

# **FACULTY OF ENGINEERING & TECHNOLOGY**

## **SYLLABUS FOR THE BATCH FROM YEAR 2025 TO 2026**

### **FOR**

### **Diploma in Artificial Intelligence & Machine Learning**

### **(Credit Based Evaluation and Grading System)**

### **SEMESTER: I-II**

### **EXAMINATIONS: 2025-2026**

#### **The Diploma programme offered:**

- Certificate Course in Artificial Intelligence & Machine Learning(6 months duration)
- Diploma in Artificial Intelligence & Machine Learning(1 year duration)



#### **Program Outcomes:**

- ☐ The candidates are able to design, implement and evaluate a AI based computer oriented system, process and program to meet their needs as well as IT industry requirements
- ☐ The candidates are able to apply knowledge of computation and data structure approaches according to their desire outcomes
- ☐ The candidates are able to understand their professional responsibilities and having ability to make judgments of practice in AI and ML based on social and ethical principles
- ☐ The candidates are able to work efficiently in a team as a team member or team leader both in technical as well as management activities appropriate to the course

### **DEPARTMENT OF COMPUTER ENGINEERING**

### **IN COLABORATION WITH**

### **DIRECTORATE OF ODL AND ONLINE STUDIES**

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**GURU NANAK DEV UNIVERSITY AMRITSAR**

**SEMESTER-I**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1.	ODAML111T	Programming using Python	3	0	1	4
2.	ODAML112T	Data Structures	4	0	0	4
3.	ODAML113T	AI, Ethics and Society	4	0	0	4
4.	ODAML114P	Minor Project-I	0	0	4	4
<b>Total Credits:</b>			11	0	5	16

**SEMESTER-II**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1.	ODAML211T	Machine Learning	4	0	0	4
2.	ODAML212T	Introduction to Data Science	4	0	0	4
3.	ODAML213T	Data Structures	4	0	0	4
4.	ODAML214P	Minor Project-II	0	0	4	4
<b>Total Credits:</b>			12	0	4	16

**Diploma in Artificial Intelligence & Machine Learning (Semester System) Offered by  
Department of Computer Engineering in Collaboration with Directorate of Open &  
Distance Learning and Online Studies, Guru Nanak Dev University Amritsar**

**Diploma in AI & ML Syllabus for session 2025-2026**

**Subject Code: ODAML111T (Semester –I)**

<b>Course Name</b>	<b>Programming using Python</b>
<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (3-0-1)</b>
<b>Total Marks</b>	<b>100</b>
<b>Mid Semester Examination</b>	<b>30% weightage</b>
<b>End Semester Examination</b>	<b>70% weightage</b>

**Instructions for the Paper Setters:** Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be

**SECTION - A**

**Algorithm and Flowchart-** Introduction and components. Introduction to Python and Installation on various Operating Systems.

**Overview–** IDEs (Jupyter, PyCharm, Visual Studio, Colab, etc.), PEP style guide

**Python Basics –** keywords, Importance of indentation, scripting, comments, DocString, Data-types in Python.

**Variables in Python –** Rules of declaration and usage, Typecasting

**Operators in Python –** Assignment, Logical, Arithmetic etc., Taking User Input

**SECTION - B**

**Conditional Statements –** If else and Nested If else and elif. Collections – List, Tuple, Sets and Dictionary (with in-built methods)

**Loops –** For, While and Nested loops, loops with else, break and continue

**String Manipulation –** Indexing, Slicing, etc., Functions and Methods, F-string.

**SECTION - C**

**User Defined Functions –** Defining, Calling, Types of Functions & Arguments, pass

**Importing Modules –** Math Module, Random module etc., Aliasing module names

**Additional –** Taking help in Python, Listing all methods, magic commands etc.

**SECTION – D**

**File Management –** open, close, read, write, append (on text files).

**Text files:** reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

<b>Course Outcomes:</b>	
1	Implement a given algorithm as a computer program in python language with the understanding of hardware components and memory utilization.
2	Able to use standard programming constructs: repetition, selection, functions, composition, modules and different data types
3	Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms) and to debug the program written in python language
<b>Course Name</b>	<b>Data Structures</b>

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<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (4-0-0)</b>
<b>Total Marks</b>	<b>100</b>
<b>Mid Semester Examination</b>	<b>30% weightage</b>
<b>End Semester Examination</b>	<b>70% weightage</b>

**Diploma in AI & ML Syllabus for session 2025-2026**

**Subject Code: ODAML112T (Semester –I)**

**Instructions for the Paper Setters:** Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION - A**

**Introduction:** About data structure, Data structure operations, Algorithm: Def., Complexity, Time-space trade off, Algorithmic notations, Big O notation.

**Arrays:** Linear array, Representation of Linear array in memory, Traversing linear array, Inserting, Deleting, Sorting (Bubble sort), Searching (Linear search, Binary search).

**SECTION - B**

**Stacks:** Introduction, operations, Arithmetic expression, Polish notations, Transforming infix to postfix, Quick sort, Recursion concept, Tower of Hanoi.

**Queues:** Define Queues, Operations, Dequeues, PriorityQueues.

**SECTION –C**

**String Processing:** Introduction, Basic terminology, Storing strings, String operations, Word processing.

**Linked List:** Representation in memory, Traversing, Searching, Insertion, deletion, Header Linked List, Two ways List: operations.

**SECTION –D**

**Trees:** Binary trees, Representation in memory, Traversing, Traversal algorithms using stacks, Binary Search trees: Searching, Inserting and Deleting. Heap and Heap sort.

**Graphs:** Graph Theory Terminology, Sequential Representation, Warshall's Algorithm, Linked Representation, Traversing a graph, Hashing.

<b>Course Outcomes:</b>	
1	Comprehend concepts related to write algorithms/pseudo code.
2	Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, stacks, queues using array and linked list, tree structure implementation using pointers, use of dynamics memory allocation.
3	Comprehend the concepts of linear and Non-Linear data structures

<b>Suggested / Reference Books:</b>	
1	Seymour Lipschutz: Theory and Problems of Data Structures, Schaum's Outline Series
2	Aho A. V. J. E. Hopcroft, J.D. Ullman; Data Structures and Algorithms, Addison-Wesley, 1983.
3	Baase, S Computer Algorithms; Introduction to Design and Analysis, Addison-Wesley, 1978

**Diploma in Artificial Intelligence & Machine Learning (Semester System) Offered by  
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4	Berztiss, A. T.: Data Structures, Theory and practice: 2nd ed., Academic Press, 1977.
5	Collins, W.J. Data Structures, AnObject–Oriented Approach, Addison–Wesley, 1992.
6	Goodman, S.E., S.T.Hedetniemi: Introduction to the Design and Analysis of Algorithms, McGraw Hill, 1977.
7	Horowitz, E.S. Sahni: Algorithms: Design and Analysis, Computer Science Press, 1977.
8	Kunth, D.E. The Art of Computer Programming. Vols. 1–3, Addison–Wesley, 1973

**Diploma in AI & ML Syllabus for session 2025-2026**

**Subject Code: ODAML113T (Semester –I)**

<b>Course Name</b>	<b>AI, Ethics and Society</b>
<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (4-0-0)</b>
<b>Total Marks</b>	<b>100</b>
<b>Mid Semester Examination</b>	<b>30% weightage</b>
<b>End Semester Examination</b>	<b>70% weightage</b>

**Instructions for the Paper Setters:** Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION –A**

Introduction to AI, Data, Individuals, Society, Impact of data analytics and AI on individuals and society, understanding the concept of fairness and bias, ethics of AI, legality, ethics vs law, data collection and public use.

**SECTION –B**

Introduction to Big Data, Big Data Analytics, Various components of Big Data, Types of BigData, statistical techniques to data scenarios, Various challenges in learning from Big Data.

**SECTION –C**

Fundamental AI methods for data handling, identification of fairness and bias, Challenges in the design of decision-making systems, assessment of fairness and bias in facial recognition, natural language processing, and predictive algorithms.

**SECTION –D**

Bias Mitigation, common strategies for bias mitigation, leveraging analytics and AI to transform biased datasets into objective solutions

<b>Course Outcomes:</b>	
1	Identify and explain the fundamental principles of artificial intelligence, its technological foundations, and its societal implications.
2	Develop a comprehensive understanding of the key components that make up big data.
3	Learn to apply basic AI techniques to data scenarios, focusing on detecting and addressing fairness and bias issues.

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**Suggested / Reference Books:**

1	Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy by Cathy O'Neil (2016)
2	AI ethics by mark Coeckelbergh, MIT Press, 2020.
3	Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson.
4	M. Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, Addison Wesl

**Diploma in AI & ML Syllabus for session 2025-2026**

**Subject Code: ODAML114P (Semester –I)**

**Course Name**

**Minor Project-I**

<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (0-0-4)</b>
<b>Total Marks</b>	<b>100</b>

**Guidelines**

A candidate should work on the Minor Project under the guidance of their guide

**Examination**

Final Project Report	Final Project Report & Viva Voce	4 Credits
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**The evaluation shall be done as per the common ordinances for courses Credit Based Evaluation and Grading System.**

**Course Outcomes:**

At the end of this course, the student should be able to understand the Design / Fabrication / Implementation work under the guidance of faculty member. The students have an exposure to work in a group and to understand the working of IT industry.

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**Diploma in AI & ML Syllabus for session 2025-2026**

**Subject Code: ODAML211T (Semester –II)**

<b>Course Name</b>	<b>Machine Learning</b>
<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (4-0-0)</b>
<b>Total Marks</b>	<b>100</b>
<b>Mid Semester Examination</b>	<b>30% weightage</b>
<b>End Semester Examination</b>	<b>70% weightage</b>

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**SECTION - A**

**Introduction:** Introduction to Machine learning, Application areas, types: supervised learning, unsupervised learning, semi-supervised and reinforcement learning.

**SECTION – B**

**Supervised Learning algorithms:** Naïve Bayes, Decision Tree, KNN, SVM, Bayesian Network, Multilayer perceptron or back propagation neural network, linear regression, logistic regression.

**SECTION - C**

**Unsupervised Learning Algorithms:** K-means Clustering, Hierarchical clustering

**Ensemble Machine Learning models:** Ensemble Machine Learning techniques such as Bagging, Boosting and Voting.

**Model Selection:** Metrics, Feature Selection, Principal Component Analysis, Confusion Matrix, Overfitting, Underfitting, Bias-Variance Trade-off.

**SECTION – D**

**Reinforcement Learning:** Introduction, Markov decision process (MDP), Bellman equations, Value iteration and policy iteration, Q-learning, Value function approximation, Policy search.

<b>Course Outcomes:</b>	
1	The students will be able to solve various real time problems related to image classification, signal processing and classification, marketing, finance, healthcare and other engineering problems in the field of data analytics.
2	The theoretical understanding of machine learning and deep learning algorithms and its implementation in Python make the students familiar with its deep insights and enable them to further enhance their problem-solving capability.

<b>Suggested / Reference Books:</b>	
1	Zurada, J.M., Introduction to Artificial Neural Network System, Jaico Publication (2006).
2	Sivanandam S.N., Principles of Soft computing, Wiley India.
3	Ethem Alpaydin, Introduction to Machine Learning, Third Edition, Prentice Hall of India.
4	Anuradha Srinivasaraghavan, Vincy Joseph, Machine Learning, Wiley India.

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**Subject Code: ODAML212T (Semester –II)**

<b>Course Name</b>	<b>Introduction to Data Science</b>
<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (4-0-0)</b>
<b>Total Marks</b>	<b>100</b>
<b>Mid Semester Examination</b>	<b>30% weightage</b>
<b>End Semester Examination</b>	<b>70% weightage</b>

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**SECTION–A**

**Introduction: Data Science**

- Big Data and Data Science hype and getting past the hype, Datafication
- Current landscape of perspectives
- Skill sets needed
- **Understanding data:** Introduction, Types of data: Numeric, Categorical, Graphical, High dimensional data, Classification of digital data: Structured, Semi-Structured and UnStructured, Example Applications

**SECTION–B**

**Statistical Inference**

- Populations and samples
- Statistical modeling, probability distributions, fitting a model

**Exploratory Data Analysis and the Data Science Process**

- Basic tools (plots, graphs and summary statistics) of EDA
- Philosophy of EDA- The Data Science Process
- Case Study: Real Direct (online real estate firm)

**SECTION–C**

**Mining Social-Network Graphs**

- Social networks as graphs- Clustering of graphs
- Direct discovery of communities in graphs
- Partitioning of graphs
- Neighborhood properties in graphs

**SECTION–D**

**Data Visualization**

- Basic principles, ideas and tools for data visualization



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- Examples of inspiring (industry) projects
- Exercise: create your own visualization of a complex dataset

**Data Science and Ethical Issues**

- Discussions on privacy, security, ethics
- Next-generation data scientists

<b>Course Outcomes:</b>	
1	Provide an understanding of data science, and its process.
2	Enable with the understanding of problems that can be solvable with data science.
3	An understanding to use the different machine learning algorithms and their usage in different applications.

<b>Suggested / Reference Books:</b>	
1	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2014.
2	Jure Leskovek, AnandRajaraman and Jerrey Ullman. Mining of Massive Datasets. v2.1,Cambridge University Press, 2014.
3	Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. MIT Press-ISBN 0262018020, 2013.
4	Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. O'Reilly, ISBN 1449361323, 2013.
5	Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Springer-Verlag, Second Edition, ISBN 0387952845, 2009.
6	Mohammed J. Zakiand, Wagner, Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, 2014.

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**Subject Code:ODAML213T (Semester –II)**

<b>4Course Name</b>	<b>Advance Python Programming</b>
<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (3-0-1)</b>
<b>Total Marks</b>	<b>100</b>
<b>Mid Semester Examination</b>	<b>30% weightage</b>
<b>End Semester Examination</b>	<b>70% weightage</b>

**Instructions for the Paper Setters:** Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION - A**

**Quick Revision:** Python Collections (List, Tuple, Set, Dictionary)

**Concepts:** F-String, List Comprehension, Dictionary Comprehension, pip

**Functional Programming Techniques:** Indefinite Arguments (\*args, \*\*kwargs), lambda, Filter, Map, Reduce, zip

**Core Modules:** re, csv, os, random, datetime, pickle

**Errors and Exception Handling:** try, except (also with else), raise, finally

**SECTION - B**

**Object Oriented Basics Python:** Class, Object, Method, Attributes, Constructor, self

**OOPs Core:** Inheritance, Polymorphism, Abstraction and Encapsulation in Python.

**Advanced Concepts:** Special methods, Decorators, Generators

**SECTION - C**

**Python Database Connectivity (using SQL):**CRUD Operations

Create (Database, Table), Insert, Select, Where, Order By, Drop, Update, Limit, Join

**SECTION - D**

**Data Science Basics:**

**Numpy:** array (creating, indexing, slicing), data types, shape, reshape, iterating, join, split, search, sort, filter

**Pandas:** Series, DataFrames, reading (csv and json), cleaning data (empty, wrong, duplicate, etc.)

**Matplotlib or Seaborn:** Plotting (Line, Bar, Scatter, Pie, Donut, Histogram), BoxPlot, HeatMaps, etc.

<b>Course Outcomes:</b>	
1	Understanding of Advanced Python core concepts.
2	In-Depth knowledge of data analysis using Python.
3	Practical understanding of visualizing data using Python.
4	Ability to use Python for data science and machine learning.

<b>Suggested / Reference Books:</b>	
1	Rituraj Dixit, “Data Analysis with Python: Introducing NumPy, Pandas, Matplotlib, and Essential Elements of Python Programming”, by BPB Publications.
2	Steven F. Lott, Dusty Phillips, “Python Object-Oriented Programming”, by Packt Publishing.

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3	John C. Shovic, Alan Simpson, “Python All-In-One for Dummies”, by John Wiley & Sons.
4	Lee Vaughan, “Python Tools for Scientists: An Introduction to Using Anaconda, JupyterLab, and Python's Scientific Libraries”, by No Starch Press.

**Subject Code: ODAML214P (Semester –II)**

<b>Course Name</b>	<b>Minor Project-II</b>
<b>Course Code</b>	
<b>Credits (L-T-P)</b>	<b>4 (0-0-4)</b>
<b>Total Marks</b>	<b>100</b>

<b>Guidelines</b>
A candidate should work on the Minor Project under the guidance of their guide

<b>Examination</b>		
Final Project Report	Final Project Report & Viva Voce	2 Credits

**The evaluation shall be done as per the common ordinances for courses Credit Based Evaluation and Grading System.**

<b>Course Outcomes:</b>
At the end of this course, the student should be able to understand the Design / Fabrication / Implementation work under the guidance of faculty member. The students have an exposure to work in a group and to understand the working of IT industry.