Lesson Plan

B.E. (CE- Section A) (Semester VI)

Subject: Artificial Intelligence

Subject code: CSC604

Teacher-in-charge: Dr. B. S. Daga

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, Thenature of environment, The structure of Agents, Types ofAgents, 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 boundedheuristic Search.	
	3.2	3.2 Local Search Algorithms and Optimization Problems: Hillclimbingsearch Simulated annealing,Genetic algorithms	
	3.3	Adversarial Search: Game playing, Min-Maxsearch, Alpha-Beta Pruning	
4		**Knowledge and Reasoning**	**12**
	4.1	Knowledge based Agents, The Wumpus World, ThePropositional logic, First Order Logic: Syntax and Semantic,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 uncertaindomain, The semantics of belief network, Inference in beliefnetwork	
	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, ConditionalPlanning	

	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 Objectives:

1. To conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2. To make students understand and explore the mechanism of mind that enables intelligent thought and action.
3. To make students understand advanced representation formalism and search techniques
4. To make students understand how to deal with uncertain and incomplete information

Course Outcomes:

Upon completion of this course students will be able to:

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

CO-PO-PSO Mapping:

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

Provide justification of PO to CO mapping

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 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	2.3.1 Able to apply computer engineering

		formulate and interpret a model	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	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.
		3.3 Demonstrate an ability to select optimal design scheme for further development	3.3.1 Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
			3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development

	3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1 Able to refine architecture design into a detailed design within the existing constraints. 3.4.2 Able to implement and integrate the modules. 3.4.3 Able to verify the functionalities and validate the design.
	4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1 Define a problem for purposes of investigation, its scope and importance 4.1.2 Able to choose appropriate procedure/algorithm, dataset and test cases. 4.1.3 Able to choose appropriate hardware/software tools to conduct the experiment.
	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.
	3.3 Demonstrate an ability to select optimal design scheme for further development	3.3.1 Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
		3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development
	3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1 Able to refine architecture design into a detailed design within the existing constraints.
		3.4.2 Able to implement and integrate the modules.
		3.4.3 Able to verify the functionalities and validate the design.
	4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1 Define a problem for purposes of investigation, its scope and importance
		4.1.2 Able to choose appropriate procedure/algorithm, dataset and test cases.
		4.1.3 Able to choose appropriate hardware/software tools to conduct the experiment.
	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
CSC604.5	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 anArtificial 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 Assessment Tools:

Course Outcomes	Direct Method (80%)					Indirect Method (20%)
	Unit Test	Assignment	Quiz	End Sem Exam (T)	End Sem Exam (Oral)	Course exit survey
CSC604.1	20%	20%	10%	30%	20%	100%
CSC604.2	20%	20%	10%	30%	20%	100%
CSC604.3	20%	20%	10%	30%	20%	100%
CSC604.4	20%	20%	10%	30%	20%	100%
CSC604.5	20%	20%	10%	30%	20%	100%

CO calculation= (0.8 *Direct method + 0.2*Indirect method)

Rubrics for assessing Course Outcome with each assessment tool:

Assignment:

Indicator			
Organization (2)	Readable with some mistakes and structured(1)	Readable with some mistakes and structured (1)	Very well written and structured without any mistakes (2)
Level of content(4)	All major topics are covered, the information is accurate (2)	Most major and some minor criteria are included. Information is accurate (3)	All major and minor criteria are covered and are accurate (4)
Depth and breadth of discussion and representation (4)	Minor points/information may be missing and representation is minimal (1)	Discussion centers on some of the points and covers them adequately (2)	Information is presented in depth and is accurate (4)

Curriculum Gap identified: (with action plan)

Nil

Content beyond syllabus:

Nil

Modes of content delivery

Modes of Delivery	Brief description of content delivered
Class room lecture	1. Introduction to Artificial Intelligence 2. Intelligent Agents 3. Problem solving 4. Knowledge and Reasoning 5. Planning and Learning

	6. AI Applications
Assignments	Assignment 1: based onProblem solving Assignment 2: Knowledge and Reasoning
Quizzes	Quiz 1: on 1. Introduction to Artificial Intelligence 2. Intelligent Agents 3. Problem solving Quiz 2: on 4 Knowledge and Reasoning 5 Planning and Learning 6. AI Applications

Text books:
1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education.
2. SarojKaushik "Artificial Intelligence" ,Cengage Learning.
3. George F Luger "Artificial Intelligence" Low Price Edition , Pearson Education., Fourth edition.

Reference Books:
1. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight "Artificial Intelligence" Third Edition
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. Hagan, Demuth, Beale, "Neural Network Design" CENGAGE Learning, India Edition.
5. Patrick Henry Winston , "Artificial Intelligence", Addison-Wesley, Third Edition.
6. Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers.
7. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press.

Web Reference Material:
8. http://www.sanfoundry.com/artificial-intelligence-mcqs-agent-architecture/
9. IIT Kahragpur NPTEL program/Video series on AI by Prof. Sudishna Sarkar

Lesson Plan

CLASS	BE Computer Engineering (A), Semester VI	
Academic Term	January-April 2023	
Subject	**Artificial Intelligence(CSC604)**	

Periods (Hours) per week		*Lecture*	3	
		Practical		
		Tutorial		

Evaluation System			*Hours*	*Marks*
		Theory examination	3	80
		Internal Assessment	--	20
		Practical/Oral Examination	2	25
		Term work	--	25
		Total	--	150

Time Table	*Day*	*Time*
	Tuesday	2.45-3.45pm
	Wednesday	2.45-3.45pm
	Thursday	1.45-2.45pm

Course Content and Lesson plan

Week	Lecture No.	Date Planned	Actual	Topic	Remarks
				Module 1: **Introduction to Artificial Intelligence**	
	1	9/01/23		Introduction, History of Artificial Intelligence,	
	2	11/01/23		Intelligent Systems: Categorization of Intelligent System,	
	3	13/01		Components of AI Program, Foundations of AI, Sub-areas of AI	
	4	16/01		Applications of AI, Current trends in AI.	
				Module 2: **Intelligent Agents**	
	5	18/01		Agents and Environments, The concept of rationality, The nature of environment,	
	6	20/01		The structure of Agents, Types of Agents, Learning Agent	
	7	24/01		Solving problem by Searching: Problem Solving Agent, model,	
	8	25/01		Class Formulating Problems, Example Problems	
				Module 3: Problem solving	
	9	26/01		Uninformed Search Methods: Breadth First Search (BFS),	**Republic Day**
	10	31/01		Depth-First Search (DFS), Depth Limited Search,	
	11	01/02		Depth-First Iterative Deepening(DFID),	

	12	07/02		Informed Search Methods: Greedy best first Search , A* Search ,	
	13	08/02		Problem Solving	
	14	09/02		Local Search Algorithms and Optimization Problems: Hill climbing search	
	15	14/02		Simulated annealing, Genetic algorithms	
	16	15/02		Adversarial Search: Game playing,	
	17	16/02		Min-Max search, Alpha-Beta Pruning	
	18	21/02		Problem Solving	
Module 4: Knowledge and Reasoning
	19	22/02		Knowledge based Agents, The Wumpus World, The Propositional logic,	
	20	23/02		First Order Logic: Syntax and Semantic, Inference in FOL,	
	21	28/02		Forward chaining, backward Chaining.	**UT1(27Feb – 1st March)**
	22	01/03		Knowledge Engineering in First-Order Logic	**UT1**
	23	02/03		Unification, Resolution	
	24	07/03		Uncertain Knowledge and Reasoning: Uncertainty	
	25	08/03		Representing knowledge in an uncertain domain,	
	26	09/03		The semantics of belief network, Inference in belief network	
	27	14/03		Prolog Programming – Ontological Engineering-Categories and Objects	
	28	15/03		Reasoning Systems for Categories	
	29	16/03		Problem Solving	
	30	21/03		Problem Solving	
*Module 5: **Planning and Learning***
	30	22/03		The planning problem, Planning with state	
	31	23/03		Partial order planning, Hierarchical planning, Conditional Planning	
	32	28/03		Learning: Forms of Learning, Theory of Learning,	
	33	29/03		PAC learning. Introduction to statistical learning (Introduction only). Introduction to reinforcement learning:	
	34	30/03		Learning from Rewards, Passive Reinforcement Learning, Active reinforcement Learning	
Module 6: AI Applications
	35	04/04		Introduction to NLP- Language models, Grammars, Parsing	
	36	05/04		Robotics - Robots, Robot hardware, Problems Robotics can solve	
	37	06/04		AI applications in Healthcare, Retail,	

	38	11/04		Problem Solving	
		12/04		Revision	
		13/04		Revision	
		18/04			**UT2 : 17/18/19/20**

Submitted By	Approved By
Dr. B. S. Daga	Dr. Sujata Deshmukh (HOD)
Date of Submission:	**Date of Approval:**
Remarks by DQAC (if any)	