate (HSC) Examination (Std. XII) in Science stream conducted by the Maharashtra State Board of Higher Secondary Education or an examination recognized as equivalent thereto, with Mathematics as compulsory subjects.

Candidates who have passed the Diploma in Engineering/Technology (recognized by the Board of Technical Education, Maharashtra State or equivalent) are also eligible for admission to the First Year of the programme.

SEMESTER I

COURSE STRUCTURE

VERTICAL		COURSE CODE	SUBJECT	CREDIT
Vertical 1	Major	NUAM101	Python Programming	**2**
	Major	NUAM102	Artificial Intelligence & Machine Learning Fundamentals	**2**
	Major	NUAM103	Mathematics for AI & ML - I	**2**
Vertical 2	Minor	***		
Vertical 3	OE1	NUAM104	Indian Financial Systems	**2**
	OE2	NUAM105	Social Media and Communication	**2**
Vertical 4	VSC	NUAM106	Web Designing - Lab	**2**
	SEC	NUAM107	Python Programming - Lab	**2**
Vertical 5	AEC	NUEN101	Communication Skills in English I	**2**
	VEC	NUGT101	Green Technologies	**2**
	IKS	NUIK101	Indian Knowledge System	**2**
Vertical 6	CC	NUCC103	Fitness and Sports-I	**2**
			Total Credits	**22**

SEMESTER II

COURSE STRUCTURE

VERTICAL		COURSE CODE	SUBJECT	CREDIT
Vertical 1	Major	NUAM201	Generative AI Workflows	2
	Major	NUAM202	Fundamentals of Database Management System	2
	Major	NUAM203	Mathematics for AI & ML - II	2
Vertical 2	Minor	NUAM204	Data Wrangling	2
Vertical 3	OE1	NUAM205	Basics of Stock Market	2
	OE2	NUAM206	Research Principles and Practices	2
Vertical 4	VSC	NUAM207	Data Visualization & Exploratory Data Analysis - Lab	2
	SEC	NUAM208	Fundamentals of Database Management Systems - Lab	2
Vertical 5	AEC	NUEN201	Communication Skills in English II	2
	VEC	NUDT201	Digital Tools for Sustainability	2
Vertical 6	CC	NUCC203	Fitness & Sports-II	2
			Total Credits	**22**

Semester – I

Vertical - I

Mandatory Courses

Name of the Course: Python Programming

Sr. No.	Heading	Particulars
1	**Description the course:**	• **Introduction:** Python has emerged as a fundamental language in the tech industry, valued for its simplicity, versatility, and readability. Its wide range of applications—from web development and data analysis to artificial intelligence and automation—has made it highly relevant and increasingly in demand across various domains. This introduction highlights Python's practical utility and its growing significance in today's technology-driven landscape. • **Relevance and Usefulness:** Python's adaptability has made it a key player across various sectors—including web development, data science, and automation—cementing its role in today's rapidly evolving tech environment. Its user-friendly syntax, combined with a vast collection of libraries, empowers developers to solve problems efficiently and streamline development processes with ease. • **Applications:** Python is widely applied in web development using frameworks like Django, in data science through powerful libraries such as NumPy and Pandas, and in cutting-edge fields like IoT and blockchain, making it a versatile tool across traditional and emerging technologies. • **Interest and Connection with Other Courses:** Python's beginner-friendly nature and wide-ranging interdisciplinary applications have made it one of the most sought-after programming languages, easily integrating into diverse academic courses and professional fields alike. • **Demand in the Industry:** With industries increasingly relying on Python for web development, data analysis, machine learning, and automation, there is a rising demand for professionals skilled in Python programming to meet these evolving technological needs. • **Job Prospects:** Professionals proficient in Python programming have strong career prospects, with opportunities spanning roles such as web developers, data analysts, and data scientists—highlighting the language's versatility and sustained demand across the tech industry.
2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours

6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To Learn Programming fundamentals using Python. 2. To understand the concept of data types and other basic elements in python. 3. To learn control statements and operators in python. 4. To learn to write different functions and strings in python. 5. To understand the concept of dictionaries in python.	
8	**Course Outcomes:** CO 1. Ability to use variables with different data types and input output functions. CO 2. Ability to use control statements and operators in programming. CO 3. Proficiency in using function and strings. CO 4. Acquire knowledge of dictionaries.	
9	**Modules** **Module 1: Fundamentals of Python Programming (15 Hours)** 1. **Introduction to Python Language**: Overview and key features of Python, Execution process of Python programs, Internal architecture of Python, Concept of frozen binaries, Understanding the Python interpreter, Comparison of Python with C and Java, Installing Python and setting up the environment, Writing and executing Python code, Introduction to IDLE (Integrated Development and Learning Environment) 2. **Data Types, Variables, and Basic Elements**: Comments and docstrings, Data types: Numeric, compound, Boolean, dictionary, sets, and mappings, Fundamental elements of Python programming, Variable declaration and usage 3. **Input and Output Operations; Control Statements**: Using input functions and output statements, Handling command-line arguments, Control flow statements: loops (for, while), else clause in loops, Key control keywords: break, continue, pass, assert, and return 4. **Functions**: Defining and invoking functions, Returning single and multiple values, Utilizing built-in functions, Parameters and arguments handling, Recursive functions, Anonymous (lambda) functions **Module 2: Operators, Arrays, Strings, and Dictionaries (15 Hours)** 1. **Operators in Python**: Arithmetic, assignment, and unary minus operators, Relational and logical operators, Bitwise, membership, and identity operators, Operator precedence and associativity 2. **Arrays:** Creating and initializing arrays, Indexing, slicing, and basic array operations, Array processing and mathematical operations, Understanding aliasing in arrays, Advanced slicing and indexing in NumPy arrays, Array dimensions and key attributes 3. **Strings:** Creating and manipulating strings, String functions and methods, Indexing, slicing, concatenation, and repetition, Checking membership and comparison, Trimming spaces, finding and counting substrings, String immutability and transformations (splitting, joining, case changes), Checking start/end patterns, sorting, searching, and formatting 4. **Dictionaries:** Creating and managing dictionaries, Dictionary operators and methods, Using loops with dictionaries, Dictionary operations and ordered dictionaries	

<table>
<tr><td>10</td><td colspan="2">Text Books
1. Programming through Python M. T. Savaliya, R.K Maurya, G.M Magar, Staredu Solutions, 1st edition (2018)
2. Python DataScience Handbook, Jake VanderPlas, O'Reilly Media, 1stedition (2016)
3. Let Us Python, Yashwant Kanetkar, BPB publication , 1st edition (2019)</td></tr>
<tr><td>11</td><td colspan="2">Reference Books
1. Programming in Python3, Mark Summerfield, Pearson Education, 2nd edition (2018)
2. Learning Python, LutzM, O’Reilly- Shroff, 5th edition, 2013.
3. Beginning Python, Magnus LieHetland, Apress, 2nd edition, 2009.
4. Star Python, Star Certification, Star Certification,1st, 2018.</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination: 60%</td></tr>
<tr><td>13</td><td>Continuous Evaluation through:
Class test of 15 marks

Quizzes/ Presentations/ Assignments: 5 marks
Total: 20 marks</td><td>Format of Question Paper: External Examination (30 Marks)– 1 hr duration</td></tr>
<tr><td>14</td><td colspan="2">Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)
<table>
<tr><th>Questions</th><th>Based On</th><th>Options</th><th>Marks</th></tr>
<tr><td>Q.1</td><td>Module 1</td><td>Any 2 out of 4</td><td>10</td></tr>
<tr><td>Q.2</td><td>Module 2</td><td>Any 2 out of 4</td><td>10</td></tr>
<tr><td>Q.3</td><td>Module 1 & 2</td><td>Any 2 out of 4</td><td>10</td></tr>
</table></td></tr>
</table>

Name of the Course: Artificial Intelligence & Machine Learning Fundamentals

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The **Artificial Intelligence (AI) & Machine Learning (ML) Fundamentals** course introduces students to the core concepts, techniques, and applications that drive intelligent systems. This course covers the basics of AI, search strategies, problem-solving, and machine learning approaches, providing a foundation for students to understand how intelligent agents learn, adapt, and make decisions in dynamic environments. **Relevance:** In today's world, AI and ML are no longer futuristic concepts but practical technologies that shape industries such as healthcare, finance, transportation, e-commerce, and entertainment. This course enables students to grasp the significance of these technologies, making it highly relevant in the era of automation and data-driven decision-making. **Usefulness:** Students gain knowledge of fundamental AI problem-solving methods and the mathematical and logical foundations of ML algorithms. The course emphasizes conceptual clarity along with real-world illustrations, equipping learners with the skills to build intelligent systems and prepare datasets for model training. **Application:** The knowledge acquired in this course finds applications in numerous areas including **chatbots, recommendation systems, predictive analytics, computer vision, and natural language processing**. Students will learn how theoretical AI/ML concepts are transformed into applications that solve real-world challenges. **Interest:** Artificial Intelligence & Machine Learning Fundamentals is both **theoretical and hands-on**, stimulating students' curiosity about how machines mimic human intelligence. The course sparks interest by showcasing simple yet powerful AI models and ML workflows that lead to exciting projects in gaming, smart assistants, and data-driven problem-solving. **Connection with Other Courses:** This course serves as a stepping stone to advanced courses such as **Machine Learning Techniques, Deep Learning, Natural Language Processing, Reinforcement Learning, and AI Ethics**. It also connects with mathematics courses (linear algebra, probability, statistics) and programming courses, ensuring a strong interdisciplinary foundation. **Demand in the Industry:** With AI/ML driving the future of work, industries worldwide seek professionals capable of developing, deploying, and optimizing intelligent systems. From startups to global enterprises, the demand for

		AI/ML skills is rapidly expanding, making this course industry-aligned. **Job Prospects:** Graduates proficient in AI/ML fundamentals can explore careers as **AI Engineer, Data Scientist, ML Developer, AI Research Assistant, and Business Intelligence Analyst**. These roles span across industries like IT, healthcare, fintech, autonomous systems, and education technology.
2	**Vertical:**	**Major**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. To understand the fundamentals of Artificial Intelligence and its role in problem-solving and decision-making. 2. To learn basic search strategies, logic-based reasoning, and knowledge representation techniques. 3. To introduce Machine Learning concepts, including supervised and unsupervised learning. 4. To develop skills in data preprocessing, model building, and evaluation metrics. 5. To gain exposure to real-world applications of AI/ML across different domains.	
8	**Course Outcomes (CO):** **CO1:** Describe the basic concepts, history, and applications of Artificial Intelligence and Machine Learning. **CO2:** Apply simple AI problem-solving techniques such as search strategies. **CO3:** Differentiate between supervised, unsupervised, and reinforcement learning with real-world examples. **CO4:** Demonstrate the working of basic ML algorithms like regression, classification, and clustering. **CO5:** Discuss the challenges, limitations, and ethical aspects of AI and ML.	
9	**Modules:-** **Module 1:Artificial Intelligence Fundamentals (15 hours):**	
	1. **Introduction to AI** • Definition and Evolution of AI (from rule-based systems to modern AI) • Applications in daily life: voice assistants, chatbots, recommendation systems, robotics • Types of AI: Weak AI vs Strong AI, Narrow vs General AI • Opportunities and Challenges in AI 2. **Problem Solving and Search** • Concept of problem formulation: initial state, actions, goal state	

- State space and search trees (visual illustrations, puzzles like 8-puzzle, pathfinding)
- **Uninformed Search:** Breadth-First Search (BFS), Depth-First Search (DFS) – explained with flowcharts/examples
- **Informed Search:** Heuristic Search, A* Algorithm (introduction with examples like Google Maps shortest path)
- Constraint Satisfaction Problems – simple examples (Sudoku, timetable scheduling overview)

3. **Knowledge Representation & Reasoning**
   - Simple propositional logic and examples ("if-then" rules)
   - Basic idea of predicate logic (illustrative, not mathematical depth)
   - Rule-based systems and Expert Systems in practice (e.g., medical diagnosis)
4. **Ethics in AI**
   - Bias and fairness issues with examples (biased hiring tools, facial recognition problems)
   - Explainable AI (XAI) in simple terms
   - Social impact: Privacy, accountability, automation & jobs

Module 2: Machine Learning Fundamentals (15 hours) :

1. **Introduction to ML**
   - What is ML? How it differs from traditional programming
   - Types of ML: Supervised, Unsupervised, Reinforcement (with day-to-day examples like spam filter, customer segmentation, self-driving cars)
   - ML Workflow: Data → Preprocessing → Model Training → Evaluation → Deployment
   - Concept of overfitting and underfitting (using simple graphs/illustrations)
2. **Supervised Learning**
   - **Regression:**
     - Linear Regression (predicting house price, student marks)
     - Logistic Regression (binary classification like pass/fail, spam detection)
   - **Classification:**
     - K-Nearest Neighbors (KNN) with a simple diagram
     - Decision Trees – splitting criteria (Entropy, Gini) explained with examples (e.g., weather dataset)
   - Hands-on case study (Iris dataset or simple numeric example – conceptual, no coding in exam)
3. **Unsupervised Learning**
   - Clustering: K-Means (illustration with customer segmentation)
   - Hierarchical clustering (basic concept with dendrogram idea)
   - Dimensionality Reduction: Concept of PCA (only intuition, no math)
4. **Reinforcement Learning & Emerging Trends**
   - Basics of RL: Agent, Environment, Reward, Policy (game-based examples like chess, tic-tac-toe, self-driving car simulation)

	• Q-Learning (conceptual explanation only) • Emerging trends: Generative AI (ChatGPT, DALL·E), Ethical AI, Edge AI	
10	**Text Books** 1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach (Beginner chapters) 2. Tom Mitchell, Machine Learning (Introductory concepts)	
11	**Reference Books** 1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (selected chapters) 2. Ethem Alpaydin, Introduction to Machine Learning (MIT Press, simple introduction) 3. Charu Aggarwal, Artificial Intelligence: A Textbook (Springer, beginner to intermediate)	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	**Format of Question Paper: External Examination (30 Marks)– 1 hr duration**

14 **Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Name of the Course: Mathematics for AI & ML – I

Sr.No.	Heading	Particulars
1	**Description the course:**	• Introduction: This subject introduces the fundamental mathematical tools of linear algebra and probability, which form the backbone of modern Artificial Intelligence (AI) and Machine Learning (ML). Concepts such as vectors, matrices, eigenvalues, and probability distributions provide the foundation for data representation, transformation, and modeling of uncertainty. • Relevance and Usefulness: Linear Algebra is essential for handling large datasets, dimensionality reduction, and representation learning. Probability equips students with skills to model uncertainty, randomness, and statistical inference, which are crucial in predictive modeling. Both topics are indispensable in understanding core ML algorithms and AI systems. • Applications: Dimensionality reduction using PCA in image processing and NLP. Naïve Bayes classifier in spam detection and text classification. Probabilistic reasoning in Bayesian networks and generative AI models. Eigenvalue methods in recommendation systems and clustering. • Interest and Connection with Other Courses: Builds the mathematical foundation for Machine Learning, Deep Learning, and Data Mining. Strongly connected to Statistics, Computer Vision, and Natural Language Processing (NLP) courses. Provides necessary tools for Data Science practicals using Python, R, and MATLAB. • Demand in the Industry: Probability and linear algebra are heavily used in data analysis, AI model development, and financial analytics. Companies such as Google, Meta, Amazon, and Microsoft rely on these concepts in search, recommendation, and predictive systems. • Job Prospects: Roles like Data Analyst, Machine Learning Engineer, AI Researcher, and Quantitative Analyst demand strong foundations in linear algebra and probability. Essential for jobs in data-driven industries such as fintech, healthcare analytics, robotics, and AI startups.
2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives (CO):** By the end of this course, the student will be able to: 1. Provide students with a solid foundation in linear algebra concepts such as vectors, matrices, eigenvalues, and decompositions. 2. Introduce the principles of probability and statistics for modeling uncertainty and randomness. 3. Develop analytical and problem-solving skills required for data representation and	

	probabilistic reasoning. 4. Relate linear algebra and probability concepts to AI/ML applications such as PCA, Naïve Bayes, and probabilistic models.
8	**Course Outcomes (CO):** On successful completion of this course, the student will be able to: CO1. Apply linear algebra concepts to data transformation, dimensionality reduction, and feature extraction in ML. CO2. Use probability theory and statistical measures to analyze and interpret data distributions. CO3. Apply Bayes' theorem and random variable modeling to develop probabilistic learning algorithms. CO4. Integrate linear algebra and probability concepts in solving real-world AI/ML problems such as classification and clustering.
9	**Modules** **Module 1: Linear Algebra for AI (15 Hrs)**
	• Vectors (2 Hours): **Definition, vector operations (addition, scalar multiplication, dot/cross product), Norms (L1, L2, L∞) and geometric interpretation** • Matrices (2 Hours): **Types of matrices (identity, diagonal, symmetric, orthogonal) and properties, Matrix operations: transpose, determinant, inverse, transformations** • Rank of a Matrix (2 Hours): **Concept of rank, row rank = column rank, Rank-nullity theorem and computation (Gaussian elimination)** • Eigenvalues & Eigenvectors (3 Hours): **Definition, characteristic equation, and computation, Diagonalization and properties of eigenvalues/eigenvectors** • Singular Value Decomposition (SVD) (2 Hours): **Concept of SVD and relation to eigen decomposition, Geometric interpretation (orthogonal transformations)** • Orthogonality & Projections (2 Hours): **Orthogonal vectors, orthogonal matrices, Gram–Schmidt process, Vector projection onto subspaces, projection matrices** • Principal Component Analysis (PCA) (2 Hours): **Motivation and steps (standardization, covariance matrix, eigen decomposition), Dimensionality reduction and variance maximization**

Module 2: Probability & Statistics (15 Hrs)

- **Probability Basics (2 Hours):**
  Classical and conditional probability, addition and multiplication rules, Independence of events and law of total probability
- **Random Variables (2 Hours):**
  Definition of discrete and continuous random variables, Probability mass function (PMF) & probability density function (PDF)
- **Distributions (3 Hours):**
  Common distributions: Bernoulli, Binomial, Poisson (discrete), Normal, Exponential, Uniform distributions (continuous)
- **Bayes' Theorem (2 Hours):**
  Statement and derivation of Bayes' theorem, Prior, likelihood, posterior, and evidence
- **Expectation & Variance (2 Hours):**
  Expected value and its properties, Variance, standard deviation, covariance, correlation
- **Hypothesis Testing (2 Hours):**
  Null and alternative hypotheses, Type I & Type II errors, t-test, chi-square test, p-value interpretation
- **ML Applications of Probability & Statistics (2 Hours):**
  Probabilistic models in ML (Naïve Bayes, HMMs, Bayesian inference), Statistical measures for model evaluation (confidence intervals, z-scores)

10 & 11 **Text Books & Reference Books**

1. Mathematics for Machine Learning (Deisenroth et al.) PDF
2. Linear Algebra (Jim Hefferon) PDF
3. Linear Algebra Done Right (Axler) PDF
4. Introduction to Probability (Bertsekas & Tsitsiklis) PDF
5. Introduction to Probability (Grinstead & Snell) PDF
6. Mathematics for Machine Learning (Deisenroth et al.) PDF

12

Internal Continuous Assessment: 40%	**Semester End Examination: 60%**

13

Continuous Evaluation through: Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	**Format of Question Paper: External Examination (30 Marks)– 1 hr duration**

14 **Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Vertical - III

Open Elective (OE)

Name of the Course: Indian Financial System

Sr. No.	Heading	Particulars
1	**Description the course:**	This course provides a comprehensive introduction to the Indian financial system, offering foundational knowledge of its structure, components, and functioning. It delves into the role of banks and other financial institutions in economic development and explores various banking services available to individuals and businesses. The course also introduces students to the basics of insurance and personal financial planning, enabling them to make informed financial decisions and develop sound saving and investment strategies. Through real-world examples, case studies, and practical insights, students will gain a deeper understanding of how financial instruments, services, and institutions interact to support the financial stability of individuals and the economy.
2	**Vertical:**	**Open Electives**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. Understand the basic structure and role of the Indian financial system in the economy. 2. Identify the key functions of banks and the services they offer to individuals. 3. Recognize the importance of the Reserve Bank of India (RBI) as a regulatory authority. 4. Explain the concept of insurance and its relevance in personal financial planning. **5.** Develop basic awareness of saving, budgeting, and investment as essential financial habits.	
8	**Course Outcomes:** **After completing this course, students will have the knowledge and skills to** CO1. Describe the structure and components of the Indian financial system. CO2. Explain the roles and functions of various banking institutions and the regulatory framework. CO3. Understand the concept and significance of insurance in financial planning. CO4. Gain awareness of essential financial habits such as saving, budgeting, and basic investment concepts. CO5. Build a foundational understanding of financial services relevant to individuals in everyday life.	

<table>
<tr><td></td><td></td></tr>
<tr><td>•</td><td>Modules:- Module 1 (10 hours):

• Overview of Indian Financial System

o What is a financial system?
o Importance of financial systems in the economy
o Basic components: Institutions, markets, instruments, and services (in simple language)</td></tr>
<tr><td></td><td>Module 2 (10 hours):

• Banks and Banking Services
o Types of banks: Public, private, cooperative
o Basic services: Savings account, fixed deposits, loans, credit cards
o Role of RBI in regulating banks</td></tr>
<tr><td></td><td>Module 3 (10 hours):

• Insurance and Financial Planning Basics
o What is insurance? Types: Life and general insurance
o Importance of insurance in financial planning
o Basic idea of budgeting, saving, and investment</td></tr>
<tr><td>10</td><td>Text Books

1. Halan, Monika. Let’s Talk Money, Harper Business
2. Pathak, Bharati V. The Indian Financial System (selected basic chapters)
3. RBI’s “Financial Literacy” booklets and SEBI’s student guides</td></tr>
<tr><td>11</td><td>Reference Books

4. Introduction to Financial Planning (4th Edition 2017) - Indian Institute of Banking & Finance.
5. Bhasham, A.L, Wonder that was India: A Survey of the Culture of the Indian Subcontinent Before the Coming of the Muslims. London, Sidgwick and Jackson, 1954'
6. Sinha, Madhu. Financial Planning: A Ready Reckoner July 2017, McGraw Hill.
7. Halan, Monika, Let’s Talk Money: You've Worked Hard for It, Now Make It Work for You, July 2018 Harper Business.
8. Pandit, Amar The Only Financial Planning Book that You Will Ever Need, Network 18 Publications Ltd.</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination : 60%</td></tr>
<tr><td>13</td><td>Continuous Evaluation through:

<table><tr><th>Sr. No</th><th>Particular</th><th>Marks</th></tr><tr><td>1.</td><td>Class Test</td><td>15</td></tr><tr><td>2.</td><td>Class participation</td><td>05</td></tr><tr><td></td><td>Total</td><td>20</td></tr></table></td><td>Semester End Examination (30 Marks)</td></tr>
</table>

14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Type & Module	Marks
Q1.	Objective Question A) Multiple choice questions B) True or False	 08 Marks 07 Marks
Q2.	Theory Question	15 Marks
	OR	
Q2.	Theory Question	15 Marks
	Total	**30**

Name of the Course: Social Media and Communication

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course offers a comprehensive overview of the evolution, structure, and impact of social media from its early platforms to the modern digital ecosystem. Students will explore the historical development of social media, the rise of mobile-based platforms, and the societal transformations driven by these technologies. The course also examines contemporary trends, including algorithmic curation, data privacy, ethical concerns, and the growing role of AI and machine learning in shaping digital interactions. Emphasis is placed on the application of social media in academic, professional, and interpersonal communication, equipping students with both theoretical understanding and practical insight.
2	**Vertical :**	**Open Electives**
3	**Type :**	**Theory**
4	**Credit**:	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted**:	**50 Marks**
7	**Course Objectives**: 1. **To introduce** students to the evolution and historical development of social media platforms and digital communication tools. 2. **To familiarize** students with modern social media platforms, their key features, and their influence on communication, culture, and society. 3. **To explore** the role of algorithms, artificial intelligence, and machine learning in shaping user experiences on social media. 4. **To sensitize** students to issues of digital ethics, data privacy, and the responsible use of social media. 5. **To enable** students to critically assess the use of social media in academic, interpersonal, and professional settings.	
8	**Course Outcomes:** By the end of this course, **students will be able to**: CO1. Describe the historical evolution and foundational concepts of social media platforms and their societal impact. CO2. Analyze the features and influence of major modern social media platforms, including their role in shaping digital interactions. CO3. Evaluate the ethical, privacy, and algorithmic challenges associated with social media usage in contemporary digital society. CO4. Apply knowledge of social media tools and technologies in academic, interpersonal, and professional contexts.	

9	**Modules**:-
	Module 1: Social Media – Past and Present 1. Concept and Scope of Social Media 2. Brief History and Evolution of Social Media 3. Early Platforms: Orkut, Friendster, MySpace 4. Evolution of Digital Communication Tools 5. Societal and Cultural Impact of Early Social Media
	Module 2: Modern Social Media Landscape and Applications 1. Overview of Major Platforms: Instagram, Twitter, TikTok, Snapchat 2. Recommendation Systems and Algorithmic Influence 3. Data Privacy, Ethics, and Digital Footprint 4. Social Media in Interpersonal and Academic Communication 5. Influencer Economy and Monetization Models 6. Academic and Research Applications of Social Media 7. Copyright Acts
10	**References:** 1. Boyd, D, and Ellison, N., 2007, Social network sites: Definition, history, and scholarship. Journal of computer-mediated communication, 13(1), 210-230 2. Burton, G. (2010). Media and Society: Critical Perspectives. New York; Mc Graw-Hill Publication. 3. Lipschultz, J.H. (2020). Social Media Communication Concepts, Practices, Data, Law and Ethics. Routledge. 4. Kaplan, A.M. and Haenlein, M. (2010) Users of the World, Unite! The Challenges and Opportunities of Social Media. Business Horizons, 53, 59-68. 5. Williams, R, and Gulati, G. J, 2017, Social Media Communication: Concepts, Practices Data, Law and Ethics. https://slejournal.springeropen.com/articles/10.1186/s40561-020-00118-7
12	**Internal Continuous Assessment: 40%** | **Semester End Examination : 60%**
	Internal Evaluation: 20 Marks 1. Classroom Presentations/ Assignments 10 Marks 2. Essay Submission/ Book review/ Field Visit Report /Educational Activity Report 10 Marks
	External Evaluation : 30 Marks **Format of Question Paper:** for the final examination Time: 1hour Marks: 30 **Q.1 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.2 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.3 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)**

Vertical - IV

Vocational Skill Courses (VSC)

Name of the Course: Web Designing - Lab

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Web Designing Course is an immersive exploration into the core technologies that drive the visual and interactive aspects of the web. Covering HTML, CSS, Javascript, XML, and PHP, this course equips individuals with the skills needed to create dynamic and aesthetically pleasing websites. **Relevance:** In the digital age, web design is paramount. The course remains highly relevant as it introduces participants to the fundamental languages and technologies that form the backbone of modern web development. **Usefulness:** The course is invaluable for anyone interested in creating responsive, user-friendly, and visually appealing websites. Participants gain practical skills in structuring web content, styling layouts, and implementing interactive features. **Application:** The concepts learned in this course find direct application in real-world web development projects. Participants design and build websites, applying HTML for structure, CSS for styling, Javascript for interactivity, XML for data representation, and PHP for server-side scripting. **Interest:** The creative and hands-on nature of web design often captivates students. Through practical exercises, participants engage in designing and developing websites, fostering a deep interest in creating visually engaging online experiences. **Connection with Other Courses:** This course establishes strong connections with various other courses in the field of web development and computer science. It provides a foundation for advanced studies in full-stack development, database management, and server-side scripting. **Demand in the Industry:** Professionals with strong web designing skills are in high demand. Industries spanning e-commerce, technology, and media actively seek individuals who can create user- friendly and visually appealing websites to enhance online presence and user engagement. **Job Prospects:** Graduates from a Web Designing Course find diverse job prospects. Roles may include web designer, front-end developer, UI/UX designer, and web content manager. These professionals are sought after for their ability to create visually stunning and functional web interfaces.
2	**Vertical:**	VSC
3	**Type:**	Practical
4	**Credits:**	2 credits (1 credit = 15 Hours of Practical work in a semester)
5	**Hours Allotted:**	30 Hours

6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To understand the concept of Web Technologies 2. To understand the concepts of Hyper Text Markup Language and Cascading Style Sheets. 3. To learn JavaScript for creating dynamic websites. 4. To learn various operations performed on data among web applications using XML 5. To learn Server-Side Programming using PHP	
8	**Course Outcomes:** 1. Design valid, well-formed, scalable, and meaningful pages using emerging technologies. 2. Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites 3. Develop and implement client-side and server-side scripting language programs. 4. Develop and implement Database Driven Websites. 5. Design and apply XML to create a markup language for data and document centric applications.	
9	**Modules:-** **Module 1 (15 hours):**	
	Module I: **Concepts**: Internet and the World Wide Web: What is Internet? Applications of Internet, internet related concepts. HTML 5: Getting started with HTML, Doctypes, Headings, Paragraphs, Text Formatting, Anchors and Hyperlinks, Lists, Tables, Comments, Classes and IDs, Linking Resources, Images, Image Maps. HTML OTHER ELEMENTS: Input Control Elements, Forms, Div Element, Sectioning Elements, Navigation Bars, Label Element, Output Element, Void Elements, Media Elements, Progress Element, Selection Menu Controls, Embed, IFrames, SVG, Canvas, Tabindex. CSS: Implementing Styles using CSS – Stylesheets, Formatting Text and Links using CSS, CSS Selectors, Changing Background, Adding Border, Margin and Padding, Setting Dimensions, Using Inline Container to mark up a part of a text. ***Programs to be completed during lab sessions :*** **1. Create a Personal Web Page** Design a personal webpage with your name, photograph, short bio, and links to your social media profiles. Use appropriate headings, paragraphs, text formatting, hyperlinks, and images. **2. Design a Student Registration Form** Create a form using various input controls (text, email, password, radio buttons, checkboxes, dropdown, etc.). Organize the form using <fieldset>, <legend>, , and <section>. Include labels and use the required attribute. **3. Build a Responsive Navigation Bar with Embedded Media** Design a webpage with a horizontal navigation bar using <nav>. Embed a YouTube video using <iframe>, include an audio clip using <audio>, and add a Google Map using <embed>. **4. Apply CSS Styling to a Multi-Section Webpage** Create a webpage with at least three sections and apply an external CSS file to: • Change fonts and text color • Set background images/colors • Add padding, margins, and borders • Style links and headings **5. Create a Canvas and SVG Drawing** Use the <canvas> element and JavaScript to draw a rectangle, circle, and line. Additionally, use an inline <svg> to draw a star or a basic geometric shape.	

Mini-Assignment:

Title: *"Designing a Multi-page Portfolio Website using HTML5 and CSS"*

Assignment Description:

Design a personal portfolio website with **minimum 3 interlinked pages** using HTML5 and CSS. The pages should include:

- **Home Page** – with your photo, introduction, and navigation bar
- **Projects Page** – showcasing 2–3 projects using tables and images
- **Contact Page** – a form for visitors to contact you (with input fields, radio buttons, dropdown, etc.)

Requirements:

- Use of <header>, <footer>, <section>, <article>, <nav>, , and <aside>
- Apply **external CSS** to style text, layout, background, margins, and borders
- Include **at least one embedded video or audio file**

Use **responsive images and hyperlinks**

Module 2 (15 hours):

Module II:

Concepts: Java Script Events and Event Handlers: HTML Events, DOM Events, DOM Event Listener, onAbort, onBlur, onChange, onClick, onDblClick, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onReset, onResize, onSelect, onSubmit, onUnload, Form Validation Example. jQuery: Introduction, Syntax, Selectors, Events, Effects, Hide/Show, Fade, Slide, Animate, stop(), Callback, Chaining, HTML, Get, Set, Add, Remove, CSS Classes, css( ), Dimensions. JSON: Introduction, JSON Grammar, JSON Values, JSON Tokens, Syntax, JSON vs XML, Data Types, Objects, Arrays, Creating JSON, JSON Object, Parsing JSON, Persisting JSON, Data Interchange, JSONHTM, JSONP.

Programs to be completed during lab sessions :

1. Validate a Form Using JavaScript Events

Create a form with fields like name, email, and age. Write JavaScript code to:

- Ensure no field is left blank
- Display an alert if validation fails
- Use onBlur, onFocus, and onSubmit events

2. Handle Mouse and Keyboard Events on a Webpage

Create a webpage where:

- Clicking a button changes a paragraph's text (onClick)
- Hovering over an image changes it (onMouseOver, onMouseOut)
- Pressing a key updates a display box (onKeyDown, onKeyUp)

3. Create a jQuery-based Image Gallery

Build a webpage that shows images with buttons to:

- Hide/show them using hide() and show()
- Fade images in/out using fadeIn() and fadeOut()
- Slide images up/down using slideUp() and slideDown()
- Use chaining for combined effects

4. Create and Manipulate HTML Elements using jQuery

Create a dynamic to-do list where users can:

- Add new tasks
- Mark tasks as completed

	• Remove tasks Use jQuery methods like append(), remove(), addClass(), css() **5. Load and Display Data from a JSON File** Create a webpage that loads student data (name, course, contact) from a JSON file and displays it in a table. Use JavaScript or jQuery to parse the JSON and dynamically populate the table. **<u>Mini-Assignment</u>**: **Title:** *"Create a Dynamic Quiz Application using JavaScript, jQuery, and JSON"* **Assignment Description:** Develop a simple **MCQ quiz application** that: • Loads a set of questions and options from a JSON file • Allows users to select answers one by one • Displays score at the end with basic feedback (e.g., "Well done!", "Try again!") • Uses **jQuery** to dynamically show/hide questions and apply basic animations (fade/slide)	
10	**Text Books** 1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press, 2016 2. Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India, 2018 PHP: A Beginners Guide, Vikram Vaswani, TMH	
11	**Reference Books** 1. HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY, 2011 2. Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'Reilly, 2018 3. PHP, MySQL, JavaScript & HTML5 All-in-one for Dummies, Steve Suehring, Janet Valade Wiley, 2018	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks • Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	Format of Question Paper: (Semester End Practical Examination : 30 Marks. Duration:2 hours) Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Skill Enhancement Course (SEC)

Name of the Course: Python Programming - Lab

Sr. No.	Heading	Particulars
1	**Description the course:**	The Python Programming Lab introduces students to the fundamentals of programming using Python, one of the most widely used languages in Artificial Intelligence and Machine Learning. Through hands-on exercises, students will learn problem-solving techniques, control structures, data structures, and basic libraries essential for AI applications. This lab course emphasizes practical coding skills, preparing students for advanced courses in data science, AI, and ML.
2	**Vertical:**	**SEC**
3	**Type:**	**Practical**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. To introduce students to Python syntax, semantics, and core programming concepts. 2. To develop problem-solving skills using control structures, functions, and data structures. 3. To provide hands-on experience in file handling and error handling in Python. 4. To build familiarity with Python libraries commonly used in AI/ML workflows (NumPy, Pandas, Matplotlib). 5. To prepare students to apply Python programming for data analysis and AI-related tasks.	
8	**Course Outcomes:** **CO1:** Write Python programs using variables, operators, and expressions. **CO2:** Apply conditional statements, loops, and functions to solve problems. **CO3:** Implement and manipulate Python's built-in data structures (lists, tuples, sets, dictionaries). **CO4:** Perform file handling and basic exception handling in Python. **CO5:** Utilize Python libraries (NumPy, Pandas, Matplotlib) for simple data processing and visualization tasks.	
9	**Modules:-** **Module 1 (15 hours):**	
	Practical 1: Introduction to Python and Data Types **Aim:** To write Python programs demonstrating the use of variables, data types, and basic input/output operations. **Practical 2: Control Structures (Decision Making)** **Aim:** To implement conditional statements (if, if-else, nested if) for solving simple decision-making problems (e.g., finding the largest number, grade calculator). **Practical 3: Looping Constructs** **Aim:** To implement iterative statements (for, while, nested loops`) in Python for	

	problems like factorial, prime numbers, and pattern generation. **Practical 4: Functions in Python** **Aim:** To write user-defined functions in Python and demonstrate function parameters, return values, recursion, and use of built-in functions. **Practical 5: Data Structures – Lists, Tuples, Sets, and Dictionaries** **Aim:** To perform operations on Python's built-in data structures including list slicing, tuple operations, set union/intersection, and dictionary key-value manipulations.	
	Module 2 (15 hours) :	
	Practical 6: File Handling **Aim:** To read from and write to text/CSV files using Python and demonstrate file operations like open, read, write, append, and close. **Practical 7: Exception Handling** **Aim:** To implement error handling in Python using try, except, finally, and demonstrate multiple exception handling with user-defined exceptions. **Practical 8: NumPy for Array Operations** **Aim:** To perform array creation, indexing, slicing, reshaping, and mathematical operations using the NumPy library. **Practical 9: Pandas for Data Handling** **Aim:** To create and manipulate Series and DataFrames in Pandas, import/export CSV files, and perform basic operations such as filtering, grouping, and sorting. **Practical 10: Data Visualization using Matplotlib** **Aim:** To visualize datasets using line charts, bar charts, scatter plots, and histograms with the Matplotlib library. **Mini Project (Optional / Internal Assessment)** **Aim:** To apply Python programming concepts and libraries to a small real-world dataset (e.g., Student Marks Analysis, Sales Report Visualization, or COVID-19 Data Insights).	
10	**Text Books** 1. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press. 2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, O'Reilly.	
11	**Reference Books** 1. Mark Lutz, Learning Python, O'Reilly. 2. Wes McKinney, Python for Data Analysis, O'Reilly. 3. Online Tutorials: Python.org, W3Schools, GeeksforGeeks (Python & Libraries).	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at*

	• Assignments: 10 Marks Total: 20 marks	*the time of practical exam*
14	**Format of Question Paper: (Semester End Practical Examination : 30 Marks. Duration:2 hours)** Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Vertical - V

Ability Enhancement Course (AEC)

Name of the Course: Communication Skills in English I

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course aims to develop foundational communication skills in English through both theoretical and practical approaches. It begins with an introduction to the nature of communication, including verbal and non-verbal forms, effective writing and speech, and listening techniques. Learners will enhance their reading and listening skills through guided practice using varied texts and listening materials. The second part of the course focuses on speaking and formal writing. It includes training in public speaking, conversational English for different contexts, and practical writing tasks such as job applications, RTI requests, and formal letters. The course is designed to build confidence and competence in real-world communication scenarios.`
2	**Vertical :**	**Ability Enhancement Courses(AEC)**
3	**Type :**	**Theory**
4	**Credit**:	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted**:	**50 Marks**
7	**Course Objectives**: • To enhance the English language proficiency of students by familiarizing them with • Listening, Speaking, Reading, and Writing (LSRW) skills • To introduce learners to different perspectives of looking at a text or passage • To equip learners in the functional aspects of English so that they use the • acquired language skills correctly and confidently • To guide learners in the effective use of the digital medium of communication	
8	**Course Outcomes:** After completion of the course, learners would be able to: CO1. Understand and interpret any text they are reading from different perspectives CO2. Arouse the interest of learners in listening to and watching good-quality audio and visual media CO3. Acquire proficiency in the skills of listening, speaking, reading, and writing that will help them meet the challenges of the world CO4. Develop good oral and written skills of communication in the English language	
9	**Modules**:-	
	Module 1: 1. Introduction to Communication Skills • English as an international language and varieties of English • Verbal and Non-Verbal Communication • Features of Effective Writing Skills • Characteristics of an Effective Speech • Effective Listening Skills	

	This section provides a theoretical base for the following units that are practical in nature. 2. Reading Skills: • Scanning a text for information • Skimming a passage to look for main ideas, understanding text type Passages of around 200- 250 words from fables, folk stories, short stories, non-fiction, history, business or environment could be chosen in this section. 3. Listening Skills • Listening for main ideas/Gist • Listening for details • Listening for text organization features • Listening for tone, accent, style and register Listening skills in English should be developed through various activities, along with the practice done while teaching in the class.
	Module 2 : 1. Speaking Skills in English i) Public Speaking in English • Introduction • Characteristics of an effective speech • Analysis of model speeches • Drafting and presenting a speech in formal and informal gatherings ii) Conversation skills • Opening a conversation • Introducing oneself in various contexts • Introducing others formally and informally 2. Formal Writing Skills: • Job applications with biodata (solicited and unsolicited) • RTI applications • Applications for duplicate documents (I-cards / mark sheet, etc.)
10	**References:** 1. Bellare, Nirmala. Reading & Study Strategies. Books. 1 and 2. Oxford University Press, 1997, 1998 2. Bellare, Nirmala. Easy Steps to Summary Writing and Note-Making. Amazon Kindle Edition, 2020 3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, 1994. 4. Das, Bikram K., et. al. An Introduction to Professional English and Soft Skills.Cambridge University Press India Pvt. Ltd., 2010 5. Das, Yadjnaseni& R. Saha (eds.) English for Careers. Pearson Education India, 2012. 6. Dimond-Bayir, Stephanie. Unlock Level 2 Listening and Speaking Skills Student's Book and Online Workbook: Listening and Speaking Skills Student's Book+ Online Workbook. Cambridge University Press, 2014. 7. Doff, Adrian and Christopher Jones. Language in Use (Intermediate and Upper Intermediate). CUP, 2004.

11	**Internal Continuous Assessment: 40%**	**Semester End Examination : 60%**

Internal Evaluation: 20 Marks

Assignment	10 marks
Viva	05 marks
Class Participation and Attendance	05 marks

External Evaluation: 30 Marks

Semester End Examination

Question Paper Pattern

Question No.	Questions	Marks
Q 1	Short Notes (Any 2 out of 4)	10 marks
Q 2	Attempt any one of the following A OR B	10 marks
Q 3	Attempt any one of the following A OR B	10 marks

Value Education Course (VEC)

Name of the Course: Green Technologies

Sr. No.	Heading	Particulars
1	**Description the course:**	● **Introduction:** Green Technologies represent a modern approach to development that emphasizes environmental sustainability, energy efficiency, and eco-friendly innovations. These technologies are designed to minimize negative impacts on the environment while addressing global challenges like climate change, pollution, and resource depletion. They form the backbone of sustainable development in the 21st century, bridging the gap between technological advancement and ecological responsibility. ● **Relevance and Usefulness:** In today's world of increasing environmental concerns, Green Technologies have become essential to promote long-term sustainability. They provide practical solutions for reducing carbon footprints, conserving natural resources, and enabling cleaner production processes. Their usefulness spans across industries—helping businesses, governments, and communities to transition toward greener, more responsible practices. ● **Applications:** Green Technologies are applied in multiple domains: renewable energy systems like solar, wind, and hydro power; eco-friendly building designs; electric and hybrid vehicles for sustainable transport; smart waste management systems; and innovative practices like carbon capture and recycling. These applications directly contribute to mitigating environmental damage while supporting economic growth. ● **Interest and Connection with Other Courses:** The study of Green Technologies is intellectually stimulating, combining environmental science, engineering, and innovation. It connects seamlessly with courses in environmental studies, energy systems, computer science (through AI-enabled sustainability solutions), and management (via corporate social responsibility and sustainability reporting). Its interdisciplinary nature makes it a valuable field of study for students across diverse academic streams. ● **Demand in the Industry:**

		With governments and industries worldwide committing to sustainable development goals (SDGs), there is a rapidly growing demand for professionals skilled in Green Technologies. Companies in energy, manufacturing, automotive, construction, and IT are actively seeking expertise to meet green compliance standards and develop innovative solutions for sustainability. • **Job Prospects:** Graduates with knowledge of Green Technologies are well-positioned for careers in renewable energy companies, environmental consulting firms, sustainable architecture, transportation industries, and policy-making organizations. Job roles may include sustainability analyst, renewable energy engineer, green building consultant, and environmental policy advisor. The global push for greener economies ensures that these opportunities will only continue to expand.
2	**Vertical:**	VEC
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To introduce students to the concepts and need of green technologies for sustainable development. 2. To familiarize students with renewable energy systems and their applications. 3. To understand eco-friendly practices in waste management, green buildings, and transportation. 4. To encourage adoption of sustainable and responsible technologies in daily life and industry.	
8	**Course Outcomes:** CO1: Explain the need and significance of green technologies in addressing environmental challenges. CO2: Demonstrate understanding of renewable energy systems and sustainable practices. CO3: Analyze the role of green innovations in waste management, transportation, and urban planning. CO4: Apply eco-friendly approaches to promote sustainable development in personal and community life.	
9	**Modules** **Module 1: Introduction to Green Technologies(15 Hours)**	
	1. Introduction to Green IT: need, scope, and importance 2. Environmental impact of IT: energy consumption, carbon footprint, e-waste 3. Sustainable IT practices – Reduce, Reuse, Recycle	

	4. Energy-efficient hardware and software 5. Low-power processors, green devices 6. Power management in OS & networks 7. Green coding & algorithm optimization 8. E-waste management and eco-labels (Energy Star, EPEAT, ISO 14001)
	Module 2: Applications of Green Technologies (15 Hours)
	1. Green Data Centers: virtualization, cloud computing, server consolidation, energy-efficient cooling 2. Green Networking: smart routing, bandwidth optimization, IoT for sustainability. 3. Role of IT in smart grids, smart cities, and environmental monitoring 4. Case studies: Google, Microsoft, Infosys, TCS initiatives. 5. Future trends: carbon-aware computing, AI & Blockchain for sustainability, edge computing for energy efficiency
10	**Text Books** 1. Newton, David E. Green Technologies and the Environment. ABC-CLIO, 2015. 2. Godfrey Boyle. Renewable Energy: Power for a Sustainable Future. Oxford University Press, 2012.
11	**Reference Books** 1. Gopal Nath Tiwari & Swapnil Dubey. Fundamentals of Renewable Energy Systems. Narosa Publishing, 2016. 2. Vesma, Vilnis. Energy Management Principles and Practice. Routledge, 2021. 3. United Nations Reports on Sustainable Development Goals (SDGs).
12	**Internal Continuous Assessment: 40%** / **Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks / **Format of Question Paper: External Examination (30 Marks)– 1 hr duration**
14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Name of the Course: Indian Knowledge System

Sr. No.	Heading	Particulars
1	**Description the course :**	This course offers a comprehensive introduction to the Indian Knowledge System (IKS), exploring its core principles, historical context, and contemporary relevance. It examines the impact of colonial education policies and emphasizes the need to revisit ancient Indian traditions. The course highlights traditional Indian entrepreneurship through handloom, khadi, tribal handicrafts, herbal products, and culturally rooted food ventures. It also showcases sustainable practices like the use of clay bottles, banana leaf plates, and the repair-and-reuse culture. Students will further explore key domains of IKS such as Ayurveda, ancient sports, astronomy, yoga, traditional banking, trade, commerce, and governance models from texts like the Arthashastra.
2	**Vertical :**	IKS
3	**Type :**	Theory
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives**: The student should be able to: 1. To sensitize the students about context in which they are embedded i.e. Indian culture and civilization including its Knowledge System and Tradition. 2. To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system. 3. To help to study the enriched scientific Indian heritage. 4. To introduce the contribution from Ancient Indian system & tradition to modern science & Technology.	
8	**Course Outcomes**: CO1. Learner will understand and appreciate the rich Indian Knowledge Tradition CO2. Learner will understand the contribution of Indians in various fields CO3. Learner will experience increase subject-awareness and self-esteem CO4. Learner will develop a comprehensive understanding of how all knowledge is ultimately intertwined	
9	**Module:** Module 1: (15 Hours) 1. Introduction to IKS: What is knowledge System, Characteristic Features of Indian Knowledge System 2. Why IKS? Macaulay's Education Policy and its impact, Need of revisiting Ancient Indian Traditions 3. IKS and Entrepreneurship: Handloom, Khadi, Tribal Handicrafts and Herbal Products, Food-based start-ups rooted in tradition 4. Sustainable Indian Practices: Clay bottles, Banana leaf plates, Cloth Bags-Repair	

culture (Reuse, Patchwork, Jugaad)

Module 2: (15 Hours)

1. Medicine (Ayurveda)
2. Ancient Sports
3. Astronomy
4. Yoga and Wellbeing
5. Banking
6. Trade and Commerce
7. Art of Governance (Arthashastra)

10 **Reference Books:**

1. Concise history of science in India- D.M. Bose, S.N Sen, B.V. Subbarayappa.
2. Positive sciences of the Ancient Hindus- Brajendranatha seal, Motilal Banrasidas, Delhi1958.
3. History of Chemistry in Ancient India & Medieval India, P.Ray- Indian Chemicals
4. Society, Calcutta 1956
5. Charaka Samhita- a scientific synopsis, P. Ray & H.N Gupta National Institute of Sciences of India, New Delhi 1965.
6. MacDonnell A.A- History of Sanskrit literature
7. Winternitz M- History of Indian Literature Vol. I, II & III
8. Dasgupta S.N & De S.K- History of Sanskrit literature Vol. I.
9. Ramkrishna Mission- cultural heritage of India Vol. I, II & III.
10. Majumdar R. C & Pushalkar A.D- History & culture of the Indian people, Vol. I, II & III.
11. Keith A.B- History of Sanskrit literature.
12. Varadachari V- History of Sanskrit literature Chaitanya Krishna- A new History of Sanskrit

11 **Internal Continuous Assessment: 40%**

Continuous Internal Assessment: 20 Marks

- Field Visit Report: **10 Marks,**
- Class Participation/Activities :**10 Marks**

12 **External Assessment: 60% : (30 Marks)**

Format of Question Paper: For the External examination

Q1	(A)	Objectives (MCQs)	5
	(B)	Concept/One Sentence	5
Q2		A **OR** B	10
Q3		A **OR** B	10

Vertical - VI

Co-Curricular Course (CC)

Name of the Course: Fitness and Sports I

Sr. No.	Heading	Particulars
1	**Description the course :** **Including but Not limited to :**	India is growing rapidly as a global super-power. To face the challenges of the century and to keep up with the pace of the world, maintaining health is of prime importance. Giving thrust to healthy society, Physical Education, Sports, Health & fitness and Yoga are of great significance in today's world. The Government of India insists on Physical Fitness, Mental Health and Overall Development of Personality for every citizen. However, creating efficient and skilled human resource in the field of Physical Education, Sports and Yoga is identified as the need of the hour. Thus, the Governments of India and Government of Maharashtra have included Physical Education, Sports and Yoga as a key area under the NEP 2020.
2	**Vertical :**	Co-Curricular
3	**Type :**	Activity Based
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives**: The student should be able to : • **To understand the core components of physical fitness** and learn basic techniques for assessing and improving personal health and endurance. • **To gain knowledge of various sports classifications, rules, and techniques** for both individual and team-based indoor and outdoor games. • **To develop life skills such as discipline, teamwork, and leadership** through active	
8	**Course Outcomes**: • **Understanding of physical fitness components** and apply appropriate assessment techniques like BMI, flexibility, and endurance tests. • **Identify and explain the rules, techniques, and classifications** of major indoor and outdoor sports, including both individual and team games. • **Exhibit improved teamwork, discipline, and personal growth** through participation in physical activities and application of sportsmanship values.	

9	**Module :** This module introduces the fundamentals of physical fitness, including strength, endurance, flexibility, body composition, and cardiovascular health. It emphasizes the importance of fitness for students and explains basic assessment methods like BMI and endurance tests. It also covers the classification of sports into indoor/outdoor and individual/team. Basic rules and techniques of popular games like cricket, football, volleyball, and athletics are explained. The module highlights how sports encourage discipline, teamwork, and contribute to personality development.
10	**Reference Books:** 1. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication. 2. Muller, J.P. (2000). Health, Exercise and Fitness. Delhi: Sports. 3. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics. 4. Kamlesh, M.L. (2007). Physical Education and Sports. New Delhi: Metropolita Book Singh Hardayal (1991), Science of Sports Training, DVS Publication, New Delhi
11	**Internal Continuous Assessment: 40%(20 Marks)** ❖ Assignment/Report Writing
12	**External Assessment: 60% (30 Marks)** **Certificate Submission Guidelines** *Each student must submit at least* **three certificates** *from the following approved categories:* 1. Attending **Zumba or Aerobics** sessions conducted by a certified fitness trainer. 2. Participation in **Team Sports** such as Cricket, Volleyball, Football, Kabaddi, Basketball, or Kho-Kho. 3. Participation in **Indoor Sports** like Carrom, Chess, or Badminton. 4. Participation in **Marathons or Walkathons**. 5. Serving as a **Volunteer** in roles such as Event Coordinator, Scorekeeper, Timekeeper, or Referee. *Note: Students participating in sports competitions conducted by University at State or National Level, students who have represented Mumbai University or College at Intercollegiate / Inter Zonal / West Zone Inter University / All India Inter University/ International tournament are exempt from submission of report.*

Semester – II

Vertical - I

Mandatory Courses

Name of the Course: Generative AI Workflows

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The **Generative AI Workflows** course introduces students to the principles and practical applications of generative artificial intelligence, focusing on how machines can create new content such as text, images, music, and code. This course explores the fundamental techniques that power generative AI models, such as transformers and diffusion models, while emphasizing structured workflows for building, fine-tuning, and deploying these systems. **Relevance:** Generative AI has emerged as a transformative technology, reshaping industries by enabling creative automation, human–machine collaboration, and rapid prototyping. From ChatGPT-like systems to AI-generated art and automated coding assistants, generative AI is becoming integral to modern workspaces. This course ensures that students are prepared to understand and work with these cutting-edge technologies. **Usefulness:** Students will learn the **step-by-step workflows** of generative AI, from data preparation and model selection to fine-tuning and evaluation. The course emphasizes not only technical understanding but also **ethical considerations**, including bias, misinformation, and responsible AI use. By the end, students will be able to design and apply generative AI workflows in diverse domains. **Application:** Generative AI finds practical applications in **content creation, natural language processing, image and video generation, personalized learning, product design, and software development**. Students will work with simplified examples and case studies to understand how generative AI can be applied to solve real-world challenges. **Interest:** Generative AI Workflows is an exciting subject that stimulates creativity and innovation. Students will enjoy experimenting with models that can **write stories, generate visuals, compose music, or simulate conversations**, blending technical learning with imaginative exploration. **Connection with Other Courses:** This course connects with subjects like **Artificial Intelligence & Machine Learning Fundamentals, Deep Learning, Natural Language Processing, Computer Vision, and AI Ethics**. It builds upon prior knowledge of AI/ML to explore the generative side of intelligent systems, providing a bridge to advanced AI applications. **Demand in the Industry:** Generative AI is revolutionizing industries such as **media, design, education, healthcare, and software engineering**. Companies actively

		seek professionals who understand how to apply and manage generative workflows to improve productivity, enhance creativity, and automate complex processes. **Job Prospects:** Proficiency in generative AI opens pathways to careers as **AI Workflow Engineer, Prompt Engineer, AI Application Developer, Research Associate in Generative Models, and Data/AI Consultant**. These roles are in high demand across technology, entertainment, design, and innovation-driven industries.
2	**Vertical:**	**Major**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. To introduce the fundamentals of generative AI and its underlying principles. 2. To understand structured workflows for building and applying generative models. 3. To explore applications of generative AI in text, image, and multimedia generation. 4. To provide knowledge of tools, frameworks, and platforms for implementing generative workflows. 5. To highlight ethical, social, and practical considerations in the deployment of generative AI.	
8	**Course Outcomes (CO):** **CO1:** Describe the foundations of Generative AI and its applications in real-world domains. **CO2:** Explain the key components of generative AI workflows such as data preparation, model selection, and evaluation. **CO3:** Differentiate between text, image, audio, and multimodal generative AI models with examples. **CO4:** Apply simple generative AI tools to create outputs such as text generation, image synthesis, and chatbots. **CO5:** Discuss the ethical, legal, and social issues of generative AI.	
9	**Modules:-** **Module 1:Fundamentals of Generative AI (15 hours):**	
	1. **Introduction to Generative AI** • Evolution of AI to Generative AI • What is Generative AI? How it differs from traditional AI/ML • Applications: Text generation (chatbots, summarization), Image generation (art, design), Audio/Music synthesis, Video generation 2. **Building Blocks of Generative AI** • Concept of training data and datasets for generative AI	

	• Neural networks (very simple introduction – only layers, training, no heavy math) • Generative models overview: Autoencoders, GANs, Diffusion models (basic idea only, intuitive explanation) • Pre-trained foundation models (GPT, Stable Diffusion, DALL·E) – concept of fine-tuning and prompt engineering 3. **Generative AI Workflows** • Workflow steps: Data collection → Preprocessing → Model selection → Training/Fine-tuning → Evaluation → Deployment • Tools and platforms: Hugging Face, OpenAI APIs, Google Colab demos (conceptual introduction) • Examples of simple workflows: • Text → Text (chatbots, story generation) • Text → Image (creative designs, posters) • Text → Music (AI-based composition)
	Module 2: Applications, Workflows & Ethics (15 hours) :
	1. **Generative AI in Action** • Text-based applications: Content creation, summarization, coding assistants • Image-based applications: Digital art, design mockups, medical imaging aids • Audio & Speech: Voice cloning, AI music, speech synthesis • Multimodal AI: Combining text, image, and audio (intro to tools like Gemini, GPT-4V) 2. **Case Studies & Mini Workflows** • Educational use case: AI-generated lesson notes/quiz questions • Business use case: Marketing content and chatbots • Healthcare use case: Synthetic medical data for research (with caution) • Student mini-project workflow (conceptual): Build a simple chatbot using prompts or generate an AI poster with DALL·E/Stable Diffusion 3. **Ethical and Social Issues in Generative AI** • Copyright and intellectual property issues • AI Bias and misinformation risks (deepfakes, fake news) • Responsible AI practices: Transparency, Explainability, Human-in-the-loop approaches
10	**Text Books** 1. Pam Baker, ChatGPT For Dummies, Wiley 2. OpenAI, Hugging Face, and Google AI documentation/tutorials (latest online resources)
11	**Reference Books** 1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (selected chapters on deep learning)

<table>
<tr><td></td><td colspan="2">2. Ian Goodfellow, Deep Learning (basic sections on generative models – simplified for reference)
3. YouTube tutorials & MOOCs: Generative AI Fundamentals (Coursera, Google Cloud Skills Boost)</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination: 60%</td></tr>
<tr><td>13</td><td>Continuous Evaluation through:
Class test of 15 marks
Quizzes/ Presentations/
Assignments: 5 marks
Total: 20 marks</td><td>Format of Question Paper: External Examination (30 Marks)– 1 hr duration</td></tr>
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<tr><td>Q.1</td><td>Module 1</td><td>Any 2 out of 4</td><td>10</td></tr>
<tr><td>Q.2</td><td>Module 2</td><td>Any 2 out of 4</td><td>10</td></tr>
<tr><td>Q.3</td><td>Module 1 & 2</td><td>Any 2 out of 4</td><td>10</td></tr>
</table></td></tr>
</table>

Name of the Course: Fundamentals of Database Management Systems

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Fundamentals of Database Systems course is a foundation in the study of information management and technology. It provides students with a comprehensive understanding of the principles, design, and implementation of databases, which are critical components in virtually every domain where data is utilized. **Relevance:** In today's data-driven world, the management and retrieval of information are paramount. This course is highly relevant as it addresses the core concepts essential for organizing, storing, and manipulating data efficiently. **Usefulness:** This course is immensely useful for individuals aspiring to work with data in various capacities. Whether designing databases, developing applications that interact with databases, or analyzing data trends, a solid understanding of database fundamentals is crucial. **Application:** The principles learned in this course find application across diverse sectors, including business, healthcare, finance, and technology. Students will gain the skills to model real- world scenarios, design efficient databases, and implement systems that store and retrieve information seamlessly. **Interest:** This course often attracts students due to its practical and tangible applications. The ability to structure and manage data effectively, ensuring its integrity and accessibility, can be intellectually stimulating and applicable to numerous real-world scenarios. **Connection with Other Courses:** This course forms a vital connection with various other courses in computer science and information technology. It is foundational to courses like database management, data warehousing, and data mining. Additionally, it complements courses related to software development, ensuring a holistic understanding of system architecture. **Demand in the Industry:** As businesses and organizations amass ever-growing volumes of data, there is an increasing demand for professionals versed in database systems. Industries such as finance, healthcare, e-commerce, and technology actively seek individuals who can design, implement, and manage robust databases. **Job Prospects:** Graduates proficient in the fundamentals of database systems enjoy promising job prospects. Potential roles include database administrator, data analyst, database developer, and business intelligence analyst. These professionals play a pivotal role in ensuring the efficient and secure management of an organization's data assets.

2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** **1.** To introduce students to the fundamentals and architecture of database systems. **2.** To explain the role of ERD components in database design and implementation. **3.** To provide hands-on experience in database creation and manipulation using MySQL. **4.** To develop understanding of normalization techniques and database security concepts. **5.** To educate students on data protection, access control, and the use of DCL statements like GRANT and REVOKE.	
8	**Course Outcomes:** CO1. Analyze database requirements and design entity-relationship models for a given system. CO2. Create and manage relational databases using MySQL commands for data manipulation and query execution. CO3. Apply normalization techniques to improve database efficiency and integrity. CO4. Implement data access control using permissions, and understand indexing for query optimization.	
9	**Modules** **Module 1 (15 hours):**	
	Introduction to DBMS: Overview of Database, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture. **Data models**: Client/Server Architecture, Object Based Logical Model, Record Based Logical Model (relational, hierarchical, network). **Entity Relationship Model and ER to Table:** Entities (Weak and Strong), Attributes, Relations (with and without Constraints), and additional constraints (key constraints, participation constraints, aggregation / generalization), Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER) Entity to Table. **DDL Statements:** Creating Databases, Using Databases, Data types, Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables. **DML statements:** Viewing the structure of a table: insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate functions (count, min, max, average, sum), group by clause, having clause.	
	Module 2 (15 hours):	
	Relational data model: Domains, attributes, Tuples and Relations, Relational Model Notation, Characteristics of Relations, Relational Constraints - primary key, referential integrity, unique constraint, Null constraint, Check constraint. **Functions:** String Functions, Math Functions, Date Functions. **Joining Tables and Sub-queries**: inner join, outer join (left outer, right outer, full outer), sub-queries with IN, EXISTS, ANY/ALL clause. **Normal forms:** Functional dependencies, first, second, third, and BCNF normal forms based on primary keys, lossless join decomposition. **Database Protection:** Security Issues and Mechanisms, Threats to Databases, Role of DBA, Backing Up and Restoring databases. **Views**: Creating, altering, dropping, renaming and manipulating views. **DCL Statements:** Creating/dropping users, privileges (granting/revoking/viewing privileges),	

<table>
<tr><td></td><td colspan="2">Transaction control commands – Commit, Rollback.</td></tr>
<tr><td>10</td><td colspan="2">Text Books
1. Fundamentals of Database System, ElmasriRamez, NavatheShamkant, Pearson Education, Seventh edition, 2017
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition,2014
3. Murach's MySQL, Joel Murach, 3rd Edition, 3rd Edition, 2019</td></tr>
<tr><td>11</td><td colspan="2">Reference Books
1. Database System Concepts, Abraham Silberschatz, HenryF.Korth, S.Sudarshan, McGraw Hill,2017
2. MySQL: The Complete Reference, VikramVaswani , McGraw Hill, 2017
3. Learn SQL with MySQL: Retrieve and Manipulate Data Using SQL Commands with Ease, Ashwin Pajankar, BPB Publications, 2020</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination: 60%</td></tr>
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Class test of 15 marks

Quizzes/ Presentations/ Assignments: 5 marks
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<tr><td>Q.3</td><td>Module 1 & 2</td><td>Any 2 out of 4</td><td>10</td></tr>
</table></td></tr>
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Name of the Course: Mathematics for AI & ML – II

Sr.No.	Heading	Particulars
1	**Description the course:**	Introduction: This subject covers the mathematical framework of calculus and optimization, focusing on techniques to analyze change, compute gradients, and minimize error functions. It is central to training AI/ML models, where optimization algorithms adjust parameters to improve accuracy. Relevance and Usefulness: Calculus enables understanding of gradients, back propagation, and learning dynamics in neural networks. Optimization provides tools for solving high-dimensional problems efficiently, ensuring model convergence. Critical in designing scalable and robust AI/ML systems. Applications: Back propagation in deep learning (e.g., CNNs, RNNs, and Transformers). Gradient descent and its variants in training neural networks. Convex optimization in Support Vector Machines (SVMs). Reinforcement learning applications using optimization strategies. Interest and Connection with Other Courses: Closely connected to Artificial Neural Networks, Deep Learning, and Reinforcement Learning. Provides mathematical grounding for Optimization Techniques in Operations Research. Links with Numerical Methods used in scientific computing. Demand in the Industry: Industries rely on optimization to train AI models in autonomous systems, robotics, and financial modeling. High demand for professionals who understand advanced optimization algorithms to improve AI scalability. Job Prospects: Career opportunities in roles such as Machine Learning Engineer, AI Developer, Data Scientist, Optimization Specialist, and Research Scientist. Required in industries like autonomous vehicles, robotics, supply chain optimization, and high-frequency trading.
2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives (CO):** By the end of this course, the student will be able to: 1. Introduce the fundamental ideas of **calculus** including differentiation, gradients, and multivariable analysis. 2. Equip students with mathematical tools to **analyze cost functions and gradient-based learning** in ML. 3. Provide a strong understanding of **optimization methods** for solving unconstrained and constrained problems.	

	4. Develop the ability to apply calculus and optimization to **train and improve AI/ML models**.
8	**Course Outcomes (CO):** On successful completion of this course, the student will be able to: CO1. Apply calculus concepts such as derivatives, gradients, and Taylor expansions to **analyze ML models**. CO2. Compute and interpret gradients for **backpropagation in neural networks**. CO3. Apply optimization techniques such as gradient descent, SGD, and Lagrangian methods to **minimize loss functions**. CO4. Demonstrate the ability to use numerical and optimization methods in **training and fine-tuning ML algorithms**.
9	**Modules** **Module 1: Calculus for Machine Learning (15 Hrs)**
	• **Limits & Continuity (2 Hours):** Concept of limits, left-hand & right-hand limits, Continuity and differentiability of functions • **Differentiation (2 Hours):** Derivatives of algebraic, exponential, logarithmic functions, Higher-order derivatives and chain rule • **Partial Derivatives (2 Hours):** Concept of multivariable functions and partial derivatives, Mixed partial derivatives and Jacobians • **Gradient & Multivariable Calculus (3 Hours):** Gradient vector and directional derivatives, Hessian and Laplacian matrices • Taylor Expansion & Approximation (2 Hours) Taylor and Maclaurin series, Linear and quadratic approximations • **Integration (2 Hours):** Definite and indefinite integrals, Multiple integrals and applications in probability • **Backpropagation in Neural Networks (2 Hours):** Concept of chain rule applied to layered networks, Computation of weight updates using gradients
	Module 2: Optimization & Numerical Methods (15 Hrs)
	• **Convex Sets & Functions (2 Hours):** Definition of convex sets and convex functions, Properties of convexity • **Optimization Fundamentals (2 Hours):** Unconstrained vs. constrained optimization, Local vs. global minima, saddle points • **Gradient Descent Method (3 Hours):** Concept of steepest descent and learning rate, Convergence properties and issues (plateaus, local minima) • **Stochastic Gradient Descent (SGD) & Variants (2 Hours):** Batch gradient descent vs. stochastic gradient descent, Variants: Momentum, RMSProp, Adam • **Lagrange Multipliers & Constrained Optimization (2 Hours):** Concept of constraints in optimization problems, Lagrangian function and Karush-Kuhn-Tucker (KKT) conditions • **Numerical Linear Algebra Methods (2 Hours):**

Solving linear systems (Gaussian elimination, LU decomposition), Iterative methods (Jacobi, Gauss-Seidel)

- **Applications in ML (2 Hours):**
  Optimization in regression and classification models, Neural network training and hyperparameter tuning, Reinforcement learning optimization techniques

10 & 11 **Text Books & Reference Books**

1. Calculus Made Easy (Silvanus Thompson) PDF
2. Active Calculus (Matt Boelkins) PDF
3. Mathematics for Machine Learning (Deisenroth et al.) PDF
4. Convex Optimization (Stephen Boyd) PDF
5. MIT Numerical Analysis Notes PDF
6. Mathematics for Machine Learning (Deisenroth et al.) PDF

12 **Internal Continuous Assessment: 40%** | **Semester End Examination: 60%**

13 **Continuous Evaluation through:**
Class test of 15 marks

Quizzes/ Presentations/
Assignments: 5 marks
Total: 20 marks

Format of Question Paper: External Examination (30 Marks)– 1 hr duration

14 **Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Vertical - II

Minor

Name of the Course: Data Wrangling

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The **Data Wrangling** course introduces students to the essential techniques of cleaning, transforming, and preparing raw data for analysis and machine learning applications. As real-world data is often messy, incomplete, and inconsistent, this course equips students with the knowledge and skills to transform raw datasets into structured, usable forms. **Relevance:** In the age of **data-driven decision-making**, the ability to preprocess and prepare data is as crucial as building machine learning models. Since more than 70% of the effort in AI/ML projects goes into preparing data, this course ensures that students develop one of the most in-demand skills in the industry. **Usefulness:** Students will gain hands-on experience in handling missing values, removing duplicates, encoding categorical variables, and performing feature scaling and normalization. The course emphasizes **practical workflows** using Python libraries, bridging the gap between raw datasets and ready-to-use data for AI/ML pipelines. **Application:** Data wrangling skills find application in diverse domains such as **business analytics, healthcare, e-commerce, finance, and research**. By mastering these skills, students will be able to build high-quality datasets for AI models, ensuring reliability and accuracy in predictive analytics. **Interest:** Data Wrangling is a highly engaging subject because it allows students to see immediate results of their transformations on messy datasets. It combines **problem-solving with hands-on coding**, sparking curiosity in students as they learn to extract meaning and structure from unorganized data. **Connection with Other Courses:** This course connects directly with **Artificial Intelligence & Machine Learning Fundamentals, Data Analytics, Database Management Systems, and Machine Learning Techniques**. It provides the necessary foundation for advanced topics such as **Big Data Processing, Deep Learning, and Natural Language Processing**. **Demand in the Industry:** Industries increasingly demand professionals who can not only analyze data but also **clean and preprocess it effectively**. Roles such as **Data Analyst, ML Engineer, Data Scientist, and Business Intelligence Developer** require strong data wrangling expertise to ensure the success

		of analytics and AI projects. **Job Prospects:** Proficiency in data wrangling opens doors to careers in **data science, business intelligence, analytics consulting, AI/ML development, and research**. It is considered a core skill for most modern technology-driven industries.
2	**Vertical:**	**Minor**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. To introduce the fundamentals of data wrangling and its role in AI/ML pipelines. 2. To understand techniques for handling missing, inconsistent, and noisy data. 3. To provide knowledge of data transformation methods such as scaling, encoding, and feature engineering. 4. To develop hands-on skills in Python libraries (Pandas, NumPy, Matplotlib/Seaborn) for data preprocessing. 5. To prepare students for real-world applications of data wrangling in analytics and AI/ML projects.	
8	**Course Outcomes (CO):** **CO1:** Understand the fundamentals and importance of data wrangling in AI/ML workflows. **CO2:** Apply techniques to clean, preprocess, and transform raw datasets. **CO3:** Handle missing, inconsistent, and noisy data using standard tools. **CO4:** Perform exploratory data analysis to prepare datasets for modeling. **CO5:** Demonstrate the ability to document and validate cleaned datasets for AI/ML tasks.	
9	**Modules:-** **Module 1:Fundamentals of Data Wrangling(15 hours):**	
	1. **Introduction to Data Wrangling** • Definition, scope, and importance in AI/ML workflows • Difference between raw and cleaned data • Overview of the data wrangling process: Collection → Cleaning → Transformation → Validation 2. **Data Collection and Exploration** • Sources of data: CSV, Excel, JSON, databases, APIs, web scraping (conceptual) • Understanding data types: Numeric, categorical, datetime, text	

	• Exploratory Data Analysis (EDA) basics: Summary statistics, data visualization (histograms, boxplots) • Identifying patterns, outliers, and anomalies 3. **Handling Missing and Inconsistent Data** • Types of missing data: MCAR, MAR, MNAR (conceptual) • Techniques: Removing, imputing (mean, median, mode), forward/backward fill • Handling duplicates, inconsistencies, and formatting issues • Data standardization and normalization (conceptual introduction) 4. **Data Transformation Techniques** • Feature scaling: Min-Max scaling, Z-score standardization (conceptual) • Encoding categorical data: Label encoding, One-hot encoding • Combining and splitting columns, date-time transformations • Introduction to simple feature engineering
	Module 2: Data Wrangling Tools and Workflow Applications (15 hours) :
	1. **Data Wrangling Tools Overview** • Introduction to Python for data wrangling • Pandas: Series and DataFrames, reading/writing data files • NumPy basics for array operations • Simple visualization using Matplotlib/Seaborn for data understanding 2. **Practical Data Cleaning and Transformation** • Handling missing values and duplicates using Pandas • Filtering, selecting, and indexing data • Aggregation and grouping data • Merging, joining, and concatenating datasets • Reshaping data: Pivot tables and stacking/unstacking 3. **Data Validation and Documentation** • Checking data consistency, validity, and integrity • Detecting outliers and anomalies • Documenting transformations and cleaning steps • Preparing datasets for AI/ML model training 4. **Case Study and Applications** • Example workflow: Cleaning a real-world dataset (e.g., e-commerce sales, student performance, COVID-19 data) • Stepwise transformation, handling missing values, encoding, normalization • Generating a clean dataset ready for ML modeling
10	**Text Books** 1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (Chapters on preprocessing & EDA) 2. Joel Grus, Data Science from Scratch, O'Reilly

<table>
<tr><td>11</td><td colspan="2">Reference Books
1. Wes McKinney, Python for Data Analysis, O’Reilly
2. Jacqueline Kazil & Katharine Jarmul, Practical Data Wrangling, O’Reilly
3. Online Documentation: Pandas, NumPy, Matplotlib, Seaborn tutorials</td></tr>
<tr><td>12</td><td>Internal Continuous Assessment: 40%</td><td>Semester End Examination: 60%</td></tr>
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Quizzes/ Presentations/
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</table></td></tr>
</table>

Vertical - III

Open Elective (OE)

Name of the Course: Basics of Stock Market

Sr. No.	Heading	Particulars
1	**Description the course:**	This course provides a comprehensive introduction to the Indian financial system, offering foundational knowledge of its structure, components, and functioning. It delves into the role of banks and other financial institutions in economic development and explores various banking services available to individuals and businesses. The course also introduces students to the basics of insurance and personal financial planning, enabling them to make informed financial decisions and develop sound saving and investment strategies. Through real-world examples, case studies, and practical insights, students will gain a deeper understanding of how financial instruments, services, and institutions interact to support the financial stability of individuals and the economy.
2	**Vertical:**	**Open Electives**
3	**Type:**	**Theory**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. Understand the concept and function of stock markets. 2. Identify the key participants and their roles in the stock market. 3. Familiarize with Indian stock exchanges (NSE & BSE). 4. Recognize common stock market terms such as shares, IPO, and dividends. 5. Compare features of stocks, bonds, mutual funds, ETFs, and SIPs. 6. Understand the concept of risk vs return. 7. Learn the importance of diversification in portfolio building.	
8	**Course Outcomes (CO):** **After completing this course, students will have the knowledge and skills to** CO1. Explain the basic structure of stock markets, key participants, and commonly used investment terms. CO2. Differentiate between various investment options and evaluate them based on risk and return, with basic understanding of portfolio diversification.	
•	**Modules:-** **Module 1 (15 hours): Introduction to Stock Markets**	

- What is a stock market?
- Types of markets: Primary vs Secondary
- Key participants: Investors, Brokers, SEBI
- Indian stock exchanges: NSE, BSE
- Basic terms: stock, share, equity, IPO, index, dividend

Module 2 (15 hours): Investment Instruments

1. Types of investment options: Stocks, Bonds, Mutual Funds, ETFs, SIPs
2. Risk vs Return: Low-risk vs High-risk options
3. Diversification and Portfolio basics

10 Text Books

1. Halan, Monika. *Let's Talk Money*, Harper Business
2. Pathak, Bharati V. *The Indian Financial System* (selected basic chapters)
3. RBI's "Financial Literacy" booklets and SEBI's student guides

11 Reference Books

1. Investment Analysis and Portfolio Management – Prasanna Chandra
2. Security Analysis and Portfolio Management – Punithavathy Pandian
3. Financial Markets and Institutions – L.M. Bhole & Jitendra Mahakud
4. Investment Management – V.K. Bhalla

12 Internal Continuous Assessment: 40% | **External Assessment : 60%**

13 Continuous Evaluation through:

Sr. No	Particular	Marks
1.	Class Test	15
2.	Class participation	05
	Total	**20**

Semester End Examination (30 Marks)

14 Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)

Questions	Type & Module	Marks
Q1.	Objective Question A) Multiple choice questions B) True or False	 08 Marks 07 Marks
Q2.	Theory Question	15 Marks
	OR	
Q2.	Theory Question	15 Marks
	Total	**30**

Name of the Course: Research and Principles

Sr. No.	Heading	Particulars
1	**Description the course :**	This course provides a comprehensive introduction to the principles and practices of research, with a focus on its application in academic and professional settings. Students will explore both **qualitative and quantitative research methods**, learn how to **formulate research problems**, and understand the **process of developing a research proposal**. Key aspects include **literature review**, **data collection strategies**, **research design**, and **hypothesis formulation**. By the end of the course, students will be equipped with the essential skills to **initiate, plan, and present a research study**, preparing them for future academic projects, internships, or industry-driven research.
2	**Vertical :**	**Open Elective**
3	**Type :**	**Theory**
4	**Credits :**	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** • To introduce students to the fundamental concepts, types, and purposes of research. • To develop an understanding of qualitative and quantitative research methodologies. • To guide students through the research process—from identifying a topic to formulating objectives and hypotheses. • To familiarize students with research design strategies, ethical considerations, and techniques for writing research proposals.	
8	**Course Outcomes:** By the end of the course, students will: **CO1.** Gain a clear understanding of what research is and why it is important in academic and professional fields. **CO2.** Learn the difference between qualitative and quantitative research methods and when to apply them. **CO3.** Be able to identify research topics, review related literature, and frame effective research questions and hypotheses. **CO4.** Understand various research designs and how to choose appropriate methods for different types of studies. **CO5.** Acquire the skills to prepare a structured and ethical research proposal, ready for academic or practical use.	
9	**Modules:**	
	Module 1: Foundations of Research (15 Hrs) 1. Definition and Purpose of Research 2. Types of Research (Qualitative vs Quantitative; Basic vs Applied) 3. The Research Process (From idea to publication) 4. Sources of Research Problems 5. Research Ethics and Integrity	

	Module 2: Research Design (15 Hrs) 1. Types of Research Designs (Experimental, Exploratory, Descriptive) 2. Formulation of Hypothesis 3. Sampling Methods and Techniques 4. Preparing a Research Proposal (Topic, Objectives, Research Questions) 5. Data Collection Techniques and Tools	
10	**References** • Booth, W. C. Colomb, G. G. and Williams, J. M. (2016). *The Craft of Research.* • 4th edition, University of Chicago Press. • Bryman, Alan. (2018). *Social Research Methods*, London: OUP. • Creswell, J.W.(2014). *Research Methods: A Practical Guide*. 9th Edition, Pearson • Creswell, J.W.(2014). *Research Methods: A Practical Guide*. 9th Edition, Pearson. • Creswell, J.W. and Creswell, D. J. (2017). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* , 5th edition, SAGE Publications. • Creswell, J.W. and Creswell, D. J. (2017). *Research Design*, New Delhi: SAGE Publications. • Ghosh, B.N. (1984). *Scientific Method and Social Research*, New Delhi: Sterling. • Goode, W. J. and Hatt, P. K. (1952). *Methods in Social Research*, New York: Mc Graw-Hill Book Co.	
11	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
12	**Continuous Evaluation through:** **Internal Evaluation:** 20 Marks • Classroom Presentations/ Assignments :10 Marks • Essay Submission/ Book review/ • Field Visit Report /Educational Activity Report 10Marks	**Semester End Examination : 30 Marks**
14	**Format of Question Paper:** for the final examination Time: 1hour Marks: 30 **Q.1 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.2 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)** **Q.3 Answer the following: (ATTEMPT ANY 2 OUT OF 4) (10 Marks)**	

Vertical - IV

Vocational Skill Courses (VSC)

Name of the Course: Data Visualization & Exploratory Data Analysis - Lab

Sr. No.	Heading	Particulars
1	**Description the course:**	This lab course introduces students to the practical aspects of data visualization and exploratory data analysis (EDA) using Python libraries. Students will learn how to handle datasets, clean and prepare data, visualize patterns, and interpret results for decision-making. The focus is on hands-on practice with real-world datasets to build analytical thinking and visualization skills.
2	**Vertical:**	**VSC**
3	**Type:**	**Practical**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. To provide practical exposure to data cleaning, preprocessing, and transformation. 2. To enable students to apply visualization techniques for understanding datasets. 3. To develop the ability to analyze data trends and summarize insights. 4. To introduce the use of Python libraries such as Pandas, Matplotlib, and Seaborn for EDA.	
8	**Course Outcomes:** **CO1:** Perform data wrangling and preprocessing on raw datasets. **CO2:** Apply appropriate visualization techniques to explore data. **CO3:** Interpret statistical and graphical summaries of datasets. **CO4**: Use Python libraries to perform exploratory data analysis on real-world data.	
9	**Modules:-** **Module 1 (15 hours):**	
	• Introduction to datasets: loading CSV/Excel files. • Handling missing values and outliers. • Data cleaning and transformation with Pandas. • Univariate and bivariate visualization using Matplotlib and Seaborn (bar plots, histograms, scatter plots, boxplots). **Practical Aims:** • Aim: To load and inspect datasets using Pandas. • Aim: To clean data by handling missing values and outliers. • Aim: To summarize datasets using descriptive statistics.	

	• Aim: To create basic visualizations (bar, histogram, pie chart). • Aim: To compare two variables using scatter plots and boxplots.	
	Module 2 (15 hours) :	
	• Multivariate analysis and correlation. • Heatmaps, pair plots, and distribution plots. • Feature selection through visualization. • Case studies with real datasets (e.g., sales, healthcare, social media). • Report preparation and storytelling with data. **Practical Aims:** • Aim: To perform correlation analysis and visualize results using heatmaps. • Aim: To explore relationships in datasets using pair plots and regression plots. • Aim: To analyze categorical data with count plots and stacked bar plots. • Aim: To perform EDA on a real-world dataset (e.g., Titanic dataset). • Aim: To prepare a mini-project report with insights from EDA and visualization.	
10	**Text Books** 1. McKinney, Wes. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media, 2017. 2. Waskom, Michael. Data Visualization with Seaborn. Packt Publishing, 2021.	
11	**Reference Books** 1. Grus, Joel. Data Science from Scratch: First Principles with Python. O'Reilly Media, 2019. 2. VanderPlas, Jake. Python Data Science Handbook. O'Reilly Media, 2016.	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	**Format of Question Paper: (Semester End Practical Examination : 30 Marks. Duration:2 hours)** Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Skill Enhancement Course (SEC)

Name of the Course: Fundamentals of Database Management Systems - Lab

Sr. No.	Heading	Particulars
1	**Description the course:**	This course provides an introduction to Database Management Systems with a strong focus on practical implementation using PostgreSQL/MySQL. Students will learn database design through ER diagrams, normalization, and relational modeling. They will gain hands-on skills in creating databases, managing tables, performing CRUD operations, writing advanced queries, and handling user permissions. The course emphasizes applied learning through mini-assignments and projects such as Hotel Reservation Management and Inventory Management Systems.
2	**Vertical:**	**SEC**
3	**Type:**	**Practical**
4	**Credits:**	**2 credits**
5	**Hours Allotted:**	**30 Hours**
6	**Marks Allotted:**	**50 Marks**
7	**Course Objectives:** 1. To introduce students to the fundamental concepts of database systems, database design, and relational models. 2. To provide hands-on experience in creating and managing databases using SQL. 3. To develop skills in designing ER diagrams, normalization, and converting ER models into relational models. 4. To enhance students' ability to use SQL for CRUD operations, queries, joins, sub-queries, and aggregate functions. 5. To equip students with practical knowledge of user management, permissions, and database backup/restore operations.	
8	**Course Outcomes:** **CO1**: Identify entities, relationships, and attributes to design ER diagrams. **CO2**: Apply SQL commands to create databases, manage tables, and perform CRUD operations. **CO3**: Use advanced SQL features such as joins, subqueries, aggregate, string, date, and math functions. **CO4**: Convert ER models into relational models and normalize them up to 3NF. **CO5**: Manage users, permissions, and transactions (COMMIT/ROLLBACK). **CO6**: Apply knowledge to real-life scenarios by building mini-projects on Hotel Reservations and Inventory Management.	
9	**Modules:-** **Module 1 (15 hours):**	
	1. Conceptual Design Using ER Diagrams:	

- Identify entities, attributes, keys, and relationships.
- Apply generalization and specialization.

2. **Database Management Operations:**
   - View all databases
   - Create a database.
   - View all tables in a database.
   - Create tables with and without constraints.
   - Perform CRUD operations.
3. **Table Management Operations:**
   - Alter a table (add column, drop column, drop table, truncate table, rename table).
   - Perform backup/restore operations on a database.
4. **Basic Queries and Aggregate Functions:**
   - Execute simple queries.
   - Utilize aggregate functions.
5. **Advanced Query Functions:**
   - Utilize Date functions.
   - Utilize String functions.
   - Utilize Math functions.

Module 2 (15 hours) :

1. **Join Queries:**
   - Execute inner join queries.
   - Execute outer join queries.
2. **Sub-queries:**
   - Apply sub-queries with IN clauses.
   - Apply sub-queries with EXISTS clauses.
3. **ER Model to Relational Model Conversion and Normalization:**
   - Convert ER model to a relational model
   - Apply normalization up to 3rd Normal Form.
4. **Views:**
   - Create views with and without check options.
   - Drop views.
   - Select data from views.
5. **Data Control Language (DCL) Statements:**
   - Implement DCL statements for granting and revoking permissions.
   - Demonstrate COMMIT and ROLLBACK statements.

Mini Assignment:

1. Generate an E-R Diagram for Hotel Management System.
2. Create a database for Book Store. Introduce 5 Tables in Database. And Perform CRUD and table alteration operations.
3. Create users and give permissions.

	Mini Project/Mini Assignment: 1. Create a Database for Hotel Reservations Management. Apply CRUD operations on it. 2. Create a Database for a small Inventory Management System. Apply CRUD operations on it. **Preferred Software for practicals : PostgreSQL (Open Source)/MySQL**	
10	**Text Books** 3. Elmasri, R., & Navathe, S. B. (2017). Fundamentals of Database Systems (7th Edition). Pearson. 4. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2020). Database System Concepts (7th Edition). McGraw-Hill.	
11	**Reference Books** 3. Connolly, T., & Begg, C. (2015). Database Systems: A Practical Approach to Design, Implementation and Management (6th Edition). Pearson. 4. Ramakrishnan, R., & Gehrke, J. (2014). Database Management Systems (3rd Edition). McGraw-Hill. 5. Molinaro, A. (2009). SQL Cookbook. O'Reilly Media. 6. Coronel, C., & Morris, S. (2018). Database Systems: Design, Implementation, and Management (13th Edition). Cengage Learning.	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
13	**Continuous Evaluation through:** Practical journal submission, viva, assignments • Journal Submission : 10 Marks • Assignments: 10 Marks Total: 20 marks	**A semester end practical examination of 2 hours duration for 30 marks as the paper pattern given below.** *Its compulsory to carry certified journal at the time of practical exam*
14	**Format of Question Paper: (Semester End Practical Examination : 30 Marks. Duration:2 hours)** Q1: Module 1 (12 marks) Q2: Module 2 (12 marks) Q.3 Viva (06 Marks)	

Vertical - V

Ability Enhancement Course (AEC)

Name of the Course: Communication Skills in English II

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course develops essential communication skills for professional and digital environments. It covers vocabulary, business writing, effective communication techniques, public speaking, and presentation skills. Learners also gain digital communication abilities, including virtual meeting etiquette, content creation for blogs and social media, SEO writing, and cross-cultural awareness for global interactions.
2	**Vertical :**	**Ability Enhancement Courses(AEC)**
3	**Type :**	**Theory**
4	**Credit**:	**2 credits**
5	**Hours Allotted :**	**30 Hours**
6	**Marks Allotted**:	**50 Marks**
7	**Course Objectives**: 1. To equip the learners with confidence and proficiency in spoken and written English in and professional and social context 2. To enhance confidence in public speaking, interpersonal exchanges and professional interactions 3. To enable the learners to adapt to diverse audiences, cultural frameworks and workplace setups 4. To equip them with deftness in use of different digital platforms to communicate efficiently in every situation	
8	**Course Outcomes:** **After completion of the course, learners would be able to:** CO1. Acquire proficiency in English for media-specific platforms and forums CO2. Speak and write effectively for diverse media platforms CO3. Enhance critical abilities to present effective social media content CO4. Understand the roles and functions of English in global media framework CO5. To attain proficiency in understanding media trends at a global level	
9	**Modules**:-	
	Module 1: **1.1 Professional English Language Development** • Vocabulary Building • Punctuation and Style • Close Reading of Content for Different Genre • Phrasal Verbs and Idioms • Business English for Letters, Emails, Reports • Paraphrasing **1.2 : Essentials for Effective Communication** • The Seven C's of Effective Communication • The 4 C's of 21st Century Skills • 'You' Attitude and Professional Etiquette	

	• Conflict Management **1.3 Public Speaking and Presentation Skills** • Organizing a speech • Presentation skills with visual aids like PowerPoint • Overcoming stage fright • Use of visual aids and storytelling
	Module 2 : **1.1 : Digital Communication Skills** • Communicating in online platforms • Managing digital identity • Virtual meetings etiquette (Zoom, Teams) • Understanding Video scripts and Podcast Scripts • Social Media Marketing **1.2 : Digital Writing and Content Creation** • Writing Blogs, Articles, and Online Features • SEO Writing and Keyword Optimization • Writing for Social Media • Writing Captions, White Paperand Headlines **1.3 Cross-cultural Communication** • Cultural Quotient and Cultural Intelligence • Cultural differences in communication styles • Global communication etiquette • Dining Etiquette in Professional and Social Setup
10	**References:** 1. Effective Communication Skills" – by M.S. Rao 2. Mass Communication in India (4th Edition): Keval J. Kumar 3. Taylor, Grant. English Conversation Practice. 1967. Tata McGraw-Hill, 2013 4. Labade, Sachin, Katre Deepaetal. *Communication Skills in English*. Orient Black swan, Pvt Ltd, 2021 5. Sethi, J. Standard English and Indian usage: Vocabulary and grammar. PHI Learning Pvt. Ltd., 2011 6. The Secret of Viral Content Creation- Priyanka Agarwal 7. Mohan, R C Sharma Krishna. Business Correspondence and Report Writing. Third edition. Tata McGraw-Hill Education, 2002 8. Writing Skills For Technical Purposes: Raj Mohan Josh 9. Cross-Cultural Communication: Concepts, Cases and Challenges: Francisca O. Norales 10. Fundamentals of Writing: How to Write Articles, Media Releases, Case Studies, Blog Posts and Social Media Content: Paul Lima 11. Excuse Me: The Survival Guide to Modern Business Etiquette: Rosanne Thomas 12. Business Etiquette: A Guide For The Indian Professional: Shital Kakkar Mehra
11	**Internal Evaluation:** 20 Marks 10 marks Assignment, 05 marks Viva, 05 marks Class Participation and Attendance

12	**External Evaluation : 30 Marks** **Semester End Examination** **Question Paper Pattern**

Question No.	Questions	Marks
Q 1	Short Notes (Any 2 out of 4)	10 marks
Q 2	Attempt any one of the following A OR B	10 marks
Q 3	Attempt any one of the following A OR B	10 marks

Value Education Course (VEC)

Name of the Course: Digital Tools for Sustainability

Sr. No.	Heading	Particulars
1	**Description the course:**	• Introduction: Digital Tools for Sustainability highlight the role of information and communication technologies (ICT), data-driven systems, and emerging digital innovations in promoting sustainable development. These tools help in optimizing resource usage, reducing environmental impact, and supporting the global push toward the United Nations Sustainable Development Goals (SDGs). • Relevance and Usefulness: As industries and governments strive for sustainable practices, digital tools provide real-time monitoring, predictive analytics, and automation to achieve efficiency. From smart sensors to AI-based climate models, these tools make sustainability initiatives more measurable, scalable, and impactful. • Applications: Applications include IoT-based smart cities, AI for climate prediction, blockchain for transparent supply chains, digital dashboards for energy and water management, and cloud-based collaboration tools that reduce physical infrastructure needs. These innovations help reduce waste, emissions, and resource overuse. • Interest and Connection with Other Courses: The course connects with subjects such as Artificial Intelligence, Internet of Things, Data Science, and Smart City Planning. It captures student interest by showing how modern digital solutions are not just technological but also socially impactful, creating a bridge between computer science and environmental responsibility. • Demand in the Industry: The growing emphasis on green digital transformation has created demand for professionals who can combine sustainability knowledge with digital expertise. Organizations across IT, manufacturing, energy, and logistics increasingly rely on such tools to meet environmental compliance and efficiency standards.

		• Job Prospects: Career opportunities include roles like Sustainability Data Analyst, IoT Solutions Engineer, Smart City Planner, Environmental Data Scientist, and Digital Transformation Consultant. These positions are growing across private companies, government agencies, and international NGOs committed to sustainable development.
2	**Vertical:**	VEC
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives:** 1. To understand the role of digital tools in promoting sustainability and addressing global environmental challenges. 2. To familiarize students with applications of ICT, IoT, AI, and data-driven decision-making in sustainable development. 3. To introduce students to digital platforms for waste, energy, and water management. 4. To develop awareness of how technology supports UN Sustainable Development Goals (SDGs).	
8	**Course Outcomes:** CO1: Explain the role of digital tools in advancing sustainable practices. CO2: Use knowledge of ICT, IoT, and AI applications for environmental monitoring and management. CO3: Analyze how data, digital platforms, and blockchain contribute to sustainability. CO4: Demonstrate awareness of real-world digital solutions supporting SDGs and smart city initiatives.	
9	**Modules** **Module 1: Foundations of Digital Sustainability (15 Hours)**	
	1. Introduction to ICT for Sustainability: Role of information and communication technologies in energy conservation and environment protection. 2. IoT and Smart Systems: IoT for smart homes, agriculture, water management, and pollution monitoring. 3. Data-Driven Sustainability: Role of big data and analytics in predicting and managing environmental trends. **4.** AI for Sustainability: AI in climate modeling, energy optimization, and biodiversity tracking.	
	Module 2: Applications of Digital Tools in Sustainability (15 Hours)	

	1. Digital Platforms for Sustainability: Smart city apps, digital dashboards, and e-governance for resource management. 2. Blockchain for Transparency: Blockchain in supply chain sustainability, carbon trading, and waste tracking. 3. Cloud Computing & Collaboration Tools: Reducing physical infrastructure, digital workspaces, and remote collaboration for carbon reduction. 4. Future Trends: Role of digital twins, virtual simulations, and gamification for sustainable awareness.
10	**Text Books** 1. Hilty, L. M., & Aebischer, B. (2015). ICT Innovations for Sustainability. Springer. 2. Gupta, M. P. (2018). *Digital Transformation: Powering the Great Reset*. McGraw Hill.
11	**Reference Books** 1. Suryawanshi, V. (2020). ICT for Sustainable Development. CRC Press. 2. Gupta, M. P., & Sharma, A. (2019). Digital India: Technology to Transform a Nation. McGraw Hill.
12	**Internal Continuous Assessment: 40%** / **Semester End Examination: 60%**
13	**Continuous Evaluation through:** Class test of 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks / **Format of Question Paper: External Examination (30 Marks)– 1 hr duration**
14	**Format of Question Paper: (Semester End Examination: 30 Marks. Duration:1 hour)**

Questions	Based On	Options	Marks
Q.1	Module 1	Any 2 out of 4	10
Q.2	Module 2	Any 2 out of 4	10
Q.3	Module 1 & 2	Any 2 out of 4	10

Vertical - VI

Co-Curricular Course (CC)

Name of the Course: Fitness and Sports II

Sr. No.	Heading	Particulars
1	**Description the course :**	India is growing rapidly as a global super-power. To face the challenges of the century and to keep up with the pace of the world, maintaining health is of prime importance. Giving thrust to healthy society, Physical Education, Sports, Health & fitness and Yoga are of great significance in today's world. The Government of India insists on Physical Fitness, Mental Health and Overall Development of Personality for every citizen. However, creating efficient and skilled human resource in the field of Physical Education, Sports and Yoga is identified as the need of the hour. Thus, the Governments of India and Government of Maharashtra have included Physical Education, Sports and Yoga as a key area under the NEP 2020.
2	**Vertical :**	Co-Curricular
3	**Type :**	Activity Based
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives**: The student should be able to: • **To develop foundational knowledge of physical fitness techniques** including strength, cardiovascular, and flexibility training, along with understanding basic nutrition for sports performance. • **To enhance students' mental preparedness and focus** by introducing key concepts of sports psychology such as goal setting, motivation, confidence, and stress management. • **To promote a holistic approach to health and performance**, integrating physical	
8	**Course Outcomes**: • **Apply appropriate physical training methods** including strength, cardiovascular, and flexibility routines to enhance overall fitness and performance. • **Demonstrate understanding of basic sports nutrition** and its role in supporting physical activity and athletic goals. • **Utilize principles of sports psychology** such as goal setting, stress management, and motivation to improve mental focus and performance in sports.	

9	**Module :** This module covers key aspects of physical training, including strength training through bodyweight and resistance methods, and cardiovascular workouts like HIIT and circuit training. It introduces flexibility and mobility routines essential for injury prevention and performance. Basic nutrition for fitness and sports is also discussed. The module then explores sports psychology, focusing on mental preparation and goal setting. It addresses techniques to manage performance anxiety and stress. Finally, it highlights the role of concentration, confidence, and motivation in achieving success in sports.
10	**Reference Books:** 1. Singh, Hardayal. (1991). Science of Sports Training. New Delhi: DVS Publications. 2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication. 3. Iyengar, B.K.S. (2001). Light on Yoga. London: Thorsons. 4. Tiwari, O.P. (1996). Asana: Why and How? Lonavla: Kaivalyadhama Yoga Institute. 5. Nagendra, H. R. & Nagarathna, R. (2002). Samagra Yoga Chikitse. Bengaluru: Swami
11	**Internal Continuous Assessment: 40% (20 Marks)** • Assignment/Report Writing
12	**External Assessment: 60% : (30 Marks)** • Submission of **minimum 3 certificates** from approved fitness/sports activities (yoga, aerobics, team sports, etc.). • Attendance and involvement in fitness sessions, group games, or workshops. *Note: Students participating in sports competitions conducted by University at State or National Level, students who have represented Mumbai University or College at Intercollegiate / Inter Zonal / West Zone Inter University / All India Inter University/ International tournament are exempt from submission of report.*

Letter Grades and Grade Points:

Semester GPA/ Program CGPA Semester/ Program	% of Marks	Alpha-Sign / Letter Grade Result		Grade Points
9.00-10.00	90.0-100	O	(Outstanding)	10
8.00-<9.00	80.0-<90.0	A+	(Excellent)	9
7.00-<8.00	70.0-<80.0	A	(Very Good)	8
6.00-<7.00	60.0-<70.0	B+	(Good)	7
5.50-<6.00	55.0-<60.0	B	(Above Average)	6
5.00-<5.50	50.0-<55.0	C	(Average)	5
4.00-<5.00	40.0-<50.0	P	(Pass)	4
Below 4.00	Below 40	F	(Fail)	0
Ab (Absent)	-	AB	(Absent)	0

Signature of BOS Chairman
Dr. Bhakti Chaudhari
BOS (Computer Science)

Signature of Faculty Member
Ms. Jeenal Jain
(Computer Science)

Signature of I/C Principal
Dr. Swiddle D'Cunha