Uka Tarsadia University

B.Tech.

Semester VI

MACHINE INTELLIGENCE

XXXXXX

EFFECTIVE FROM July-2021

Syllabus version: 1.00

Subject Code	Subject Title	Teaching Scheme			
		Hours		Credits	
		Theory	Practical	Theory	Practical
XXXXXX	Machine Intelligence	3	2	3	1

Subject Code	Subject Title	Theory Examination Marks		Practical Examination Marks	Total Marks
		Internal	External	CIE	
XXXXXX	Machine Intelligence	40	60	50	150

Objectives of the course:

- To provide breadth and depth for understanding and designing artificially intelligent system.
- To provide fundamentals of statistical learning methods along with their different approaches.
- To provide foundation of neural network as a novel approach to address various classification and regression problems.

Course Outcomes:

Upon completion of the course, the student will be able to:

CO1: Get the basic idea about concepts of artificial intelligence.

CO2: Get the basics of problem solving with AI agent and understanding the role of knowledge and its representation.

CO3: Get the in depth understanding of statistical learning techniques for classification, regression and clustering.

CO4: Understand the need of classification in solving real world problem and get the understanding of decision tree classifiers.

CO5: Gain the knowledge about design of different neural network models to address machine learning problems.

CO6: Understand the approach of reinforcement learning along with its application in real world.

Sr. No.	Topics	Hours
	Unit – I	
1	**Fundamentals of AI:** Foundation of AI, History of AI and The state of the art, Intelligent agents – Agents and environments, The concept of rationality, Nature of environment, Structure of agents.	6
	Unit – II	
2	**Problem Solving:** Problem solving agents, Searching for solutions, Uninformed and informed search techniques, Heuristic functions, Local search algorithms and optimization, Local search in continuous spaces.	13

	Representation of Knowledge: Knowledge based agents, The wumpus world problem, Logic, Propositional logic, Propositional theorem proving, Agents based on propositional logic, Syntax and semantics of first order logic, Knowledge engineering in first order logic, Inference in first order logic.	
Unit – III		
3	**Fundamentals of Learning:** Linear separability, Learning associations, Decision theory, Classification, Regression, Types of learning algorithms, Over-fitting and under-fitting, Feature subset selection, Principle component analysis, Mixture densities, Maximum likelihood estimation, Evaluating estimator with bias and variance, The Bayes' estimator, Model selection procedures.	11
Unit – IV		
4	**Types of Classifiers, Decision Tree Classifiers:** Univariate trees, Pruning, Rule extraction from trees, Learning rules from data – Rule induction, Sequential covering, Ripper and Foil, Support vector machines, Bayesian decision theory, Classification using discriminant functions – Two class problem and Multiclass problem.	14
	Clustering: K-means clustering, Expectation-maximization algorithm, Mixtures of latent variable models, Supervised learning after clustering, Spectral and hierarchical clustering.	
Unit – V		
5	**Fundamentals of Neural Networks:** Functioning of biological neurons, Structure of artificial neuron, Activation functions, Neural network topologies, Multilayer perceptron for linear classification, Feed forward neural network, Back propagation neural network, Convolutional Neural Networks, Recurrent Architectures – Recurrent neural network, Long short term memory (LSTM).	10
Unit – VI		
6	**Reinforcement Larning:** Single state case – K – Armed bandit, Elements of reinforcement learning, Model based learning, Temporal difference learning, Generalization, Partially observable states.	6

Sr.No.	Machine Intelligence (Practical)	Hours
1	To study various machine learning libraries like - Scipy, Sklearn, Keras, Tensorflow with their usage.	2
2	Write a python program to solve the following problems:	2

	a) Find the probability of drawing two kings from a deck. b) A math teacher gave her class two tests, 25 % of the class passed both tests and 42 % of the class passed the first test. Find the probability, number of students passed the second test.	
3	Write a python program to perform Linear classification using AND and OR logic.	2
4	Write a python program to perform multiclass classification on iris dataset.	2
5	Write a program to predict total payment for given number of claims on Swedish auto insurance dataset using linear regression.	2
6	Write a python program to classify various types of from iris dataset using Support Vector Machine (SVM).	2
7	Write a program to perform dimensionality reduction on German loan dataset using Principal Component Analysis (PCA).	4
8	Write a program to implement K-means clustering on iris dataset.	2
9	Write a program to apply decision tree classifier on pima Indian diabetes dataset	4
10	Design and implement a neural network with Pima Indian diabetes dataset.	4
11	Implement multiclass classification with neural network on Iris flower species.	4

Text books:

1. Staurt Rushell and Peter Norving - “Artificial Intelligence- A Modern Approach”, Third Edition, Pearson.
2. Ethem Alpaydin - “Introduction to Machine Learning“, The MIT Press.

Reference books:

1. Christopher Bishop - “Pattern Recognition and Machine Learning”, Springer-Verlag New York.
2. Tom M. Mitchell – “Machine Learning”, McGraw Hill Education.
3. Simon Rogers, Mark Girolami, “A First Course in Machine Learning – Second Edition”, CRC Press.
4. Ian Goodfellow and Yoshua Bengio and Aaron Courville - “Deep Learning”, MIT Press.
5. Deepak Khemani - “A First Course in Artificial Intelligence”, McGraw Hill Education.
6. Nikhil Buduma - “Fundamentals of Deep Learning”, O’Reilly.
7. Luis Torgo – “Data Mining with R – Second Edition”, CRC Press.

Course objectives and Course outcomes mapping:

- To provide breadth and depth for understanding and designing artificially intelligent system: CO1, CO2, CO5
- To provide fundamentals of statistical learning methods along with their different approaches: CO3, CO4
- To provide foundation of neural network as a novel approach to address various classification and regression problems: CO5, CO6

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Fundamentals of Computer and Logical Thinking	✓					
2	Basics of C & Operators and Expressions		✓				
3	Decision Making and Branching &Decision Making with Looping			✓			
4	Array and String				✓		
5	Functions					✓	
6	Structure and Union & Pointers						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behaviour, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to 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/receive clear instructions.

PO 11: Project management and finance: An ability to 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: A recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1		✓	✓	✓		
PO2		✓	✓		✓	
PO3	✓		✓		✓	✓
PO4		✓		✓		✓
PO5			✓	✓		
PO6		✓				✓
PO7		✓				
PO8						
PO9					✓	
PO10	✓					
PO11		✓				
PO12	✓	✓			✓	✓