



**Swami Keshvanand Institute of Technology, Management
& Gramothan, Jaipur**

Semester

III



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: II	Semester: III
Course Name: Foundation of Artificial Intelligence	Course Code: CAUL302	Credit: 3
Max Marks: 100	CIE: 40	SEE: 60
End Term Exam Time: 3 Hrs	Teaching Scheme: CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	Introduction: Objective, Scope, Outcome of the Course and Prerequisite	1
2	Introduction to Artificial Intelligence and Intelligent Agents: Definition and scope of AI, The Foundations of AI, History of AI, Emerging Trends and Future Directions in AI, Weak AI, Strong AI, Agents and Environments, The concept of Rationality, and the structure of Agents.	9
3	Problem-Solving: Problem solving, Examples of problems, Blind Search: Depth first search, Breadth first search and their variants; Informed search: Uniform cost search, heuristic function, hill climbing, best first search, A* and AO* search. Constraint satisfaction problem.	9
4	Knowledge & Reasoning: Building a Knowledge Base: Introduction to KR, Knowledge Agents, Propositional logic, Predicate logic and resolution. Uncertain Knowledge and Reasoning, Probabilistic logic, Bayes' rule, Bayes theorem and Bayesian Network. Introduction to Fuzzy Logic.	9
5	Learning Models: Overview of different forms of Learning, Supervised, Unsupervised, Reinforcement Learning, Neural Network: Activation Function, Gradient Descent. Introduction to Deep Learning	9
6	Application and Ethics of AI: Natural Language Processing, Expert System, Computer Vision, Robotics, Recommendation Systems. Bias and Fairness in AI Systems, Privacy and Data Protection Concerns, The Ethics and Risks of Developing AI, FAIR, FATE Concept.	8
Total		45

Text Books:

1. Elaine Rich and Kevin Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2017.
2. Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, 3rd Edition, Pearson Education, 2009.
3. D. W. Patterson, *Introduction to Artificial Intelligence and Expert Systems*, Prentice Hall of India, 2000.

Reference Books:

1. Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press. 2009.
2. P.H. Winston, *Artificial Intelligence*, 3rd Edition, Addison-Wesley Publishing Company, 2006.
3. Deepak Khemani, *A First Course in Artificial Intelligence*, 1st Edition, McGraw-Hill Education, 2013.
4. George F. Luger, *Artificial Intelligence – Structures and Strategies for Complex Problem Solving*, 5th Edition, Pearson Education Limited, 2005.

Prerequisite:

Data Structures and Algorithms, Probability and Statistics



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: II	Semester: III
Course Name: Logic Programming Lab	Course Code: CAUP322	Credit: 1.5
Max Marks: 100	CIE: 60	SEE: 40
End Term Exam Time: 3 Hrs	Teaching Scheme: LI (45) = 45 hrs. per semester	

S. No.	Experiments
1	Develop a program that defines and models family member relationships.
2	Implement a solution for the Monkey and Banana problem, where the monkey attempts to reach the banana using available actions.
3	Create a program to solve the Tower of Hanoi puzzle, demonstrating the movement of disks between pegs according to the puzzle's rules.
4	Design a program that implements the Breadth-First Search (BFS) algorithm to explore a graph or tree.
5	As part of a Logic Programming Lab, develop a program that implements the Depth-First Search (DFS) algorithm to explore a graph or tree.
6	Build a program that allows a user to attempt logging in up to three times. After the third failed attempt, the program should terminate and display the message "Login Denied."
7	Create a program that checks whether a graph is connected, and if it is, determines whether the graph is unidirectional or bidirectional.
8	Develop a program that verifies if all elements of a given set are present in a list.
9	Implement a Tic-Tac-Toe game where two players can compete on a 3x3 grid.
10	Construct a mini-project that implements an expert system in a specific domain, providing expert-level advice based on user input.



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Management & Gramothan, Jaipur**

Semester

IV



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Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: II	Semester: IV
Course Name: Introduction to Data Analytics	Course Code: CAUL406	Credit: 3
Max Marks: 100	CIE: 40	SEE: 60
End Term Exam Time: 3 Hrs	Teaching Scheme: CI (45) + TW & SL (45) = 90 Hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	Introduction: Objective, Scope, Outcome of the Course and Prerequisite	1
2	Fundamentals of Data Science: Introduction to Data Science, Terminologies related with Data Science, Types of Data, Data Science Process, Data Science Project's Lifecycle, Data Science Toolkits, Applications.	8
3	Data Collection and Management: Introduction, Sources of data, Data Collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.	8
4	Data Analysis and algorithms: Introduction, Role of Statistics, Types of Statistics, Central Tendency and its measures, Normal Distribution Curve, Variations, Standard Deviation, Z-Scores and Normalization, Samples/CLT. Basic Machine Learning Algorithms, Linear Regression, SVM, Naïve Bayes.	10
5	Data Visualization: Introduction to Data Visualization and its importance, types of Data Visualization, various Visualization Techniques, Retinal Variables, Mapping variables to Encodings.	9
6	Recent Trends in Data Science: Applications of Data Science, Technologies for Visualization, Recent Trends in various Data Collection and Analysis Techniques, Bokeh (Python), Application Development Methods used in Data Science.	9
Total		45

Textbooks:

1. C. O'Neil and R. Schutt, Doing Data Science: Straight Talk from the Frontline, 1st ed., O'Reilly Media, 2013.
2. D. Cielen, A. D. B. Meysman, and M. Ali, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, 1st ed., Manning Publications, 2016.
3. R. D. Peng and E. Matsui, The Art of Data Science, Leanpub, 2015.

Reference Books:

1. J. Leskovec, A. Rajaraman, and J. D. Ullman, Mining of Massive Datasets, 3rd ed., Cambridge University Press, 2020.
2. J. Grus, Data Science from Scratch: First Principles with Python, 2nd ed., O'Reilly Media, 2019.
3. G. James, D. Witten, T. Hastie, and R. Tibshirani, An Introduction to Statistical Learning: With Applications in R, 2nd ed., Springer, 2021.

Prerequisite:

Basics of Computer Fundamentals



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: II	Semester: IV
Course Name: Data Analytics and Visualization Lab	Course Code: CAUP423	Credit: 1.5
Max Marks: 100	CIE: 60	SEE: 40
End Term Exam Time: 3 Hrs.	Teaching Scheme: LI (45) = 45 hrs. per semester	

S. No.	Experiments
1	Understanding Data Structures and Basic Operations in Python. a) Create different Python data structures such as List, Tuple, Set, and Dictionary. b) Perform basic operations including insertion, deletion, updation, searching, and traversal on these data structures. c) Analyze the difference between mutable and immutable data structures in Python. d) Implement Python data structures for efficient storage, organization, and processing of data.
2	Study and use of NumPy and Pandas libraries in Python for performing basic data analysis operations. a) Create NumPy arrays and perform mathematical operations. b) Create Pandas Series and DataFrames. c) Analyze tabular data using Pandas functions. d) Calculate statistical measures such as mean, maximum, minimum, and sum.
3	Understand and apply data preprocessing techniques and perform EDA. a) Load a dataset (e.g., a CSV file with raw data like customer transactions, weather data, etc.). b) Handle missing values, outliers, and perform data normalization. c) Visualize data distributions (e.g., histograms, box plots). d) Analyze correlations using heatmaps and scatter plots.
4	Create and customize various visualizations using Python. a) Load a preprocessed dataset. b) Create visualizations: bar charts, line charts, scatter plots, pie charts using Matplotlib/ Seaborn. c) Customize charts with titles, labels, legends, and colors. d) Experiment with subplots to display multiple visualizations on a single figure. e) Interpret the visualizations and describe the insights.
5	Learn the basics of Tableau and create simple visualizations. Discuss the advantages of using Tableau for data visualization. a) Import a dataset into Tableau (e.g., superstore sales data). b) Create different chart types: bar charts, line charts, and pie charts. c) Explore Tableau's drag-and-drop interface and customize visualizations. d) Add filters and parameters to allow dynamic data exploration.
6	Develop an interactive dashboard using multiple visualizations in Tableau. a) Create various visualizations (e.g., sales by region, product category performance). b) Combine visualizations into a single interactive dashboard. c) Add interactive elements like filters, parameters, and actions. d) Test the dashboard by exploring the data through interactivity. e) Analyze the usefulness of dashboards in real-world scenarios.



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

7	Learn how to create and customize visualizations using Power BI. a) Import a dataset into Power BI. b) Create visualizations: bar charts, line charts, pie charts, and maps. c) Customize visualizations with labels, colors, and formatting options. d) Add slicers and filters to allow interactive data exploration. e) Discuss the advantages and limitations of Power BI for data visualization.
8	Explore advanced visualization options and custom visuals in Power BI. a) Create advanced visualizations such as tree maps, waterfall charts, and gauge charts. b) Experiment with custom visuals from the Power BI marketplace. c) Use DAX (Data Analysis Expressions) to create calculated columns or measures for deeper insights.



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Semester V



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Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: III	Semester: V
Course Name: Machine Learning	Course Code: CAUL502	Credit: 3
Max Marks: 100	CIE: 40	SEE: 60
End Term Exam Time: 3 Hrs.	Teaching Scheme: CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	Introduction: Objective, Scope, Outcome of the Course and Prerequisite.	1
2	Introduction to Machine Learning: Overview, Comparison with Traditional Programming, Types of Machine Learning, Machine Learning Process Flow, Applications and Challenges, Bias and Variance Tradeoff. Data Preprocessing: Data Quality Issues, Data Cleaning (Missing Values, Outlier Detection), Feature Scaling (Normalization, Standardization), Encoding Categorical Variables (One-Hot Encoding, Label Encoding).	8
3	Supervised Learning - I (Regression & Fundamentals)— Regression Techniques: Linear Regression, Multiple Regression, Polynomial Regression. Performance Measures (Regression): Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE).	5
4	Supervised Learning - II (Classification Algorithms)— Probability-Based Learning: Naïve Bayes Classifier; Boundary-Based Learning: k-Nearest Neighbors (k-NN), Support Vector Machine (SVM), Perceptron Model, Logistic Regression, Introduction to Neural Networks (Biological Inspiration), Activation Functions (Sigmoid, Tanh, ReLU); Rule-Based Learning: Decision Trees; Ensemble Learning: Random Forest, Bagging, Boosting; Performance Measures (Classification): Confusion Matrix, Accuracy, Precision, Recall, F1-Score.	11
5	Unsupervised Learning— Clustering Techniques: Partitioning (K-Means, K-Medoids), Hierarchical Clustering, DBSCAN, Gaussian Mixture Model (GMM); Association Rule Mining: Apriori Algorithm, Frequent Pattern Growth (FP-Growth); Performance Measures: Elbow Method, Silhouette Score.	10
6	Feature Engineering and Dimensionality Reduction: Filter methods, wrapper methods, and embedded methods; need for dimensionality reduction, curse of dimensionality, Principal Component Analysis (PCA), Singular Value Decomposition (SVD). Recommendation Systems: Overview, Importance and Applications, Collaborative Filtering (User-based, Item-based), Content-Based Filtering (Concept and Working Principles).	10
Total		45

Text Books:

1. T. M. Mitchell, *Machine Learning*, 1st ed. New York, NY, USA: McGraw-Hill Education, 2025, ISBN: 978-8176711401
2. S. Dutt, S. Chandramouli and A. K. Das, *Machine Learning*, 2nd ed. New Delhi, India: Pearson Education, 2024, ISBN: 978-8119896738

Reference Books:



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

1. A. Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022, ISBN: 978-1098125974.
2. A. C. Müller and S. Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists. Sebastopol, CA, USA: O'Reilly Media, 2016, ISBN: 978-1449369415.
3. P. Harrington, Machine Learning in Action. Manning Publications, Shelter Island, NY, USA, 2012, ISBN: 978-1617290183

Prerequisite:

1. Fundamentals of linear algebra (vectors, matrices, operations)
2. Basic statistics (mean, variance, probability distributions)



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: III	Semester: V
Course Name: Machine Learning Lab	Course Code: CAUP521	Credit: 1
Max Marks: 100	CIE: 60	SEE: 40
End Term Exam Time: 3 Hrs.	Teaching Scheme: LI (30) = 30 hrs. per semester	

S. No.	Experiments
1	Use of Python libraries such as NumPy, SciPy, Pandas, Matplotlib, and scikit-learn for data creation, loading, preprocessing, exporting, and visualization.
2	Write a Python program to demonstrate various Data-processing techniques for data cleaning (Reshaping, Filtering, merging data, and handling missing values) and transformations (scaling & encoding).
3	Write a Python program to implement Regression for continuous and discrete data and plot the graph.
4	Write a program to implement the k-Nearest Neighbor and Naïve-bayes classifier algorithm to classify the breast cancer data set in scikit-learn. Print both correct and wrong predictions.
5	Implement Support Vector Machine for a dataset and compare the accuracy by applying the following kernel functions: a. Linear b. Polynomial c. RBF
6	Write a program to demonstrate the working of the Decision Tree-based ID3 algorithm using an appropriate dataset.
7	Apply the Random Forest algorithm on a given dataset to predict the output class. Analyze the model performance by varying the number of trees and comparing the results.
8	Implement the K-Means clustering algorithm and analyze its performance by varying the number of clusters (k) and comparing the results.
9	Write a program to implement Principal Component Analysis (PCA) for transforming high-dimensional data into a lower-dimensional feature space.
10	Train a simple neural network and compare the performance using Sigmoid, Tanh, and ReLU activation functions.
11	Mini Project on Industry-Based Case Studies.



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Management & Gramothan, Jaipur**

Semester

VI



Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: Minor Degree in Artificial Intelligence and Machine Learning	Year: III	Semester: VI
Course Name: Internet of Things	Course Code: CAUL602	Credit: 3
Max Marks: 100	CIE: 40	SEE: 60
End Term Exam Time: 3 Hrs.	Teaching Scheme: CI (45) + TW & SL (45) = 90 Hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	Introduction: Objective, Scope, Outcome of the Course and Prerequisite.	1
2	Introduction to IoT: Definition, Characteristics, Applications, Challenges, Basics of Networking, Layered Network Model, Data Link Layer Addressing, Network Link Layer Addressing, Basics of WSN, M2M communication, Cyber Physical System.	9
3	IoT Sensing, Actuation and Processing: Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Humidity sensors, Ultrasonic sensors, Temperature sensors, Proximity Sensors, Infrared sensors, Actuators, Actuator Types, Actuators Characteristics, IoT Processing Topologies and Types.	10
4	IoT Connectivity Technologies: IEEE 802.15.4, Zigbee, Wi-Fi, Bluetooth, LoRa, NB -IoT, RFID, NFC, Sigfox, Z-Wave, Cellular Network (4G LTE, 5G).	8
5	IoT Communication Protocols: Infrastructure Protocols- IPv6, RPL, 6LoWPAN, Data Protocols- MQTT, CoAP, AMQP, XMPP, SOAP, REST, WebSocket.	9
6	Case study of IoT Applications: Home automation, Smart Cities, Agricultural IoT, Vehicular IoT, Healthcare IoT, Internet of battlefield things, Internet of drones.	8
Total		45

Text Books:

1. S. Misra, A. Mukherjee, and A. Roy, Introduction to the Internet of Things. Cambridge, U.K.: Cambridge University Press, 2021.
2. A. Bahga and V. Madiseti, Internet of Things: A Hands-On Approach. New Delhi, India: Orient Blackswan Private Limited, 2015.

Reference Books:

1. R. Buyya and A. V. Dastjerdi, Eds., Internet of Things: Principles and Paradigms. Amsterdam, Netherlands: Elsevier, 2016.
2. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, and J. Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. Indianapolis, IN, USA: Cisco Press, 2017.
3. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. Boca Raton, FL, USA: CRC Press, 2020.

Prerequisite:

1. Computer Networks
2. Embedded Systems
3. Cloud and Data Management