



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Diploma Engineering**

**Level: Diploma**

**Branch: Computer Engineering / Computer Science and Engineering**

**Subject Code : DI04000311**

**Subject Name : Fundamentals of Artificial Intelligence**

<b>W.E. F. Academic Year:</b>	2025-26
<b>Semester:</b>	4 <sup>th</sup>
<b>Category of the Course:</b>	Professional Elective - II

<b>Prerequisite:</b>	Basic Computer Literacy, Basic Programming Knowledge of Python, Logical Thinking and Basic Mathematics
<b>Rationale:</b>	The course is designed to provide students with a foundational understanding of Artificial Intelligence, its problem-solving techniques, machine learning principles, practical tools, and ethical implications. It balances theory, practical applications, and hands-on learning, preparing students to understand and apply AI in real-world contexts.

### Course Outcomes:

After Completion of the Course, Student will be able to:

No	Course Outcome	RBT Level
01	Describe the fundamentals, applications, and limitations of Artificial Intelligence.	Understand
02	Apply problem-solving techniques and search algorithms to design AI solutions.	Apply
03	Illustrate the issues in knowledge representation and the use of resolution procedures for solving AI problems	Apply
04	Analyze the structure, components, development phases, and applications of Expert Systems and Knowledge-Based Systems.	Apply
05	Use modern AI tools and applications for practical problem solving.	Apply

*\*Revised Bloom's Taxonomy (RBT)*

### 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 (M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>Introduction to Artificial Intelligence</b> <ul style="list-style-type: none"><li>• <b>History and Evolution of AI</b></li><li>• <b>Applications of AI</b></li><li>• <b>Areas of AI:</b> Machine Learning, NLP, Computer Vision, Robotics, Expert Systems</li><li>• <b>Advantages and Disadvantages of AI</b></li><li>• <b>Generative AI:</b> Definition and concept</li><li>• <b>Agentive AI:</b> Definition and concept</li></ul>	07	16
2.	<b>AI Problem-Solving and Search Techniques</b> <ul style="list-style-type: none"><li>• <b>Introduction to AI Problem-Solving:</b> Definition, Characteristics and steps</li><li>• <b>Rule-Based Systems:</b> Structure: If-Then rules, Forward Chaining and Backward Chaining, Simple examples using if-else logic</li><li>• <b>Problem-Solving Approaches:</b> Uninformed Search: BFS, DFS and Informed (Heuristic) Search: Best-First Search</li><li>• <b>AI Agents Overview:</b> Definition and types, Components and examples</li><li>• <b>Weak AI vs. Strong AI</b></li></ul>	12	26
3.	<b>Knowledge Representation Techniques</b> <ul style="list-style-type: none"><li>• <b>Introduction and Issues to Knowledge Representation:</b> Need and role of knowledge representation in AI; data vs. information vs. knowledge.</li><li>• <b>Logical Representation of Knowledge:</b> Concept of logic, symbols, propositions, and rules.</li><li>• <b>First-Order Logic (FOL):</b> Basic syntax and semantics; objects, predicates, and quantifiers with simple examples.</li><li>• <b>Reasoning Methods :</b> Concept of inference; Forward Reasoning (Data-driven) and Backward Reasoning (Goal-driven)</li><li>• <b>Unification and Lifting:</b> Concept of unification in matching logic expressions</li><li>• <b>Resolution Procedure:</b> Simple explanation of how</li></ul>	10	22



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	resolution helps in deriving conclusions.		
4.	<p><b>Expert Systems and Knowledge-Based Systems</b></p> <ul style="list-style-type: none"> <li>• <b>Introduction to Expert Systems:</b> Definition, need, and role of Expert Systems; how they differ from traditional programs.</li> <li>• <b>Characteristics of Expert Systems</b></li> <li>• <b>Building Blocks of Expert Systems:</b> Knowledge Base, Inference Engine, User Interface, Explanation Facility, and Knowledge Acquisition Module.</li> <li>• <b>Development Phases of an Expert System:</b> Problem identification, knowledge acquisition, system design, implementation, testing, and maintenance.</li> <li>• <b>Knowledge Acquisition:</b> Methods to gather knowledge from experts, data, or rules; challenges in acquiring expert knowledge.</li> <li>• <b>Applications of Expert Systems:</b> Examples from: medical diagnosis (MYCIN), agriculture, finance, education, customer support, and manufacturing.</li> </ul>	08	18
5.	<p><b>AI Tools and Their Applications</b></p> <ul style="list-style-type: none"> <li>• <b>Introduction to AI Tools:</b> Definition, classification, and importance</li> <li>• <b>Chat GPT:</b> Overview, applications (<i>Content writing and programming</i>), limitations, ethical considerations</li> <li>• <b>Google AI Tools:</b> Google Translate, Google Lens (overview and applications (<i>Notebook LM, Google Assistant, Gemini</i>))</li> <li>• <b>Canva AI:</b> Overview and applications (<i>AI Image Generator, Magic Design</i>)</li> <li>• <b>Netflix Recommendation System:</b> Collaborative filtering, content-based filtering, hybrid approaches</li> <li>• <b>Alexa Voice Assistant:</b> Speech recognition, NLU, response generation</li> </ul>	08	18
	<b>Total</b>	<b>45</b>	<b>100</b>

**Suggested Specification Table with Marks (Theory):**

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
26	44	30	0	0	0

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



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## References/Suggested Learning Resources:

### (a) Books:

1. **Artificial Intelligence: A Modern Approach** by Stuart Russell & Peter Norvig
2. **Python Machine Learning** by Sebastian Raschka & Vahid Mirjalili
3. **Data Mining: Practical Machine Learning Tools and Techniques** by Ian H. Witten, Eibe Frank, and Mark A. Hall
4. **Artificial Intelligence** by Pankaj Sharma (S.K. Kataria & Sons)
5. **Artificial Intelligence** by Elaine Rich, Kevin Knight, Shivashankar and B. Nair, Tata McGraw Hill, 3rd Edition, 2017
6. **Artificial Intelligence: A Modern Approach** by Stuart J. Russell and Peter Norvig, Pearson Education Asia, 4th Edition, 2022.

### (b) Open-source software and website:

1. Python – Programming language for AI/ML/NLP
2. Google Colab – Cloud-based Python notebooks
3. Weka – GUI-based machine learning tool
4. Orange – Visual programming for data mining and ML
5. Scikit-learn – Python library for machine learning
6. NLTK – Python library for natural language processing
7. <https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/>
8. [https://www.tutorialspoint.com/artificial\\_intelligence/index.htm](https://www.tutorialspoint.com/artificial_intelligence/index.htm)
9. <https://www.britannica.com/technology/artificial-intelligence>
10. <https://nptel.ac.in/>
11. <https://www.coursera.org/>
12. <https://scikit-learn.org/>
13. [https://www.w3schools.com/ai/ai\\_what\\_is.asp](https://www.w3schools.com/ai/ai_what_is.asp)
14. <https://www.udemy.com/>



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## **Suggested Course Practical List (30 Hours):**

1. Explore AI Applications and present 5 real-world AI applications in daily life.
2. Identify AI in products. List AI features in common products (smartphones, social media, home assistants) and classify them as ML, NLP, or Robotics.
3. Create a comparative table or chart of AI advantages and limitations.
4. Write a simple BFS algorithm to traverse a graph using Python.
5. Write a simple DFS algorithm to traverse a graph using Python.
6. Build a simple rule-based system (if-else) for a decision-making scenario (e.g., weather-based clothing suggestion).
7. Open a simple dataset (Iris / Play Tennis) and visualize it using graphs to understand features, classes, and basic data exploration in Weka / Orange.
8. Use a decision tree or k-NN classifier on the same dataset to check data classification using Weka / Orange.
9. Identify the missing values from given CSV file.
10. Write a python program to implement simple Chatbot.
11. Write a python program to remove stop words for a given passage from a text file using NLTK.
12. Write a python program for Text Classification for the given sentence using NLTK.
13. Use ChatGPT to generate content (essay, email, or summary) and evaluate results.
14. Translate sentences using Google Translate; identify objects using Google Lens.
15. Create a poster or social media banner using Canva AI text-to-image or design suggestions.
16. Use a small dataset of users and movie ratings to manually recommend movies based on similar users' preferences.
17. Explore AI voice assistants like Alexa or Google Assistant to perform daily tasks and observe their responses.

## **List of Laboratory/Learning Resources Required:**

### **Hardware**

- Desktop/Laptop with internet
- Microphone & speakers (for voice assistants)
- Smartphone (for Google Lens/Assistant, Alexa app)



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## Software & Tools

- Programming & Development: Python (Anaconda/Jupyter/Colab), Scratch or any GUI rule engine
- ML & Data Mining: Weka, Orange
- AI Platforms: ChatGPT, Google Translate, Google Lens, Canva AI
- Productivity: MS Excel/Google Sheets, MS PowerPoint/Google Slides
- Browsers: Chrome, Edge, Firefox (or any modern browser)

## Suggested Activities for Students:

1. Prepare a timeline chart of AI evolution with key milestones.
2. Write a short report on applications of AI in their own field of interest (e.g., healthcare, education, business).
3. Conduct a debate on “Advantages vs. Disadvantages of AI.”
4. Solve a puzzle (e.g., 8-puzzle or maze) using BFS or DFS in Python or Google Colab
5. Create a flowchart for a rule-based system (e.g., diagnosing a disease, student grading).
6. Group activity: Compare uninformed vs. informed search with real-life examples (e.g., finding shortest path in Google Maps).
7. Use Weka/Orange to build a simple classification model (e.g., predicting pass/fail).
8. Perform text preprocessing: tokenization and stop-word removal on sample text.
9. Mini-project: Collect a small dataset (CSV) and apply supervised learning (decision tree).
10. Explore ChatGPT and prepare a report on its applications in education, content creation, and problem solving.
11. Demonstrate Google Translate & Google Lens on real-life examples (sign boards, foreign text).
12. Create a poster using Canva AI on “Future of AI in Society.”
13. Case study presentation: How Netflix recommends movies or How Alexa works.
14. Group discussion: Ethical challenges in AI (privacy, bias, job loss).
15. Write a short essay on “Future Scope of AI for Social Good.”

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