SCHEME –I
SEMESTER 8

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
COM-801(A)	Advanced Machine learning	PEC	3	3	0	0	50	100	150

Course Outcomes:

At the end of the course the students will be able to:	
CO1	Apply probabilistic learning techniques for optimizing AI models
CO2	Articulate the application of decision trees for solving classification and regression problems.
CO3	Develop understanding of optimization techniques for ANNs.
CO4	Apply Deep Learning Architectures for a specific class of applications.
CO5	Appreciate reinforcement learning technique and its applications to specific use-cases.

Detailed Syllabus

Section-A

Unit 1: Probabilistic Model: Probability theory: sample space, probability function, conditional probability, Bayesian Learning Probability theory and Bayes rule, Naive Bayes learning algorithm, Bayes nets. **(9 Hrs.)**

Unit 2: Representation of Decision Tree: Decision Trees concepts, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting and underfitting, Noisy data, and Data pruning. Random Forest approach. **(10 Hrs.)**

Unit 3: Artificial Neural Network (ANN): Introduction to ANN, Perceptron, Cost Function, Gradient Checking, Multi-Layer Perceptron and Backpropagation Algorithm, Neural Network, Random Initialization. **(10 Hrs.)**

Section B

Unit 4: Introduction to Deep Learning Architectures: Overview of deep learning architectures and their advantage, Understanding the depth, width, and capacity of neural networks. Concept of autoencoders for unsupervised learning and dimensionality reduction. **(10 Hrs.)**

Unit 5: Reinforcement Learning: Introduction to Reinforcement Learning (RL), Markov Decision Process (MDP) formulation, Components of RL: Agent, Environment, State, Action, Reward, Policy, Value function, Function approximation. **(9 Hrs.)**

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Machine Learning	Tom Mitchell	McGraw Hill	1st (1997)
2	Machine Learning: a Probabilistic Perspective	Kevin P. Murphy	The MIT Press	1st (2012)

Reference Book

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Machine Learning	Jeeva Jose	Khanna Book Publishing	1st (2020)
2	Introduction to Machine Learning,	Ethem Apaydin,	The MIT Press	2nd (2010)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
COM-801(B)	Generative Artificial Intelligence (AI)	PEC	3	3	0	0	50	100	150

Course Outcomes:

At the end of the course the student will be able to: -	
CO1	Explain the foundational concepts of Generative Artificial Intelligence.
CO2	Analyze various AI based generative models and their applications.
CO3	Describe GANs and their applicability to various unsupervised learning problems.
CO4	Evaluate RNNs and LSTM models for sequential processing in Natural Language Processing.
CO5	Explore use of pre-trained language models including metrics for evaluating generative models.

Detailed Syllabus

Section-A

Unit 1: Introduction: Overview of Generative AI (GenAI) and its applications in various domains, Understanding the difference between generative and discriminative models, Taxonomy of generative models, GenAI modalities mappings. **(10 Hrs.)**

Unit 2: Generative Models: Fundamentals and Techniques, Introduction to basic generative models (Gaussian Mixture Models (GMMs) and Hidden Markov Models (HMMs)), Latent Variable Models, Statistical Language Models (SLM), Role of encoder and decoder networks. **(10 Hrs.)**

Unit 3: Generative Adversarial Networks (GANs): Introduction to GANs and the GAN framework, Generator-discriminator adversarial training process, Variants of GANs: Conditional GANs, Wasserstein GANs. Autoregressive Models (PixelCNN and PixelRNN architectures for image generation). **(10 Hrs.)**

Section-B

Unit 4: Sequence Generation and Transformers: Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) cells, Introduction to Transformers: Motivation for Transformers and their advantages over RNNs, Transformer architecture: self-attention and feed-forward layers, multi-head attention mechanism. (**10 Hrs.)**

Unit 5: Language Generation with Transformers: Using pre-trained language models like GPT (Generative Pre-trained Transformer), Conditional language generation, Metrics and techniques for evaluating generative models. **(10 Hrs.)**

Textbooks

S.No	Name of the Suggested Books	Name of Author	Publisher Name	Edition (Pub. Yr.)
1	Generative AI with python	Joseph Babcock, Raghav Bali	Packt	1st (2021)
2	ChatGPT for Thought Leaders and Content Creators: Unlocking the	Dr. Gleb Tsipursky	Intentional Insights	1st (2023)

	Potential of Generative AI for Innovative and Effective.			

Reference Books

S.No.	Name of the Book	Name of Author	Publisher Name	Edition (Pub. Yr.)
1	Exploring Deepfakes	Bryan Lyon (Author), Matt Tora	Packt Publishing	1st (2023)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
COM-801(C)	Knowledge Representation and Reasoning	PEC	3	3	0	0	50	100	150

Course Outcomes

At the end of the course the students will be able to	
CO1	Describe the modern view of Artificial Intelligence (AI).
CO2	Comprehend the knowledge representation techniques in AI.
CO3	Apply the knowledge representations in real-world problem-solving.
CO4	Analyze the control knowledge to make informed decisions.
CO5	Develop AI-driven chatbots and virtual assistants.

Detailed Syllabus

Section-A

UNIT 1: Introduction: - The AI problems, AI techniques, The level of the model, Criteria for success, AI tasks. Problems, Problem Spaces & Research, Defining problem as a state space search, Production system, Problem characteristics, Production system characteristics, Issues in the design of search programs. **(9 Hrs.)**

UNIT 2: Knowledge Representation: - Representation and mappings, approaches to knowledge representation, Issues of knowledge representation, the frame problem, Semantic networks. **(9 Hrs.)**

UNIT 3: Representing Knowledge using Rules: -Procedural Vs. declarative knowledge, Logic programming, Forward Vs. backward searching, Matching, Control knowledge, Heuristic search techniques: - Generate & test, Hill climbing, Best First Search, Problem reduction, Constraint satisfaction, Means and analysis. **(11 Hrs.)**

Section B

UNIT 4: Logic: - Representing simple facts, Its Logic representing instances and its relationship, Computable Functions & Predicates, Resolution, Natural Deduction, Conversion to Clause Form. **(11 Hrs.)**

UNIT 5: Reasoning: - Introduction to non-monotonic reasoning, Logics for non- monotonic reasoning, Implementation Issues, Augmenting a Problem Solver, Implementation by a) Depth - First Search b) Breadth - First Search. Statistical Reasoning, Dempster Shafer Theory, Fuzzy logic, Introduction to expert system development. **(10 Hrs.)**

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivshankar B Nair	McGraw Hill Education	3rd (2017)
2	Artificial Intelligence: A modern approach	Stuart Russel	Pearson Education	3rd (2010)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Knowledge Representation and Reasoning	Ronald Brachman & Morgan Kaufmann	McGraw Hill Education	1st (2004)
2	Artificial Intelligence	Padhy	Oxford Press	1st (2005)