Institute Vision

"To be the center of excellence in technical education and research"

Institute Mission

"To address the emerging needs through quality technical education and advanced research"

Department Vision

"To be a globally recognized center of excellence in the field of Artificial Intelligence and Data Science that produces innovative pioneers and research experts capable of addressing complex real-world challenges and contributing to the socio-economic development of the nation."

Department Mission

1. To provide cutting-edge education in the field of Artificial Intelligence and Data Science that is rooted in ethical and moral values.
2. To establish strong partnerships with industries and research organizations in the field of Artificial Intelligence and Data Science, and to excel in the emerging areas of research by creating innovative solutions.
3. To cultivate a strong sense of social responsibility among students, fostering their inclination to utilize their knowledge and skills for the betterment of society.
4. To motivate and mentor students to become trailblazers in Artificial Intelligence and Data Science, and develop an entrepreneurial mindset that nurtures innovation and creativity.

Programs offered

The Department offers Under Graduate program in B.E. (Artificial Intelligence & Data Science) with an intake of 120 students. At the Post Graduate level, the Department offers specialization in M.Tech. (Artificial Intelligence & Data Science) with an intake of 18 students.

Program Educational Objectives (PEOs)

Graduates of AI & DS will be able to:

1. Adapt emerging technologies of Artificial Intelligence & Data Science and develop state of the art solutions in the fields of Manufacturing, Agriculture, Health-care, Education, and Cyber Security.
2. Exhibit professional leadership qualities to excel in interdisciplinary domains.
3. Possess human values, professional ethics, application-oriented skills and engage in lifelong learning.
4. Contribute to the research community to meet the needs of public and private sectors.

Program Specific Outcomes (PSOs)

After successful completion of the program, students will be able to:

1. Exhibit proficiency of Artificial Intelligence and Data Science in providing sustainable solutions by adapting to societal, environmental and ethical concerns to real world problems.
2. Develop professional skills in the thrust areas like ANN and Deep learning, Robotics, Internet of Things and Big Data Analytics.
3. Pursue higher studies in Artificial Intelligence and Data Science in reputed Universities and to work in research establishments.

Programme Outcomes

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

OPEN ELECTIVES OFFERED BY AI&DS DEPARTMENT

S.No	Course Code	Course Name
1	20ADO01	Introduction to Python Programming
2	20ADO02	Data Analysis and Visualisation
3	20ADO03	Fundamentals of Data Science

20AD O01

INTRODUCTION TO PYTHON PROGRAMMING
(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Programming for problem solving.

Course Objectives: This course aims to:
1. To introduce the python programming environment.
2. To impart knowledge basics data types and operation.
3. To familiarize with function, tuple, dictionary to process the data.
4. To introduce various packages in python
5. To familiarize class, object, exception handling and working with files.

Course Outcomes: Upon completion of this course, students will be able to:
1. Explore data operations on list, tuple and dictionary in python.
2. Understand deployment of models on different datasets.
3. Apply supervised, unsupervised, resembling and NLP models on different datasets.
4. Perform data analysis using python packages.
5. Build and evaluate the models using python programming.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	-	-	-	1	1	1	1	1	1	-
CO2	2	1	2	1	2	-	-	-	-	-	1	-	-	1	1
CO3	2	1	2	2	1	-	-	-	-	-	-	-	-	1	1
CO4	2	1	1	1	1	-	-	-	-	-	-	1	1	1	-
CO5	2	1	1	1	1	-	-	-	-	-	-	1	1	1	1

UNIT-I:
Introduction: Historical introduction to python, Installing Python, python interpreter and its environment: Argument passing and interactive mode, source encoding; Informal introduction to python: Python as calculator: Numbers, Strings, Lists, Programming steps.

UNIT - II
Control Statements and functions: control flow tools: if statement**,** for statements, range function, break and continue statements, else clauses on loops, pass and match statements; Defining function: default and keywords argument valuses, special parameters: positional-or-keywords arguments, positional parameters, keywords arguments, function examples, Arbitrary and Unpacking argument lists, lambda expression, documentation strings, function annotations, coding style, Input and output, reading and writing files.

UNIT - III
Data structures and Modules: More on lists: Lists as stack and queues, list comprehensions, nested list comprehensions, del statement, Tuples and sequences, sets and operations, Dictionaries, looping and conditional statements on dictionary; Modules: Executing modules as scripts, module search path, compiled python files, standards modules, dir() function, packages: Importing * from packages, intra packages references, packages in multiple directories, error and exception handling.

UNIT - IV
Design with Classes: Classes and Objects, python scopes and namespaces, class defining syntax: class objects, instances, method objects, instances variables, Inheritance, private variables, odds and ends, Iterators, generators and their expressions, standards library: OS interfaces and string pattern matching, virtual environment and packages, pip, floating point arithmetics: issue and limitations, error representation.

UNIT - V
Graphical User Interfaces: GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons. Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing, GUI case studies.

Text Book:
1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning. 2. Think Python First Edition, by Allen B. Downey, O'reilly publishing

Suggested Reading:
1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing
3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)

Web Resources:
1. https://python.org/tutorial/
2. Joy of computing Nptel course by prof. Sudersan Iyengar, IIT Roper
3. https://www.udemy.com/course/python-programming-beginner-to-advanced/

20AD O02

DATA ANALYSIS AND VISUALISATION
(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Python programming.

Course Objectives: This course aims to:
1. To introduce the Numpy library in Python to support storage and operations on large multi- dimensional arrays and matrices
2. To introduce large collection of mathematical functions to operate on multidimensional sequential data structures
3. To demonstrate the functionality of the Pandas library in Python for open source data analysis and manipulation
4. To demonstrate Data Aggregation, Grouping and Time Series analysis with Pandas
5. To introduce the Matplotlib library in Python for resting static, animated and interactive visualizations

Course Outcomes: Upon completion of this course, students will be able to:
1. Efficiently store and manipulate dense data in arrays with Numpy
2. Apply high level mathematical functions to aggregate, broadcast, index and sort multidimensional arrays.
3. Create Series and DataFrame objects to operate on datasets.
4. Perform Data cleaning, transformation, merging, aggregation on datasets.
5. Apply 2-D and 3-D plotting techniques on datasets

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	3	1	1	-
CO2	3	2	-	1	1	-	-	-	-	-	-	3	1	1	1
CO3	3	1	-	3	1	-	-	-	-	1	-	3	1	1	1
CO4	2	2	-	2	1	-	-	-	-	3	-	3	1	1	1
CO5	3	3	-	1	3	-	-	-	-	2	-	3	1	1	1

UNIT-I
Introduction to Numpy: Data types in Python - Fixed type arrays, creating arrays, array indexing, array slicing, reshaping arrays, array concatenation and splitting, Universal Functions, Aggregations, Broadcasting rules, Comparisons, Boolean Arrays, Masks Fancy Indexing, Fast Sorting using np.sort and np.argsort, partial sorting - partitioning with K-nearest neighbors, Creating Structured Arrays, Compound types and Record Arrays.

UNIT- II
Introduction to Pandas: Series Object, DataFrame Object, Data Indexing and Selecting for Series and DataFrames, Universal Functions for Index Preservation, Index Alignment and Operations between Series and DataFrames, Handling missing data, Operating on Null values, Hierarchical Indexing.

UNIT-III
Combining Datasets: Concat, Append, Merge and Joins, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance functions - query() and eval()

UNIT-IV
Inferential Statistics - Normal distribution, Poisson distribution, Bernoulli distribution, z-score, p-score, One- tailed and two-tailed, Type 1 and Type-2 errors, Confidence interval, Correlation, Z-test vs T-test, F- distribution, Chi-square distribution, the chi-square test of independence, ANOVA, data mining, titanic survivors dataset analysis

UNIT-V
Visualization with Matplotlib: Simple Line plots, Scatter plots, Visualizing errors, Density and Contour plots, Histograms, Binnings, Multiple subplots, Three-dimensional plotting with Matplotlib, Geographic data with Basemap, Visualization with Seaborn.

Text Books:
1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, 2016.
2. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Web Resources:
1. https://www.coursera.org/learn/python-data-analysis?specialization=data-science-python
2. https://www.coursera.org/learn/python-plotting

20AD O03

FUNDAMENTALS OF DATA SCIENCE

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Python programming & Statistics.

Course Objectives: This course aims to:
1. To understand the fundamentals concepts of Data Science
2. Demonstrate and analyze the different data types and analytic techniques.
3. To learn about various machine learning algorithms.
4. To familiarize with data collection techniques.
5. To study different evaluation techniques.

Course Outcomes: Upon completion of this course, students will be able to:
1. Explain the need of Data Science to analyze the skill sets of data scientists.
2. Describe the Data Science Process and its components interact.
3. Apply basic machine learning algorithms for predictive modeling.
4. Simplify a real-world problem into mathematical terms.
5. Create effective visualization of given data.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	1	-	-	-	-	-	2	1	1	1	1
CO2	3	3	-	2	-	-	-	-	-	-	1	-	1	1	1
CO3	2	2	3	-	3	-	-	-	-	-	-	3	2	2	2
CO4	3	1	-	2	1	-	-	-	-	-	1	2	2	1	2
CO5	1	1	2	3	3	-	-	-	-	-	-	-	1	1	2

UNIT-I
Introduction: Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Information vs Data, Computational Thinking, Skills for Data Science, Tool for Data Science, Issues of Ethics, Bias, Privacy in Data Science.

UNIT-II
Data: Data Types, Data Collection, Data Pre-Processing, Data Analysis and Analytics, Descriptive Analytics, Diagnostic Analytics, Predictive and Perspective Analytics, Explorative Analysis, Mechanistic Analysis.

UNIT-III
Machine Learning for Data Science: Introduction to Machine Learning, Regression, Gradient Descent, Supervised Learning-Introduction, Logistic Regression, Softmax Regression, Classification with KNN, Decision Tree, Random Forest, Naive Bayes, SVM, Unsupervised Learning.

UNIT-IV
Data Collection: Introduction to Data Collection, Surveys, Question Types, Survey Audience, Services, Analyzing Survey Data, Pros and Cons of Surveys, Interview and Focus groups, Pros and Cons of Interview and Focus, Log and Diary Data, User Studies in Lab and Field.

Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in **SEE**: (**Max. Marks: 100**)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce