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:)

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

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 – 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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<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>
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</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>
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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>
<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>
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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