MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Information Technology
Course Hand-out

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING| IT3201 | 4 Credits | 3 1 0 4

Session: Jan 24– May 24| Faculty: **Dr.Pratistha Mathur|**

Dr Devesh Kumar Srivastava| Dr Sulabh Bansal|Dr Avani Shama| Mr Venkatesh Gauri Shanker: Core

Introduction: This course introduces artificial intelligence techniques and machine learning techniques to the students. The aim is to teach about Autonomous Agents, Problem solving, Search, Heuristic methods, State space Learning, Knowledge Representation, Uncertainty, Propositional Logic, Predicate Logic, Logic-based Agents, Basics of Machine Learning with its types, Concept Learning, Decision Tree Learning, Classification and Regression, Introduction to ANN with perceptron and backpropagation algorithms.

A. Course Outcomes: At the end of the course, students will be able to

IT3201.1 Discuss basics of Artificial intelligence and some representative applications of artificial intelligence.
IT3201.2 Formalise a given AI problem and analyse it along different dimensions.
IT3201.3 Identify and implement appropriate A.I. search technique to solve the problem.
IT3201.4 Illustrate knowledge representation using propositional, first order predicate logic and semantic network and apply reasoning process to draw conclusions.
IT3201.5 Apply different models performing common machine learning tasks such as classification and clustering.
IT3201.6 Discuss basic concepts of ANN and illustrate the working of Backpropagation algorithm.

B. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1]. To apply creativity in support of the design, simulation, implementation and inference of existing and advanced technologies.

[PSO.2]. To participate & succeed in IT oriented jobs/competitive examinations that offer inspiring & gratifying careers.

[PSO.3]. To recognize the importance of professional developments by pursuing postgraduate studies and positions.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam (Closed Book)	30
	In class Quizzes, Assignments and Class Performance (Accumulated and Averaged)	30
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. SYLLABUS

Pre-requisite(s): Programming in C, Data Structures, Engineering Mathematical - III, Design and Analysis of Algorithms

Introduction: : Introduction to Artificial Intelligence, Current Trends in AI; **Intelligent Agents**, Agent v/s Software Program, Classification of Agents, Working of an Agent, Single and Multi-Agent System, Performance Evaluation of Agents, Architecture of Intelligent Agents**; AI Problems- Problem Space**: Problem analysis; **Problem Solving Techniques**: Heuristic search Techniques; **Knowledge Representation**: Semantic Networks, Propositional and Predicate Logic: Propositional and Predicate calculus, semantics for predicate calculus, theorem prover, inference rules, unification, Resolution, Refutation in predicate logic**; Machine Learning**: Introduction, Types of Learning, Supervised vs Unsupervised Learning, Concept Learning- Concept Learning as Search, Find-S, Version Spaces and Candidate Elimination Algorithm, Decision Tree Learning, Classification and Regression using Supervised Learning; **ANN-Introduction**, Perceptron Learning, Multilayer Networks and the Back-propagation Learning.

E. TEXT BOOKS

T1. E. Rich, K. Knight, and S.B. Nair, "Artificial Intelligence", 3rd Ed., Tata McGraw Hill, 2009.

T2. S. Russell, and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, 2011.

T3. Tom M. Mitchell, Machine Learning, (1e India Edition), McGraw Hill Education, 2017.

F. REFERENCE BOOKS

Prateek Joshi, Artificial Intelligence with Python, (1e), Packt Publishing Limited, 2017.

G. Lecture Plan:

Lec No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1- 2	Fundamental Concepts	Intelligent Systems, Foundation and Application of AI Current Trends in AI	Lecture *A* theory page 7*	**IT3201.1**	In Class Quiz Sessional End Term
3– 5	Problems, Problem Spaces *Manhattan Euclidean distance*	Defining a Problem Characteristics of a Problem A brief introduction to problem solving techniques.	Lecture	**IT3201.2** *Difference b/w informed and uninformed*	In Class Quiz Sessional End Term
6-11	Heuristic Search Techniques *Notes ppt go through* *tic tac heuristic* *a* ao* graph* *underestimation and over for a**	Heuristic search technique: Generate and Test, Hill Climbing, Best-first search, Depth First Search, Branch and Bound Search, Problem reduction, Constraint satisfaction	Lecture Tutorial *Best first search from notes* *generate theory* *hill climbing theory* *constraint theory*	**IT3201.3**	In Class Quiz Sessional End Term
12-14	Intelligent Agents *MIN MAX algo* *alpha beta prunning* *Study ppt*	Agent v/s Software Program Rational Agent and PEAS Description Classification of Agents, Working of an Agent Single and Multi-Agent System Performance Evaluation of Agents, Architecture of Agent, Intelligent Agents;	Lecture Tutorial *ppt* *easy engineering knowlefge represation* *knowledge represtion baada question resolution*	**IT3201.2** *reolstuin tree*	In Class Quiz Sessional End Term
18	Knowledge Representation *tautotlogy*	Knowledge Representation Issues	Lecture *theory*	**IT3201.4**	Class Quiz Sessional End term
19-22	Propositional and Predicate Logic *unification* *Education 4 u*	Propositional and Logic operators, Simplification laws, Predicate Calculus: Limitations of Propositional Logic, Quantifiers: Existential and Universal, Domain Constraints, Nested Quantifiers	Lecture Tutorial *first order predicate* *FACTS TO FIRST ORDER BY MAHESH HUDDAR* *Neso acad for questions of nested quantifier*	**IT3201.4**	Class Quiz Sessional End term
23-26	Propositional and Predicate Logic *Parichay sei puchna*	Semantics for predicate calculus, Inference rules, Resolution principle	Lecture Tutorial	**IT3201.4**	Class Quiz Sessional End term
27-32	Knowledge Representation	Knowledge Representation using predicate logic Semantic nets	Tutorial *semantic nets*	**IT3201.4** *resolution in predicate and propostion*	Class Quiz End term
33	Machine Learning	Introduction to Machine Learning, different types of learning.	Lecture	**IT3201.5**	Class Quiz End term
34-38	Machine Learning *concept learning ppt*	Concept Learning- Concept Learning as	Lecture Tutorial	**IT3201.5**	Class Quiz

					End term
	Trouble Free Mahesh Huddar	Search, Find-S, Version Spaces and Candidate Elimination Algorithm *revise this !!!* ←			
39-43	Machine Learning *ID3 method* *Practice needed for decision tree*	Decision Tree Learning, Classification and Regression using Supervised Learning	Lecture Tutorial *Validation formulae*	**IT3201.5**	Class Quiz End term
44 – 47	Artificial Neural Networks *Back propagation question*	Introduction, Neuron, Model, Perceptron, Multilayer Networks, Back propagation	Lecture *Advantages of BackPropagation*	**IT3201.6**	Class Quiz End term
48	Conclusion and Course Summarization	NA	Lecture	**NA**	NA

Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES THRESHOLD VALUE: 40%												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
IT3201.1	Discuss basics of Artificial intelligence and some representative applications of artificial intelligence.	1	1	2	1									2	2	1
IT3201.2	Formalise a given problem and analyse it along different dimensions	1	3	2	1	1								3	2	1
IT3201.3	Identify and implement appropriate A.I. search technique to solve the problem.	2	3	1	1	2								3	2	1
IT3201.4	Illustrate knowledge representation using propositional, first order predicate logic and semantic network and apply reasoning process to draw conclusions.	2	2	2	2	2								3	3	2
IT3201.5	Apply different models performing common machine learning tasks such as classification and clustering.	2	2	2	2	2								3	3	2
IT3201.6	Discuss basic concepts of ANN and illustrate the working of Backpropagation algorithm.	2	2	2	2	2							2	3	3	2

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment