

MS (AI) 1st Semester Code

Code	C.Hrs	Title of Subject
AI-717	3(3+1)	Advanced Artificial Intelligence (Th + Pr)
AI-719	3(2+1)	Advanced Machine Learning (Th + Pr)
AI-721	3	Knowledge Representation and Reasosning
AI-723	3	Multi-Agent Systems
AI-725	3	Computer Vision

MS (AI) 2nd Semester Code

Code	C.Hrs	Title of Subject
AI-718	3(2+1)	Artificial Intelligence in Cyber Security (Th + Pr)
AI-720	3	Mathematical Foundations of AI
AI-722	3	Deep Learning
AI-724	3(2+1)	Intelligent Systems Design (Th + Pr)

Course Contents of MS (AI)

AI-717 Advanced Artificial Intelligence

Cr. Hrs. 3(2+1)

Pre- requisites : Introduction to Artificial Intelligence

Theory

Intelligent Agents, Adversarial Search, Constraint Satisfaction Problem, Logical Agent, First-Order Logic, Inference in First Order Logic, Quantifying Uncertainty, Probabilistic Reasoning, Probabilistic Reasoning over Time, Utility Theory, Making Complex Decisions, Game Theory, Learning from Examples, Artificial Neural Networks, Support Vector machines, Decision Trees, Learning Probabilistic Models, Learning with Hidden Variables, Deep Learning, Natural Language Processing, Computer Vision, Robotics, Case Studies.

Practical

Recommended book(s)

Text book:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson, 2016.
2. Daphne Koller and Nir Friedman, "Probabilistic Graphical Models", MIT Press, 2009.

AI- 719 Advanced Machine Learning

Cr. Hrs. 3(2+1)

Pre- requisites : Introduction to Artificial Intelligence

Theory

The Learning Problem, Components of Learning, Types of Learning, Learning Feasibility, Linear Mod Linear Classification and Regression, Logistic Regression, Non-Linear Transformation; Error and Nois Error Measures and Noisy Targets, Training vs. Testing, Theory of Generalization, The Vapnik-Chervonenkis (VC) Dimension, Definition, VC Dimension of Perceptrons, Interpreting VC Dimension Generalization Bounds; Bias-Variance Tradeoff, Neural Networks: Stochastic Gradient Descent, Backpropagation Algorithm, Overfitting, Regularization, Validation, Model Selection and Cross Validation.

Practical

Recommended book(s) for the approved course

Text book:

1. Miroslav Kubat, “An Introduction to Machine Learning”, 2nd edition, Springer, 2018
2. Yaser S. Abu-Mostafa, Malik Magdon-Ismail, Hsuan-Tien Lin, “Learning from Data”, AML Book, 1
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT

AI- 721 Knowledge Representation and Reasoning

Cr. Hrs. 3(3+0)

Pre- requisites : familiarity with basic notions in data structures and with techniques in algorithm design and analysis, computational logic .

Theory

Introduction, Principles of knowledge based representation and Reasoning, Production System of KR & R., Representing knowledge using logic, Reasoning Algorithm and implementation, propositional logic as a simple knowledge representation, Representing Knowledge in first order predicate logic, Descriptive logic as Knowledge Representation language, Reasoning in Descriptive Layer, Light weight descriptive logic, Frames of KR& R, Kripke model, Approaches to handle uncertain or incomplete knowledge, Understanding Principles of reasoning with respect to explanation and planning, Classes w/ nonMonotonic logic, Stable model semantics.

Recommended Book(s)

Knowledge Representation and Reasoning by Ron Brachman and Hector Levesque
Morgan Kaufmann

AI-723 Multi-Agent Systems

Cr. Hrs. 3(3+0)

Pre- requisites : Introduction to Artificial Intelligence

Theory

Introduction and foundation of Multi agent System, Intelligent agents & Multi agents system, Multi agent learning, Mechanism Design of Multi agent system, Multiagent Resources allocation, Autonomy in natural and artificial systems,- Agent-oriented middleware for (intelligent) distributed Systems,(ACL & Protocols; FIPA; JADE), - Models for intelligent agents and MAS(Game Theory; Intentional agents, BDI; A&A, Technologies for intelligent agents and MAS), Agreement technologies: (Semantics; Norms; Organisations & Institutions; Argumentation & Negotiation; Trust & Reputation ,Coordination Models & Technologies, Agent-oriented Software Engineering, (GAIA & SODA), Simul Alchemist,Self-organisation, Swarm intelligence and MAS , Logics for MAS, Information gathering, Models of Intelligent agents.

Recommended Books:

1. Wooldridge, M.J.: An Introduction to Multiagent Systems.
2. Multi agent system by vicent botti, Andrea omicini in 2019.

AI- 725 Computer Vision

Cr. Hrs. 3(3+0)

Pre- requisites : Introduction to Artificial Intelligence

Theory

Fundamentals of Computer Vision, Geometrical and Optical Image Formation, Vision Systems Design, Basics of Image Processing, Filtering, Edge Detection, Features Detection, Contours, Segmentation, Morphological Operators, Motion Detection, Optical Flow, Object Tracking, Motion Capture, Recognition, Large-Scale Instance Recognition and Retrieval, Category Recognition and Advanced Feature Encoding, Applications (Optical Character Recognition, Facial Recognition, Quality Control, Visual Feedback, Mapping and Robot Guidance, Activity Monitoring, Motion Estimation, Autonomous Systems).

Recommended book(s)

1. E.R. Davies, "Computer Vision", 5th edition, Academic Press, 2017.
2. Synder & Qi, "Fundamentals of Computer Vision", Cambridge University Press, 2017.
3. Gustavo Olague, "Evolutionary Computer Vision", Springer, 2016.

AI-718 Artificial Intelligence in Cyber Security
Pre- requisites :

Cr. Hrs. 3(2+1)

Theory

Practical

Recommended book(s)

Text book:

AI- 720 Mathematical Foundation of Artificial Intelligence Cr. Hrs. 3(3)
Pre- requisites : Introduction to Artificial Intelligence

Theory

Applied Linear Algebra for Artificial Intelligence, Linearly dependency, Matrices, Eigen Values & Eigen Vectors, Computational Geometry, Hyperplane, Convolution in Image Processing, Multi-variate Calculus, Functions, Scalar Derivatives, Gradient, Gradient Algorithms, Probabilistic and Bayesian Reasoning, Bayes Rule, Random Variables, Dimensionality Reduction, Principle Components Analysis & Singular Value Decomposition, Maximum A-Posteriori (MAP) & Maximum Likelihood Estimation (MLE) and Distributions, Empirical Risk Minimization, Parameter Estimation, Density Estimation, Linear Regression and Classification Methods, Optimization Theory.

Recommended book(s)

Text book:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, “Mathematics for Machine Learning” University Press, 2019
2. Edward A. Bender, “Mathematical Methods in Artificial Intelligence”, 1st edition, Wiley, 1996

Pre- requisites : Introduction to Artificial Intelligence**Theory**

Deep Learning (DL), success of DL models, Gradient descent, logistic regression, cost functions, hypotheses and tasks, training data, maximum likelihood based cost, cross entropy, Mean Square Error (MSE) cost, feed-forward networks, Multi-layer Perceptron (MLP), sigmoid units, neuroscience inspiration, Graphics Processing Unit (GPU) training, regularization, Rectified Linear Convolutional neural networks (CNNs), probabilistic methods, Recurrent neural networks (RNNs), attention memory networks, auto encoders, deep generative models, Generative adversarial networks (GANs), Boltzmann Learning.

Recommended book(s)**Text book:**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, Massachusetts Institute of Technology, 2016
3. Andrew W. Trask, “Grokking Deep Learning”, Manning Publishing Co., 2019

Pre- requisites : Introduction to Artificial Intelligence

Theory

Intelligent Systems, Types of Intelligent Systems and Design Methodology, Intelligent Agents, Rule-based Expert Systems, Neural Networks and Deep Learning, Genetic Algorithms, Fuzzy Logic, Emerging Artificial Intelligence Technologies and Computing Hardware, GPGPUs and Hardware Accelerators, Soft Computing, Web Technologies, Cloud Computing and Fog Computing in Intelligent Systems, Role of IoT in Intelligent Systems Design. Chat Bots, Intelligent Human Machine Interface, Ethics, Case Studies (Autonomous Cars, Robots, Humanoids, Smart Agriculture).

Practical

Recommended Books:

Intelligent Systems by Edited By Bogdan M. Wilamowski, J. David Irwin