Gyanmanjari Innovative University

Syllabus
Gyanmanjari College of Computer Application
Semester-1(MCA)

Subject: Foundations of AI and Data Science - MCA2AI11504

Type of course: Minor Stream

Prerequisite: Basic knowledge of programming, computer fundamentals, mathematics, and statistics.

Rationale:

This course provides fundamental knowledge of Artificial Intelligence (AI), Data Science, and Data Analytics, which are essential in modern computing, business, and industry applications. It enables students to understand intelligent systems, data-driven decision-making, machine learning concepts, and the role of data in solving real-world problems while developing analytical, computational, and critical thinking skills. The course also introduces students to current AI tools, emerging trends, and industry best practices, encouraging lifelong learning and adaptability.

The course emphasizes practical applications of AI and analytics through real-world case studies, hands-on activities, and problem-solving techniques. It builds a strong foundation for advanced AI and Data Science technologies, fosters innovation and ethical awareness in the use of AI, and prepares students for higher studies as well as emerging career opportunities in the rapidly evolving digital and data-driven economy. By integrating theoretical concepts with practical exposure, it equips students with the knowledge and confidence to contribute effectively to AI-driven and data-centric environments.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	2	5	100	50	150

Legends: CI-Classroom Instructions; T-Tutorial; P -Practical; C –Credit; SEE -Semester End Examination; MSE-Mid Semester Examination; V–Viva; CA-Continuous Assessment; ALA-Active Learning Activities.

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Course Content:

Sr. No	Course content	Hrs	% Weightage

1	**Introduction to Artificial Intelligence & Data Science**
	Theory Topics:
	• **Fundamentals of Artificial Intelligence**
	  • Introduction to Artificial Intelligence
	  • History and evolution of AI
	  • Characteristics of AI systems
	  • Types of Artificial Intelligence
	  • Narrow AI
	  • General AI
	  • Super AI
	  • Applications of AI in industry
	• **Fundamentals of Data Science**
	  • Introduction to Data Science
	  • Scope and importance of Data Science
	  • Data Science lifecycle
	  • Role of Data Scientist
	  • Data-driven decision making
	• **AI, Machine Learning & Deep Learning**
	  • AI vs Machine Learning vs Deep Learning
	  • Introduction to Neural Networks
	  • Intelligent systems overview
	  • Real-world AI applications
	• **Ethical & Social Aspects of AI**
	  • Ethics in AI
	  • Bias and fairness
	  • Privacy and security
	  • Responsible AI systems
	
	Practical:
	
	1. Create prompts and analyze AI-generated outputs using ChatGPT or Google Gemini.
	2. Prepare a timeline representing the history and evolution of Artificial Intelligence using presentation tools.
	3. Compare Narrow AI, General AI, and Super AI using real-world examples.
	4. Identify and analyze AI applications in healthcare, banking, education, agriculture, and e-commerce sectors.
	5. Analyze business problem scenarios and identify suitable AI applications for real-world use cases.
		18%	20%

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6. Represent the Data Science lifecycle using flowcharts or diagram tools.
7. Perform data analysis and decision-making exercise using sample datasets in Excel or Google Sheets.
8. Perform comparative analysis of Artificial Intelligence, Machine Learning, and Deep Learning concepts.
9. Demonstrate and visualize simple Neural Network concepts using online AI simulators/tools.
10. Identify and classify intelligent systems used in daily life applications.
11. Perform comparative evaluation of AI-based systems and traditional software systems.
12. Explore and demonstrate AI-powered tools such as chatbots, recommendation systems, and virtual assistants.
13. Explore and compare virtual assistants such as Google Assistant, Siri, and Amazon Alexa.
14. Analyze case studies related to AI ethics, bias, fairness, privacy, and security issues.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1.	**1. Analytical & Conceptual Evaluation:** Students will be assessed through a viva on AI, ML, DL, Data Science, Intelligent Systems, and AI applications, focusing on conceptual understanding and communication skills.	**10**	
	2. Conceptual Knowledge Assessment Quiz Students will complete an MCQ-based assessment on AI, ML, DL, Data Science, Intelligent Systems, and AI applications to evaluate conceptual understanding, analytical thinking, and application of knowledge.	**10**	
2.	**AI Technology Trend Exploration:** Students will analyze recent AI and Data Science trends, prepare a brief report on emerging technologies and applications, and upload it on the GMIU web portal.		**10**

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		Total	**20**	**10**	
	Examination Style: **Analytical & Conceptual Evaluation:(10 Marks):** Students will undergo viva-based evaluation on topics related to Artificial Intelligence, Machine Learning, Deep Learning, Data Science, Intelligent Systems, and AI applications assigned by the faculty. The viva may include conceptual questioning, comparative analysis, case-based discussions, AI tool understanding, and real-world application-oriented questions to assess students' conceptual understanding, analytical thinking, communication skills, and awareness of emerging AI technologies. **Conceptual Knowledge Assessment Quiz(10 Marks):** Students will complete an objective multiple-choice assessment covering the fundamental concepts of Artificial Intelligence, Machine Learning, Deep Learning, Data Science, Intelligent Systems, and AI applications. The assessment is designed to evaluate conceptual understanding, logical reasoning, analytical thinking, and the ability to differentiate between related concepts while applying theoretical knowledge to real-world scenarios. **AI Technology Trend Exploration(10 Marks):** Students will study and analyze recent trends and advancements in Artificial Intelligence and Data Science across various industries. Students are required to prepare and submit an analytical document based on emerging AI technologies, industry applications, and future developments, and upload the same on the GMIU web portal.				

2	**Python for Data Analytics**
	Theory Topics:
	• **Data Analysis using Python**
	  • Introduction to data analysis concepts
	  • Statistical summaries and descriptive analysis
	  • Data selection and manipulation
	  • Pattern and trend identification
	  • Correlation analysis basics
	  • Exploratory Data Analysis (EDA) concepts
	  • Data interpretation techniques
	  • Business data analysis using Python
	• **Data Processing & Analytical Techniques**
	  • Dataset importing and exporting using Python
	  • Data cleaning and preprocessing techniques
	  • Handling missing and duplicate data
	  • Data filtering and sorting operations
	  • Data transformation concepts
				18%	20%

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- Structured and unstructured data handling
- Analytical reporting basics
- Data-driven decision-making concepts

Practical:

15. Install and configure Python, Jupyter Notebook, and Google Colab environment.
16. Import and export datasets using Python libraries such as Pandas and NumPy.
17. Generate statistical summaries and perform descriptive analysis using Python functions.
18. Perform data selection, indexing, and manipulation operations using Pandas.
19. Identify patterns and trends using analytical operations on datasets.
20. Perform correlation analysis using correlation matrices and basic analytical methods.
21. Conduct Exploratory Data Analysis (EDA) using sample business datasets.
22. Interpret datasets and generate analytical findings using Python techniques.
23. Analyze sales, marketing, or financial datasets using Python-based analytical methods.
24. Identify and handle missing data and duplicate records using Python techniques.
25. Perform data cleaning and preprocessing using Python libraries and methods.
26. Apply data filtering and sorting operations on structured datasets.
27. Apply data transformation operations such as column modification, aggregation, and formatting.
28. Handle structured and unstructured data using Python libraries.
29. Perform data-driven decision-making analysis based on dataset observations and analytical outputs.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1.	**Data Processing Task:** Students will perform data cleaning, preprocessing, and analysis using Python tools such as Pandas and NumPy, and interpret insights from datasets.	20	
2.	**Dataset Analysis & Interpretation Activity:**		10

		Students will analyze datasets using Python tools, prepare a report on findings and insights, and upload it on the GMIU web portal.			
		Total	**20**	**10**	

Examination Style:

Data Processing Task (20 Marks):

Students will perform data importing, cleaning, preprocessing, filtering, sorting, transformation, and analytical activities on datasets using Python libraries/tools such as Pandas and NumPy in Jupyter Notebook or Google Colab. Students will analyze datasets, identify patterns, generate statistical summaries, and interpret analytical findings.

Dataset Analysis & Interpretation Activity (10 marks):

Students will perform analytical activities on given datasets using Python tools and techniques to identify trends, patterns, correlations, and meaningful insights. Students are required to prepare and upload an analytical document containing dataset analysis, interpretations, findings, and conclusions on the GMIU web portal.

3	**Data Visualization & Exploratory Data Analysis**
	Theory Topics:
	• **Data Visualization Fundamentals**
	  • Importance of data visualization
	  • Principles of effective visualization
	  • Visual representation of data
	  • Storytelling with data
	• **Exploratory Data Analysis (EDA)**
	  • Introduction to EDA
	  • Statistical summaries
	  • Pattern identification
	  • Correlation analysis
	  • Trend analysis
	• **Visualization Techniques**
	  • Bar charts
	  • Pie charts
	  • Histograms
	  • Scatter plots
	  • Heat maps
	  • Dashboards
	• **Analytical Reporting**
	  • Data interpretation
	  • Business reporting
	  • Visualization for decision support
		18%	20%

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- Analytical insights generation

Practical:

30. Demonstrate principles of effective visualization using sample graphical representations.
31. Create visual representations of datasets using data visualization techniques in Python.
32. Develop storytelling visualizations for representing business data insights.
33. Perform Exploratory Data Analysis (EDA) using statistical summaries on datasets.
34. Identify patterns and trends using analytical and visualization techniques.
35. Perform correlation analysis using visualization and statistical methods.
36. Analyze trends in datasets using graphical and analytical approaches.
37. Create bar charts for categorical data visualization using Python libraries.
38. Generate pie charts for proportional data representation.
39. Create scatter plots for relationship and correlation visualization between variables.
40. Generate heat maps for correlation analysis and visual representation of dataset intensity patterns.
41. Design interactive dashboards for analytical reporting and business data visualization.
42. Interpret visualized data and generate analytical insights using charts, graphs, and dashboard outputs.
43. Prepare business analytical reports using visualization techniques and EDA findings.
44. Apply visualization techniques for decision support systems using business datasets and analytical reports.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1.	**Data Visualization & Representation Task:** Students will create appropriate visualizations from datasets, interpret insights, and prepare a report for decision-making and analysis.	20	
2.	**Industry Interaction & Workshop:** Students must prepare a document describing the expert talks and workshops they have attended and upload it to the GMIU ERP Portal.		10

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		Total	**20**	**10**	
	Examination Style: **Data Visualization & Representation Task (20 Marks):** Students will analyze the given datasets and identify appropriate graphical representation techniques such as bar charts, pie charts, histograms, scatter plots, heat maps, and dashboards using visualization tools like Python libraries, Excel, Power BI, Tableau, or similar analytical tools. Students are required to justify the selection of visualization methods, interpret the represented data, and generate analytical insights for decision-making and reporting purposes. **Industry Interaction & Workshop (10 Marks):** Students must prepare a document covering the expert talk and workshop they attended. The document should include the date of each session, the name of the speaker or resource person, the organizing department or organization, the topics covered, key points discussed, and the knowledge or skills learned from each session. Students must prepare separate sections for the expert talk and workshop and upload the completed document to the GMIU ERP Portal.				

4	**Fundamentals of Machine Learning**
	Theory Topics:
	• **Introduction to Machine Learning**
	  • Introduction and importance of Machine Learning
	  • Machine Learning workflow
	  • Applications of Machine Learning
	• **Types of Machine Learning**
	  • Supervised Learning
	  • Unsupervised Learning
	  • Reinforcement Learning
	• **Machine Learning Techniques**
	  • Regression concepts
	  • Classification concepts
	  • Clustering concepts
	  • Recommendation systems overview
	• **Model Evaluation Concepts**
	  • Training and testing data
	  • Accuracy and performance measures
	  • Overfitting and underfitting
	  • Model improvement basics
	
	Practical:
	
	45. Compare supervised and unsupervised learning models.
				18%	20%

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46. Implement basic regression analysis.
47. Perform classification on sample datasets.
48. Implement clustering techniques using sample data.
49. Develop a simple prediction model.
50. Analyze training and testing datasets.
51. Evaluate model accuracy using sample cases.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1.	**Predictive Analytics & Model Development Task:** Students will develop and analyze basic Machine Learning models using datasets to perform prediction, classification, and pattern identification.	20	
2.	**Learning Model Comparative Analysis:** Students will analyze datasets, identify suitable Machine Learning approaches, justify their selection, and upload the report on the GMIU web portal.		10
	Total	20	10

Examination Style:

Predictive Analytics & Model Development Task (20 Marks): Students will develop and analyze basic Machine Learning models using sample datasets to perform prediction, classification, and pattern identification activities. The task focuses on understanding model behavior, data analysis, and practical implementation of Machine Learning concepts.

Learning Model Comparative Analysis (10 Marks):

Students will analyze given problem statements and datasets to identify the most suitable Machine Learning approach such as supervised or unsupervised learning based on the data characteristics and problem requirements. Students must prepare a comparative analysis report including problem description, dataset type, selected learning model, justification, and observations, and upload the PDF report/activity sheet on the GMIU web portal.

5	**Emerging Trends & Applications of AI and Data Science** **Theory Topics:**	18%	20%

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- **Generative AI & Intelligent Systems**
  - Introduction to Generative AI
  - Large Language Models (LLMs)
  - AI chatbots and virtual assistants
  - Prompt engineering basics

- **Applications of AI & Data Science**
  - Healthcare analytics
  - Financial analytics
  - E-commerce recommendation systems
  - Cyber Security applications
  - Smart systems and automation

- **Industry Tools & Platforms**
  - AI-powered platforms
  - Cloud-based AI services
  - Data Science workflow tools
  - Analytics platforms overview

- **Future Trends & Career Opportunities**
  - Future scope of AI and Data Science
  - Career opportunities in AI and Analytics
  - Challenges in AI adoption
  - Emerging technologies in AI

Practical:

52. Explore Generative AI tools and applications.
53. Create prompts for AI-based systems.
54. Analyze AI-generated outputs.
55. Case study on AI implementation in industry.
56. Study cloud-based AI platforms.
57. Presentation on future trends in AI & Data Science.
58. Mini project on an AI or Data Analytics application.
59. Develop an analytical report using a real-world case study.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1.	**Generative AI Exploration Task:** Students will explore Generative AI tools, create prompts, analyze outputs, and compare AI systems to demonstrate practical understanding of AI technologies.	20	

2.	**AI & Data Analytics Mini Project:** Students will develop a mini project based on AI or Data Analytics applications using real-world datasets and upload the project report on the GMIU web portal.		**10**
	Total	**20**	**10**

Examination Style:

Generative AI Exploration Task(20 Marks):

Students will explore Generative AI tools and virtual assistants by creating prompts, analyzing AI-generated outputs, and comparing intelligent AI systems. Students will demonstrate prompt usage, output interpretation, comparative understanding, and practical exploration of AI tools during the activity.

AI & Data Analytics Mini Project(10 Marks):

Students will develop a mini project on given definition based on AI or Data Analytics applications using real-world scenarios and datasets. Upload document on GMIU web portal.

Suggested Specification :

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	10%	10%	20%	30%	20%	10%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand the fundamentals of Artificial Intelligence, Data Science, and intelligent systems.
CO2	Analyze and interpret data using analytical, visualization, and exploratory techniques.
CO3	Apply Machine Learning concepts and predictive analytics techniques for problem solving.
CO4	Evaluate AI technologies, intelligent applications, and data-driven decision-making approaches.

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CO5	Explore emerging AI technologies, Generative AI tools, and modern industry applications.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students.

A minimum of 20–30% of the course content shall be suggested to deliver through Flipped Learning, where students study digital learning resources before the classroom session. Classroom time shall be utilized for discussion, problem-solving, practical applications, and higher-order learning activities.

Students shall be encouraged to use AI-powered learning platforms, simulation software, virtual laboratories, digital libraries, research databases, online certification courses, NPTEL, SWAYAM, MOOCs, and other technology-enabled learning resources to strengthen conceptual understanding and practical competence.

Continuous assessment shall be conducted through Active Learning Assignments (ALAs), quizzes, skill demonstrations, presentations, practical exercises, projects, case studies, innovation activities, peer assessment, reflective learning, and industry-oriented tasks instead of relying primarily on conventional written assignments.

Reference Books:

[1] Data Analytics, Data Science & Artificial Intelligence: Systems for Decision Support,Dursun Delen
[2] Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig
[3] Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron
[4] Python for Data Analysis, Wes McKinney.

Suggested Assessment Guidelines:

Module 1: Introduction to Artificial Intelligence & Data Science

1. Analytical & Conceptual Evaluation (10 Marks):		
Criteria	**Description**	**Marks**
Conceptual Understanding	Understanding of AI, ML, DL, Data Science, and intelligent system concepts	5
Communication & Explanation Skills	Ability to identify insights, challenges, and practical implications	5
Total		**10**
2. Conceptual Knowledge Assessment Quiz		
Accuracy	Selects the correct answers with minimal errors	10
Total		**10**

Module 2: Python for Data Analytics

Data Processing Task:(20 Marks):		
Criteria	**Description**	**Marks**
Dataset Understanding & Importing	Understanding dataset structure and accuracy in data importing and organization	5
Data Cleaning & Preprocessing	Handling missing values, filtering, sorting, transformation, and preprocessing accuracy	5
Data Analysis & Statistical Summaries	Ability to generate summaries, identify patterns, and perform analytical operations	5
Interpretation & Tool Usage	Effective use of Python libraries/tools and interpretation of analytical findings	5
Total		**20**

Module 3: Data Visualization & Exploratory Data Analysis:

Data Visualization & Representation Task (20 Marks):		
Criteria	**Description**	**Marks**
Dataset Understanding & Preparation	Understanding dataset structure, data organization, and preprocessing accuracy	5
Visualization Selection & Design	Selection of appropriate charts/graphs and effectiveness of visual representation	5
Insight Generation & Interpretation	Ability to interpret visualized data, identify trends, patterns, and generate insights	5
Analytical Thinking & Tool Usage	Effective use of visualization tools and logical justification of selected techniques	5
Total		**20**

Module 4: Fundamentals of Machine Learning:

Predictive Analytics & Model Development Task (20 Marks):		
Criteria	**Description**	**Marks**
Problem Understanding & Dataset Analysis	Understanding of problem statement, dataset, and analytical requirements	5
Data Preparation & Preprocessing	Data cleaning, transformation, and preparation accuracy	5
Model Development	Selection and implementation of appropriate predictive or analytical model	5
Analytical & Logical Approach	Ability to apply analytical thinking and logical problem-solving techniques	5
Total		**20**

Module 5: Emerging Trends & Applications of AI and Data Science:

Generative AI Exploration Task (20 Marks):		
Criteria	**Description**	**Marks**
Understanding of AI Tools	Understanding of Generative AI tools, intelligent systems, and virtual assistants	5
Prompt Design & Usage	Ability to create effective prompts and interact with AI systems efficiently	5
Analysis of AI Outputs	Ability to analyze, interpret, and evaluate AI-generated outputs	5
Participation & Practical Performance	Exploration and effective use of Generative AI tools and platforms	5
Total		**20**