



MANIPAL

ACADEMY *of* HIGHER EDUCATION

(Deemed to be University under Section 3 of the UGC Act, 1956)

Master of Engineering

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ME (Artificial Intelligence & Machine Learning)

Syllabus

July 2022 Onwards

**MANIPAL SCHOOL OF INFORMATION SCIENCES
MANIPAL ACADEMY OF HIGHER EDUCATION
MANIPAL - 576104, KARNATAKA, INDIA.**



Program Structure

Semester 1: Course Name	Semester 2: Course name
Algorithms and Data Structures for Big Data	Advanced Applications of Probability & Statistics
Applied Linear Algebra	Deep Learning
Applied Machine Learning	Machine Learning Principles & Applications
Applied Probability and Statistics	Reinforcement Learning
Elective - I	Elective - II
Mini Project - I	Mini Project - II
Professional Skill Development - I	Professional Skill Development - II
Semester III & IV	Project Work
Elective-1	Elective-2
Applications of Graph Theory	Applied Mathematics for Machine Learning
Architecture of Big Data Systems	Convolutional Neural Networks for Computer Vision
Principles of Data Visualization	Natural Language Processing Principles & Applications
	Entrepreneurship



SEMESTER I

BDA 5101: Algorithms and Data Structures for Big Data

Algorithm specification and analysis techniques; Elementary data structures; Sorting & Searching, Hash Tables, Graph; String and text processing techniques, Data stream algorithms.

AML 5101: Applied Linear Algebra

Vectors concept -Application example. Matrices - concept & examples - Systems of linear equations - Solving linear equations. Linear Least Squares - Solving linear least squares problems - Least squares classification.

AML 5102: Applied Machine Learning

Introduction to Machine Learning; Introduction to Supervised Learning; Decision Trees; Linear Models; Feature Selection; Introduction to Unsupervised Learning; Probabilistic Models for Supervised Learning; Support Vector Machine; Ensemble Methods.

AML 5103: Applied Probability and Statistics

Counting; Probability Concepts; Sampling - Distribution problems - Decomposition and the law of total probability. Random Variables - Modelling using discrete random variables - Probability mass function and cumulative distribution function - Expectation and variance - Modelling using continuous random variables - Expectation and variance. Sampling and Parameter Estimation - Population and sample - Statistic & sampling distribution - Sample mean and variance - Hypothesis testing.

MPT 5100: Mini Project - I

Problem identification, literature survey, formation of detailed specifications; Design and implementation of the proposed system architecture; Demonstrate an ability to present and defend project work carried out to a panel of experts.

PSD 5100: Professional Skill Development - I

Topic selection for the presentation; Report writing; slide preparation; presentation to audience.



ELECTIVES SEMESTER I

AML 5131: Applications of Graph Theory

Graphs; Euler Tours and Hamilton Cycles; Flow in Networks; Matchings; Colouring Problems; Random walks and Applications; Spectral Clustering and Applications.

BDA 5102: Architecture of Big Data Systems

Classifying Big Data Characteristics and Big Data processing - the Lambda architecture; Batch layer, Serving layer and Speed layer; Spark: Alternatives to MapReduce; Stream Processing and Machine Learning using Spark.

BDA 5132: Principles of Data Visualization

Introduction to Web scraping - Case study; Data Analysis - Data Wrangling - Data Visualization - Visualization techniques - Data visualization for web.

SEMESTER II

AML 5201: Advanced Applications of Probability and Statistics

Multivariate Distributions; Linear and Logistic Regression; Principal Component Analysis; Cluster Analysis; Time Series Analysis.

AML 5202: Deep Learning

Introduction to Deep Learning; Matrix Calculus; Logistic Regression; Shallow Neural Network; Deep Neural Network; Improving the Way neural Networks Learn; Hyperparameter Tuning; Recurrent Neural Networks.

AML 5203: Machine Learning Principles & Applications

Kernel Methods; Linear Regression; Generative Learning Algorithms; Regularization, Model Selection, & Evaluation; Imbalanced Data; Expectation Maximization; Dimension Reduction; Independent Component Analysis.

AML 5204: Reinforcement Learning

Introduction to the Reinforcement Learning Problem; Reinforcement Learning Framework; Dynamic Programming; Model Free Reinforcement Learning; Approximate Solution Methods; Policy Based Methods.



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(A constituent unit of MAHE, Manipal)

MPT 5200: Mini Project - II

Problem identification, literature survey, formation of detailed specifications; Design and implementation of the proposed system architecture; Demonstrate an ability to present and defend project work carried out to a panel of experts.

PSD 5200: Professional Skill Development - II

Topic selection for the presentation; Report writing; slide preparation; presentation to audience.

ELECTIVES SEMESTER II

AML 5231: Applied Mathematics for Machine Learning

Matrix Decompositions and Applications - Nonnegative matrix factorization - Computing Derivatives - Continuous Optimization - Constrained optimization and Lagrange multipliers - Convex optimization - Sub gradients - Stochastic gradient descent - Momentum methods.

AML 5232: Convolutional Neural Networks for Computer Vision

Introduction to Computer Vision; Features; Neural Networks Basics; Convolutional Neural Networks (CNN); CNN Learning; Visualizing and Understanding CNNs; CNN Architectures; Applications of CNNs in Computer Vision.

AML 5233: Natural Language Processing Principles & Applications

Introduction to Natural Language Processing (NLP); Regular Expressions; N-gram Language Models; Naive Bayes and Sentiment Classification; Vector Semantics and Embeddings; NLP with Deep Learning; Applications of Natural Language Processing.

ENP 5230: Entrepreneurship

Introduction to Entrepreneurship; Entrepreneurial Traits; Process of Entrepreneurship; Business Start-up Process; Business Plan writing; Case studies.

SEMESTERS III & IV

AML 6098: Project Work

Problem identification, literature survey, formation of detailed requirement specification document; Design and implementation of the proposed modules with specific test cases; Detailed report of the work carried out, present, and defend the project work carried out to a panel of experts.