Intelligent Systems and Machine Learning Algorithms		Semester	5
Course Code	**BEC515A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	THEORY		

Course objectives:

This course will enable students to:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward Problem-Solving
- Get to know approaches of inference, perception, knowledge representation, and learning
- Define Machine Learning and understand the basic theory underlying machine learning.
- Differentiate supervised, unsupervised, and reinforcement learning

Teaching-Learning Process (General Instructions)

.

These are sample Strategies teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method; different teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS (Higher Order Thinking) questions in the class, which promotes criticalthinking.
4. Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skillssuch as evaluating, generalizing, and analyzing information rather than simply recalling it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up withcreative ways to solve them.
7. Discuss how every concept can be applied to the real world and when that's possible, it helps improve the student's understanding.
8. Adopt the Flipped class technique by sharing the materials/Sample Videos before the class and having discussions on the topic in the succeeding classes.

Module-1

Introduction: What is AI? Foundations and History of AI Intelligent Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4

Module-2

Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4

Module-3

Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

Text book 1: Chapter 3-3.5,3.6 Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5

Module-4
Introduction: Machine learning Landscape: what is ML?, Why, Types of ML, main challenges of ML Concept learning and Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm – Remarks on VS- Inductive bias. Text book 3: Chapter 1, Textbook 4:Chapter 1 and 2
Module-5
End-to-end Machine learning Project: Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model. Classification: MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi-label classification, multi-output classification Textbook 4: Chapter 2, Chapter 3
Course outcome (Course Skill Set) At the end of the course, the student will be able to: CO1. Apply knowledge of agent architecture, searching, and reasoning techniques for different Applications. CO 2. Compare various Searching and Inferencing Techniques. CO 3. Develop knowledge base sentences using propositional logic and first-order logic CO 4. Understand the concept of Machine Learning and Concept Learning. CO 5. Apply the concept of ML and various classification methods in a project

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Book:

1. Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015
2. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd Edition,Tata McGraw Hill,2013.
3. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
4. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &Tensor Flow , O'Reilly, Shroff Publishers and Distributors Pvt. Ltd 2019.

Reference Books:

1. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014.

4. Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
5. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
6. Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley, 2019
7. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

Web links and Video Lectures (e-Resources):

- NPTEL Video lectures: https://nptel.ac.in/courses/106105077
- NPTEL Video lectures: https://nptel.ac.in/courses/106102220
- https://archive.nptel.ac.in/courses/106/105/106105152
- https://archive.nptel.ac.in/courses/106/106/106106202
- https://nptel.ac.in/domains/discipline/106?course=106_0

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Group Discussion/Quiz
- Mini projects.