Centre for Artificial Intelligence

FYUGP BSc. AI

Course Code: CAI101MD.

Course Name: Generative AI.

Credits – 3			
L	T	P	S
3	0	0	0

Course Objectives:

- Provide a foundational understanding of AI, ML, and DL concepts and principles.
- Introduce students to practical AI tools and frameworks for real-world applications.
- Equip students with the knowledge to design and implement Generative AI models.
- Encourage critical thinking on interdisciplinary applications and ethical issues in AI.

Course Outcomes:

By the end of the course, students will be able to:

- Demonstrate a clear understanding of AI, ML, and DL concepts and apply them effectively.
- Utilize AI tools to build and evaluate machine learning and deep learning models.
- Develop and deploy Generative AI models for creating text, images, or audio.
- Critically assess the ethical implications and potential societal impacts of AI solutions.

Course Contents

Unit – 1

What is AI? Introduction to AI and its applications (e.g., virtual assistants, chatbots). Basic ML Concepts: Understanding types of learning (supervised, unsupervised, reinforcement learning) through real-life examples like recommendation systems. Introduction to DL: Neural networks explained simply (e.g., how AI recognizes images and voices), Convolutional Neural Networks (CNNs). Understanding AI in Everyday Life: Explore AI in facial recognition, chatbots, and recommendation systems (like YouTube or Netflix).

Unit – 2

What is Generative AI? Explanation of how AI creates new things (e.g., generating images, text, and music). Generative AI Models - Explore tools like DALL·E (image generation) and Chat GPT (text generation), Gamma AI (presentation), Google duplex (AI-powered conversational agent), Project Debater (debating AI), SciSpace (academic research), Grammarly (writing assistant), Smart Assistants, IBM Watson Health. Ethical Considerations: Discuss the impact of Generative AI (e.g., deepfakes, AI-generated art, and its ethical implications).

Unit – 3

AI in Different Fields: Understand how AI is used in healthcare (disease detection), art (AI-generated content), media (AI-enhanced video), and science (AI-driven research). AI for Good: Explore how AI can be used for positive social impact, such as improving education, detecting fake news, or advancing environmental solutions. Ethics and Social Responsibility: Learn about the ethical concerns related to AI, like privacy issues, bias, and the potential for misuse.

Book/Resources

1. “Artificial Intelligence: A Guide for Thinking Humans (2019)” by Melanie Mitchell

2. “Pattern Recognition and Machine Learning”, Springer (2006) by Christopher M. Bishop

3. “Deep Learning (2016)” by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

4. “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (2022)”, O'Reilly Media, Inc." by Aurélien Géron

5. “Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play (2022)” , O'Reilly Media, Inc by David Foster

Course Code: CAI101MD.

Course Name: Introduction to Python Programming.

Credits – 3			
L	T	P	S
3	0	0	0

Course Objectives:

- Master Python Basics: Learn Python syntax and basic programming constructs.
- Understand Object-Oriented Programming: Gain insights into Python's object-oriented programming features.
- Build Practical Applications: Develop real-world Python applications for data analysis, web, and automation.
- Enhance Problem-Solving Skills: Improve problem-solving and debugging abilities in a programming context.

Course Outcomes:

By the end of the course, students will be able to:

- Understand programming fundamentals and concepts.
- Write and execute basic Python programs.
- Utilise control structures (conditional statements and loops).
- Implement and use functions effectively.
- Manipulate various data structures (lists, tuples, sets, dictionaries).
- Apply object-oriented programming concepts.

Course Contents:

Unit - 1

Introduction to programming concepts - algorithm, flowcharts, pseudocode, Brief history of Python, Installation of Python and setting up the environment (Jupyter Notebook, VS Code), Writing your first Python program, Python syntax - indentation and comments, Input and output in Python (print(), input()), Declaring variables, Common data types - Integers, Floats, Strings, Booleans, Type casting and type conversion.

Unit - 2

Operators in Python - Arithmetic operators, Comparison operators, Logical operators (and, or, not), Assignment operators, Conditional statements - if, elif, and else statements, Nested conditionals, Loops - for loops, while loops, Loop control (break, continue, pass), Functions - defining functions (def keyword), Function arguments and return values, Function scope (local vs global variables), Built-in functions - common functions (len(), type(), range()), Modules - importing modules (import statement), Using Python's standard library (math, random).

Unit – 3

Data structures - Lists - creating and accessing lists, List methods (append(), remove(), sort(), etc.), Tuples - immutable sequences, Tuple operations, Sets - set operations (union, intersection, difference), Dictionaries - key-value pairs, Dictionary methods (get(), update(), pop(), etc.), Introduction to Object-Oriented Programming (OOP) - classes and objects, Creating classes and objects, Attributes and methods, The init method, Basic OOP concepts - encapsulation, inheritance.

Practicals which cover Python syntax, data types, control structures, functions, modules, data structures, and basic OOP concepts.

Book/Resources

1. Downey, A. (2012). Think python. " O'Reilly Media, Inc.".
2. Shaw, Z. A. (2024). Learn Python The Hard Way. Addison-Wesley Professional.
3. Sweigart, A. (2016). Invent your own computer games with python.
4. Barry, P. (2016). Head first Python: A brain-friendly guide. " O'Reilly Media, Inc.".
5. Matthes, E. (2023). Python crash course: A hands-on, project-based introduction to programming.

Course Code: CAI102AU.

Course Name: Basic Mathematics for Four-year Data Science.

Credits – 3			
L	T	P	S
3	0	0	0

Course Objectives:

- The course is a brief overview of the basic tools from Algebra and Matrix Theory that will be needed in subsequent course of the program.
- To introduce fundamental mathematical concepts required for Data Science.
- To bridge the gap in mathematical knowledge, ensuring readiness for advanced Data Science coursework.

Course Outcomes:

By the end of the course, students will be able to:

- Use basic algebraic tools, such as functions, equations, and inequalities, to address mathematical problems related to data science.
- Use basic Matrix Theory principles including matrix operations, determinants, and eigenvalues to model and solve Data Science challenges.
- Understand and explain important mathematical principles at the heart of Data Science, ensuring a solid foundation for more advanced courses in the area.
- Identify and fix mathematical knowledge gaps, successfully bridging them to better prepare for challenging Data Science coursework.

Course Contents

Unit 1

Sets, notation and types of sets, operation on sets, Venn diagrams, Cartesian product of sets, relations and functions, domain, co-domain and range of a function, types of function (one-one, onto, bijective), real valued functions, domain and range of different types of functions with their graphs.

Unit 2

Introduction to logic, statements and propositions, logical connectives, conjunction (AND), disjunction (OR), negation (NOT), implication (IF-THEN), Biconditional (IF AND ONLY IF), truth tables, logical equivalences and laws (De Morgan's laws, distributive laws, associative laws, tautologies and contradictions).

Unit 3

Introduction to counting principles, permutation and combinations, binomial theorem, introduction to algebra, algebraic identities, linear equations in one and two variables and methods of solving's, linear inequalities, graphical representation, methods of solving linear and system of linear inequalities (upto two variables). Introduction to matrices, types of matrices, operation on matrices, determinants, inverse of a matrix, rank of a matrix, application of matrices (solving system of equations), eigen values and eigen vectors, Caley Hamilton theorem.

Book/Resources

1. Calculus by James Stewart
2. Basic Algebra by Serge Lang
3. Linear Algebra and its Applications by Gilbert Strang
4. Gilbert Strang, Linear Algebra and its Applications. Thomson /Brooks Cole (Available in a Greek Translation).
5. Thomas M. Apostol, Calculus, Wiley, 2nd Edition, 1991 ISBN 960-07-0067-2.
6. Michael Spivak. Calculus, publish or perish, 2008, ISBN 978-0914098911.
7. Ross L. Finney, Maurice D.Weir . and Frank R. Giordano. Thomas's Calculus, Pearson 12th Edition 2009.
8. David C. Lay, Linear Algebra and Its Applications, 4th Editoin.
9. Yourself saad, Iterative Methods for spare Linear Systems.