UNIVERSITY OF MYSORE
Estd.1916

**Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005**

(Re-accredited by NAAC at 'A')

(NIRF-2023 Ranked 44 in University Category & 71 in Overall Category)

No.: PMEB-1/10/Spl./2023-24

Date: 04-11-2024

NOTIFICATION

Sub.: Syllabus and Examination pattern of **BCA (Artificial Intelligence & Data Science)** course under Specialized Programmes from the academic year 2024-25-reg.

Ref.: 1. Decision of the BOS Meeting held on 01-10-2024.
2. Decision of the Academic Council meeting held on 22-10-2024.

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The Board of Studies in **BCA (Artificial Intelligence & Data Science) (UG)** at its meeting held on 01-10-2024 has recommended approve the 1st year Syllabus of **BCA(Artificial Intelligence & Data Science)** course in University of Mysore under specialized/specified programs from the academic year 2024-25.

The Academic Council has also approved the above said proposals at its meeting held on 22-10-2024 and the same is hereby notified.

The 1st year syllabus of **BCA(Artificial Intelligence & Data Science)** course may be downloaded from the University website **https://uni-mysore.ac.in/PMEB/**.

REGISTRAR
University of Mysore
MYSURU - 570 005

To,
1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DoS in Mathematics, Manasagangotri, Mysuru.
3. Prof. Suresha, DoS in Computer Science, Manasagangothri, Mysuru.
4. The Centre Head, Universal Institute For Private Training, Moghera Bin Shoba Street, P.O. Box 6938, Salmiya, Kuwait.
5. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
7. Office Copy.

Proceedings of the Meetings of the Board of Studies in BCA (Artificial Intelligence & Data Science) (UG) Universal Institute For Private Training, Kuwait, held on 01-10-2024 at 11:00 a.m. through Virtual Mode.

Ref.: UA-5/ BoS /21/Spl./2022-23, Dated: 05-08-2024.

<u>Members Present:</u>

6. Prof. Suresha	- Chairperson, BOS.
7. Ms. Syeda Roshmi Ahmed	- Member
8. Ms. Shaistha Naaz	- Member
9. Ms. Renuka Devi G	- Member
10. Mrs. Syeda Fathima	- Member

The meeting was initiated with a welcome speech by Chairman of the board through Virtual Mode. The importance of the meeting was presented along with the agenda of framing the syllabus and regulation for BCA (Artificial Intelligence & Data Science) programme as per SEP.

After detailed discussion among the members, the following were resolved to be recommended through Virtual Mode.

The proposed BCA (Artificial Intelligence & Data Science) program offered under the SEP regulations being followed by the university from time to time.

The Eligibility criteria, 1st Year Syllabus and methodology of assessment and evaluation for BCA (Artificial Intelligence & Data Science) program- Prepared & approved.

Finally, the chairman of BoS thanked all the members for their valuable time, support and valuable suggestions.

(Prof. Suresha)
Chairperson, BOS

UNIVERSAL INSTITUTE FOR PRIVATE TRAINING, KUWAIT
Offers

BCA (ARTIFICIAL INTELLIGENCE & DATA SCIENCE)
(With effect from the academic year 2024-2025)

Proposed Regulations for 3-Years (6 Semesters) Program Leading to

BCA (ARTIFICIAL INTELLIGENCE & DATA SCIENCE)

Regulations - 2024

These regulations are applicable to students taking admission to I Semester **BCA (ARTIFICIAL INTELLIGENCE & DATA SCIENCE)**

1.0 NAME OF THE COURSE AND DURATION OF THE PROGRAM

BCA (ARTIFICIAL INTELLIGENCE & DATA SCIENCE)

The duration of the **BCA (ARTIFICIAL INTELLIGENCE & DATA SCIENCE)** program shall be of 03 years (6 semesters). A candidate shall complete his / her degree within 06 academic years from the date of admission to the program.

2.0 ELIGIBILITY FOR ADMISSION

Students who have passed Pre-University Examination (10+2) or equivalent examination with Maths / Computer Science / Business mathematics / Accounting or 3 years Diploma after SSLC / 10th with CS engineering/ Information Science Engineering or equivalent.

3.0 SCHEME OF INSTRUCTIONS:

In the first four semesters, there shall be 19 courses from Discipline Specific Courses and 10 courses from Ability Enhancement Compulsory Courses. In the last two semesters, there shall be 6 coruses each Discipline Specific Elective. For each course there shall be lecture sessions, tutorials, and practicals depending on the type of course being offered. The credits for each course vary between 3 and 5 credits per course per week as prescribed in the curriculum.

Credits Matrix:

Course	No. of Courses	Total credits
Discipline Specific Course (DSC)	19 Courses	84
Discipline Specific Elective (DSE)	06 Courses X 5 Credits	30
Ability Enhancement Compulsory Courses (AECC)	10 Courses X 3 Credits	30
TOTAL (36 Courses)		144 Credits

4.0 SCHEME OF EXAMINATION AND EVALUATION:

There shall be university examination at the end of each semester for maximum marks of 80 for Theory examination and the Internal Assessment will be for 20marks.

All courses of this program except courses that are common to all other graduate programs of the University of Mysore shall be set / valued / reviewed by BoE for a maximum of 80 marks. The pattern of question paper will be as follows:

Part- A: Answer any three out of five questions   3*15 = 45 Marks

Part- B : Answer any two out of four questions   2*10 = 20 Marks

Part- C : Answer any three out of five questions   3*05 = 15 Marks

TOTAL   **80 Marks**

Evaluation of each course is divided into Internal Assessment (IA) and term end / semester end examination with marks allocated as shown in the table. Internal Assessment will be carried out in two stages: One, after the first eight weeks of instructions designated as C1, the second, after sixteen weeks of instruction designated as C2. The term end / semester end examination designated as C3 will be held between eighteenth and twentieth week of the semester. IA marks will be awarded on the basis of continuous assessment that include announced and surprise tests, term papers / seminars / quizzes / case discussions, viva, and practical's.

The breakup of marks will be as follows:

a. C1(Covering the first half of the syllabus)   – 10 Marks

b. C2(Covering the second half of the syllabus)   - 10 Marks

c. C3 (Covering entire syllabus)   – 80 Marks

Total   –100 Marks

Term end examination (C3) will be of 3 hours duration for each subject.

Evaluation of each course is divided into internal assessment (IA) and end term examination with marks allocated as shown in the table. Internal assessment will be carried out in two stages: One, after the eight weeks of instructions designated as C1, the second, after sixteen weeks of instruction designated as C2. The end of term examination designated as C3 will be held between eighteenth and twentieth week of the semester. IA marks will be awarded on the basis of continuous assessment that include announced and surprise tests, term papers / seminars / quizzes / case discussions, viva, and practical's.

Scheme of Assessment

Course Type	C1	C2	C3		Total
	Marks	Marks	Marks	Duration (Hrs)	
AECC	10	10	80	3	100
DSE	10	10	80	3	100
DSC	10	10	80	3	100

Courses in the programme are of three types: Ability Enhancement Compulsory Courses, Discipline Specific Elective and Discipline Specific Course

5.1 ATTENDANCE:

♦ Each semester shall be taken as a unit for the purpose of calculating attendance and a student shall be considered to have put in the required attendance for that semester if the candidate has attended not less than 75% of the number of working days (lectures during each semester).

- A candidate who does not satisfy the requirement of attendance shall not be eligible to take the examination of the concerned semester.
- A candidate who fails to satisfy the requirement of attendance in a semester shall re-join the same semester by obtaining prior permission from the University.

6.0 MEDIUM OF INSTRUCTION:

The medium of instruction shall be English.

7.0 APPEARANCE FOR THE EXAMINATION:

A candidate shall apply for all the papers of a semester when he appears for examination of each semester for the first time.

8.0 BOARD OF EXAMINERS, VALUATION:

- There shall be a Board of Examiners for scrutinizing and approving the question papers and scheme of valuation constituted by the University.
- There will be single valuation for all the papers.

9.1 DECLARATION OF RESULT:

- Minimum for a pass in each paper shall be 35%, and for all the papers in the semester average shall be 40%. However, a candidate has to score minimum of 35% of theory component of semester end examination i.e. 28(rounded off) marks out of 80 marks.
- There shall be no minimum marks for C1 and C2.
- Classification of successful candidates and Gradation of results shall be as per the University regulations as shown below;

Letter grade	Grade point
O (Outstanding)	10
A+(Excellent)	9
A (Very Good)	8
B+(Good)	7
B (Above	6

Average)	
C (Average)	5
P (Pass)	4
F (Fail)	0

10.1 PROVISION FOR REPEATERS:

♦ A candidate is allowed to carry all the previous un-cleared paper/s to the subsequent semester/s.

♦ The candidate shall take the examination as per the syllabus and scheme of examination in force during the subsequent appearances.

PROVISION FOR RE-ADMISSION:

♦ Such of those candidates who have discontinued the course/failed to take admission to the next semester, shall get admitted to the concerned semester in the immediate next academic year only. This provision is available to a student only two times in the entire duration of the course.

♦ **Any other issue not envisaged above** shall be resolved by the Vice Chancellor in consultation with the appropriate bodies of the University which shall be final and binding.

♦ Wherever the regulation is silent, the provisions of University regulations shall be applicable.

DSC = Discipline Specific Course DSE = Discipline

Specific Elective

AECC = Ability Enhancement Compulsory Courses

* Any one of the languages from the below mentioned;

Kannada / Sanskrit / Urdu / Tamil / Telugu / Marathi / Hindi / French / German / Persian / Arabic

SEMESTER I

Sl. No.	Courses	Category	Credits	L:T:P Pattern
1	English	AECC	3	2:1:0
2	Kannada / Sanskrit / Urdu / Tamil / Telugu / Marathi / Hindi / French	AECC	3	2:1:0
3	Foundations of Data Science, ML and AI	DSC	5	3:2:0
4	Python for Machine Learning & Artificial Intelligence	DSC	3	3:0:0
5	Fundamentals of IT & Programming in C	DSC	3	3:0:0
6	Environmental Stuides	DSC	2	2:0:0
7	Practical 1: Python for Machine Learning & Artificial Intelligence	DSC	2	0:0:2
8	Practical 2: Fundamentals of IT & Programming in C	DSC	2	0:0:2
	Total Credits		23	

SEMESTER II

Sl. No.	Courses	Category	Credits	L:T:P Pattern
1	English	AECC	3	2:1:0
2	Kannada / Sanskrit / Urdu / Tamil / Telugu / Marathi / Hindi / French	AECC	3	2:1:0
3	Data Structures & Algorithms using Python	DSC	3	3:0:0
4	Object Oriented Programming using JAVA	DSC	3	3:0:0
5	Statistical Methods for Data Science	DSC	5	3:2:0
6	Constitution of India	DSC	2	2:0:0
7	Practical 1: Data Structures & Algorithm using Python	DSC	2	0:0:2
8	Practical 2: Object Oriented Programming using JAVA	DSC	2	0:0:2
	Total Credits		23	

L	Lecture
T	Tutorial
P	Practical
AECC	Ability Enhancement Compulsory Courses
DSC	Discipline Specific Core
DSE	Discipline Specific Elective

SEMESTER I

1. **English** – Syllabus as per the university norms

2. **Kannada / Sanskrit / Urdu / Tamil / Telugu / Marathi / Hindi / French** – Syllabus as per University norms

3. Fundations of Data Science, ML & AI

Course Objective:

1. The course aims to provide a comprehensive introduction to Artificial Intelligence, covering intelligent agents, search algorithms, planning, knowledge representation, and learning in Artificial Intelligence.

Course Content:

Modules	Course Topics
I	Introductions to Data science, Machine Learning Introduction to AI: Overview, Scope, Foundations, Applications, Techniques, and Issues of Artificial Intelligence. Intelligent Agents: Agent and its Environment; Concept of a Rationality: Omniscience, Learning and autonomy; Structure of Agents: Simple Reflex, Model-Based, Goal Based, Utility Based Agents.
II	Introduction to Search: Introduction to search algorithms and search space in Artificial Intelligence, Searching for solutions; Uninformed search strategies: Introduction to Depth – First search, Breadth - first search, Informed search strategies: Hill Climbing; Adversarial Search: Minimax Algorithm.
III	Logical Agents: Knowledge based Agent, Logic, Propositional logic, Agents Based on Propositional Logic, Introduction to First Order Logic and Inference. Planning: Classical Planning, Algorithms for Planning as State Space Search, Time Schedule and Resources, Hierarchical Planning, Planning in Nondeterministic Domains, Multi-agent Planning.
IV	Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Reasoning Systems, reasoning with default information; Acting under Uncertainty, Basic Probability Notation, Probabilistic Reasoning, Bayes Rule. Learning: Learning from Observations, Inductive Learning, Knowledge in Learning, Explanation-based Learning. Case Studies: MYCIN: Overview, Domain, and features

References:

1. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach" (3rd ed.), Pearson Education, 2011.

2. Elaine Rich and Kelvin Knight, "Artificial Intelligence", Tata McGraw Hill, 2002.

3. Eugene Charniak and Drew McDermott, "Introduction to Artificial Intelligence", Pearson Education, 2009.

4. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, 2006.

5. George F. Luger, "Artificial Intelligence, Structures and Strategies for Complex Solving", Pearson Education, 5th Edition, 2010.

Online Resources:

1. https://www.youtube.com/watch?v=pKeVMlkFpRc

2. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-artificial-intelligence

4. Python for Machine Learning & Artificial Intelligence

Course Objective:

The primary objective of this course is to provide students with a comprehensive understanding of Python Programming language concepts, techniques, Environment, Basic Syntax, Variable Types, Basic Operators, and Installing Python.

Course Content:

Modules	Course Topics
I	Introduction to Python - Introduction to Python, History of Python, Features of Python, Installing Python, Python Interpreter and IDLE, Writing your first Python program
II	Python Basics - Variables and Data Types, Basic Input and Output, Operators in Python, Conditional Statements (if, else, elif), Loops (while loop, for loop), Lists, Tuples, and Dictionaries
III	Functions - Introduction to Functions, Defining Functions, Parameters and Arguments, Return Statement, Lambda Functions, Recursion
IV	File Handling - Opening and Closing Files, Reading and Writing Text Files, Working with JSON and CSV files, Exception Handling Modules and Packages, Understanding modules, Creating and using modules, Working with built-in modules , Creating and installing packages, Foundations of Machine learning and Artificial intelligence using Python

References:

1. Programming Python: Powerful Object Oriented Programming; Mark Lutz; Shroff/O'Reilly; 2010.

2. Beginning Python: Using Python 2.6 & Python 3.1; James Payne; Wiley India; 2011.

3. Head First Programming: A Learner's Guide to Programming using Python Language; Barry & Griffiths; Shroff/O'Reilly; 2009

5. Fundamentals of IT & Programming in C

Course Objective:

The course focuses on the fundamental of Computer and its peripherals. It introduces basics to computer system along with methodology of programming with concepts of C Programming.

Course Outcome:

Upon successful completion of the course the student will be able to:

1. Demonstrate the knowledge of the basic structure of computer, History of Computer, Hardware, Software, Input / Output devices.

2. Describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.

3. Learn various constructs of C Language along with proper syntax.

4. Understand the concept of decision control statements and array.

Course Content:

Modules	Course Topics
I	Introduction to Computers: Introduction to computer, Basics of computers and its operation, History of computer, Capabilities and limitations of computers, Types of computers; Hardware: CPU(Architecture & Related Technology) and Microprocessors; Storage Devices: Primary & Secondary; Auxiliary Storage Devices; Cache Memory; Memory Hierarchy; Buffering and Spooling; Software: Types of software; System Software: Control, Development, Management; Input devices: Keyboard, Mouse, Joystick, Stylus, Tablet, Touchpad, Touch Screen, Data Gloves, Camera Scanner, Microphones, Barcode reader, OCR, OMR, MICR; Output Devices: Display; CRT Plasma, LCD, LED, Printers and Plotters, projectors, Speaker, VR Head; Booting and POST; Operating System: Functions, Types; DOS: Internal and External Commands; Basics of MS Office
II	Introduction to Programming Concept: Introduction; History of programming languages; Programming Approach: Top-down Approach, Bottom-up Approach; Concept of Translator: Compiler, Interpreter & Assembler; Types of Languages: Machine Language, Assembly Languages, High level Languages; Loader, Linker, Relationship between Compiler, Loader and Linker; Flowchart; Algorithms: Introduction, Definition, Characteristics, Limitations

III	Introduction to C: Introduction; Structure of C Program; Writing the first C Program; File used in C Program; Compiling and Executing C Programs Using Comment; Data Type: Primitive, Derived, User-Defined; Token: Keywords, Literals, Identifiers, Variables, Constants; I/O Statements ; Operators: Types of operators, Precedence and Associativity of operators; Programming Examples; Type Conversion and Type Casting
IV	Decision Control and Looping Statements: Introduction to Decision Control Statements: IF, IF-ELSE, Nested IF, IF-ELSE ladder, Switch-case; Iterative Statements: FOR loop, WHILE loop, DO-WHILE loop; Jump Statement: Break and Continue

References:

1. E. Balagurusamy, "Fundamentals of Computers", McGraw Hill Education.

2. Peter Norton's., "Introduction to Computers", McGraw Hill Education.

3. Raja Raman .V, "Fundamentals of Computers", PHI Publications, 3rd Edition, 2004.

4. Thareja R., "Fundamentals of Computers", Oxford University Press.

5. Yashavant P. Kanetkar, "Let us C", BPB

6. E.Balagurusamy, "Programming in ANSI C", TMH Publications.

7. Reema Thareja, "Programming in C", OXFORD University Press

6. Environmental Studies

Course Content:

Modules	Course Topics
I	Definition of Environmental studies, Relationship to other branches (Multidisciplinary nature), scope and importance. Need for public awareness.
II	Renewable and Non-renewable Resources : **Forest Resources**: Use and over exploitation, deforestation, timber logging, Mining, Dams and their effects on Forest and tribals. **Water Resources**: use and over utilization of surface and ground water, floods, droughts, dams, benefits and problems **Mineral Resources**: Use and exploitation, environmental effects of extracting and using mineral resources. **Food Resources**: Definition, use, changes caused by agriculture and overgrazing effects of modern agriculture, fertilizer-pesticide, water logging, salinity **Energy Resources**: Growing energy needs renewable and nonrenewable energy sources, use of alternate energy sources. **Land Resources**: Land as a resource, land degradation, man induced landslides, soil erosion and decertification. Role of an individual in conversation of natural resources.
IIIb	**Concept of an Ecosystem :** Structure and function of an ecosystem Producers, consumers and decomposers Energy flow in ecosystem, Ecological succession Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following; forest ecosystem Grassland ecosystem Desert ecosystem, Aquatic ecosystem: ponds, streams, lakes, rivers, oceans, estuaries
IV	Introduction to Biodiversity – Definition, genetic species and ecosystem diversity, Biogeographical classification of India, Value of Biodiversity: Consumptive use, production use, social, ethical, aesthetic and option value, Hotspots of biodiversity Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts, endangered and endemic species of India, Conversation of biodiversity In-situ and ex-situ conversation of biodiversity
V	Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management and control measures of urban and industrial waste Pollution case studies, Disaster Management: Flood, earthquake, cyclone and landslides.

References:

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.

2. E.P. Odum, Fundamentals of Ecology, W.B. Sunders Co., USA.

3. M.N. Rao and A.K. Datta , Waste Water Treatment, Oxford and IBK Publications.

4. Benny Joseph, Environmental Studies, Tata McGraw Hill, 2005.

5. V.K. Sharma, Disaster Management, National Centre for Disaster Management, IIPE,1999. 6. Green Building Council of India, Teri Document.

7. Python for Machine Learning & Artificial Intelligence Lab

Module	Course Topics
I	1. Write a program to demonstrate different numbers data types in python. 2. Write a python program to design simple calculator using functions. 3. Write a python program to check whether a given number is Armstrong number or not. 4. Write a python program to generate prime numbers between different intervals. 5. Write a python program to find factorial of a number using recursion.
II	6. Write a python program to check whether a string is palindrome or not. 7. Write a python program to count the number of characters present in a word. 8. Write a python program to create, append and remove lists. 9. Write a program to demonstrate working with tuples in python. 10. Write a program to demonstrate dictionaries in python.

8. Fundamentals of IT & Programming in C Lab

Module	Course Topics
I	1. Implementation of internal and external commands of DOS. 2. Introduction to MSWord, Menus, Shortcuts, Document types 3. Working with documents and formatting documents. 4. Creating Tables, inserting files and pictures, working with various tools. 5. Opening new Presentation, Different presentation templates, setting backgrounds, selecting presentation layouts. 6. Creating and Formatting of presentation. 7. Adding Graphics and effects to presentation. 8. Implementation and working of spreadsheet. 9. Entering and Editing and Computing data in spreadsheet. 10. Working with database using MS Access.
II	1. Implementation of Fundamental Data Types. 2. Implementation of Fundamental Operators. 3. Implementation of Conditional Program such as if, switch etc. 4. Implementation of Basic Control Constructs such as for loop, while loop, do while loop. 5. Implementation of Various Pattern Printing Program. 6. Implementation of program to print various series

SEMESTER II

1. **English** – Syllabus as per the university norms

2. **Kannada / Sansktrit / Urdu / Tamil / Telugu / Marathi / Hindi / French** – Syllabus as per University norms

3. Data Structures & Algorithms using Python

Course Objective:

1. The objective of this course is to learn fundamental data structures and algorithms. The course describes and implements algorithms such as stacks, queues, linked lists, trees, searching techniques, sorting techniques, hashing techniques and graphs.

2. Comprehend alternative implementations using the differing logical relationships and appreciate the significance of choosing a particular logical relationship for implementation within real-world setting.

3. Demonstrate the ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures. Be familiar with the use of data structures as the foundational base for computer solutions to problems. Become introduced to and investigate the differing logical relationships among various data items.

Learning Outcome: Having successfully completed this course, the student will be able to:

1. Apply advance Python programming techniques to develop solutions for particular problems.

2. Design and implement abstract data types such as linked list, stack, queue and tree by using Python as the programming language using static or dynamic implementations. Analyse, evaluate and choose appropriate abstract data types and algorithms to solve particular problems. Design and implement Python programs that apply abstract data types.

Course Content:

Modules	Course Topics
I	Introduction to Data Structures: Introduction to Data Structure, Classification of Data Structure: Linear, Non-Linear, Python Specific Data Structure; Operations on Data Structure, Algorithms Analysis, Approach to solve algorithm design problems, Types of Case Analysis, Big-O Notation, Abstract Data Type. Array: Creation, array(data_type, value), Basic operations on Array: Adding elements, Accessing elements, Removing elements, Slicing, Searching element, Updating Array; List: Creation, list(), Accessing Elements in List, Negative List Indices, List Slicing[start:end], Updating List, Deleting List Elements, Built-in list class Methods, List operators, List Comprehension, Difference between list & array; Tuple: Creation, tuple(),Accessing Elements in Tuple, Updating Tuple, Deleting Tuple Elements Built-in tuple class methods, Indexing & slicing, Operations on tuple, List & Tuple.

II	Set: Creation, set(), Accessing values in set, Adding items in set, Removing items in set, set operator, Built-in set class methods, Set operations: union(), intersection(), difference(), symmetric_difference(); Dictionary: Creation, dict(), Adding values, Replacing values, Retrieving Values, Formatting, Deleting items, Comparing, Built-in dict class methods, Traversing, Nested Dictionary, Traversing Nested Dictionary; 2D Array, Matrix, Map(); Functions: Syntax, use of function, return statement, parameters & arguments; Recursion: Recursive Definition and Processes, Principles of Recursion, Tower of Hanoi Problem, Recursion Vs. Iteration Stack: Introduction, Implementation of stack in python, Operations on Stacks: Empty, Full, Push & Pop, Applications of stack, Conversion in Infix, Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Queue: Introduction, Implementation of Queues in Python, Operations on Queue: Create, Add, Delete, Full and Empty Queue, Circular Queue, Dequeue and Priority Queue.
III	Classes: Defining Classes: Adding Attributes, Assigning values to an attribute; Self parameters and adding methods to a class, Displaying class attributes and methods, special class attributes, Accessibility, _init_() (Constructor), _del_() (Destructor) Link Lists: Linear List concept, Linked List Terminology, Representation of Linked List in Memory, Types of Linked List, Single Linked List, Doubly Linked List, Single Circular Linked list, Circular Doubly Linked List, Operations on Link List: Creation, Traversing, Insert a node(empty list, beginning, middle, end), Delete a node (first, Last, at any position), Traversing node, Searching node, Print list, Count Nodes, Sort Lists, Implementation using Linked List: Stack Queue, Circular Queue, Dequeue, Priority Queue.
IV	Trees: Introduction to Tree & its Terminology, Binary trees, Types of Binary trees, Representation of Binary Tree, Traversals (Inorder, Preorder, Postorder), Expression Tree, Binary Search Tree, Insertion and Deletion in BST, Heap: Min Heap, Max Heap. Graph: Terminology, Representation of Graph: Adjacency Matrix, Incidence Matrix. Sorting & Searching Techniques: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort Sequential/Linear Search, Binary Search.

References:

1. Ashok N. Kamthane & Amit A. Kamthane, Programming and Problem Solving with Python, McGraw Hill Educations

2. Rance D. Necaise, Data Structures and Algorithms Using Python, JOHN WILEY & SONS, INC

3. Hemant Jain, Problem Solving in Data Structures & Algorithms Using Python, Createspace Independent Pub, First edition

4. Narasimha Karumanchi, Data Structure and Algorithmic Thinking with Python, Career Monk (1 January 2015)

5. Brad N. Miller and David L. Ranum, Problem Solving with Algorithms and Data Structures using Python, Franklin, Beedle & Associates

6. Data Structure and Algorithmic Thinking with Python

7. Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi.

8. S. Lipschutz, "Data structures", Mc-Graw-Hill International Editions, 1986.

9. Jean-Paul Tremblay, Paul. G. Soresan, "An Introduction to Data Structures with Applications", Tata Mc-Graw-Hill International Editions, 2nd edition 1984.

10. A. Michael Berman, "Data Structures via C++", Oxford University Press, 2002.

11. M. Weiss, "Data Structures in C++", Pearson Education, 2nd Edition, 2002.

4. Object Oriented Programming with JAVA

Course Objective:

1. To introduce the fundamental concepts of object oriented Programming.

2. Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard. To familiarize the concepts of packages and interfaces, handling exceptions, and demonstrate the concept of event handling used in GUI

3. To impart foundation for understand java based technologies like HADOOP etc.

Course Outcome:

On completion of this course students will be able to:

1. Understand the concept of object oriented programming and implement it in Java.

2. Comprehend building blocks of OOPs language, class, objects and method etc.

3. Understand inheritance, package and interfaces.

4. Implement multithreading in object oriented programs; design GUI using AWT Control and understanding about events.

Course Content:

Module	Course Topics
I	Introduction to Java: Evolution of Java, Features of Java, Byte Code and Java virtual machine, JDK, Structure of Simple Java Program, Compiling and Interpreting Applications, Java Tokens: Java Character set, Keyword and Identifiers. Data Types, Operators and Expression, Control Statements, Looping. Array and String: Single and Multidimensional Arrays, String Class, StringBuffer Class, Operations on String, Command Line Argument, and Use of Wrapper Class.
II	Classes, Objects & Methods: Class, Object, Object Reference, Methods in Java, Method Overloading, Constructor, Constructor Overloading, Passing and Returning Object from method, new Operator, this & Static Keyword, finalize() method, Visibility modifiers, Nested Class, Inner

	Class.
III	Inheritance and Polymorphism: Inheritance in Java, Types of Inheritance, Member Access Rule, Use of this and Super Keyword, Abstract class, Dynamic Method Dispatch, Use of final Keyword Package & Interface: Defining and Importing Packages, Defining and Implementing Interfaces, Extending Interfaces. I/O STREAM: Concept of Streams, Streams Classes: Byte and Character Stream, Reading Console input & Writing Console output.
IV	Exception Handling: Exception Type, Usage of try, catch, throw, throws and finally Keywords, Creating Own Exception Classes. Multi-Threading: Concept of Thread, Thread Life Cycle, Creating Thread Using Thread Class and Runnable Interface, Thread Priority, AWT Control: The AWT Class Hierarchy, User Interface Components: Labels, Button, Text Components, Check Box, Check Box group, Choice, List Box, Panels, Working with Frame Class, Fonts and Layout Manager, Event Handling: Events, Event Sources, Event Listeners, EDM, Handling Mouse and Keyboard Events.

References:

1. Herbert Schild, "The Complete Reference, Java 2 (Fourth Edition),", TMH

2. E.Balaguruswamy, Programming with Java A Primer, Mc Grawhill

3. Head First Java, O'rielly publications

4. Udit Agrawal, "Internet and Java Programming," Dhanpat Rai & Co.

5. Statistical Methods for Data Science

Course Objective:

1. To introduce the fundamental concepts of Statistical Procedures

2. Show competence in the use of the statistical methods in solving real world problems specially related to AI and ML

Course Outcome:

On completion of this course students will be able to:

1. Understand the concept of Statistics and its relevance to Data Science.

2. Comprehend various building blocks of statistical analysis processes.

Course Content:

Modules	Course Topics
I	Meaning and Scope of Statistics in Business and Industry. Sources of Statistical data – Methods of Data Collection, Summerization and Presentation.
II	Measures of Central Tendency – Mean, Median & Mode. G M & H M (Individual Series only). Partition Values – Quartiles and Percentiles. Measures of Dispersion – Quartiles Deviation & Standard Deviation (Absolute and Relative Measures) – Skewness, Coefficient of Variation.
III	Correlation – Meaning – Types – Methods – Karlpearson's & Charles Spearmen's Probable Error, Linear Regression Analysis – Regression Co- efficient -Regression equations, Estimation using the Regression Equation. Properties of Correlation and Regression Co-efficient between two variables
IV	Time Series Analysis – Meaning – Components – Moving average Method – Method of least squares.

References:

1. James D. Miller, Statistics for Data Science, Paperback Nov. 2017

2. Introduction to Statical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshrani, Springer Publications.

6. CONSTITUTION OF INDIA

Modules	Course Topics
I	Constitution – Structure and Principles 3 hours - Meaning and importance of Constitution - Making of Indian Constitution – Sources - Salient features of Indian Constitution
II	Fundamental Rights and Directive Principles - Fundamental Rights - Fundamental Duties - Directive Principles
III	Government of the Union - President of India – Election and Powers - Prime Minister and Council of Ministers - Lok Sabha – Composition and Powers: Rajya Sabha – Composition and Powers
IV	Government of the States-Governor – Powers -Chief Minister and Council of Ministers -Legislative Assembly – Composition and powers- Legislative Council – Composition and powers

The Judiciary - Features of judicial system in India -Supreme Court – Structure and jurisdiction -: High Court – Structure and jurisdiction |
| V | Administrative organisation and constitution - Federalism in India – Features Local Government -Panchayats –Powers and functions; 73rd and 74th amendments Election Commission – Organisation and functions -Citizen oriented measures – RTI and PIL – Provisions and significance. |

Reference:

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; Lexis Nexis, 2018 (23rd Edn.)

7. Data Structures & Algorithm using Python Lab

Course Contents:

Module	Course Topics
I	1. Implementation of Arrays, Implementation of List, Implementation of tuple, Implementation of set, Implementation of dictionary, Implementation of matrix., Implementation of 2D Array, Implementation of Recursive Procedures, Implementation of Tower of Hanoi, Implementation of Various Recursive Functions 2. Implementation of Stack, Implementation of Queue, Implementation of Circular Queue, Implementation of Dequeue, Implementation of Priority Queue.
II	1. Implementation of various operations on Linked List, Implementation of various operations on Double Linked List, Implementation of Stack using Linked List. 2. Implementation of Queue using Linked List, Implementation of Circular Queue using Linked List, Implementation of Dequeue using Linked List, Implementation of Priority Queue using Linked List. 3. Implementation of Binary tree, Implementation of Linear Search, Implementation of Binary Search, Implementation of Bubble sort, Implementation of Merge sort, Implementation of Insertion sort, Implementation of Selection sort, Implementation of Quick sort.

8. Object Oriented Programming with JAVA Lab

Course Contents:

Module	Course Topics
I	1. Implementation of a simple Java Program, Interpreting & Compiling. 2. Implementation of Fundamental Data Type. 3. Implementation of control, such as Loop etc. 4. Implementation of Single and Multidimensional Array. 5. Implementation of String class and String Operations. 6. Implementation of Classes and Objects. 7. Implementation of Method in Java. 8. Implementation of Constructors and Constructor Overloading. 9. Implementation of Access Modifier. 10. Implementation of static and this keyword.
II	1. Implementation of Inheritance in Java 2. Implementation of Super Keyword. 3. Implementation of Abstract class and final Keyword. 4. Defining and Importing Packages. 5. Defining and Implementing Interface. 6. Implementation of I/O Stream. 7. Implementation of Exception Handling 8. . Handling of Multiple Threads. 9. Implementation of AWT Control. 10. Implementation of Event Handling.