Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-7 (B.Tech)

Subject: AI and Robotics – BETCE17404

Type of course: Professional Core

Prerequisite: Basic understanding of programming concepts, mathematics, logical reasoning, and fundamental knowledge of computer systems and electronics.

Rationale:

Artificial Intelligence and Robotics are transforming modern industries by enabling intelligent decision-making, automation, and autonomous system operation. This course is designed to provide foundational and applied knowledge of Artificial Intelligence techniques and robotic systems, including intelligent agents, problem-solving methods, machine learning concepts, sensors, actuators, and robotic control mechanisms. The course helps students understand how AI algorithms and robotic components work together to develop smart and automated systems capable of performing real-world tasks. Through practical exposure using free and industry-relevant tools such as Python, Google Colab, OpenCV, and simulation platforms, students will gain hands-on experience in implementing basic AI models and robotic applications. The course also promotes analytical thinking, problem-solving ability, and innovation skills essential for emerging domains in intelligent systems, automation, robotics, and modern computing technologies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

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

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Introduction to Artificial Intelligence and Robotics:** Introduction to Artificial Intelligence and Robotics, history and evolution of intelligent systems and robots. Concepts of Artificial Intelligence, characteristics of intelligent agents, types of AI, and applications of AI in real-world domains. Overview of robotics, components of robotic systems, sensors, actuators, controllers, and robotic movement. Introduction to problem-solving techniques, search methods, and basic machine learning concepts. Study of human–robot interaction and ethical considerations in AI and robotics systems.	12	20%
2	**Intelligent Agents and Problem Solving:** Introduction to intelligent agents and their characteristics. Study of agent environments, types of agents, and agent architectures. Concepts of problem formulation and problem-solving techniques in Artificial Intelligence. Overview of state space representation, search strategies, and uninformed and informed search algorithms such as Breadth First Search (BFS), Depth First Search (DFS), and heuristic search methods. Introduction to knowledge representation techniques and reasoning methods used in intelligent systems. Applications of intelligent agents and AI-based problem-solving in robotics and real-world systems.	12	20%
3	**Machine Learning and Computer Vision:** Introduction to machine learning concepts and their role in Artificial Intelligence systems. Study of supervised, unsupervised, and reinforcement learning techniques. Overview of datasets, training, testing, and model evaluation methods. Introduction to classification, regression, and clustering algorithms. Fundamentals of computer vision including image acquisition, image processing, object detection, and pattern recognition. Applications of machine learning and computer vision in robotics, automation, healthcare, smart systems, and autonomous technologies.	12	20%
4	**Robotics Systems and Automation:** Introduction to robotic systems and automation concepts. Study of robot architecture, degrees of freedom, coordinate systems, and robotic motion control. Overview of sensors and actuators used in robotic systems, including proximity sensors, infrared sensors, servo motors, and DC motors. Introduction to robotic kinematics, path planning, and obstacle avoidance techniques. Concepts of autonomous and semi-autonomous robots, industrial robotics, and mobile robots. Applications of robotics in manufacturing, healthcare, agriculture, smart homes, and industrial automation systems.	12	20%

5	**AI Applications and Human–Robot Interaction:** Introduction to real-world applications of Artificial Intelligence and Robotics in various domains. Study of AI-based systems in healthcare, smart cities, autonomous vehicles, industrial automation, agriculture, and security systems. Concepts of human–robot interaction, collaborative robots, and intelligent decision-making systems. Overview of natural language processing, speech recognition, and robotic communication methods. Introduction to ethical issues, safety standards, privacy concerns, and future trends in Artificial Intelligence and Robotics. Discussion of emerging technologies such as autonomous systems, smart robotics, and AI-driven automation solutions.	12	20%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**A.I. Problem-Solving Mini Project:** In this individual ALA, students will develop a simple AI-based problem-solving application using Python and Google Colab. Students may implement search techniques, intelligent agents, or basic machine learning models for solving real-world problems such as route finding, recommendation systems, or decision-making tasks. The final submission must include source code, execution screenshots, output analysis, and a technical report uploaded on the GMIU Web Portal.	10
2	**Robotics Simulation and Automation Task:** In this ALA, each students will design and simulate a basic robotic system using free tools such as Tinkercad, Arduino IDE, or robotics simulation platforms. Students will demonstrate robotic movement, sensor interaction, or automation logic and analyze system behavior. The final report including circuit diagrams, simulation outputs, and observations shall be submitted through the GMIU Web Portal.	10
3	**Big Data–ML Integration Case Study:** In this ALA, each students will execute a mini case study integrating Artificial Intelligence and Robotics concepts for a real-world application such as smart surveillance, obstacle detection, smart assistant systems, or automated monitoring. Students must present workflow diagrams, AI logic, robotic interaction concepts, and implementation outcomes through a structured technical report and presentation uploaded on the GMIU Web Portal.	10
	Total	30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage %	20%	25%	20%	15%	10%	10%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the basic concepts of Artificial Intelligence, intelligent agents, and robotics.
CO2	Apply search techniques and knowledge representation methods to solve AI problems.
CO3	Analyze machine learning, computer vision, and AI models for real-world applications.
CO4	Demonstrate robotic design and automation using simulation tools.
CO5	Develop AI and Robotics-based solutions for intelligent automation.

List of Practical

Sr. No	Description	Unit No	Hrs.
1	Introduction to Google Colab and Python programming environment for Artificial Intelligence and Robotics applications.	01	02
2	Implementing basic Python programs for mathematical operations, logical decision-making, and simple AI problem-solving tasks.	01	02
3	Demonstrating intelligent agent behavior using simple rule-based programs in Python.	02	02
4	Implementing Breadth First Search (BFS) and Depth First Search (DFS) algorithms for pathfinding problems.	02	02
5	Developing heuristic search applications for solving AI-based problem scenarios.	02	02

6	Performing basic machine learning operations such as data loading, training, and prediction using Python libraries in Google Colab.	03	04
7	Implementing simple classification and clustering algorithms for AI applications using Scikit-learn.	03	04
8	Demonstrating basic computer vision operations such as image reading, image processing, and object detection using OpenCV.	03	04
9	Simulating robotic movement and sensor interaction using Tinkercad or Arduino IDE.	04	02
10	Demonstrating robotic control using sensors, actuators, and basic automation logic in simulation environment.	04	02
11	Designing a simple obstacle detection or autonomous robotic system using simulation tools.	05	02
12	Developing a mini A.I. & Robotics application integrating intelligent decision-making and automation concepts.	05	02
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and needs of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done based on the Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Artificial Intelligence: A Modern Approach, by Stuart Russell and Peter Norvig, Pearson Education.
[2] Introduction to Artificial Intelligence and Expert Systems, by Dan W. Patterson, Pearson Education.
[3] Machine Learning with Python, by Andreas C. Müller and Sarah Guido, O'Reilly Media.
[4] Pra Robotics: Control, Sensing, Vision, and Intelligence, by K. S. Fu, R. C. Gonzalez, and C. S. G. Lee, McGraw-Hill Education.
[5] Introduction to Robotics: Mechanics and Control, by John J. Craig, Pearson Education.