

FOR EXAMINATIONS TO BE HELD IN THE MAY 2021, 2022, 2023

Class: M.Tech 2nd Semester

Branch: CSE

Course Title: Artificial Intelligence and Machine Learning

Course No.: MCSE201

Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
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Course Overview: This course will survey the aspects of intelligence exhibited in biological systems and algorithmic approaches to mimic it. Material will include theoretical and applicative treatment of inductive learning, reinforcement learning, artificial neural networks and knowledge representation.

Course Outcomes: By the end of the course students shall be able to:

CO201.1	Design and implement intelligent solutions to classification, regression and clustering problems
CO201.2	Design and implement various Deep learning algorithms in a range of Real world applications.
CO201.3	Understand various Knowledge representation techniques.

Detailed Syllabus

UNIT 1: Introduction to Artificial Intelligence and Machine Learning: Basic questions of AI, history of AI, State of the art, Symbolic AI: Decision trees, symbolic computation (medical diagnosis), Generalization Theory, Statistical learning, sample complexity, proof of learnability of finite hypothesis class. **(08 hrs)**

UNIT 2: Optimization: Sample complexity of python programs, optimization SVMs / linear classification, The perceptron, margin, proof of convergence, mathematical optimization, convexity, introduction to convex analysis, constrained optimization, Gradient Descent, proof of convergence example: learning SVM with SGD, Stochastic optimization: Stochastic estimation of the gradient, stochastic gradient descent. **(08 hrs)**

UNIT 3: Introduction to Deep Learning: Deep nets, Non-convex optimization, Training via backpropagation algorithm, Neural nets for image recognition, Convolutional architectures, Deep nets, Regularization strategies. **(06 hrs)**

UNIT 4: Knowledge representation: Bayesian Networks: Definition of probabilistic Bayesian nets, Modelling via Bayes nets, Inferences, Markov Chain Monte Carlo: The sampling problem, simple sampling methods, Markov chains, stationarity, ergodicity, The MCMC algorithm, Hidden Markov Models: Temporal models, application to text tagging, Viterbi decoding algorithms. **(06 hrs)**

UNIT 5: Reinforcement learning: Game playing, Search, A* heuristic, Reinforcement learning, Markov Decision Process, Markov chains, Markov Reward processes, Ergodic theory reminder, Dynamic programming, The Bellman equation, value iteration, Policy iteration, Q-learning, function approximation, TD learning, policy gradient. **(08 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 2015
- Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press, 2014
- Artificial Intelligence: Strategies and techniques for complex problems solving by George Luger, Addison-Wesley, 2003.
- Artificial Intelligence - A Modern Approach by Stuart Russell & Peter Norvig, Prentice Hall.