



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Industry Led Minor/Hons.

Level: UG

Branch: Gen AI Specialist

Course / Subject Code : BE04IA0011

Course / Subject Name : Foundations of Gen AI and Software Systems

w. e. f. Academic Year:	2025-26
Semester:	4
Category of the Course:	Core Courses

Prerequisite: Basic knowledge of Python programming, mathematics (linear algebra, probability, statistics), and data handling.

Rationale:	With Artificial Intelligence and Machine Learning transforming industries, there is a growing need for learners to acquire practical skills in data-driven problem-solving. These courses are designed to build a strong foundation in programming, AI concepts, and machine learning techniques while offering hands-on projects ranging from open-source contributions to algorithm development. By combining fundamentals with real-world applications such as neural networks, chatbots, and financial trading models, the curriculum prepares students to apply advanced AI and ML methods in diverse domains.
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Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	By the end of this course, learners will be able to write Python programs using fundamental programming constructs, apply coding skills to real-world problem-solving, and develop serverless AI-based applications. They will also gain experience in contributing to socially impactful open-source projects and deploying an AI-powered solution such as a hotdog detector app.	A
02	By the end of this course, learners will understand core AI concepts, machine learning fundamentals, and the role of ethics in AI. They will also be able to apply mathematical optimization techniques to solve business problems and develop a practical project by creating a cryptocurrency trading algorithm in Python.	N
03	By the end of this course, learners will understand the fundamentals of machine learning, gain hands-on experience in building and training neural networks with PyTorch, and apply these skills to design and implement an interactive chatbot.	C
04	By the end of this course, learners will be able to apply machine learning techniques using both R and Python, understand and implement dimensionality reduction methods, and develop a practical project by creating a cryptocurrency trading algorithm in Python.	C

*Revised Bloom's Taxonomy (RBT)



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
5	0	0	5	100	0	0	0	100
*Total Lecture Hrs. (L) =75			Total Practical Hrs. (PR) =00.		Total Hours =75 Hrs			

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Python Fundamentals and Applied AI Projects - This course introduces the essentials of Python programming, covering core concepts such as variables, data types, control structures, functions, and libraries. Learners will then apply these skills in socially relevant contexts through the “Call for Code for Racial Justice” open-source project, gaining hands-on experience in collaborative coding. The course culminates in the development and deployment of an AI-driven hotdog detector as a serverless Python application, integrating cloud services and machine learning principles to demonstrate practical, end-to-end problem-solving.	30	40
2.	Artificial Intelligence and Machine Learning Applications - This course provides a comprehensive introduction to Artificial Intelligence, beginning with fundamental AI concepts and an overview of its applications. Learners will explore the basics of machine learning, including supervised and unsupervised methods, while also addressing critical aspects of AI ethics. The course emphasizes the use of mathematical optimization techniques for real-world business problem-solving. In the final module, students will apply their knowledge in a hands-on project by designing and implementing a cryptocurrency trading algorithm in Python, combining AI principles with financial applications.	15	20



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3.	Applied Machine Learning with Neural Networks and Chatbots - This course begins with a quick introduction to the principles of machine learning, covering key concepts such as data processing, model training, and evaluation. Learners will then dive into deep learning by building and experimenting with neural networks using PyTorch, one of the most popular ML frameworks. The course culminates in a practical project where students apply their knowledge to create a functional chatbot, integrating natural language processing concepts with neural network models to deliver real-world AI solutions.	15	20
4.	Machine Learning with R, Python, and Applied Projects - This course provides hands-on experience with machine learning using two powerful programming languages—R and Python. Learners will explore key ML techniques including data preprocessing, supervised and unsupervised learning, and model evaluation. Special focus will be given to dimensionality reduction methods to handle high-dimensional datasets effectively. The course concludes with a capstone project, where students apply their knowledge to design and implement a cryptocurrency trading algorithm in Python, integrating real-world data and predictive modeling for financial applications.	15	20
Total		75	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
5	15	25	20	10	25

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig
2. Introduction to Machine Learning – Ethem Alpaydin
3. Python Machine Learning – Sebastian Raschka & Vahid Mirjalili
4. Generative Deep Learning – David Foster

(b) Open-source software and website:

1. Python (Anaconda Distribution) – <https://www.anaconda.com>
2. TensorFlow – <https://www.tensorflow.org>
3. PyTorch – <https://pytorch.org>



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4. Hugging Face (Transformers, LLMs) – <https://huggingface.co>
5. Kaggle (Datasets & Competitions) – <https://www.kaggle.com>

Suggested Course Practical List: Implement ML/DL models in Python, use generative AI frameworks, design prompts, and deploy models on cloud platforms.

Laboratory / Learning Resources: Jupyter/Colab, Python (Anaconda), TensorFlow, PyTorch, Hugging Face, GitHub, Kaggle, Docker, and cloud ML platforms.

Suggested Project List: Chatbot, text summarizer, recommender system, generative image app, fake news detector, or AI-driven sentiment analyzer.

Suggested Activities for Students: Kaggle challenges, hackathons, GitHub collaboration, project demos, open-source contributions, and cloud deployment.

Skill & Practical Activities to be carried out during Semester						
Important Note:- Please keep only applicable categories relevant to your offerings in this table and delete not applicable categories						
Sr. No.	Category of Engagement	Describe the activities to be carried out by students in brief	Expected Frequency & Duration	Mode of Delivery (Online / Offline / Hybrid)	Tools / Platforms / Equipment / Machinery to be Used	Expected major Learning Outcomes in 2 or 3 bullet points
1	Master Classes / Expert Lectures by Industry Professionals	Expert lectures on Introduction to AI, Generative AI Fundamentals, Future of AI Careers, and Real-World Use Cases of AI in Business,	2-3 sessions (2 hours)	Online	Zoom / MS Teams, AI demo tools (ChatGPT, Gemini, Claude), Slides	<ul style="list-style-type: none">• Gain foundational understanding of AI and Generative AI trends.• Learn industry expectations and emerging career roles in AI.



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		Healthcare & Tech.				
2	Quizzes / Competency-Based Evaluation	Quizzes on Python basics, data types, control structures, intro to AI concepts, and computational thinking.	Every 2 weeks	Online	IBM LMS	<ul style="list-style-type: none">• Reinforce foundational programming and AI concepts.• Build computational thinking and problem-solving skills.
	Hands-on Training / Lab Exercises / Tool-Based Learning	Practical coding labs on Python programming, data structures, data cleaning, basic visualization, introduction to ML libraries (NumPy, Pandas), and building simple AI workflows.	Weekly (3 hours per session)	Online	IBM LMS	<ul style="list-style-type: none">• Develop strong Python programming skills.• Learn to clean, process, and visualize data.• Build introductory AI and ML pipelines.
