

AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER
Department of Artificial Intelligence & Data Science
Honors in Advanced AI & DS
(18 Credits)

Year	Semester	Course Code	Course Name	Credits
Second Year	Sem III	R25-AI-HOC-201	Advanced Python Programming	3
	Sem IV	R25-AI-HOC-202	Statistical Foundation for Big Data Analysis	3
Third Year	Sem V	R25-AI-HOC-301	Introduction to Application of Artificial Intelligence to Robotics	3
	Sem VI	R25-AI-HOC-302	Exploratory Data Analysis for Data Science with R Software	3
Final Year	Sem VII	R25-AI-HOC-401	Introduction to Large Language Models	3
	Sem VIII	R25-AI-HOC-402	Responsible & Safe AI Systems	3
Total				18



Chairman
 BoS, Artificial Intelligence & Data Science
 Amrutvahini College of Engineering, Amrutnagar
 Sangamner-422608



Chairman
 Academic Council
 Amrutvahini College of Engineering, Amrutnagar
 Sangamner-422608

Program:	S. Y. B. Tech (Artificial Intelligence & Data Science)			Semester:		III	
Course:	Advanced Python Programming			Course Code:		R25-AI-HOC-201	
Teaching Scheme (Hrs. / week)			Credits (TH)	Examination Scheme			
Lecture	Practical	Tutorial		CCE	ESE	TW	PR
3	-	-	3	40	60	-	-

Course Description: This course introduces advanced concepts of Python programming, including Python programming environments, data types, control flow, functions, and built-in data structures. It develops skills in object-oriented programming, file handling, exception handling, modules, NumPy, Pandas, data visualization, and basic data analysis. The course emphasizes practical programming and problem-solving using Python for data science and real-world applications.

Course Relevance: This course develops advanced Python programming and problem-solving skills required for applications in Data Science, Artificial Intelligence, Machine Learning, and software development. It provides a foundation for working with data processing, analysis, visualization, and real-world computational problems.

Prerequisite: Programming Fundamentals.

Bridge Content: Programming Fundamentals, Data Structures and Algorithms, Database Management Systems.

Course Objectives:

- **Understand** Advanced python programming constructs, data types, control structures, functions, and sequence data types.
- **Analyze** searching, sorting, and basic data structures based on their operations and algorithmic complexity.
- **Apply** object-oriented programming concepts and advanced Python features to develop modular and reusable solutions.
- **Apply** advanced Python techniques including higher-order functions, recursion, exception handling, and file processing, and backtracking to solve computational problems.
- **Apply** Python libraries such as NumPy, Pandas, Matplotlib, and Seaborn for data processing, analysis, and visualization.

Course Outcomes: After learning the course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Apply advanced Python programming constructs, built-in data structures, functions, and algorithmic techniques to develop computational solutions.	3
CO2	Analyze searching, sorting, and basic data structures based on their operations and algorithmic complexity.	4
CO3	Apply object-oriented programming concepts and advanced data structures to develop efficient Python-based solutions.	3
CO4	Apply advanced Python programming techniques including higher-order functions, recursion, exception handling, and file	3




	processing, and backtracking to solve computational problems.	
CO5	Analyze and process real-world datasets using advanced Python libraries and develop Python-based applications for data analysis and visualization.	4
Course Contents		
Unit 1	Python Programming Fundamentals	Weeks 1-2
CO1		
Python programming environment and Spyder IDE, Variables, objects and data types, Operators and expressions, Control flow statements, Functions, Strings, Lists, tuples, sets and dictionaries, Sequence operations, Mutable and immutable objects, Python memory model, List, set and dictionary comprehensions		
Exemplars / Practical Applications and usage: 1. Development of real-world applications using functions, data structures, and modules. 2. Basic AI/ML data preprocessing and analysis using Python libraries. 3. Practical use of Python for automation, problem-solving, and scientific computing.		
Assignments: 1. Explain the concepts of mutable and immutable objects and the Python memory model. 2. Demonstrate different sequence operations such as indexing, slicing, searching, and iteration. 3. Write a Python program that demonstrates the use of variables, objects, different data types, operators, expressions, and control flow statements. Explain the output of the program.		
Unit 2	Algorithms and Data Structures in Python	Weeks 3-4
CO2		
List and Sequence, Searching: Linear Search, Binary Search, Sorting: Selection, Insertion, Merge Sort, Quick Sort, Stable and in-place sorting, Algorithm Analysis and Big-O Notation, Arrays vs. Lists, Abstract Data Types, Stack and Queue		
Exemplars / Practical Applications and usage: 1. Demonstrate arrays vs. Python lists through practical data storage examples. 2. Apply Selection, Insertion, Merge, and Quick Sort to arrange marks, prices, or records. 3. Compare sorting algorithms using time complexity and Big-O notation.		
Assignments: 1. Implement Stack and Queue using Python lists and develop a simple real-world application 2. Implement Merge Sort and Quick Sort in Python. Compare them based on time complexity. 3. Write Python programs to implement Linear Search, Binary Search Compare their performance		
Unit 3	Object-Oriented and Advanced Python Programming	Weeks 5-6
CO3		
Classes and objects, Constructors, Instance, class and static methods, Encapsulation, Inheritance, Multiple inheritance, Polymorphism, Method overriding, Operator overloading, Magic/Dunder methods, Abstract Base Classes, Interfaces using abstract classes, Properties and decorators, Composition and aggregation, Data classes, Iterators and iterables, Generators, yield, Decorators, Context managers		
Exemplars / Practical Applications and usage: 1. Implement abstract classes and interfaces for designing reusable application components. 2. Develop class-based applications for student, employee, bank account, or library management systems.		


Chairman

BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608


Chairman
Academic Council

Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

Assignments: 1. Create a Python class with a constructor, instance method, class method, and static method for managing student information. 2. Implement inheritance and method overriding for a simple vehicle or employee management system. Analyze the role of polymorphism. 3. Design a small Python application using abstract classes, decorators, generators, and a context manager to solve a real-world problem.			
Unit 4	Advanced Python Programming Techniques	Weeks 7-8	CO4
Scope and namespaces, Nested functions, Lambda functions, Higher-order functions, map(), filter(), reduce(), List/Set/Dictionary comprehensions, Recursion, Exception handling, User-defined exceptions, File handling, String processing, CSV processing, HTTP basics, JSON processing, RESE API, Serialization and deserialization, Backtracking, N-Queens problem, Memorization, Introduction to functional programming.			
Exemplars / Practical Applications and usage: 1. Use HTTP and REST APIs to retrieve and exchange application data. 2. Apply recursion and backtracking to solve problems such as the N-Queens problem. 3. Use serialization and deserialization for storing and transferring Python objects.			
Assignments: 1. Write a Python program using lambda, map(), filter(), reduce(), and comprehensions to process a list of student marks. 2. Develop a Python program to read and process CSV/JSON data using file handling and exception handling. Analyze the errors that may occur.			
Unit 5	Python for Data Analytics and Advanced Applications	Weeks 9-11	CO5
NumPy - array , Array creation ,Indexing and slicing ,Vectorization, Broadcasting , Pandas - Series, Data Frame, Indexing and selection, Grouping, Merging and joining, Data cleaning and pre-processing, Exploratory Data Analysis, Matplotlib, Seaborn, Working with real-world datasets, Functional programming applications, Introduction to multiprocessing and multithreading, Python package, management, Virtual environments, Introduction to testing using pytest, Python application development, Database connectivity, Python–MySQL connectivity			
Exemplars / Practical Applications and usage: 1. Use Matplotlib and Seaborn to create meaningful data visualizations. 2. Develop Python applications with database connectivity and MySQL. 3. Perform basic software testing using pytest.			
Assignments: 1. Develop a simple Python–MySQL application to perform insert, update, delete, and display operations on student records. 2. Perform data cleaning and EDA on a real-world dataset using NumPy and Pandas, and summarize the findings. 3. Create Matplotlib/Seaborn visualizations for a dataset and analyze the relationships or trends shown in the graphs.			
Textbooks: 1. Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 3rd Edition, 2023,			




ISBN: 978-0357501320.

2. John V. Guttag, Introduction to Computation and Programming Using Python: With Application to Understanding Data, MIT Press, 3rd Edition, 2021, ISBN: 978-0262542364.
3. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, No Starch Press, 3rd Edition, 2023, ISBN: 978-1718502703.

Reference Books:

1. Mark Lutz, Learning Python, O'Reilly Media, 5th Edition, 2013, ISBN: 978-1449355739.
2. Luciano Ramalho, Fluent Python: Clear, Concise, and Effective Programming, O'Reilly Media, 2nd Edition, 2022, ISBN: 978-1492056355.
3. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley, 1st Edition, 2013, ISBN: 978-1118290279.
4. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, O'Reilly Media, 3rd Edition, 2022, ISBN: 978-1098104030.
5. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, O'Reilly Media, 3rd Edition, 2024, ISBN: 978-1098155438.

MOOCs Links and additional reading material:

- NPTEL –Algorithms Using Python – <https://nptel.ac.in/courses/106106145>
- NPTEL - Python for Data Science - <https://nptel.ac.in/courses/106106212>
- NPTEL – The Joy of Computing Using Python – <https://nptel.ac.in/courses/106106182>
- Coursera – Programming for Everybody – <https://www.coursera.org/learn/python>
- Coursera – Python Specialization – <https://www.coursera.org/specializations/python>
- Kaggle – Python – <https://www.kaggle.com/learn/python>
- Kaggle – Pandas – <https://www.kaggle.com/learn/pandas>
- NPTEL – Data Analytics with Python – <https://nptel.ac.in/>

Strength of CO-PO-PSO Mapping

CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO3
CO1	3	3	3	1	3	–	–	1	1	–	2	3	2	2
CO2	3	3	2	2	3	–	–	1	1	–	2	3	3	2
CO3	3	3	3	1	3	–	–	1	1	–	2	3	3	2
CO4	3	3	3	2	3	–	–	1	1	–	3	3	3	2
CO5	3	3	3	3	3	1	1	2	2	1	3	3	3	3
Avg	3	3	3	3	3	3	3	3	1	1	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

a) Continuous Comprehensive Evaluation (CCE) – 40 Marks

Acharya

Chairman

BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

R. Ganesh

Chairman
Academic Council

Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

The Continuous Comprehensive Evaluation shall be carried out by the Department based on the student's performance throughout the duration of the SWAYAM-NPTEL course.

- NPTEL Weekly Assignments / Institute-Level CCE Examination: 30 Marks
The marks obtained by the student through NPTEL Weekly Assignments or the Institute-Level CCE Examination, whichever is higher, shall be considered for the CCE evaluation.
- Course Progress and Participation: 10 Marks
Course progress and participation shall be assessed based on completion of video lectures, timely submission of weekly assignments, and periodic progress monitored by the Faculty Mentor.

b) End Semester Evaluation (ESE) – 60 Marks

1. Students shall register for and appear in the SWAYAM-NPTEL Proctored Certification Examination.
2. The marks obtained in the NPTEL Proctored Examination shall be converted proportionally to 60 marks using the following formula:
3. Students who successfully obtain the NPTEL certificate shall have the converted score considered as the End Semester Evaluation (ESE) marks.
4. Students who fail to obtain the NPTEL certificate, fail to appear for the NPTEL certification examination, or fail the certification examination shall appear for the Institute End Semester Examination conducted by the College.
5. If a student appears for both the SWAYAM-NPTEL Certification Examination and the Institute End Semester Examination, the higher of the two ESE scores shall be considered for the award of the final grade.
6. The decision of the Department regarding verification of NPTEL scores and award of marks shall be final and binding.

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	-	-	✓	-	-	-	✓
K2	-	-	✓	-	-	-	✓
K3	-	-	✓	-	-	-	✓
K4	-	-	✓	-	-	-	✓
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses: Data Science and Data Analytics, Machine Learning, Artificial Intelligence, Deep Learning, Big Data Analytics, Natural Language Processing

Job Mapping:

- Python Developer
- Data Analyst /Scenetist
- Machine Learning Engineer




Program:	S. Y. B. Tech (Artificial Intelligence & Data Science)			Semester:	IV		
Course:	Statistical Foundation for Big Data Analysis			Course Code:	R25-AI-HOC-202		
Teaching Scheme (Hrs. / week)			Credits (TH)	Examination Scheme			
Lecture	Practical	Tutorial		CCE	ESE	TW	PR
3	-	-	3	40	60	-	-

Course Description: This course introduces the statistical foundations required for analysing and interpreting Big Data, covering probability, statistical inference, estimation, hypothesis testing, regression, clustering, PCA, and network analytics. It emphasizes scalable statistical methods and modern computational approaches for solving real-world AI and Big Data problems.

Course Relevance: Statistical thinking is essential for Artificial Intelligence, Machine Learning, and Big Data Analytics, providing a foundation for understanding uncertainty, inference, prediction, and model evaluation. The course prepares students for advanced applications in ML, AI, Data Mining, Deep Learning, and data-driven analytics while addressing industry needs such as high-dimensional data analysis, model validation, and network analytics.

Prerequisite: Some exposure to linear algebra and probability, Fundamentals of Machine Learning.

Bridge Content: Probability Fundamentals, Basic Machine Learning, Data Preprocessing

Course Objectives:

- Introduce the fundamental concepts of Big Data and statistical methods required for effective Big Data analysis.
- Develop understanding of statistical estimation, hypothesis testing, likelihood methods, and model assessment techniques.
- Provide knowledge of regression, classification, multivariate analysis, and clustering techniques for solving Big Data problems.
- Explain the challenges associated with high-dimensional data and develop understanding of Principal Component Analysis (PCA) for dimensionality reduction.
- Develop practical skills to apply statistical techniques to real-world Big Data problems through case studies and data-driven applications.

Course Outcomes: After learning the course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Justify the use of statistical foundations, probability concepts, point estimation, and likelihood methods in Big Data analysis.	2
CO2	Apply estimation, hypothesis testing, bias-variance analysis and cross-validation for statistical inference and model evaluation.	3
CO3	Use regression, classification, multivariate statistical models, and clustering techniques for Big Data applications.	3

Heckle

Chairman
BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

R. Gaurav

Chairman
Academic Council
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

CO4	Analyze high-dimensional data and apply Principal Component Analysis (PCA) for dimensionality reduction and improved data interpretation.	4
CO5	Analyze network data using random graph concepts and statistical techniques for social and network applications.	4
Course Contents		
Unit 1	Big Data and Statistical Foundations	Weeks 1-2
Big Data: Definition, characteristics, examples and applications, challenges in Big Data; Big Data Analysis versus Big Data Processing; role of statistics and dimensional statistics in Big Data. Statistical Framework: Population and sample, random variables, probability distributions, parameters and statistics, sampling distributions, statistical inference. Likelihood: Likelihood function, basic concepts of likelihood-based estimation and applications. Statistical Computing for Big Data: Distributed statistical computing, statistical analysis of streaming data, real-time statistical summaries, scalable computation using cloud/distributed platforms, introduction to AI-assisted statistical analysis. Exemplars / Practical Applications and usage: 1. E-commerce Analytics: Analyze customer transaction data to identify purchasing patterns and calculate statistical summaries. 2. Healthcare Analytics: Analyze patient datasets to understand distributions of age, blood pressure, glucose levels, etc. Assignments: 1. E-Commerce Big Data Analysis: Using a large e-commerce transaction dataset, identify the characteristics of Big Data (Volume, Velocity, Variety, Veracity, and Value) and compute suitable statistical summaries for important variables. 2. IoT Streaming Data Analysis: Generate or collect temperature and humidity sensor data and implement a real-time statistical monitoring system to calculate moving mean, variance, minimum, maximum, and detect unusual observations.		
Unit 2	Estimation, Hypothesis Testing and Model Assessment	Weeks 3-4
Point Estimation: Maximum Likelihood Estimation (MLE), properties of MLE, Method of Moments, asymptotic properties of estimators. Interval Estimation: Concept of interval estimation, confidence interval, confidence level, interpretation of confidence intervals. Hypothesis Testing: Null and alternative hypotheses, test statistic, significance level, p-value, Type-I and Type-II errors, decision making using hypothesis testing. Cross Validation: Need for model validation, cross-validation, k-fold cross-validation, leave-one-out cross-validation, bias-variance trade-off. Bootstrap and permutation testing, resampling-based inference, automated model evaluation, statistical		




model monitoring for continuously generated Big Data.			
Exemplars / Practical Applications and usage: 1. Confidence Intervals: Estimate the average transaction value or average customer spending with a specified confidence level. 2. Permutation Testing: Test whether two groups have significantly different performance measures.			
Assignments: 1. Maximum Likelihood Estimation: Given a dataset representing customer purchases, estimate the parameters of an appropriate probability distribution using Maximum Likelihood Estimation (MLE) and interpret the results. 2. Cross-Validation for Model Selection: Develop at least two machine learning models for a prediction problem and use k-fold cross-validation to compare their performance. Analyze the effect of different values of k on model evaluation.			
Unit 3	Regression, Multivariate Analysis and Clustering	Weeks 5-6	CO3
Regression and Classification: Concept of regression and classification, comparison and applications. Linear Regression: Simple Linear Regression, least squares estimation, model assumptions, prediction and evaluation. Multiple Linear Regression: Model formulation, parameter estimation, interpretation of coefficients, model assumptions and evaluation. Logistic Regression: Logistic function, probability estimation, classification using Logistic Regression, inference on Logistic Regression. Clustering: Supervised versus unsupervised learning, hierarchical clustering, K-means clustering and applications. Regularization using Ridge and Lasso regression, scalable clustering for large datasets, ensemble-based statistical learning, introduction to AutoML for model selection and evaluation.			
Exemplars / Practical Applications and usage: 1. Sales Forecasting: Predict sales based on advertising expenditure, seasonality and customer characteristics. 2. House Price Prediction: Apply simple and multiple linear regression.			
Assignments: 1. Customer Churn Prediction: Develop a Logistic Regression model to predict customer churn. Analyze the predicted probabilities, classification performance, and important explanatory variables. 2. Hierarchical vs K-Means Clustering: Apply both Hierarchical Clustering and K-Means to the same dataset. Compare the resulting clusters using appropriate evaluation measures and visualize the results.			
Unit 4	Curse of Dimensionality and Principal Component Analysis	Weeks 7-8	CO4
Curse of Dimensionality: Concept of dimensionality, high-dimensional data, problems associated with high dimensionality, behaviour of volume in high dimensions. Principal Component Analysis: Introduction to PCA, need for dimensionality reduction, applications of PCA.			




Mathematical Formulation of PCA: Transformation of variables, computation of principal components, explained variance and selection of principal components.

Applications of PCA: Examples of sample PCA, dimensionality reduction and inference on Principal Component Analysis.

Kernel PCA, Sparse PCA, Incremental PCA for large/streaming datasets, t-SNE and UMAP for nonlinear visualization and high-dimensional data exploration.

Exemplars / Practical Applications and usage:

1. Image Data: Reduce the number of features in image datasets using PCA.
2. Genomic Data: Apply PCA to identify patterns in high-dimensional gene-expression data.

Assignments:

1. Image Dimensionality Reduction: Apply PCA to an image dataset to reduce its dimensionality. Compare the original and reconstructed images using different numbers of principal components.
2. PCA for Healthcare/Genomic Data: Apply PCA to a high-dimensional healthcare or genomic dataset and identify the major sources of variation. Visualize the observations using the first two or three principal components.

Unit 5

Network Data, Random Graphs and Network Analytics

Weeks
9-11

CO5

Network Data and Random Graphs: Introduction to network data, graph representation, nodes and edges, random graphs and types of networks.

Properties of Random Graphs: Degree, paths, connectivity, components, network density and properties of random graphs.

Network Medicine: Introduction to Network Medicine, biological and medical networks, network-based analysis and applications.

Social Network Analysis: Introduction to Social Network Analysis, social network data, network relationships and applications.

Regression on Network Data: Simple Linear Regression on Social Network Data and interpretation of results.

Community detection and influence analysis, temporal/dynamic networks, network anomaly detection, introduction to Graph Machine Learning and Graph Neural Networks (GNNs).

Exemplars / Practical Applications and usage:

1. Fraud Detection: Identify suspicious transaction patterns using financial networks.
2. Communication Networks: Analyze connectivity and network reliability.

Assignments:

1. Social Network Analysis: Construct a social network using a real or simulated dataset and calculate degree centrality, betweenness centrality, closeness centrality, and network density. Identify the most influential nodes.
2. Random Graph Generation and Analysis: Generate random graphs using Erdős–Rényi and/or Barabási–Albert models. Compare their degree distributions, connectivity, clustering coefficient, and network density.

Textbooks:



Chairman

BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608



Chairman
Academic Council

Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani and Jonathan Taylor, An Introduction to Statistical Learning: with Applications in Python, Springer, 2nd Edition, 2023.
2. Peter Bruce, Andrew Bruce and Peter Gedeck, Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, O'Reilly Media, 2nd Edition, 2020.
3. Kevin P. Murphy, Probabilistic Machine Learning: An Introduction, MIT Press, 1st Edition, 2022.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer, 2nd Edition, 2009.
5. Richard A. Johnson and Dean W. Wichern, Applied Multivariate Statistical Analysis, Pearson, 6th Edition, 2007.

Reference Books:

1. George Casella and Roger L. Berger, Statistical Inference, Cengage Learning, 2nd Edition, 2002.
2. Larry Wasserman, All of Statistics: A Concise Course in Statistical Inference, Springer, 1st Edition, 2004.
3. Sheldon M. Ross, Introduction to Probability Models, Academic Press, 12th Edition, 2019.
4. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 1st Edition, 2010.
5. Mark Newman, Networks: An Introduction, Oxford University Press, 1st Edition, 2010.

MOOCs Links and additional reading material:

1. NPTEL – Statistical Foundation for Big Data Analysis:
<https://nptel.ac.in/courses/106105848>
2. NPTEL – Statistical Inference:
https://onlinecourses-archive.nptel.ac.in/noc18_ma22/preview
3. NPTEL – Statistical and Machine Learning Methods: Basics and Applications:
<https://nptel.ac.in/courses/105105001>

Strength of CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	3	2	3	2	1	-	1	-	1	2	3	2	2
CO2	3	3	3	3	2	1	-	1	1	1	2	3	3	2
CO3	3	3	3	3	3	1	-	1	2	2	2	3	3	3
CO4	3	3	3	3	3	1	-	1	1	2	2	3	3	3
CO5	3	3	3	3	3	2	-	1	3	3	2	3	3	3
Avg	3	3	3	3	3	1	-	1	1	2	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern



Chairman

BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608



Chairman
Academic Council

Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

a) Continuous Comprehensive Evaluation (CCE) – 40 Marks

The Continuous Comprehensive Evaluation shall be carried out by the Department based on the student's performance throughout the duration of the SWAYAM-NPTEL course.

- NPTEL Weekly Assignments / Institute-Level CCE Examination: 30 Marks
The marks obtained by the student through NPTEL Weekly Assignments or the Institute-Level CCE Examination, whichever is higher, shall be considered for the CCE evaluation.
- Course Progress and Participation: 10 Marks
Course progress and participation shall be assessed based on completion of video lectures, timely submission of weekly assignments, and periodic progress monitored by the Faculty Mentor.

b) End Semester Evaluation (ESE) – 60 Marks

1. Students shall register for and appear in the SWAYAM-NPTEL Proctored Certification Examination.
2. The marks obtained in the NPTEL Proctored Examination shall be converted proportionally to 60 marks using the following formula:
3. Students who successfully obtain the NPTEL certificate shall have the converted score considered as the End Semester Evaluation (ESE) marks.
4. Students who fail to obtain the NPTEL certificate, fail to appear for the NPTEL certification examination, or fail the certification examination shall appear for the Institute End Semester Examination conducted by the College.
5. If a student appears for both the SWAYAM-NPTEL Certification Examination and the Institute End Semester Examination, the higher of the two ESE scores shall be considered for the award of the final grade.
6. The decision of the Department regarding verification of NPTEL scores and award of marks shall be final and binding.

BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	-	-	✓	-	-	-	✓
K2	-	-	✓	-	-	-	✓
K3	-	-	✓	-	-	-	✓
K4	-	-	✓	-	-	-	✓
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-


Chairman

BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608


**Chairman
Academic Council**

Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608

This course serves as a prerequisite for / maps with the following future courses: The course provides a foundation for advanced study in Artificial Intelligence, Machine Learning, Natural Language Processing, Intelligent Systems, Industrial Engineering Analytics, Production Scheduling, and Facility Layout Optimization.

Job Mapping:

- Data Analyst
- Data Scientist
- Big Data Analyst
- Statistical Analyst
- Network Data Analyst



Chairman

BoS, Artificial Intelligence & Data Science
Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608



**Chairman
Academic Council**

Amrutvahini College of Engineering, Amrutnagar
Sangamner-422608