

Lesson Plan

TECB (Semester VI)

Subject: Artificial Intelligence

Subject code: CSC604

Teacher-in-charge: Prof. Sushma Nagdeote

Academic Term: January– April 2023

Module		Content	Hrs
1		Introduction to Artificial Intelligence	4
	1.1	Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI.	
2		Intelligent Agents	4
	2.1	Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.	
	2.2	Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems	
3		Problem solving	10
	3.1	Uninformed Search Methods: Breadth First Search (BFS), Depth-First Search (DFS), Depth Limited Search, Depth-First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search.	
	3.2	3.2 Local Search Algorithms and Optimization Problems: Hill climbing search, Simulated annealing, Genetic algorithms	
	3.3	Adversarial Search: Game playing, Min-Max search, Alpha-Beta Pruning	
4		Knowledge and Reasoning	12
	4.1	Knowledge based Agents, The Wumpus World, The Propositional logic, First Order Logic: Syntax and Semantics, Inference in FOL, Forward chaining, backward Chaining.	
	4.2	Knowledge Engineering in First-Order Logic, Unification, Resolution	
	4.3	Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Inference in belief network	
	4.4	Prolog Programming – Ontological Engineering-Categories and Objects, Reasoning Systems for Categories	
5		Planning and Learning	5
	5.1	The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning	

	5.2	Learning: Forms of Learning, Theory of Learning, PAC learning. Introduction to statistical learning (Introduction only). Introduction to reinforcement learning: Learning from Rewards, Passive Reinforcement Learning, Active reinforcement Learning	
6		AI Applications	4
	6.1	Introduction to NLP- Language models, Grammars, Parsing	
	6.2	Robotics - Robots, Robot hardware, Problems Robotics can solve	
	6.3	AI applications in Healthcare, Retail, Banking	

Course Outcomes (CO):

On successful completion of course learner will be able to:

- CSC604.1** Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
- CSC604.2** Ability to choose an appropriate problem-solving method and knowledge representation technique.
- CSC604.3** Ability to analyze the strength and weaknesses of AI approaches to knowledge-intensive problem solving.
- CSC604.4** Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
- CSC604.5** Ability to design and develop AI applications in real world scenarios.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CSC604.1	1													
CSC604.2		1												
CSC604.3			1	1										
CSC604.4			1	1										
CSC604.5													1	

Course Outcome	Competency	Performance Indicator
CSC604.1	1.1 Demonstrate competence in mathematical modelling	1.1.1 Apply the knowledge of discrete structures, linear algebra, statistics, and calculus to solve problems 1.1.2 Apply the concepts of probability, statistics and queuing theory in modelling of computer-based system, data and network protocols.
	1.2 Demonstrate competence in basic sciences	1.2.1 Apply laws of natural science to an engineering problem

	1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply engineering fundamentals
	1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply theory and principles of Computer Science and engineering to solve an engineering problem
CSC604.2	2.1 Demonstrate an ability to identify and formulate a complex engineering problem	2.1.1 Articulate problem statements and identify objectives 2.1.2 Identify processes/modules of a computer-based system and parameters to solve a problem 2.1.3 Identify an algorithm that applies to a given problem
	2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1 Reframe the computer-based system into interconnected subsystems 2.2.2 Identify functionalities and computing resources. 2.2.3 Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions. 2.2.4 Compare and contrast alternative solution/methods to select the best methods 2.2.5 Compare and contrast alternative solution processes to select the best process.
	2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Able to apply computer engineering principles to formulate modules of a system with required applicability and performance. 2.3.2 Identify design constraints for required performance criteria.
	2.4 Demonstrate an ability to execute a solution process and analyze results	2.4.1 Applies engineering mathematics to implement the solution. 2.4.2 Analyze and interpret the results using contemporary tools. 2.4.3 Identify the limitations of the solution and sources/causes. 2.4.4 Arrive at conclusions with respect to the objectives.

CSC604.3	3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	<p>3.1.1 Able to define a precise problem statement with objectives and scope.</p> <p>3.1.2 Able to identify and document system requirements from stake-holders.</p> <p>3.1.3 Able to review state-of-the-art literature to synthesize system requirements.</p> <p>3.1.4 Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard.</p> <p>3.1.5 Explore and synthesize system requirements from larger social and professional concerns.</p> <p>3.1.6 Able to develop software requirement specifications (SRS).</p>
	3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	<p>3.2.1 Able to explore design alternatives.</p> <p>3.2.2 Able to produce a variety of potential design solutions suited to meet functional requirements.</p> <p>3.2.3 Identify suitable criteria for evaluation of alternate design solutions.</p>
	3.3 Demonstrate an ability to select optimal design scheme for further development	<p>3.3.1 Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.</p> <p>3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development</p>
	3.4 Demonstrate an ability to advance an engineering design to defined end state	<p>3.4.1 Able to refine architecture design into a detailed design within the existing constraints.</p> <p>3.4.2 Able to implement and integrate the modules.</p> <p>3.4.3 Able to verify the functionalities and validate the design.</p>
	4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	<p>4.1.1 Define a problem for purposes of investigation, its scope and importance</p> <p>4.1.2 Able to choose appropriate procedure/algorithm, dataset and test cases.</p> <p>4.1.3 Able to choose appropriate hardware/software tools to conduct the experiment.</p>

	4.2 Demonstrate an ability to design experiments to solve open-ended problems	4.2.1 Design and develop appropriate procedures/methodologies based on the study objectives
	4.3 Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1 Use appropriate procedures, tools and techniques to and analyze collect data 4.3.2 Critically analyze data for trends and correlations, stating possible errors and limitations 4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions 4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions
CSC604.4	3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.1 Able to define a precise problem statement with objectives and scope. 3.1.2 Able to identify and document system requirements from stake-holders. 3.1.3 Able to review state-of-the-art literature to synthesize system requirements. 3.1.4 Able to choose appropriate quality attributes as defined by
		ISO/IEC/IEEE standard. 3.1.5 Explore and synthesize system requirements from larger social and professional concerns. 3.1.6 Able to develop software requirement specifications (SRS).
	3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1 Able to explore design alternatives. 3.2.2 Able to produce a variety of potential design solutions suited to meet functional requirements. 3.2.3 Identify suitable criteria for evaluation of alternate design solutions.

<p>3.3 Demonstrate an ability to select optimal design scheme for further development</p>	<p>3.3.1 Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.</p> <p>3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development</p>
<p>3.4 Demonstrate an ability to advance an engineering design to defined end state</p>	<p>3.4.1 Able to refine architecture design into a detailed design within the existing constraints.</p> <p>3.4.2 Able to implement and integrate the modules.</p> <p>3.4.3 Able to verify the functionalities and validate the design.</p>
<p>4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding</p>	<p>4.1.1 Define a problem for purposes of investigation, its scope and importance</p> <p>4.1.2 Able to choose appropriate procedure/algorithm, dataset and test cases.</p> <p>4.1.3 Able to choose appropriate hardware/software tools to conduct the experiment.</p>
<p>4.2 Demonstrate an ability to design experiments to solve open-ended problems</p>	<p>4.2.1 Design and develop appropriate procedures/methodologies based on the study objectives</p>
<p>4.3 Demonstrate an ability to analyze data and reach a valid conclusion</p>	<p>4.3.1 Use appropriate procedures, tools and techniques to and analyze collect data</p> <p>4.3.2 Critically analyze data for trends and correlations, stating possible errors and limitations</p> <p>4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions</p> <p>4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions</p>

CSC604.5	1.1 Demonstrate competence in mathematical modelling, and engineering fundamentals.	1.1.1 Develop mathematical concepts required for ML and AI algorithms. 1.1.2 Devise the concepts of modelling for the said systems. 1.1.3 Apply theory and principles of Computer Science and engineering.
	1.2 Demonstrate an ability to identify the applicability of AI and ML solutions to a problem.	1.2.1 Articulate problem statements and identify objectives 1.2.2 Analyze the problem for applicability of AI and ML solutions. Identify an algorithm that applies to a given problem
	1.3 Demonstrate an ability to identify solutions/methods to solve the problem.	1.3.1 Identify processes/modules of an Artificial Intelligence and Machine Learning system and parameters to solve a problem 1.3.2 Apply various methods and evaluate their performance. 1.3.3 Choose an appropriate method for the given problem
	1.4 Demonstrate an ability to execute the solution.	1.4.1 Use the chosen method to implement the solution. 1.4.2 Analyse and interpret the results using contemporary tools. 1.4.3 Identify the limitations of the solution and sources/causes.

CO Measurement Weightages for Tools:

<i>Course Outcomes</i>	<i>Direct Method (80%)</i>					<i>Indirect Method (20%)</i>
	Unit Test	Assignment	Quiz	End Sem Exam (T)	End Sem Exam (Oral)	Course exit survey
CSC604.1	20%	20%		40%	20%	100%
CSC604.2	20%	20%		40%	20%	100%
CSC604.3	20%	20%		40%	20%	100%
CSC604.4	20%	20%		40%	20%	100%
CSC604.5	20%	20%		30%	20%	100%

Attainment:

CO CSC701.1:

Direct Method

$$A_{\text{CSC701.1D}} = 0.2 * \text{Test} + 0.2 * \text{Assignment} + 0.6 * \text{SEE}_{\text{Theory}}$$

Final Attainment:

$$A_{CSC701.1} = 0.8 * A_{CSDLO6021.1D} + 0.2 * A_{CSDLO6021.1I}$$

CO CSC702.2:

Direct Method

$$A_{CSC702.2D} = 0.2 * Test + 0.2 * Assignment + 0.6 * SEE_Theory$$

Final Attainment:

$$A_{CSC702.2} = 0.8 * A_{CSC702.2D} + 0.2 * A_{CSC702.2I}$$

CO CSC703.3:

Direct Method

$$A_{CSC703.2D} = 0.2 * Test + 0.2 * Assignment + 0.6 * SEE_Theory$$

Final Attainment:

$$A_{CSC703.2} = 0.8 * A_{CSC703.2D} + 0.2 * A_{CSC703.2I}$$

CO CSC704.4:

Direct Method

$$A_{CSC704.2D} = 0.2 * Test + 0.2 * Assignment + 0.6 * SEE_Theory$$

Final Attainment:

$$A_{CSC704.2} = 0.8 * A_{CSC704.2D} + 0.2 * A_{CSC704.2I}$$

Course Level Gap (if any):

Content beyond Syllabus:

Lecture Plan:

Module	Contents	Hours	Planned date	Actual date	Content Delivery Method	Remark
1	Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System	2	09/01/2023		PPT	
	Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI.		10/01/2023		PPT	
2	Intelligent Agents, and Environments, The concept of rationality	4	13/01/2023		PPT	
	The nature of environment, The structure of Agents		16/01/2023		PPT	
	Types of Agents		18/01/2023		PPT	
	Types of Agents, Learning Agent.		20/01/2023		PPT	
3	Problem solving: Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS),	12	23/01/2023		PPT	
	Depth Limited Search, Depth First Iterative Deepening (DFID)		24/01/2023		PPT	

	Examples for Practice		27/01/2023		Blackboard	
	Informed Search Methods: Greedy best first Search		30/01/2023		PPT	
	A* Search, Memory bounded heuristic Search.		31/01/2023		PPT	
	Examples for Practice		03/02/2023		Blackboard	
	Local Search Algorithms and Optimization Problems: Hill climbing search		06/02/2023		PPT	
	Simulated annealing		07/02/2023		PPT	
	Genetic algorithms.		10/02/2023		PPT	
	Adversarial Search: Game Playing, Min-Max Search		13/02/2023		PPT	
	Alpha Beta Pruning		14/02/2023		PPT	
	Examples for Practice		17/02/2023		Blackboard	
	Class Activity		20/02/2023		Presentations	
4	Knowledge and Reasoning: Knowledge based Agents		21/02/2023		PPT	
	Brief Overview of propositional logic		24/02/2023		PPT	
	First Order Logic: Syntax and Semantic		27/02/2023		PPT	
	Knowledge Engineering in First-Order Logic, Inference in FOL		28/02/2023		PPT	
	Unification, Resolution		03/03/2023		PPT	
			06/03/2023			Sports Day
			07/03/2023			Holi
			10/03/2023			Crescendo
	Examples for Practice		13/03/2023			
	Examples for Practice		14/03/2023			
	Technical Paper Reading Activity		17/03/2023			
	Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain		20/03/2023		PPT	
	The semantics of belief network, Simple Inference in belief network		21/03/2023		PPT	
5	The planning problem, Partial order planning, Hierarchical	5	24/03/2023		PPT	

	planning, Conditional Planning.					
	Learning: Forms of Learning, Theory of Learning, PAC learning.		27/03/2023		PPT	
	Introduction to statistical learning		28/03/2023		PPT	
	Introduction to reinforcement learning: Learning from Rewards		31/03/2023		PPT	
	Passive Reinforcement Learning, Active reinforcement Learning		03/04/2023		PPT	
6		2	04/04/2023			Mahavir Jayanti
			07/04/2023			Good Friday
	AI Applications: Technical Paper Reading Activity		10/04/2023		Presentations	
	Technical Paper Reading Activity		11/04/2023			
			14/04/2023			Ambedkar Jayanti
			17/04/2023			UT-2
			18/04/2023			UT-2
			21/04/2023			Submission

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition" Pearson Education, 2020.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, First edition, 2011
3. George F Luger, "Artificial Intelligence" Low Price Edition, Fourth edition, Pearson Education.,2005

Reference Books:

1. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
4. Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, McGraw Hill Education,2017.

Web References:

1. <https://nptel.ac.in/courses/106/105/106105078/>
2. <https://thestempedia.com/blog/simple-ai-and-machine-learning-projects-for-studentsand-beginners/>
3. <https://nptel.ac.in/courses/106/105/106105079/>

Evaluation Scheme

CIE Scheme

Internal Assessment: 20 (Average of two tests)

Internal Assessment Scheme

Module		Lecture Hours	No. of questions in			No. of questions in SEE
			Test 1	Test 2	Test 3*	
1	Introduction to Artificial Intelligence	4	01 (5 marks)	-	--	
2	Intelligent Agents	4	01 (7 Marks)	-	--	
3	Problem solving	10	01 (8 Marks)	-	--	
4	Knowledge and Reasoning	12		02 (10 Marks)	--	
5	Planning and Learning	5	-	1 (5 Marks)	--	
6	AI Applications	4	-	1 (5 Marks)	--	

Note: three to four questions will be set in the Test paper

Verified by:



Programme Coordinator

Subject Expert