Progressive Education Society's

Modern College Of Arts, Science & Commerce (Autonomous)

Ganeshkhind, Pune – 411016

NATIONAL EDUCATION POLICY - 2020 (NEP-2020)

Basic and Honours Degree Program in

Bachelor of Computer Applications (Science): B.C.A. (Science)

(Faculty of Science & Technology)

Syllabus for S.Y. BCA (Science) 3rd and 4th Semesters

To be implemented from Academic Year 2024-2025

Title of the Course: Bachelor of Computer Applications (Science)

Preamble of the syllabus

The B.C.A. (Science) program is a combination of computer and applied courses from science stream. The computer related courses introduce techniques of programming, databases, web designing, system analysis, design tools and different computing environments. The applied courses include mathematics, statistics and electronics that provide theoretical and practical foundation for the learner.

Objectives

- To produce knowledgeable and skilled human resources that is employable in IT and ITeS.

- To impart knowledge required for planning, designing and building Complex ApplicationSoftware Systems as well as to provide support for automated systems or applications.

- It helps students analyze the requirements for system development and exposes students tobusiness software and information systems.

- This course provides students with options to specialize in legacy application software,system software or mobile applications.

- To produce entrepreneurs

Introduction

The Structure of three or four Year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minor as per their choices and feasibility of exploring learning in different institutions.

This Undergraduate Degree Program has been designed with a semester approach in mind. The First-year courses are aimed at skills development in computers using various technologies while the second year is more focused on core courses providing conceptual frame work. The third year provides the specialization and the project work and fourth year focused on initiate research binge at start-ups level.

Students will be awarded certificate in computer application after one-year completion, diploma in computer application after two years of completion, get B.C.A. degree after three years completion and B.C.A. (honors) degree after completion of four years. A four-year degree (Eight -semesters) in Computer Applications will get skills and information not only about Computer and Information Technology but also in communication, organization, research and management with multidisciplinary approach.

Eligibility for Admission:

Any candidate who has passed the XII standard Examination in Science stream from, Maharashtra State Board of Secondary and Higher Secondary Education or equivalent Board of

Examination, is eligible for admission to the First Year of this program.

OR

Passed Three Year Diploma Course approved by the DTE, Maharashtra State or Equivalentauthority.

Course Code	Course Type	Course Title	Credits		Evaluation		
			T	P	CIA	CE	Total
Semester -III S.Y. B.C.A (Science)							
BCA23101	MC	Data Structures	4	-	40	60	100
BCA23102	MC	Advanced Database Management System	2	-	20	30	50
BCA23103	MC	Data Structure & Advanced Database Management System laboratory	-	2	20	30	50
BCA23204	Minor	Data Science	2	-	20	30	50
BCA23205	Minor	Data Science & Web Designing Laboratory	-	2	20	30	50
BCA23407	VSC	Computer Networks	2	-	20	30	50
	GE/OE	BCA(Science) Students may adopt the OE coursesoffered by Arts and Commerce Faculty	2		20	30	50
ENG2350X	AEC	English/Hindi/Marathi	2	-	20	30	50
BCA23608	FP/CEP/ OGT	Project Based Learning-I: C/Data Structure		2	20	30	50
PHE2360X	CC	Cultural Activities/Fine/ Performing Arts	2	-	20	30	50
Total			**16**	**6**	**220**	**330**	**550**

Total Credits: [16(TH) + 6 (PR)] = 22

TH: Theory **PR**: Practical **CIA**: Continuous Internal Assessment **CSE**: CollegeSemester Examination

Course Code	Course Type	Course Title	Credits		Evaluation		
			T	P	CIA	CE	Total
BCA24101	MC	Core JAVA	2	-	20	30	50
BCA24102	MC	Python Programming	2	-	20	30	50
BCA24103	MC-IKS	Vedic Mathematics and Computing	2	-	20	30	50
BCA24104	MC	Core JAVA Programming Laboratory	-	2	20	30	50
BCA24205	Minor	Artificial Intelligence	2	-	20	30	50
BCA24206	Minor	Artificial Intelligence Laboratory		2	20	30	50
		BCA(Science) Students may adoptthe OE courses offered by Arts and Commerce Faculty	2		20	30	50
BCA24408	SEC	Python Programming & IoT Laboratory	-	2	20	30	50
	AEC	Interview and Professional skill/Hindi/Marathi	2	-	20	30	50
BCA24609	FP/CEP/ OGT	Project Based Learning-II: AI/ Java/Python		2	20	30	50
	CC	Fitness	2	-	20	30	50
Total			**14**	**8**	**220**	**330**	**550**

Total Credits: [14(TH) + 8(PR)] = 22
TH: Theory **PR**: Practical **CIA**: Continuous Internal Assessment **CSE**: College Semester Examination.

S.Y.B.C.A (Science)

SEMESTER III

Course Code: BCA23101

Course Name: Data Structures

Course Objectives:

- To understand algorithms and analysis of algorithms
- To learn static and dynamic data structures.
- To design and implementation of various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- To improve the logical ability

Course Outcomes:

After successful completion of this course, students will be able to:

- Design an efficient algorithm for the given problem.
- Apply appropriate data structures for the given problem.
- Determine the time and space complexity of a given algorithm.

Course Contents

Unit 1: Introduction to data structure   **08 Hrs**

Introduction Data structure, Data types and data objects, Types data structures, Algorithm analysis: Frequency counts, Space and Time complexity, Asymptotic notation: BigO, Omega (Ω), Algorithms and its complexity using simple example algorithms.

Unit 2: Arrays   **10 Hrs**

Introduction and definition, Matrix representation using arrays: Row and column major, operations on matrices, Sparse Matrix, Sorting techniques with time complexity: Bubble sort, Insertion sort, Merge sort, Quick sort, Searching techniques with time Complexity: Linear search, Binary search.

Unit 3: Linked Lists   **10 Hrs**

Introduction and Definition, Representation: Static & Dynamic, Types of linked lists: singly, doubly, circular, Operations on link list: create, display, insert, delete, reverse, search, sort, concatenation, Merge.

Unit 4: Stacks and Queues   **10 Hrs**

Representation of Stack: Using arrays and Linked Lists, Operations on stack: push, pop, Applications of Stack : Recursion, Infix to postfix, postfix to infix, Representation of Queues : Static & Dynamic, Operations on queue: insert, delete, Types of queue: Circularqueue and Priority queue.

Unit 5: Trees   **12 Hrs**

Introduction and Tree terminologies: Definitions: Tree, root, child, leaf, level, height, depth, Binary trees: Types: Rooted, full, complete and skewed, Representation of Trees:Using arrays and Linked Lists, Types of Traversal: Preorder, Ignored, Postorder, Applications of Binary trees, Binary Search Tree (BST): Introduction and definition.

Unit 6: Graphs   **10 Hrs**

Introduction and Graph terminologies, Representation of a Graph – Adjacency matrix, Adjacency list, Adjacency multi-list, Graph Traversals – DFS, BFS, Applications of graphs - Topological sort.

Reference Books

1. Fundamentals of Data Structures-Horowitz Sahani (Galgotia)
2. Introduction to Data Structures using C-Ashok Kamthane
3. Data Structures using C-Bandopadhyay & Dey(Pearson)
4. Data Structures using C-By Srivastava BPB Publication
5. Data Structure Using C – By Balagurusamy

E-Books

1. Data Structures and Algorithms - Gavpai
   https://mu.ac.in/wp-content/uploads/2021/05/Data-Structure-Final-.pdf
2. Classic Data Structures – Debasis Samanta
   https://sonucgn.files.wordpress.com/2018/01/data-structures-by-d-samantha.pdf

S.Y.B.C.A (Science)

SEMESTER III

Course Code: BCA23102

Course Name: Advanced Database Management System

Course Objectives:

- To understand advanced SQL features and procedural SQL.

- To study concurrency control and crash recovery techniques.

- To understand the need of database security.

- To learn different database system architecture.

Course Outcomes:

At the end of the course, students will be able to

- Formulate SQL queries using advanced SQL features.

- Perform Database operations using PL/PostgreSQL.

- Compare and contrast different concurrency control and recovery techniques.

- Apply mechanisms for database security.

- Analyze various database system architectures

Course Contents

Unit-I Relational Database Design **5Hrs**

PL/PostgrSQL: Language structure, Controlling the program flow, conditionalstatements, loops, Views, Functions and Procedure, Handling errors andexceptions, Cursors, Triggers, Packages

Unit-II Transaction Concepts **5 Hrs**

Transaction, properties of transaction, states of transactions, Concurrent execution of transactions and conflicting operations, Schedules, types of schedules, concept of serializability, precedence graph for serializability

Unit-III Concurrency Control **5 Hrs**

Ensuring serializability by locks, different lock modes, 2PLand its variations, Multiple Granularity locking protocol, Basic timestamp method for concurrency, Thomas Write Rule, Locks with multiple granularity, dynamic database concurrency (Phantom Problem) 6. Timestamps versus locking, Optimistic concurrency control algorithm, multi version concurrency control, Deadlock handling methods - Detection and Recovery

(Wait for graph), Prevention algorithms (Wound-wait, Wait-die), Deadlock recovery techniques(Selection Victim, Starvation, Rollback)

Unit-IV Crash Recovery   **5 Hrs**

Transaction Failure classification, Recovery concepts, Checkpoints, Recovery with concurrent transactions (Rollback, checkpoints, commit), Log base recovery techniques (Deferred and Immediate update), Buffer Management, Database backup and recovery from catastrophic failures, Shadow paging

Unit-V Database Security   **5 Hrs**

Introduction to database security concepts, Methods for database security, Discretionary access control method, Mandatory access control and role based access control for multilevel security, Use of views in security enforcement, Overview of encryption technique for security, Statistical database security

Unit-VI Database System Architectures   **5 Hrs**

Centralized and Client – Server Architectures, Server System Architectures,Introduction to Parallel Systems, Introduction to Distributed Systems,Introduction to Object Based Databases

Reference Books:

1   Database System Concepts – Abraham Silberschatz, Henry F. Korth, S.Sudarshan, 6th edition-McGraw-Hill
2   Fundamentals of Database Systems- Ramez Elmasri, Shamkant B. Navathe, 6thedition–Pearson.
3   Database Management Systems -Raghu Ramakrishnan, Johannes Gehrke, 3rdedition, TataMcGraw Hill
4   Introduction to Database Management System- Bipin Desai, 3rd edition, Galgotia Publication
5   An Introduction to Database Systems - C.J. Date, 7th edition, Addison-Wesley
6   Practical PostgreSQL- Joshua D. Drake, John C Worsley, O'Reilly Publications

E-Books and online resources:

1   https://link.springer.com/content/pdf/bfm:978-3-540-48399-1/1.pdf
2   https://diblokdcma.files.wordpress.com/2009/10/springer-fundamentals-of-relational database-management-systems-apr-2007.pdf
3   https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/162-Introduction- toDatabase-Management-System-Satinder-Bal-Gupta-Aditya-Mittal-Edisi-2-2017.pdf

S.Y.B.C.A (Science)

SEMESTER III

Course Code: BCA23103

Course Name: Data Structures & Advanced Database Management System Laboratory

 Part A: Data StructuresCourse Objectives:

• To understand algorithms and analysis of algorithms

• To learn static and dynamic data structures.

Course Outcomes:

After successful completion of this course, students will be able to

• Apply appropriate data structures for the given problem.

• Design an efficient algorithm for the given problem and implement it using CProgramming.

• Determine the time and space complexity of a given algorithm.

Assignment No.	Topics for the Assignments
1	Non-Recursive Sorting Techniques 1. Bubble Sort 2. Insertion Sort
2	Recursive Sorting Techniques 1. Quick Sort 2. Merge Sort
3	Searching Techniques 1. Linear search 2. Binary Search
4	Linked List 1. Linked List 2. Singly Circular Linked List 3. Doubly Linked List 4. Doubly Circular Linked List
5	Stack 1. Static Stack Implementation 2. Dynamic Stack Implementation
6	Queue 1. Static Queue Implementation 2. Dynamic Queue Implementation
7	Binary Search Tree (Dynamic)
8	Graph 1. Adjacency Matrix Representation 2. Adjacency List Representation 3. In-degree and Out-degree calculation

Part B: Advanced Database Management System Laboratory

Course Objectives:

• To learn advanced features in SQL such as Nested queries and Views

• To become familiar with PL/PostgreSQL

Course Outcomes:

After successful completion of this course, learner will be able to

• Formulate SQL queries using advanced features

• Write stored procedures, cursors and triggers using PL/Postgre SQL.

• Design a database using database normalization technique

Sr. No.	Assignments
1	Nested query
2	Views
3	Stored functions
4	Errors and Exception handling
5	Cursors
6	Triggers

S.Y.B.C.A (Science)

SEMESTER III

Course Code: BCA23204

Course Name: Data Science

Course Objectives:

- Provide students with knowledge and skills for data-intensive problem solving and scientific discovery

- Be prepared with a varied range of expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.

- Acquire good understanding of both the theory and application of applied statistics and computer science based existing data science models to analyze huge data sets originating from diversified application areas.

- Be better trained professionals to cater the growing demand for data scientists in industry

Course Outcomes:

- After successful completion of this course, students will

- Perform Exploratory Data Analysis

- Obtain, clean/process, and transform data

- Detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.

- Demonstrate proficiency with statistical analysis of data.

- Present results using data visualization techniques.

- Prepare data for use with a variety of statistical methods and models and recognize how the quality of the data and the means of data collection may affect conclusions

Course Content

Unit I Introduction to Data Science   **6Hrs**

Introduction to data science, The 3 V's: Volume, Velocity, Variety .Why learn Data Science? Applications of Data Science, The Data Science Lifecycle ,Data Scientist's Toolbox, Types of Data : Structured, semi-structured, Unstructured Data, Problems with unstructured data ,Data sources: Open Data, Social Media Data, Multimodal Data, standard datasets .Data Formats :Integers, Floats, Text Data, Text Files, Dense Numerical Arrays, Compressed or Archived Data, CSV Files, JSON Files, XML Files, HTML Files, Tar

Files, GZip Files, Zip Files, Image Files: Rasterized, Vectorized, and/orCompressed.

Unit II Statistical Data Analysis   08Hrs

Role of statistics in data science .Descriptive statistics : measuring the Frequency, Measuring the Central Tendency: Mean, Median, and Mode . Measuring the Dispersion: Range, Standard deviation, Variance, Interquartile Range. Inferential statistics: Hypothesis testing, Multiple hypothesis testing, Parameter Estimation methods, Measuring Data Similarity and Dissimilarity: Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal Attributes, Proximity Measures for Binary Attributes, Dissimilarity of Numeric Data: Euclidean, Manhattan, and Minkowski distances, Proximity Measures for Ordinal Attributes. Concept of Outlier, types of outliers, outlierdetection methods .

Unit III Data Preprocessing   08Hrs

Data Objects and Attribute Types: What Is an Attribute, Nominal , Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes Data Quality: Why Preprocess the Data? Data munging/wrangling operations Cleaning Data - Missing Values, Noisy Data (Duplicate Entries, Multiple Entries for a Single Entity, Missing Entries, NULLs, Huge Outliers, Out-of- Date Data, Artificial Entries, Irregular Spacings, Formatting Issues - Irregular between Different Tables/Columns, Extra Whitespace, Irregular Capitalization, Inconsistent Delimiters, Irregular NULL Format, Invalid Characters, Incompatible Datetimes) Data Transformation – Rescaling, Normalizing, Binarizing, Standardizing,Label and One Hot Encoding Data reduction Data discretization.

Unit IV Data Visualization   08 Hrs

Introduction to Exploratory Data Analysis, Data visualization and visual encoding, Data visualization libraries, Basic data visualization tools ,Histograms, Barcharts/graphs, Scatter plots, Line charts, Area plots, Pie charts, Donut charts Specialized data visualization tools Boxplots, Bubble plots, Heat map, Dendrogram, Venn diagram, Treemap, 3D scatter plots, Advanced data visualization tools- Word clouds Visualization of geospatial data Data Visualization types.

Reference Books:

1. Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma,BPB Publications, 2020.

2. The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017

3. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline

E- Reference:

1. https://srdas.github.io/Papers/DSA_Book.pdf

2. https://asolanki.co.in/wp-content/uploads/2019/04/Data-Science-Concepts-and-Practice-2nd-Edition-3.pdf

3. https://www.cs.cornell.edu/jeh/book.pdf

S.Y.B.C.A (Science)

SEMESTER III

Course Code: BCA23205

Course Name: Data Science & **Web Designing laboratory**

Part A: Data Science

Course Objectives:

- To understand the basics of R programming
- To study facilities for performing data mining with R packages
- To explore Data analysis and Data Visualization using Python.

Course Outcomes:

- After successful completion of this course, learner will be able to
- Implement data mining tasks using R
- Use the python packages to carry out data mining tasks.
- Perform data analysis and data visualization using python packages.

Assignment No.	Topics for the Assignments
1	1. R Programming Basics, Programs using List, Matrix, String and Factors, Program using data frame and visualization
	Write a R program to add, multiply and divide two vectors of integer type. (vector length should be minimum 4)
	2. Write a R program to calculate the multiplication table using afunction.
	3. Write a script in R to create a list of employees and perform the following: Display names of employees in the list. Add an employee at the end of the list. Remove the third element of the list.
	4. Write a R program to sort a list of strings in ascending and descending order.
	5. Write a R program to reverse a number and also calculate the sum of digits of that number.
	6. Write a R program to calculate the sum of two matrices ofgiven size.
	7. Write a R program to concatenate two given factors.
	8. Write a R program to create a data frame using two givenvectors and display the duplicate elements.

2	Write a program for Data Preprocessing, Operations of Data Munging,
3	Classification – Decision tree Conversion of Categorical values innumeric format for a given dataset. Perform Classification using Decision Tree algorithm
4	Regression Analysis and Outlier detection Perform Regression Analysis. Perform Linear Regression Regression Analysis and Outlier detection Perform Regression Analysis. Perform Linear Regression
5	Python programs for Clustering Write a python program to implement k-nearest Neighbors ML algorithm to build prediction model (Use Forge Dataset) Write a python program to implement k-means algorithms on a synthetic dataset.

Part B: Web Designing Laboratory

Course Objectives:

- To develop an ability to design and implement static and dynamic website
- Choose best technologies for solving web client/server problems
- Create conforming web pages
- Use JavaScript for dynamic effects

Program Outcome:

- Create web pages using HTML and Cascading Styles sheets
- Analyze a web page and identify its elements and attributes
- Create dynamic web pages using JavaScript

Laboratory Assignments	
1	Basic HTML Tags
2	List & Tables in HTML
3	Frames & Forms in HTML
4	CSS
5	Basics of JavaScript
6	Functions & Object in JavaScript

S.Y.B.C.A (Science)

SEMESTER III

Course Code: BCA23407

Course Name: Computer Network

Course Objectives:

- To understand the fundamental concepts of networking standards, protocols and technologies.
- To study different techniques for framing, error control, flow control and routing.
- To learn role of protocols at various layers in the protocol stacks.
- To develop an understanding of modern network architectures from a design and performance perspective.

Course Outcomes:

On successful completion of this course, a student will be able to:

- Analyze the requirements for a given organization and select appropriate network architecture, topologies, transmission mediums and technologies.
- Analyze data flow between TCP/IP model using Application, Transport and Network Layer Protocols.
- Illustrate applications of Computer Network.
- Compare and contrast different routing and switching algorithms

Course Contents

Unit I Introduction Computer Networks   4Hrs

Computer Networks applications –Business Application, Home Application, Broadcast and point-to-point networks, Network Topologies - Bus, Star, Ring ,Network Types- LAN, MAN, WAN, PAN, Wireless Networks, Home Networks, internetworks Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure.

Unit II Network Models   4 Hrs

Concept of Network models, OSI Reference Model: Basic TCP/IP Model – layers and Protocol Suite, Addressing- Physical, Logical, Port addresses, Specific addresses**.**

Unit III Physical Layer   **6 Hrs**

Analog and Digital data, Analog and Digital signals, Digital Signals-Bit rate, Bit length, Baseband and Broadband Transmission, Transmission Impairments– Attenuation, Distortion and Noise Data Rate Limits– Noiseless channel: Nyquist's bit rate, Shannon'slaw , Performance of the Network , Line Coding :Concept, Characteristics, Techniques. Transmission Modes: Parallel and Serial Multiplexing: FDM and TDM,Switching-Circuit Switching, Message Switching and Packet Switching.

Unit IV Data Link Layer   **6 Hrs**

Functions, Framing – Concept, Types: fixed size, variable size, Framing Methods, Error detection: concept and techniques, Elementary data link protocols (simplex, Stop-And- Wait, Stop and wait ARQ, Go-Back-N ARQ Selective Repeat ARQ), Sliding Window Protocols working Principal, ALOHA protocols: working principal, types– pure and slotted, CSMA Protocol: CSMA/CD,CSMA/CA ,Controlled Access - Reservation, Polling and Token Passing, Channelization – Definitions – FDMA, TDMA and CDMA

Unit V Network Layer   **4 Hrs**

IPv4 addresses: Address space, Notation, Classful addressing, Classless addressing, Sub netting, Super netting, IPv4: Datagram, Fragmentation, checksum, options, IPv6 addresses: Structure, address space, IPv6: packet format, Extension headers

Unit VI Transport and Application Layer   **6 Hrs** Process-to-Process Delivery, Multiplexing and De-multiplexing, User Datagram Protocol (UDP) - Datagram Format, Checksum, UDP operations, Use of UDP, Transmission Control Protocol (TCP) - TCP Services, TCP Features, TCP Segment Structure, TCP Vs UDP, Domain Name System (DNS) - Distribution of Name Space,DNS in the Internet, E-MAIL - Architecture, User Agent, Message Transfer Agent - SMTP, Web Based Mail, WWW – Architecture , HTTP - HTTP Transaction

Reference Books:

1   Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.

2   Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13212695-3, Pearson

E- Reference:

1   https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20%20Computer%20Networks.pdf

2   https://mrcet.com/downloads/digital_notes/CSE/III%20Year/COMPUTER%20NETWORKS%20NOTES.pdf

3   https://www.vssut.ac.in/lecture_notes/lecture1423905560.pdf

4   https://www.tutorialspoint.com/sliding-window-protocol

5   https://www.geeksforgeeks.org/services-and-segment-structure-in-tcp/

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24101

Course Name: Core Java

Course Objectives

- To learn Object Oriented Programming language
- To study various java programming concepts like Interface, File and Exception Handling etc.
- To design User Interface using Swing and AWT

Course Outcomes

On completion of the course, student will be able to–

- Understand the concept of classes, objects, packages and Collections.
- To develop GUI based application

Course Contents

Unit 1: Introduction to Java   6 Hrs

Object Oriented Programming Concepts, history of Java, Features OR Buzzwords of Java, Java Environment, Simple Java Program, Java Tools – jdbc, javap & javadoc, Types of Comments, Data Types, Final Variable , Declaring 1D, 2D Array, Accepting Input (Command Line Arguments, BufferedReader, Scanner)

Unit 2: Objects and Classes   7 Hrs

Defining your own classes Access Specifiers (public, protected, private, default), Array of Objects Constructors, Overloading Constructors and Use of 'this' keyword static block, static fields And methods, Predefined Classes Object Class, Methods (equals(), toString(),hashcode(), getClass() , String Class And String Buffer Class ,Formatting String data using format() method ,Creating , Accessing And Using Packages Wrapper Classes.

Unit 3: Inheritance and Interface   8 Hrs

Inheritance Basics (extends Keyword) and Types of Inheritance, Superclass, Subclass and use of Super Keyword, Method Overriding and runtime polymorphism , Use of final keyword related to method and class , Use of abstract class and abstract methods ,Defining and Implementing Interfaces Runtime polymorphism using interface ,Concept of Marker and Functional Interface.

Unit 4: Exception and File Handling   5 Hrs

Dealing with errors, Exception class, Checked And Unchecked Exception , Catching Exceptions, Multiple Catch Block, Nested try block ,Creating User Defined Exception, Introduction to Files And Streams ,Input-Output Stream : File Input /Output Stream, Buffered Input/ Output Stream, Data Input/Output Stream, Reader-Writer : FileReader/Writer, BufferedReader/Writer, InputStreamReader, OutputStreamWriter

Unit 5: User Interface with AWT and Swing   10 Hrs

Terms: AWT, Swing, Difference between AWT and Swing,The MVC Architecture And Swing, Layouts And Layout Managers ,Containers And Components –JButton, JLabel, JText,JTextArea, JCheckBox And JRadioButton, JList, JComboBox, JMenu And related Classes, Dialogs (Message, Confirmation, Input), JFileChooser, JColorChooser , Event Handling: Event Sources, Listeners Adapters And Anonymous Inner Class

Reference Books:

1. Complete reference Java by Herbert Schildt(5th edition)

2. Java 2 programming black books, Steven Horlzner

3. Programming with Java , A primer , Fourth edition , By E. Balagurusamy

4. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, PrenticeHall, Sun Microsystems Pres

E- References:

1. https://www.sevenmentor.com/wp-content/uploads/2020/06/Core-Java-Automation-Testing-.pdf

2. http://www.faadooengineers.com/threads/32265-Core-Java-Concepts-Pdf-notes-Download

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24102

Course Name: Python Programming

Course Objectives:

- To understand programming constructs in Python.

- To learn problems solving using Python

Course Outcomes: At the end of the course, students will be able to

- To understand basic concepts in python.

- Design an efficient algorithm for the given problem.

- Determine the time and space complexity of a given algorithm

Unit-I Introduction to Python   **06 Hrs**

Python Features, Application, Characteristics ,Installing Python, Basic Example,Variables, Data Types, Keywords, Literals,Operators, Comments, If else Loops BreakContinue Pass

Unit-II List, Tuples and Set   **06 Hrs**

List Declaration, Characteristics, List Indexing and Splitting, Updating List, Operations on List, Iterating List, Adding and Removing Elements to List, Built-in functions, Features of Tuples, Accessing Tuple Elements, Slicing, Deleting a Tuple, Tuple Methods, Iterating through Tuple, Advantages of Tuple over List, Creating set, Adding and Removing Elements from set, Set Operations, Set Comparison, Frozen Set.

Unit-III String and Dictionary   **06 Hrs**

Creating String in Python, Strings indexing and splitting, Reassigning Strings, Deleting the String, String Operators, String Formatting, The format() method, String function, Creating the Dictionary, Accessing the dictionary values, Adding Dictionary Values, Deleting Elements, Iterating Dictionary, Properties of Dictionary Keys, Built-in Dictionary Functions, Built-in Dictionary methods.

Unit-IV File I/O and Directory   **06 Hrs**

File Handling, Opening a file, The close() method, The with statement, Writing the file, Read file through

for loop, Read Lines of the file, Creating a new file, File Pointer positions, Modifying file pointer position, Python OS module, Creating the new directory, Changing the current working directory, Deleting directory, Writing Python output to the files, File methods

Unit-V Modules, Functions and Exception handling   06 Hrs

What is Modular Programming? Python import Statement, Locating Path of Modules ,The dir() Built-in Function, Namespaces and Scoping, What is an Exception? Try and Except Statement - Catching Exceptions, How to Raise an Exception, Assertions in Python, Try with Else Clause,Finally Keyword in Python, User-Defined Exceptions, Exceptions List

Reference Books:

1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic,O,,Reilly Publication

2. Django for Beginners : Build websites with Python and Django Kindle Edition byWilliam S Vincent

3. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress

4. Introduction to Computer Science Using Python- Charles Dierbach, WileyPublication Learning with Python ", Green Tea Press, 2002

E- Reference :

1. http://spoken-tutorial.org

2. https://starcertification.org/Certifications/Certificate/python

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24103

Course Name: Vedic Mathematics and Computing

Course Objectives:

- To provide knowledge about applying theoretical concepts of Vedic mathematics and computing to solve problems**.**

Course Outcomes:

On completion of the course, student will be able to

- Learn basics concepts of Vedic Mathematics

Course Contents

Unit I Table Formation   **04 Hrs**

1. Tables near to perfect base numbers

2. Tables of Even Numbers, Tables of Odd Numbers

3. Tables of numbers having units place as 5, 8, 9 ...., Tables of more than two digit numbers

Unit II Multiplication   **06 Hrs**

1. Multiplication of any number by 9, 99, 999, 9999...

2. Multiplication of numbers more than perfect base numbers, less than perfect base numbers

3. Multiplication of numbers more than sub base numbers, less than sub base numbers

4. Multiplication of any number by 11, 12 to 19, By any two digit number

5. Multiplication of numbers having sum of units place as 10..-Having sum of last two digits as 100..-Multiplication of numbers having sum of units place near to 10

6. General Multiplication - 2-2, 3-3, 4-4, 5-5 etc..

7. Multiplication of any number by 5, 25, 125 etc...

Unit III Squares and Magic Square   **06 Hrs**

1. Squares of numbers having units place as 5

2. Squares of numbers more than perfect base numbers, less than perfect base numbers

3. Squares of numbers more than sub base numbers, less than sub base numbers

4. Squares by duplexing method. Squares of numbers having last digits as 25, 75...5.

5. Squares of 1,11,111,1111,

6. Magic Square: Three by three, Five by five, Seven by seven, Nine by nine, Four byfour.

Unit IV Cubes, Square Root and Cube Root   04 Hrs

1. Cubing the numbers more than perfect base numbers, less than perfect base numbers

2. Cubing any two digit number...

3. Cubing the numbers near to sub base numbers

4. Square Roots and Cube Roots

Unit V Division and Test of Divisibility   06 Hrs

1. Division of any number by two numbers, three digit number

2. Division of any number by 9...

3. Divisions of algebraic expressions

4. Division of decimal places

5. Test of Divisibility of numbers having units place as 9

6. Test of Divisibility having units place as 1

7. Test of Divisibility of 37

8. Some other...

Unit VI Compound Interest and Fractions   04 Hrs

1. Compound Interest: For 2 years and 3 years

2. Fractions

Reference:

1. https://www.vedicmaths.org/nc-tutorials

2. https://www.udemy.com/course/vedic-maths-i/

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24104

Course Name: Core Java Programming Laboratory

Course Objectives:

- To teach the students basics of JAVA programs and its execution.
- To write programs using abstract classes.
- To write programs for solving real world problems using java collection frame work.
- To write GUI programs using swing controls in Java.

Course Outcomes: At the end of the course, students will be able to

- Write programs for solving real world problems using java collection frame work.
- Write programs using abstract classes.
- Write multithreaded programs.
- Write GUI programs using swing controls in Java..

List of Assignments

Sr. No.	Assignment
1	Java Tools and IDE, Simple java programs
2	Classes And Objects
3	Array of Objects and Packages
4	Inheritance and Interfaces
5	Exception And File Handling
6	GUI Designing, Event Handling

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24205

Course Name: Artificial Intelligence

Course Objectives:

- To learn various types of algorithms useful in Artificial Intelligence (AI).
- To convey the ideas in AI research related to emerging technology.
- To introduce ideas and techniques underlying the design of intelligent computersystems

Course Outcomes:

On successful completion of this course, a student will be able to:

- Apply the suitable algorithms to solve AI problems
- Identify and apply suitable Intelligent agents for various AI applications
- Build smart system using different informed search / uninformed search orheuristic approaches
- Represent complex problems with expressive language of representation.
- Understanding of AI's influence on society and the potential future developmentsin the field

Course Contents

Unit I Introduction to Artificial Intelligence   **04 Hrs**

Introduction to AI, Comparison of AI, Machine Learning, Deep Learning, Applications of AI, AI Techniques, Intelligent Agents, Agents and Environments,Structure of Agents.

Unit II Problems, Problem Spaces and search   **06 Hrs**

Defining problem as a State Space Search, Production System, Problem Characteristics, Search & Control Strategies, Problems – Water Jug problem, Missionary Cannibal Problem, Block words Problem, Monkey & Banana problem

Unit III Searching Algorithms   **06 Hrs**

Uninformed Search Algorithms/Blind Search Techniques, Breadth-first Search, Depth-first Search, Informed (Heuristic) search Techniques, Generate-and-test, Simple Hill Climbing, Best First Search, Constraint Satisfaction, Means End Analysis, A* and AO*

Unit IV Knowledge Representation   **06 Hrs**

Definition of Knowledge, Types of knowledge (Procedural and Declarative knowledge), Approaches to Knowledge Representation, Knowledge representation using Propositional and Predicate logic, Conversion to clause form, Resolution in Propositional logic,Resolution in Predicate logic

Unit V Recent Trends in AI and Applications   **04 Hrs**

Introduction to Machine Learning, Types of Learning, (Supervised, Unsupervised and Reinforcement Learning), Predictive Analytics (Weather Forecasting),AI-Powered Chatbots (SBI card chatbot (ILA))

Unit VI Advanced Topics and Ethical Considerations   **04 Hrs**

Natural Language Processing (NLP), Computer vision and image recognition, Bias and fairness in AI, AI in society and future directions

Reference Books:

1. Artificial Intelligence, Tata McGraw Hill, Elaine Rich and Kevin Knight
2. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
3. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
4. Introduction to Artificial Intelligence and Expert System, Dan Patterson, Prentice Hallof India Pvt. Ltd., New Delhi, 1997
5. Artificial Intelligence: A Modern Approach, Russel &Norvig, Pearson Education
6. Introduction to Machine Learning, Ethem Alpaydin, PHI

E-References:

1. **https://www.oracle.com/in/chatbots/what-is-a-chatbot/**
2. **https://www.dataversity.net/case-study-predictive-analytics-and-data-science- keep-an-eye-on-the-weather/**
3. **https://www.senseforth.ai/conversational-ai-case-studies/SBI-Cards/**
4. **https://www.oracle.com/in/artificial-intelligence/what-is-natural-language-processing/#:~:text=Natural%20language%20processing%20(NLP)%20is,natural%20language%20text%20or%20voice**
5. **https://www.simplilearn.com/computer-vision-article**
6. **https://towardsdatascience.com/understanding-bias-and-fairness-in-ai-systems- 6f7fbfe267f3**
7. **https://bernardmarr.com/what-is-the-impact-of-artificial-intelligence-ai-on- society/**

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24206

Course Name: Artificial Intelligence Laboratory

Course Objectives:

• To understand programming constructs in Artificial intelligence.

• To learn problems solving using Artificial intelligence

Course Outcomes:

At the end of the course, students will be able to

• Write programs using Artificial Intelligence programming constructs.

• Develop applications using AI.

Sr No.	Assignment
1	Implement A* Algorithm Sample Assignment Given an initial state of a 8-puzzle problem
2	Implement AO* Algorithm Sample Assignment
3	Design of an Expert System for popular domains such as Medical Diagnosis
4	Problems on BFS and DFS
5	Travelling's Salesman problem
6	Implement Bayesian network

S.Y.B.C.A (Science)

SEMESTER IV

Course Code: BCA24408

Course Name: Python Programming & IoT Laboratory

Part A: Python Programming

Course Objectives:

- To understand programming constructs in Python.

- To learn problems solving using Python

Course Outcomes: At the end of the course, students will be able to

- Write programs using Python programming constructs.

- Develop applications using Python programming.

Sr. No.	Assignment
1	Basics of Python
2	Python List, Tuple and Set
3	Python Dictionary and String
4	Python File and Directories
5	Python Modules and Functions

Part B: IoT Laboratory

Course Objectives:

- To familiarize with different types of sensors/actuators and development board used in Internet of Things applications.
- Focus on research design and development of IoT enabled technologies which are cost effective and socially relevant.

Course Outcomes: At the end of the course, students will be able to

- Setup a basic IoT hardware
- Apply IoT concept in simple real life applications.

Sr. No.	Assignment
1	Understanding the connectivity of Raspberry-Pi/ Beagle board/ ArduinoUno with IR sensor. Write a program to detect obstacle and notify a user using LEDs.
2	Understanding the connectivity of Raspberry-Pi/ Beagle board Circuit with temperature sensor. Write a program to sense temperature. If temperature crosses a threshold value, generate alerts using LEDs.
3	Understanding and connectivity of Raspberry-Pi/Beagle board with camera. Write a program to capture and store the image