**NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR**
**(AN AUTONOMOUS INSTITUTE)**

**Affiliated to**

**DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW**

# Evaluation Scheme & Syllabus

For

## Minor Degree / Specialization

## in

## Artificial Intelligence & Machine Learning

## School of Computer Science in Emerging Technologies

**(Effective from the Session: 2024-25)**

**NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR**
**(AN AUTONOMOUS INSTITUTE)**

## Minor Degree / Specialization
# Artificial Intelligence & Machine Learning

## EVALUATION SCHEME

| Sl. No. | Subject Codes | Subject Name | Periods | | | Evaluation Scheme | | | | End Semester | | Total | Credit | Sem |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | AA | QZ | TOTAL | PS | TE | PE | | | |
| **1** | AMSML0301 | Introduction to AI & Machine Learning | 3 | 0 | 0 | 25 | 25 | 50 | | 100 | | 150 | 3 | III |
| **2** | AMSML0401 | Introduction to Data Analytics | 3 | 0 | 0 | 25 | 25 | 50 | | 100 | | 150 | 3 | IV |
| **3** | AMSML0501 | Deep Learning and Neural Network | 3 | 0 | 0 | 25 | 25 | 50 | | 100 | | 150 | 3 | V |
| **4** | AMSML0601 | Specific topics in Artificial Intelligence | 3 | 0 | 0 | 25 | 25 | 50 | | 100 | | 150 | 3 | VI |
| **5** | AMSML0701 | Applications of AI | 3 | 0 | 0 | 25 | 25 | 50 | | 100 | | 150 | 3 | VII |
| **6** | AMSML0351 | Introduction to AI & Machine Learning Lab | 0 | 0 | 2 | | | | 25 | | 25 | 50 | 1 | III |
| **7** | AMSML0451 | Introduction to Data Analytics Lab | 0 | 0 | 2 | | | | 25 | | 25 | 50 | 1 | IV |
| **8** | AMSML0551 | Deep Learning and Neural Network Lab | 0 | 0 | 2 | | | | 25 | | 25 | 50 | 1 | V |
| **9** | AMSML0751 | Capstone Project | 0 | 0 | 2 | | | | 50 | | 50 | 100 | 2 | VII |
| | | GRAND TOTAL | | | | | | | | | | 1000 | 20 | |

**Abbreviation Used:-**

L: Lecture, T: Tutorial, P: Practical, AA: Assignment Assessment, QZ: Quiz, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

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# Branch wise Minor Degree / Specialization Details

| S.no. | Name of Minor Degree/Specialization | Streams/Branches of B.Tech. Programs whose students are eligible to opt for the Minor Degree | Streams/Branches of B.Tech. Programs whose students are eligible to opt for the Specialization |
|---|---|---|---|
| 1 | Artificial Intelligence and Machine Learning | All Branches except CSE and EC related Branches | CSE and EC related Branches |
| 2 | Data Science | All Branches except CSE and EC related Branches | CSE and EC related Branches |
| 3 | E-mobility | All Branches except ME related Branches | Only ME Branch |
| 4 | VLSI Design | All Branches except EC related Branches | Only EC Branch |

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# Guidelines for assessment of Minor Degree / Specialization Program

## For Theory Paper

| Internal (50) | | External (100) |
|---|---|---|
| AA (25) | QZ(25) | |
| 5 Assignments of 5 marks each | 5 Quiz papers of 5 marks each | Theory Examination will be Conduct at the end of Semester |

## For Practical Paper

| Internal (25) | External (25) |
|---|---|
| On the basis of continuous Assessment | Practical Examination will be Conduct at the end of Semester |

| Course code | AMSML0301 | L T P | Credit |
|---|---|---|---|
| Course title | INTRODUCTION TO AI & MACHINE LEARNING | 3 0 0 | 3 |

**Course objective:** To review and strengthen important mathematical concepts required for AI & ML. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

**Pre-requisites:** Basics of a programming language, Statistics, Mathematics, Analytical Skills

## Course Contents / Syllabus

| UNIT-I | Introduction to AI | 12 Hours |
|---|---|---|

Defining Artificial Intelligence, Defining Al techniques, Using Predicate Logic, and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions, and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

| UNIT-II | Idea of Machine Learning | 8 Hours |
|---|---|---|

Idea of Machines learning from data, Classification of problem -Regression and Classification, Supervised and Unsupervised learning.

| UNIT-III | Linear Regression | 10 Hours |
|---|---|---|

Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.

| UNIT-IV | Logistic Regression | 7 Hours |
|---|---|---|

Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.

| UNIT-V | Clustering Algorithms | 5 Hours |
|---|---|---|

Discussion on clustering algorithms and use-cases centered around clustering and classification.

**Course outcome:** After completion of this course students will be able to

| | | |
|---|---|---|
| CO 1 | Design and implement machine learning solutions to classification, regression, and clustering problems. | K1 |
| CO 2 | Evaluate and interpret the results of the different ML techniques. | K4 |
| CO 3 | Design and implement various machine learning algorithms in a range of Real-worldapplications. | K3 |
| CO 4 | Apply different machine learning algorithms. | K4 |
| CO 5 | Analyze data models to study patterns | K2 |

**Textbooks:**

1) Tom Mitchell, Machine Learning, McGraw Hill, 2017.

2) Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
3) T. Has tie, Tibsherany, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

**Reference Books:**

1) Saroj Kaushik, Arti ficial Intelligence, Cengage Learning, 1st Edition 2011.
2) Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and SoftComputing for beginners, Shroff Publisher-X team Publisher.
3) Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet PublishingLimited, 2017.

| Course Code | AMSML0401 | L T P | Credit |
|---|---|---|---|
| Course Title | INTRODUCTION TO DATA ANALYTICS | 3 0 0 | 3 |

**Course objective:** Provide you with the knowledge and expertise to become a proficient data scientist. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science; Produce Python code to statistically analyze a dataset; Critically evaluate data visualizations based on their design and use for communicating stories from data;

**Pre-requisites:** Basics of a programming language, Statistics, Mathematics, Analytical Skills.

## Course Contents / Syllabus

| UNIT-I | Introduction to Data Science | 7 HOURS |
|---|---|---|

Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.

| UNIT-II | Processes of Data Analytics | 7 HOURS |
|---|---|---|

Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion, and Predictions.

| UNIT-III | Feature Generation and Selection | 11 HOURS |
|---|---|---|

Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, the role of domain expertise, and place for imagination)- Feature Selection algorithms.

| UNIT-IV | Data Visualisation | 10 HOURS |
|---|---|---|

Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.

| UNIT-V | Application of Data Science | 7 HOURS |
|---|---|---|

Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.

**Course outcome:** After completion of this course students will be able to

| | | |
|---|---|---|
| CO1 | Explain how data is collected, managed and stored for data science. | K1 |
| CO2 | Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists. | K2 |
| CO3 | Apply various processes to extract features of data. | K3 |
| CO4 | Understand the key techniques and theory behind data visualization. | K2 |
| CO5 | Understand key applications of data science that are commonly linked to ethical issues. | K2 |

## Textbooks:


1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
2. Jake Vander Plas, Python Data Science Handbook , Shroff Publisher Publisher /O'Reilly Publisher

Media.
3. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.

## Reference books:

1. Jo e l Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Me dia
2. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher

| Course code | AMSML0501 | L T P | Credits |
|---|---|---|---|
| Course title | DEEP LEARNING AND NEURAL NETWORK | 3 0 0 | 3 |

**Course objective:** To strengthen important Mathematical concepts required for Deep learning and neural network. To get a detailed insight into advanced algorithms of ML.

**Pre-requisites:** Basics of a programming language, Statistics, Mathematics, Analytical Skills

## Course Contents / Syllabus

| | | |
|---|---|---|
| **UNIT-I** | **NEURAL NETWORK** | **8 Hours** |

Information flow in a neural network, understanding basic structure, and ANN.

| | | |
|---|---|---|
| **UNIT-II** | **TRAINING NEURAL NETWORK** | **8 Hours** |

Training a Neural network, how to determine hidden layers, recurrent neural network.

| | | |
|---|---|---|
| **UNIT-III** | **CONVOLUTIONAL NEURAL NETWORK** | **10 Hours** |

Convolutional neural networks, image classification, and CNN.

| | | |
|---|---|---|
| **UNIT-IV** | **RECURRENT NEURAL NETWORK** | **8 Hours** |

RNN and LSTMs. Applications of RNN in real world.

| | | |
|---|---|---|
| **UNIT-V** | **TENSORFLOW AND KERAS** | **9 HOURS** |

Creating and deploying networks using tensorflow and keras.

**Course outcome:** After completion of this course students will be able to

| | | |
|---|---|---|
| CO1 | Understand the basics of Neural Networks. | K4 |
| CO2 | Analyze ANN model and understand the ways of accuracy measurement. | K4 |
| CO3 | Develop a convolutional neural network for multi-class classification in images | K6 |
| CO4 | Apply RNNs to Time Series Forecasting, NLP, Text and Image Classification. | K3 |
| CO5 | Creating the networks using tensorflow and keras. | K6 |

**Textbooks:**

1. John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons

| Course code | AMSML0601 | L T P | Credits |
|---|---|---|---|
| Course title | SPECIFIC TOPICS IN ARTIFICIAL INTELLIGENCE | 3 0 0 | 3 |

**Course objective:** To give fundamental knowledge to the students so that they can understand what the Al is and study important topics related to the field.

**Pre-requisites:** Basics of a programming language, Statistics, Mathematics, Analytical Skills

## Course Contents / Syllabus

| UNIT-I | INTRODUCTION TO DEEP LEARNING | 8 Hours |
|---|---|---|

Bayesian Filtering; Recurrent Neural Networks, Deep Neural Networks, Deep Reinforcement Learning.

| UNIT-II | SPECIAL NETWORKS | 8 Hours |
|---|---|---|

Self- Play Networks, Generative Adversarial Networks, Learning from Concept-Drifting Data Streams.

| UNIT-III | SIGNAL PROCESSING | 8 Hours |
|---|---|---|

Audio Signal Processing Basics, mir toolbox contains many useful audios processing library functions, VOICEBOX: Speech Processing Toolbox for MATLAB, Audio processing in Matlab.

| UNIT-IV | KNOWLEDGE-BASED SYSTEMS | 8 Hours |
|---|---|---|

Architectures for second-generation knowledge-based systems, Distributed Al and its applications.

| UNIT-V | NEUROCOMPUTING | 8 HOURS |
|---|---|---|

An introduction to neurocomputing and its possible role in Al, The role of uncertainty measures and principles in Al.

**Course outcome:** After completion of this course students will be able to

| | | |
|---|---|---|
| CO1 | Design and implement Artificial Neural networks. | K1 |
| CO2 | Decide when to use which type of NN. | K2 |
| CO3 | Implement signal processing using MATLAB | K4 |
| CO4 | Understand Knowledge representation and Distributed AI along with its applications. | K2 |
| CO5 | Understand basic concepts of Neuro Computing. | K2 |

**Textbooks:**


1. Dr. Nilakshi Jain, Artificial Intelligence: Making a System Intelligent, John Wiley &Sons.
2. Artificial Intelligence &Soft Comp uting for Beginners, 3rd Edition-2018, by Anindita Das, Shroff Publisher Publisher.


**Reference Books:**


1. New Artificial Intelligence (Advanced), Takashi Mae da and Furnia Aoki, Ohmsha Publisher.

| Course code | AMSML0701 | L T P | Credits |
|---|---|---|---|
| Course title | APPLICATIONS OF AI | 3 0 0 | 3 |

**Course objective:**

To give deep knowledge of Al and how Al can be app lied in variousfields to make the life easy.

**Pre-requisites:** Basics of a programming language, Statistics, Mathematics, Analytical Skills

**Course Contents / Syllabus**

| UNIT-I | NATURAL LANGUAGE PROCESSING | 8 Hours |
|---|---|---|

Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.

| UNIT-II | APPLICATIONS TO REAL LIFE | 8 Hours |
|---|---|---|

Emotion Recognition using human face and body language, Al-based system to predict the diseases early, Smart Investment analysis, Al in Sales and Customer Support.

| UNIT-III | ROBOTICS PROCESSES | 8 Hours |
|---|---|---|

Robotic Processes Automation for supply chain management.

| UNIT-IV | AI MODELLING | 8 Hours |
|---|---|---|

AI-Optimized Hardware, Digital Twin i.e. Al Modelling, Information Technology & Security using Al.

| UNIT-V | BLOCKCHAIN IN AI | 8 Hours |
|---|---|---|

Recent Topics in Al/ ML: Al/ML in Smart solutions, Al/ML in Social Problems handling, Blockchain and Al.

**Course outcome:** After completion of this course students will be able to

| | | |
|---|---|---|
| CO1 | Design and implement AI | K1 |
| CO2 | Decide when to use which type of AI. | K2 |
| CO3 | Understand automation and robotics | K2 |
| CO4 | Implement AI Models and Understand Security Concepts in AI | K4 |
| CO5 | Understand the concepts of Blockchain Technology. | K2 |

**Textbooks:**

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
2. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, published Jul y 2018.

**Reference Books:**

1. Artificial Intelligence in Practice: How 50 Successful Companies Use d AI and Machine Learning to Solve ProblemsBernard Marr, Matt Ward , Wiley.

| Course code | AMSML0351 | L T P | Credit |
|---|---|---|---|
| Course title | INTRODUCTION TO AI & MACHINE LEARNING LAB | 0 0 2 | 1 |

**List of Experiments:**

| Sr. No. | Name of Experiment | CO |
|---|---|---|
| 1 | Implementation of logical rules in Python. | CO1 |
| 2 | Using any data apply the concept of:<br>• Linear regression<br>• Gradient decent<br>• Logistic regression | CO1 |
| 3 | To add the missing value in any data set. | CO2 |
| 4 | Perform and plot under fitting and overfitting in a data set. | CO2 |
| 5 | Implementation of clustering and classification algorithms. | CO3 |

| **Lab Course Outcome:** After completion of this course students will be able to | | **CO** |
|---|---|---|
| CO 1 | Understand various AI Techniques. | K2 |
| CO 2 | Understand the clustering models. | K1 |
| CO 3 | Implement classification models. | K3 |

| Course code | AMSML0451 | L T P | Credit |
|---|---|---|---|
| Course title | INTRODUCTION TO DATA ANALYTICS LAB | 0 0 2 | 1 |

**List of Experiments:**

| S.No. | Name of Experiment | CO |
|---|---|---|
| | **Class and Methods** | CO1 |
| 1 | Python program to demonstrate instantiating a class. | CO1 |
| 2 | Python program to demonstrate use of class method and static method | CO1 |
| 3 | Python program to implement constructors. | CO1 |
| 4 | Python program to show that the variables with a value assigned in the class declaration, are class variables and variables inside methods and constructors are instance variables. | CO1 |
| 5 | Python program to create Bank-account class with deposit, withdraw function | CO1 |
| | **Inheritance** | |
| 6 | Python program to demonstrate single inheritance | CO1 |
| 7 | Python program to demonstrate multilevel inheritance | CO1 |
| 8 | Python program to demonstrate multiple inheritance | CO1 |
| 9 | Python program to demonstrate hierarchical inheritance | CO1 |
| 10 | Python program to demonstrate hybrid inheritance | CO1 |
| | **Polymorphism** | |
| 11 | Python program to demonstrate in-built polymorphic function | CO1 |
| 12 | Python program to demonstrate user defined polymorphic functions | CO1 |
| 13 | Python program to demonstrate method overriding | CO1 |
| | **Functional Programming** | |
| 14 | Python program to demonstrate working of map | CO2 |
| 15 | Python program to demonstrate working of filter | CO2 |
| 16 | Python program to demonstrate working of reduce | CO2 |
| 17 | Python program to demonstrate immutable data types | CO2 |
| 18 | Python program to demonstrate Monkey Patching in Python | CO3 |
| 19 | Python program to demonstrate decorators with parameters in python | CO3 |
| 20 | Python program to demonstrate conditional decorators | CO3 |

**Course outcome:** At the end of course, the student will be able to

| | | |
|---|---|---|
| CO 1 | Write programs to create classes and instances in python and implement the concept of inheritance and polymorphism using python. | K3 |
| CO 2 | Write programs using functional programming in python. | K3 |
| CO 3 | Write programs to create GUI-based Python applications and to solve real-world problems. | K4 |

| Course code | AMSML0551 | L T P | Credit |
|---|---|---|---|
| Course title | DEEP LEARNING AND NEURAL NETWORK LAB | 0 0 2 | 1 |

**List of Experiments:**

| Sr. No. | Name of Experiment | CO |
|---|---|---|
| 1 | Introduction to Kaggle and h ow it can be used to enhance visibility. | CO1 |
| 2 | Build general features to build a mode l for text analytics. | CO1 |
| 3 | Build and deploy your own deep neural network on a website using tensor flow. | CO2 |

| **Lab Course Outcome:** After completion of this course students will be able to | | **CO** |
|---|---|---|
| CO 1 | Understand various AI Techniques. | K2 |
| CO 2 | Understand the clustering models. | K1 |
| CO 3 | Implement classification models. | K3 |