

**Haribhai V Desai College
of Arts, Science & Commerce, Pune.
(Autonomous)**

Faculty of Science and Technology

B.C.A. Program



**Syllabus
For
S.Y. B.C.A.**

**Choice Based Credit System (CBCS)
Syllabus Under National Education Policy (NEP)
with effect from Academic Year 2025-26**

Title of the Program: B.C.A.

Preamble:

The computing field is witnessing unprecedented growth and transformation, particularly over the last decade, due to the continuous emergence of disruptive technologies such as artificial intelligence, data science, cybersecurity, the Internet of Things, and robotics. The 21st century has seen rapid technological advancements in every sector, including computing, which have also spurred the creation of new job roles and abundant opportunities for emerging graduates.

An Institute has made significant contributions by updating its degree programs in tune with current trends.

Moreover, the institute has taken a proactive lead in designing and implementing programs aligned with the National Education Policy (NEP) 2020. These new UG and PG programs feature multiple entry/exit options, interdisciplinary education, a strong emphasis on skill development, on-job training, field projects, research initiatives, and the integration of the Indian Knowledge System for the holistic development of students. Specifically, the Board of Computer Studies has structured the Bachelor of Science (Computer Applications) program with the following key features:

- **NEP 2020 Alignment:** Designed in accordance with NEP 2020 and affiliated university guidelines.
- **Credit Structure:** A total of 132 credits over three years (six semesters), with 22 credits per semester; candidates have the option to extend to a fourth year for either an Honours with Research or an Honours degree, totalling 176 credits.
- **Multiple Entry/Exit:** Flexibility to exit after the first, second, third, or fourth year, with the corresponding award of an UG Certification, UG Diploma, Degree, or Honours Degree (with Research/Honours) respectively.
- **Diverse Course Types:** Inclusion of Major Core, Mandatory Elective, Basic Science (BSC), Program Core (PCC), Open Electives(OE), Minor(MN), Ability Enhancement(AEC), Value Education(VEC), Vocational Skill(VSC), Skill Enhancement(SEC), Vocational Skill Enhancement (VSEC), Indian Knowledge System(IKS), Co-curricular courses(CC), Entrepreneurship, Economics and Management (EEM) along with On- job Training(OJT), Field Projects(FP), Community Engagement Programs(CEP), Research Methodology(RM), and Research Projects(RP).

This comprehensive approach not only meets current educational standards but also prepares students to thrive in a rapidly evolving technological landscape.

Objectives:

- **Enhance Problem-Solving Skills:** Develop strong computer-aided problem-solving abilities to effectively address real-world challenges.
- **Build Analytical Expertise:** Equip students with the essential skillset and analytical capabilities required to design computer-based solutions.
- **Foster Professional Skills:** Provide comprehensive training in professional competencies tailored to the software industry.
- **Strengthen Research Foundations:** Establish a robust knowledge base to support research and development in the field of computer applications.
- **Cultivate Career and Entrepreneurial Success:** Empower students to build successful careers in computer applications and inspire future entrepreneurs to innovate and create software products.

Program Outcomes:

PO No.	Outcomes
PO1	Exhibit a thorough understanding of the foundational concepts in computing.
PO2	Design and implement computer-based applications effectively.
PO3	Critically analyze existing research as reported in academic literature.
PO4	Conduct research to propose innovative alternative solutions.
PO5	Develop code that is efficient, reliable, clear, and maintainable.
PO6	Demonstrate deep expertise in the selected domain of study.
PO7	Choose and apply the most suitable method or algorithm to solve given problems.
PO8	Communicate complex technical concepts clearly and effectively, both in writing and orally.
PO9	Collaborate productively with team members by valuing diverse perspectives and contributing effectively as a professional.
PO10	Uphold integrity and social responsibility in all professional endeavors.
PO11	Cultivate self-directed and lifelong learning skills.

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications****SEMESTER-I****Level: 4.5 (First Year)**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
Subject-1	BCA-101-TH	Problem Solving and Programming in C	2		2		15	35	50
	BCA-102-PR	Lab Course on BCA-101 TH		2		4	15	35	50
BSC	BCA-103-TH	Computer Organization & Architecture	2		2		15	35	50
	BCA-104-PR	Lab Course on BCA-103 TH		2		4	15	35	50
BSC	BCA-105-TH	Discrete Mathematics and Statistics	2		2		15	35	50
	BCA-106-PR	Lab Course on BCA-105 TH		2		4	15	35	50
IKS	IKS-101-TH	Introduction to Indian Knowledge System (Generic)	2		2		15	35	50
GE/OE*	OE-101-BCA-TH	Introduction to Data Science (Offering to other stream students)	2		2		15	35	50
VSEC	SEC-101-BCA-PR	HTML and Web Page Designing		2		4	15	35	50
AEC	AEC-104-ENG-TH	Professional Communication Skills-I	2		2		15	35	50
VEC	VEC-101-ENV-TH	Environmental Education	2		2		15	35	50
TOTAL			14	08	14	16	165	385	550

** The subjects offered to other faculty students under OE vertical are OE-101-BCA-TH The students of B.C.A. will opt the subjects offered by other faculty given in College OE Basket.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-II**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
Subject-1	BCA-151-TH	Advanced C Programming	2		2		15	35	50
	BCA-152-PR	Lab Course Based on BCA-151-TH		2		4	15	35	50
BSC	BCA-153-TH	Introduction to Microcontrollers	2		2		15	35	50
	BCA-154-PR	Lab Course Based on BCA-153-TH		2		4	15	35	50
BSC	BCA-155-TH	Linear Algebra	2		2		15	35	50
	BCA-156-PR	Lab Course Based on BCA-155-TH		2		4	15	35	50
GE/OE*	OE-151-BCA -PR	Data Science using Spreadsheets (Offered to other stream students)		2		4	15	35	50
VSEC	SEC-151-BCA-PR	Software Tools for Business Communications		2		4	15	35	50
AEC	AEC-154-ENG-TH	Professional Communication Skills-II	2		2		15	35	50
VEC	VEC-152-POL-TH	Fundamentals of Indian Constitution	2		2		15	35	50
CC	CC	From College CC Basket	2		2		15	35	50
TOTAL			12	10	12	20	165	385	550

Level: 4.5 (First Year)

** The subjects offered to other faculty students under OE vertical are OE-151-BCA-PR
The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Exit Option:

*Award of UG Certificate in Bachelor of Computer Application (B.C.A.) with **44 credits and an additional 8 credits** core as per guidelines OR Continue with Major and Minor.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-III****Level: 5.0 (Second Year)**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
PCC	BCA-201-MJ-TH	Data Structure	4		4		30	70	100
	BCA-202-MJ-PR	Lab Course Based on BCA-201-MJ-TH		2		4	15	35	50
VSEC	BCA-221-VSEC-TP	C++ Programming	1	1	1	2	15	35	50
FP	BCA-231-FP-PR	SEM-III Field Project		2		4	15	35	50
MN	BCA-241-MN-TH	Python Programming	2		2		15	35	50
	BCA-242-MN-PR	Lab Course on BCA-241-MN-TH		2		4	15	35	50
OE	OE-201-BCA-TH	Introduction to Artificial Intelligence	2		2		15	35	50
IKS	IKS-201-BCA-TH	Vedic Mathematics in Algorithm Optimization	2		2		15	35	50
EEM	EEM-221-COM-TH	Banking, Finance and Insurance	2		2		15	35	50
CC	CC	From College Basket	2		2		15	35	50
TOTAL			15	07	15	14	165	385	550

** The subjects offered to other faculty students under OE vertical are OE-201-BCA-TH
The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-IV****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
PCC	BCA-251-MJ-TH	Database Management Systems	4		4		30	70	100
	BCA-252-MJ-PR	Lab course on BCA-251-MJ-TH		2		4	15	35	50
VSEC	BCA-271-VSEC-TP	Advanced Python Programming	1	1	1	2	15	35	50
CEP	BCA-281-CEP-PR	SEM-IV Community Project		2		4	15	35	50
MN	BCA-291-MN-TH	Introduction to Artificial Intelligence and Machine Learning	2		2		15	35	50
	BCA-292-MN-PR	Lab course on BCA-291-MN-TH		2		4	15	35	50
OE	OE-251-BCA-PR	Software Tools for Office Administration		2		4	15	35	50
EEM	EEM-271-BCA-PR	Startup and Entrepreneurship		2		4	15	35	50
AEC	AEC	From College Basket	2		2		15	35	50
CC	CC	From College Basket	2		2		15	35	50
TOTAL			11	11	11	22	165	385	550

** The subjects offered to other faculty students under OE vertical are OE-251-BCA-PR
The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Exit Option:

Award of UG Diploma in Bachelor of Computer Application (B.C.A.) with **88 credits and an additional 8 credits** core as per guidelines OR Continue with Major and Minor.

Syllabus



The Poona Gujarati Kelavani Mandal's

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Principal:

Dr. Rajendra G. Gurao

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Restructured Syllabus (CBCS Pattern as per NEP2020)

To be implemented from Academic Year: 2025-26

Faculty	Science and Technology
Program	Computer Application
Class	S.Y. B.C.A.

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	BCA-201-MJ-TH	PCC	Data Structure	TH	4	4

Course Objectives:

- To learn the systematic way of solving problem
- To understand the different methods of organizing large amount of data
- To efficiently implement the different data structures
- To efficiently implement solutions for specific problems
- To apply linear data structures.

Course Outcomes:

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

- Implementing algorithms to solve problems using appropriate data structures.
- Usage of well-organized data structures to handle large amounts of data
- Usage of appropriate data structures for problem-solving
- Implementation of different data structures efficiently

Sr. No.	Title and Contents	No. of lectures in Clock Hours
1	Introduction to data structure Data types and data objects Abstract Data Types (ADT) Data structure Algorithm analysis: Frequency counts, Space and Time complexity, Asymptotic notation: BigO, Omega (Ω) Algorithms and its complexity using simple example algorithms	6
2	Array Introduction and definition	8
	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 (Problem Solving & Implementation) Searching techniques with time Complexity: Linear search, Binary Search	
3	Linked List 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(Implementation of all types of linked list) Real world applications of Link list (implementation not expected)	14
4	Stack & Queue 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: Circular queue and Priority queue Real world Applications of queue (Implementation not expected)	12
5	Tree 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, Inorder, Postorder, Applications of Binary trees Binary Search Tree (BST): Introduction and definition	10

6	Graph Introduction and Graph terminologies Representation of a Graph – Adjacency matrix, Adjacency list, Adjacency multi-list(Implementation of Adjacency Matrix & Adjacency list) Graph Traversals – DFS, BFS Applications of graphs - Topological sort	10
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Reference Books

1. Classic Data Structures-D. Samanta, Prentice Hall India Pvt. Ltd.
2. Fundamentals of Data Structures in C- Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, 2nd Edition, Universities Press.
3. Data Structures using C and C++-Yedidiah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education
4. Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning.
5. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education
6. Algorithms and Data Structures, Niklaus Wirth, Pearson Education
7. Data Structures using C-Bandyopadhyay &Dey(Pearson)
8. Data Structures using C-By Srivastava BPB Publication



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Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	BCA-202-MJ-PR	PCC	Lab Course based on BCA-201-TH	PR	2	4

Course Objectives:

- Explore and develop the algorithmic approaches and different data structures to problem solving.
- Understand and implement algorithms and modular programs using different data structures and methods.
- Implement the linear and non-linear data structures.

Course Outcomes:

On completion of this course, students will be able to:

- Explore and develop the algorithmic approaches and different data structures to problem solving.
- Understand and implement algorithms and modular programs using different data structures and methods.
- Implement the linear and non-linear data structures.

Practical Guidelines:

Lab-Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The problem-solving assignments are to be submitted by the student in the form of a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade and instructor's sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of students. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.

- Internal Evaluation: 15 Marks will be given based on Assignment completion and Practical attendance.
- External Evaluation :35 Marks Practical Exam based on Data structures.

Operating Environment:

For Data Structure:

- Operating system: Linux
- Editor: Any Linux based editor like vi, edit etc.
- Compiler: cc or gcc

Assignment	Title and Contents
1	Searching Algorithm Implementation of Linear search algorithm Implementation of Binary Search algorithm
2	Sorting Algorithm Implementation of Bubble Sort algorithm(Non Recursive) Implementation of Insertion sort algorithm(Non Recursive)
3	Sorting Algorithm Implementation of Merge sort algorithm(Recursive) Implementation of Quick Sort Algorithm.(Recursive)

4	Singly Linked List Implementation of Singly Linked List with operation Create, Insert, Delete, Display, Search, Sort, Reverse operation Merging of two linked list.
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5	Singly Linked List Addition of two Polynomial Implementation of Singly Circular Linked List, Create, Insert, Delete, Display, Search operation
6	Doubly Linked List Implementation of Doubly Linked List Create, Insert, Delete, Display, Search operation Implementation of Doubly Circular Linked List Create, Insert, Delete, Display, Search operation
7	Stack Static and Dynamic implementation of Stack Infix to Postfix conversion Evaluation of postfix expression
8	Queue Static and Dynamic implementation of linear Queue Implementation of circular queue
9	Binary Search Tree Implement Binary Search Tree (BST) to perform following operations on BST–Create, Recursive Traversals - Inorder, Preorder, Postorder
10	Graph implementation Implement Graph as adjacency matrix and adjacency list Calculate indegree, outdegree and total degree of vertices Graph traversals: BFS and DFS. Using adjacency matrix



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Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	BCA-221-VSEC-TP	VSEC	C++ Programming	TP	2	1T + 2P

Course Objectives:

- To learn principles of Object Oriented Programming (OOP).
- To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
- To use the object-oriented paradigm in program design.

Course Outcomes:

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

- Compare and contrast procedural and object oriented programming
- Apply principles of OOP
- Design and develop applications using object oriented programming language C++

Sr. No.	Title and Contents	No. of lectures in Clock Hours
Theory Session		
1	Introduction to C++ 1.1 How C++ evolved from C? 1.2 Features of C++ 1.3 Procedure-oriented programming Vs Object-oriented programming 1.4 The basic anatomy of a C++ program, Simple “Hello World” program 1.5 Compiling, linking and running a C++ program.	3
2	Object Oriented Programming Concepts 2.3 Classes and objects	

	2.2 Abstraction 2.3 Inheritance 2.4 Polymorphism 2.5 Data Binding 2.6 Encapsulation 2.7 Message Passing	6
3	Programming in C++ Data Types, New operators and keywords, Type casting in C++, reference variables, Classes and Access Specifiers Defining data members and member functions Arrays and Array of objects Usage of namespace, Managing Console I/O, Usage of Manipulators	6
4	Constructors, Destructors, Function and Operator overloading Static Members Call by reference, return by reference Inline Function Friend Function Function overloading Constructor & Destructor and their types Overloading unary and binary operators (with member function and with friend function) Usage of this pointer Overloading using friend functions Overloading “<<>>” operator Type Conversion, Function overloading	8
5.	Inheritance Introduction Types of Inheritance Base class and derived class examples Virtual base class Abstract class Polymorphism Virtual functions and pure virtual functions, Overriding	7
6.	Files and Exception Handling Classes for file stream operations Opening and closing a file Random access files Introduction to Exception handling mechanism	5
Reference Books: 1. Object Oriented Programming (C++) Balaguruswamy, McGraw Hill Education; Seventh edition		

2. Deitel, —C++ How to Program II, 4th Edition, Pearson Education		
3. The Complete Reference C++ by Herbert Schildt, McGraw Hill Education; 4 edition		
4. Mastering C++ by Venugopal, T Ravishankar, McGraw Hill Education; 2 edition		
Laboratory Session		
Assignment No	Topics for the Assignments	No. Of Session
1	Class , Object and methods implementation	2
2	Constructor: Copy Constructor, Default Constructor, Parameterized Constructor	3
3	Memory Allocation: new and delete operators , dynamic constructor	2
4	Inline function, friend function, default argument, Function Overloading.	3
5	Inheritance: Single, multiple, multilevel, hierarchy, Constructor and destructor in derived class	3
6	File Handling: Read, Write, Updating of files using random access	2
Total Number of Sessions per batch		15



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Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	BCA-231-FP-PR	FP	SEM-III Field Project	PR	2	4

Course Objectives:

- To study existing ICT implementation setup during a specific field visit
- To conduct SWOC analysis of organization visited

Course Outcomes:

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

- Perform SWOC analysis of an organization visited
- Identify and define problem statement
- Devise possible solution

Guidelines for Instructor's Manual

The instructor shall prepare instructor's manual consisting of University syllabus, conduction and Assessment guidelines.

Guidelines for the conduction of visits and Micro projects

- Faculty appointed for the course shall identify various organizations and prepare a plan for Field visits.
- Faculty shall define objectives, outcomes for each visit
- Faculty shall visit the website of the organization/NGO etc. before the visit and students shall also to study them.
- Faculty shall conduct an online/offline MCQ based test (A few questions about organization/NGO, a few on the field visit).
- Faculty shall arrange a group discussion of students after the visit to fine-tune the SWOC.
- Students shall identify a group project/task by identifying the problem that may help the organization/NGO and shall work on identified problem and submit micro-project report.



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Guidelines for Student Journal

The student shall participate in each field visit and submit the report of each visit in the form of a journal. Journal shall have a Certificate, table of contents, and handwritten write-up of report of each visit consisting of Title, objectives, outcomes, day, date and name of the organization visited, SWOC Analysis, date of completion, assessment grade/marks and signature of the instructor etc. The students shall also submit a report of Micro-project consisting of SWOC, Problem definition and details of the possible solution(s).

Guidelines for Assessment

The instructor shall carry out internal evaluation of assignments of 15 marks throughout the semester. For each visit, the instructor shall assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, SWOC analysis, performance in test, innovative idea/solution suggested, participation Group Discussions, neatness of the write-up etc.

A pair of examiners shall conduct end semester examination of 35 marks in the form of oral examination based on journal assignment and micro-project report.

List of suggested Field Visits

- Healthcare – HIMS, Telemedicine etc.
- Academic Institutions/Universities - e-Learning Platforms, MOOCs, ERP, IT Infrastructure and Security etc.
- Agriculture - Use of IoT Devices, drones in Agriculture, Management of Water Distribution etc.
- Social Services - Assistive Technologies for Divyanga Personnel, Support for Senior Citizens etc.
- Urban Region - Smart Cities, Traffic Management etc.
- Rural Region - Smart Villages, Agriculture Product Distribution Systems etc.
- Government offices and offices of Local Bodies - ERP, IT Infrastructure and Security etc.
- Governance - e-Governance Portals, Online Payment Systems etc.
- Industries (IT/Manufacturing/Telecomm) involved in development of solutions to solve social issues
- Prominent Local social events such as Sinhasta Kumbhamela, Vari etc. – Crowd and traffic management, surveillance, security, Environmental issues etc.



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Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	BCA-241-MN-TH	MN	Python Programming	TH	2	2

Course Objectives:

- To understand programming constructs in Python.
- To learn problem-solving using Python

Course Outcomes:

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

- Write programs using Python programming constructs.
- Develop applications using Python programming.

Sr. No.	Title and Contents	No. of lectures in Clock Hours
1	Introduction to Python Scripting 1.1 Why Scripting is Useful in Computational Science • Classification of Programming Languages • Productive Pairs of Programming Languages • Gluing Existing Applications • Scripting Yields Shorter Code, Efficiency • Type-Specification (Declaration) of Variables • Flexible Function Interfaces • Interactive Computing • Creating Code at Run Time • Nested Heterogeneous Data Structures • GUI Programming • Mixed Language Programming	4

	1.2 When to Choose a Dynamically Typed Language 1.3 Why Python? Script or Program? 1.4 Application of Python	
2	Basic Python 2.1 Python identifiers and reserved words 2.2 Lines and indentation, multi-line statements Comments 2.3 Input/output with print and input functions, 2.4 Command line arguments and processing command line arguments 2.5 Standard data types – basics data types, none, Boolean (true & False), numbers, 2.6 Python strings 2.7 Data type conversion 2.8 Python basic operators (Arithmetic, comparison, assignment, bitwise logical) 2.9 Python membership operators (in & not in) 2.10 Python identity operators (is & is not) 2.11 Operator precedence	4
3	Python String 3.1 Concept, escape characters 3.2 String special operations, String formatting operator, Single quotes, Double quotes, Triple quotes, Raw String, Unicode strings, Built-in String methods.	3
4	Python List 4.1 Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse 4.2 Indexing, slicing and Matrices 4.3 built-in List functions 4.4 Functional programming tools - filter(), map(), and reduce() 4.5 Using Lists as stacks and Queues, List comprehensions.	5
5	Python tuples and Sets 5.1 Creating & deleting tuples · Accessing values in a tuple · Updating tuples, delete tuple elements 5.2 Basic tuple operations · Indexing, slicing and Matrices, built-in tuple functions. 5.3 Sets - Concept, operations	4
6	Control Structures 6.1 Conditional Statements: if, elif, else 6.2 match statement 6.3 Loops: for, while, nested loops 6.4 Loop control: break, continue, pass	7
7	Python Dictionary	3

	7.1 Creating and accessing values in a dictionary 7.2 Updating dictionary, deleting dictionary elements 7.3 Properties of dictionary keys 7.4 Built-in dictionary functions and methods	
Reference Books: 1. Craig, A. B., (2013), “Understanding Augmented Reality, Concepts and Applications,” Morgan Kaufmann, ISBN: 9780240824086 2. Craig, A. B., Sherman, W. R., Will, J. D., (2009), “Developing Virtual Reality Applications, Foundations of Effective Design,” Morgan Kaufmann, ISBN: 780123749437 3. John Vince, J., (2002), “Virtual Reality Systems,” Pearson, ISBN: 9788131708446 4. Anand, R., “Augmented and Virtual Reality,” Khanna Publishing House 5. Kim, G. J., (2005), “Designing Virtual Systems: The Structured Approach”, ISBN: 9781852339586 6. O'Connell, K., (2019), “Designing for Mixed Reality: Blending Data, AR, and the Physical World,” O'Reilly, ISBN: 9789352138371 7. Sanni Siltanen, S., (2012), “Theory and applications of marker-based augmented reality,” Julkaisija –Utgivare Publisher, ISBN: 9789513874490		
Reference Books: 1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O., Reilly Publication 2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress 3. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014 4. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002 5. Python_tutorial. pdf, python_book_01.pdf 6. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller 7. A Beginner’s Python Tutorial: http://en.wikibooks.org/wiki/A_Beginner%27s_Python		
E-Books 1) Python Programming – John Zelle https://books.google.co.in/books?id=aJOILLxRmAC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIJzAA#v=onepage&q&f=false 2) Learning Python – Mark Lutz https://books.google.co.in/books?id=4pgQfXQvekcC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIMDAB#v=onepage&q=Python%20programming%20ebook&f=false 3) Programming with Python – Vaibhav Gondaliya https://books.google.co.in/books?id=LPOrDwAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjBiaDfqKLpAhVHILcAHUJBC204ChDoAQg_MAM#v=onepage&q&f=false		

4) A Primer on Scientific Programming with Python – Hans Petter Langtangen

<https://books.google.co.in/books?id=nUzADAAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjBiaDfqKLpAhVHILcAHUJBC204ChDoAQh0MAk#v=onepage&q=Python%20programming%20ebook&f=false>



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To be implemented from Academic Year: 2025-26

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Program	Computer Application
Class	S.Y. B.C.A.

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	BCA-242-MN-PR	MN	Lab course on BCA-242-MN-TH	PR	2	4

Prerequisites:

- Problem Solving thinking and tools like algorithms, flowcharts and pseudocodes.

Course Objectives:

- To understand programming constructs in Python.
- To learn problem-solving using Python

Course Outcomes:

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

- Write programs using Python programming constructs.
- Develop applications using Python programming.

Practical Guidelines:

LabBook: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments that the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The student will submit the problem-solving assignments as a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade, and instructor's sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on students' overall performance and lab assignments performance. Each lab assignment assessment will be assigned grades/marks based on parameters with appropriate weightage. Suggested parameters for the overall evaluation and each lab assignment assessment include- timely completion, performance, innovation, efficient codes, and good programming practices.

Operating Environment:

For Python Programming:

Operating system: Linux

Editor: Any Linux-based editor like vi, edit, etc.

Compiler: python (latest version)

Course Contents:

Python Programming

Assignment-1

Assignment Name: Problem Solving Aspects

- Pseudo-code to programs.
- Compilation process (compilers , interpreters), linking and loading, syntax and semantic errors, testing a program
- Practices (naming conventions, documentation, indentation
- Comments

Assignment-2

Assignment Name: Python Fundamentals

- Python identifiers and reserved words
- Input/output with print and input functions,
- Command line arguments and processing command line arguments
- data types, Typecasting
- Python strings

Assignment-3	Assignment Name: Python Operators	
- Python basic operators (Arithmetic, comparison, assignment, bitwise logical) , Operator Precedence - Python membership operators (in & not in) - Python identity operators (is & is not)		
Assignment-4	Assignment Name: Python String	
String special operations, String formatting operator, Single quotes, Double quotes, Triple quotes, Raw String, Unicode strings, Built-in String methods.		•
Assignment-5	Assignment Name: Python List	
- Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse - Indexing, slicing and Matrices - built-in List functions - Functional programming tools - filter(), map(), and reduce() - Using Lists as stacks and Queues, List comprehensions.		
Assignment-6	Assignment Name: Python tuples and Sets	
- Creating & deleting tuples · Accessing values in a tuple · Updating tuples, delete tuple elements - Basic tuple operations · Indexing, slicing and Matrices, built- in tuple functions. - Sets - Concept, operations		
Assignment-7	Assignment Name: Control Structures (Conditional Statements)	
- Conditional Statements: if, elif, else - match statement		
Assignment-8	Assignment Name: Control Structures (Loops)	
- Loops: for, while, nested loops - Loop control: break, continue, pass		
Assignment-9	Assignment Name: Python Dictionary	
- Creating and accessing values in a dictionary - Updating dictionary, deleting dictionary elements		
Assignment-10	Assignment Name: Python Dictionary	
- Properties of dictionary keys - Built-in dictionary functions and methods - Combinations of List, set, Dictionary		
Reference Books: 1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O,,Reilly Publication		

2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress
3. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014
4. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002
5. Python_tutorial. pdf, python_book_01.pdf
6. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller
7. A Beginner’s Python Tutorial: http://en.wikibooks.org/wiki/A_Beginner%27s_Python

E-Books

- 1) Python Programming – John Zelle

<https://books.google.co.in/books?id=aJQILILxRmAC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIJzAA#v=onepage&q&f=false>

- 2) Learning Python – Mark Lutz

<https://books.google.co.in/books?id=4pgOfXOvekcC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIMDAB#v=onepage&q=Python%20programming%20ebook&f=false>

- 3) Programming with Python – Vaibhav Gondaliya

https://books.google.co.in/books?id=LPOrDwAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjBiaDfqKLpAhVHILcAHUJBC204ChDoAQg_MAM#v=onepage&q&f=false

- 4) A Primer on Scientific Programming with Python – Hans Petter Langtangen

<https://books.google.co.in/books?id=nUzADAAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjBiaDfqKLpAhVHILcAHUJBC204ChDoAQh0MAk#v=onepage&q=Python%20programming%20ebook&f=false>



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Class	S.Y. B.C.A.

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
III	OE-201-BCA-TH	OE-BCA	Introduction to Artificial Intelligence	TH	2	2

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 computer systems

Course Outcomes:

On completion of the course, 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 or heuristic approaches
- Represent complex problems with expressive language of representation

Unit	Title and Contents	No. of lectures in Clock Hours
1	Introduction to Artificial Intelligence 1.1 Introduction to AI 1.2 Advantages of AI 1.3 Drawbacks of AI 1.4 Applications of AI 1.5 AI Techniques	6

2	Natural language Processing (NLP) 2.1 What is NLP? 2.2 NLP Techniques 2.3 How NLP works? 2.4 Advantages of NLP 2.5 Limitations of NLP 2.6 Applications of NLP	7
3	Applications of AI 3.1 Search Engines 3.2 Social Media 3.3 Predictions 3.4 Gaming 3.5 Healthcare 3.6 Education 3.7 E-Commerce 3.8 GPS and Navigations	10
4	AI in business 4.1 IT operations 4.2 Marketing and sales 4.3 Customer service 4.4 Content generation	7
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) https://www.geeksforgeeks.org/natural-language-processing-overview/ 5) http://tableau.com/data-insights/ai/examples		



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IV	IKS-201-BCA-TH	IKS	Vedic Mathematics in Algorithm Optimization	TH	2	2

Course Objectives:

- To enable the learners to explore the power of Vedic Maths.
- To make learners strong in Numerical Maths.
- To enable learners to recognize and understand simple techniques of Arithmetic Calculations.
- To train learners to use the ideas of Vedic Maths in daily calculations and make those calculations with accuracy and speed.

Course Outcomes:

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

- Perform simple arithmetic calculations with speed and accuracy
- Will be able to generate tables of any number
- To perform products of large numbers quickly
- Develop confidence in calculating square roots and cube roots of integers
- Perform difficult calculations speedily .
- Face Numerical Aptitude part of any Competitive Examination confidently

Unit	Title and Contents	No. of lectures in Clock Hours
1	Introduction to Indian Knowledge Systems and Computational Thought 1.1 Overview of Indian Knowledge Systems (IKS) 1.2 Early forms of logic and computation in ancient India 1.3 Importance of integrating traditional knowledge with modern computing	2
2	Vedic Mathematics and Algorithmic Thinking 2.1 Introduction to Vedic Mathematics 2.2 Selected Sutras for: ▪ Fast Multiplication and Division ▪ Square and Cube Roots 2.3 Deriving algorithmic steps from sutras 2.4 Coding simple Vedic algorithms (e.g., in Python)	4
3	Panini's Grammar and Modern NLP 3.1 Panini's Ashtadhyayi as a rule-based system 3.2 Sandhi rules and parsing logic 3.3 Relevance to computational linguistics and NLP applications	4
4	Ancient Indian Logic and Binary Concepts 4.1 Pingala's binary number system from Chandashastra 4.2 Basics of combinatorics and meters (Chhanda) 4.3 Logical reasoning in Nyaya philosophy and its influence on formal logic	4
5	Ancient Astronomy and Mathematical Modeling 5.1 Aryabhata's and Bhaskaracharya's algorithms 5.2 Time calculations, trigonometry, and ephemeris data 5.3 Modern applications in astronomical computation	6
6	Relevance to Modern Computing & Project Work 6.1 Mapping ancient algorithms to modern CS domains • Algorithm design • Parsing • Optimization techniques 6.2 Case study discussion 6.3 Mini project / group presentation on selected topics	10
References: 1. "Vedic Mathematics" by Bharati Krishna Tirthaji 2. "The Ashtadhyayi of Panini" 3. "History of Indian Mathematics" by Bibhutibhushan Datta		

SEM-IV

Syllabus



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Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
IV	BCA-251-MJ-TH	MJ	Database Management System	TH	4	4

Course Objectives:

- To understand the fundamental concepts of DBMS.
- To understand user requirements and frame it in a data model.
- To understand and learn Structured Query language and data manipulation language.
- To understand fundamental concepts of RDBMS (PL/PgSQL)
- To database management operations
- Be familiar with the basic issues of transaction processing and concurrency control

Course Outcomes:

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

- Solve real world problems using appropriate set, function, and relational models.
- Design E-R Model for given requirements and convert the same into database tables.
- Implement basic concepts of SQL.
- Understand various types of databases.
- Use database techniques such as SQL & PL/SQL.
- Explain transaction Management in relational database System.

Unit	Title and Contents	No. of lectures in Clock Hours
1	Introduction to DBMS 1.1. Introduction File Organisation 1.3. File system Vs DBMS Database Management System 1.5 Levels of abstraction & data independence Data Independence and Levels of data abstraction 1.6 Structure of DBMS (Roles of DBMS Users) 1.7 Structure of DBMS (Roles of DBMS Users) 1.8 Users of DBMS Advantages of DBMS Advantages and Limitations of DBMS	4
2	Conceptual Design Database design and ER Model: 2.1. Overview of DB design process 2.2. Introduction to data models (E-R model, Relational model) 2.3. Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets) 2.4. Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null constraint, Domain, Check constraint, Mapping constraints) 2.5. Extended features – Specialization, Aggregation, Generalization 2.6. Pictorial representation of ER(symbols) 2.7. Structure of Relational Databases (concepts of a table) 2.8. Case Studies on ER model	11
3	SQL 3.1. Introduction to query languages 3.2. Basic structure 3.3. DDL Commands 3.4. DML Commands 3.5. DCL Commands 3.6. TCL Commands 3.7. Forms of a basic SQL query (Expression and strings in SQL) 3.8. Set operations 3.9. Aggregate functions ,Group by and Having clause 3.10. Date and String functions 3.11. Nested Subqueries 3.12 SQL join operation (inner joins, outer joins and their types) 3.13. Examples on SQL (case studies)	10
4	Relational Database Design 4.1. Introduction to Relational-Database Design (undesirable properties of a RDB design) 4.2. Concept of normalization, Normal Forms (1NF,2NF and 3NF), Examples 4.3 Keys Concept with Examples : Candidate Keys and Super Keys, Algorithm to find the super keys / primary key for a relation	5

5.	Relational Database Design Using PLSQL 5.1 Introduction to PLSQL 5.2 PL/PgSQL: Datatypes, Language structure 5.3 Controlling the program flow, conditional statements, loops 5.4. Views 5.5 Stored Procedures 5.6 Stored Functions 5.7 Handling Errors and Exceptions 5.8 Cursors 5.9 Triggers	12
6	Transaction Concepts 6.1 Describe a transaction, properties of transaction(ACID), state of the transaction. 6.2 Executing transactions concurrently, associated problems in concurrent execution. Schedules, types of schedules, concept of Serializability (Conflict and View), Precedence graph for Serializability.	9
7	Concurrency Control 7.1 Ensuring Serializability by locks, different lock modes, 2PL and its variations. 7.2 Basic timestamp method for concurrency, 7.3 Locks with multiple granularity, dynamic database concurrency (Phantom Problem). 7.4 Timestamps versus locking. 7.5 Deadlock and deadlock handling - Deadlock Avoidance(wait-die, wound-wait) 7.5. Deadlock Detection and Recovery (Wait for graph).	9
Reference Books: 1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan,ISBN:9780071289597,Tata McGraw-Hill Education 2. Database Management Systems ,RaghuRamakrishnan,ISBN:9780071254342,Mcgraw-hill higher Education 3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631 4. Database Systems, Shamkant B. Navathe, RamezElmasri,ISBN:9780132144988, PEARSON HIGHER EDUCATION 5. Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, ISBN:9781590594780, Apress 6. Practical PostgreSQL (B/CD),JohnWorsley, Joshua Drake, ISBN: 9788173663925Shroff /O'reilly 7. Practical Postgresql , By Joshua D. Drake, John C Worsley (O'Reilly publications) 8. "An introduction to Database systems", Bipin C Desai, Galgotia Publications Reference Links: <u>PostgreSQL: The world's most advanced open source database</u>		



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IV	BCA-252-MJ-PR	MJ	Lab course based on BCA-251-MJ-TH	PR	2	4

SR. No	Title	Page No.
1	Case study – ER diagram(with generalization and aggregation)	
2	Using PostgreSQL - Data Definition queries (Create, Alter, Drop)	
3	Data Manipulation queries (Insert, Update, Delete)	
4	SQL Select queries(Select, From, Where clause)	
5	Aggregate Functions and Group by and Having Clauses	
6	Designing a Database using normalization	
7	Queries using joins and Nested queries.	
8	Views Creation	
9	Stored Functions	
10	Cursors 1) Simple Cursor 2) Parameterized Cursor	
11	Error and Exception handling 1) Raise Notice 2) Raise Exception	
12	Triggers 1) Before (Insert, Update, Delete) 2) After (Insert, Update, Delete)	



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Program	Computer Application
Class	S.Y. B.C.A.

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
IV	BCA-271-VSEC-TP	VSEC-TP	Advanced Python Programming	PR	2	1T+2P

Course Type: Subject-1 Code : BCA-271- VSC-TP

Course Title : **Lab Course - Advanced Python Programming**

Teaching Scheme

04 Hours/Week

No. of Credits

02

Examination Scheme

CIE : 15 Marks

SEE : 35 Marks

Prerequisites:

- Problem-solving thinking and tools like algorithms, flowcharts, and pseudocodes.
- Basic concepts of Python programming
- Identifies data types. Control statement concepts should be clear

Course Objectives:

- To understand programming constructs in Python and build the modules
- To learn problem-solving using Python with array, exception handling etc.

Course Outcomes:

On completion of the course, students will be able to—

- Write programs using Python programming module constructs.
- Develop applications using Python programming, which is user-friendly and efficient.

Practical Guidelines:

LabBook: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments that the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The student will submit the problem-solving assignments as a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade, and instructor's sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on students' overall performance and lab assignments performance. Each lab assignment assessment will be assigned grades/marks based on parameters with appropriate weightage. Suggested parameters for the overall evaluation and each lab assignment assessment include- timely completion, performance, innovation, efficient codes, and good programming practices.

Operating Environment:

For Python Programming:

Operating system: Linux

Editor: Any Linux-based editor like vi, edit, etc.

Compiler: python (latest version)

Course Contents:

Python Programming

Assignment-1	Assignment Name: Array and Iterators
• Declaration, Initialization, Accessing array elements • Operations on array • iterators	
Assignment-2	Assignment Name: Function
• Defining a function (def) • Function arguments - Pass by value, Keyword Arguments, default arguments • Documentation Strings • Variable Number of Arguments	

Assignment-3	Assignment Name: Advanced Concept of Function
• Return Value • Global Variable • Call by Reference	
Assignment-4	Assignment Name: Advanced Concept of Function - 2
• Order of arguments (positional, extra & keyword) • Recursion	
Assignment-5	Assignment Name: File Handling
• Reading and writing files • Working with CSV and JSON • Deleting files	
Assignment-6	Assignment Name: Error Handling and Exceptions
• try, except, finally, else • many exceptions	
Assignment-7	Assignment Name: Custom Exceptions
• Custom exceptions	
Assignment-8	Assignment Name: Inbuild Modules: Pandas
• Reading and writing files • Basic inbuilt functions of the pandas module	
Assignment-9	Assignment Name: Inbuild Modules: NumPy
• Basic inbuilt functions of the NumPy module	
Assignment-10	Assignment Name: Inbuilt math functions and Dates , RegEx modules
• Math inbuilt functions min(), max(), sqrt(), pow() etc. • Basic inbuilt functions of the Dates module • Basic inbuilt functions of the RegEx module	
Reference Books: 1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O,,Reilly Publication 2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress 3. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014	

4. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python “, Green Tea Press, 2002

5. Python_tutorial. pdf, python_book_01.pdf

6. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller

7. A Beginner’s Python Tutorial: http://en.wikibooks.org/wiki/A_Beginner%27s_Python
E-Books

1) Python Programming – John Zelle

<https://books.google.co.in/books?id=aJQILILxRmAC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIJzAA#v=onepage&q&f=false>

2) Learning Python – Mark Lutz

<https://books.google.co.in/books?id=4pgQfXQvekcC&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjwntzPp6LpAhWQXCsKHb8aACkQ6AEIMDAB#v=onepage&q=Python%20programming%20ebook&f=false>

3) Programming with Python – Vaibhav Gondaliya

https://books.google.co.in/books?id=LPOrDwAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjBiaDfqKLpAhVHILcAHUJBC204ChDoAQg_MAM#v=onepage&q&f=false

4) A Primer on Scientific Programming with Python – Hans Petter Langtangen

<https://books.google.co.in/books?id=nUzADAAAQBAJ&printsec=frontcover&dq=Python+programming+ebook&hl=en&sa=X&ved=0ahUKEwjBiaDfqKLpAhVHILcAHUJBC204ChDoAQh0MAk#v=onepage&q=Python%20programming%20ebook&f=false>

Web References :

<https://www.w3schools.com/python/default.asp>



The Poona Gujarati Kelavani Mandal's

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NAAC Grade B++ (2.86 CGPA) ■ AISHE CODE : C-41829

Principal:

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Restructured Syllabus (CBCS Pattern as per NEP 2020)

To be implemented from Academic Year: 2025-26

Faculty	Science and Technology
Program	Computer Application
Class	S.Y. B.C.A.

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
IV	BCA-281-CEP-PR	CEP	Community Engagement and Social Responsibility Project	PR	2	4

Course Objective:

- To develop students' ability to design and implement effective research questionnaires for Community-based studies.
- To enhance students' skills in collecting and analyzing socio-economic and environmental data.
- To foster critical thinking and problem-solving through real-world research.
- To deepen understanding of the relationship between human activities.
- To promote active engagement with local communities to address research issues.
- To build students competence in synthesizing and presenting research findings.
- To prepare students for advanced academic research or professional roles in related fields.

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

- Demonstrate the ability to design and implement effective research questionnaires for community-based studies.
- Exhibit enhanced skills in collecting and analyzing research data.
- Apply critical thinking and problem-solving skills in conducting real-world research.
- Display a deeper understanding of the relationship between human activities.
- Actively engage with local communities to address and resolve issues.
- Demonstrate competence in synthesizing and presenting research findings clearly and effectively.
- Prepare for advanced academic research or professional roles in related fields

Unit	Title and Contents	No. of lectures in Clock Hours
1	Planning and Preparation for Field Work 1.1 Defining the Fieldwork Topic 15 1.2 Scope of the Study Area 1.3 Identifying Key Research Questions for Field Study 1.4 Understanding the Fieldwork Objectives 1.5 Ethical Considerations in Field Work 1.6 Creating a Fieldwork Plan	15
2	Fieldwork Data Collection 2.1 Selecting the Fieldwork Methods (Surveys, Interviews, Observations) 2.2 Collecting Primary Data from the Field 2.3 Recording and Organizing Field Data (Photographs, Maps, Notes) 2.4 Handling Challenges in Data Collection 2.5 Post-Fieldwork Data Compilation and Preliminary Analysis	25
3	Fieldwork Report Preparation and Presentation 3.1 Analyzing Field Data (Quantitative and Qualitative Methods) 3.2 Structuring the Fieldwork Report 3.3 Writing the Introduction and Study Area Description 3.4 Formulating Objectives and Hypothesis 3.5 Writing the Methodology and Data Analysis Sections 3.6 Discussing Results and Significance of Findings 3.7 Conclusion and Recommendations 3.8 Bibliography and References	20

	3.9 Preparing for Oral Presentation of the Report	
	3.10 Submission of the Final Fieldwork Report	
Reference Books: Adams, J., Khan, H. T. A., Raeside, R. & White, D. (2007). Research methods for graduate business and social science students. New Delhi: Response Books. (C) Ahmeed, Najma Perveen (2002). Research Methods in Indian music (2nd ed.). New Delhi: Manohar Publication & distributors. (C) Alston, M. & Bowles, W. (2003). Research for social workers: an introduction to methods (2nd ed.). New Delhi: Rawat. (C) Angrosino, M. (2007). Doing ethnographic and observational research. Los Angeles: Sage Publications. (C)		

Evaluation consists of two parts:

Evaluate each student for 50 marks per semester at department level –

- 15 marks for Continuous evaluation (CE)

- Progress report on project implementation. (Field diary)

- 35 marks for End Semester Examination (ESE)

- Project Report

- Final presentation of field project findings assessing project outcomes and

Reflections



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Class	S.Y. B.C.A.

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
IV	BCA-291-MN-TH	MN	Introduction to Artificial Intelligence and Machine Learning	TH	2	2

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 computer systems

Course Outcomes:

On completion of the course, 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 or heuristic approaches
- Represent complex problems with expressive language of representation

Unit	Title and Contents	No. of lectures in Clock Hours
1	Introduction to Artificial Intelligence 1.1 Introduction to AI 1.2 Comparison of AI, Machine Learning, Deep Learning 1.3 Applications of AI 1.4 AI Techniques	4

	1.5 Intelligent Agents, Agents and Environments, Structure of Agents	
2	Problems, Problem Spaces and search 2.1 Defining problem as a State Space Search 2.2 Production System 2.3 Problem Characteristics 2.4 Search & Control Strategies 2.5 Problems – Water Jug problem, Missionary Cannibal Problem, Block words Problem, Monkey & Banana problem	5
3	Searching Algorithms 3.1 Uninformed Search Algorithms/Blind Search Techniques 3.1.1 Breadth-first Search 3.1.2 Depth-first Search 3.2 Informed (Heuristic) search Techniques 3.2.1 Generate-and-test 3.2.2 Simple Hill Climbing 3.2.3 Best First Search 3.2.4 Constraint Satisfaction 3.2.5 Means End Analysis 3.2.6 A* and AO*	6
4	Knowledge Representation 4.1 Definition of Knowledge 4.2 Types of knowledge (Procedural and Declarative knowledge) 4.3 Approaches to Knowledge Representation 4.4 Knowledge representation using Propositional and Predicate logic 4.5 Conversion to clause form 4.6 Resolution in Propositional logic 4.7 Resolution in Predicate logic	5
5.	Introduction to AI with Python: 5.1 Introduction to Python 5.2 Why python with AI? 5.3 Features of Python 5.4 Basic and advanced modules & Packages in Python 5.5 Python Decorators and generators 5.6 Advanced Objects & Data structures	4
6.	Machine Learning 6.1 Why Machine learning? 6.2 Types of Machine Learning: 6.2.1 Supervised learning- Classification & Regression. Random Forest, KNN Algorithm. 6.2.2 Unsupervised learning-Clustering & Association. Reinforcement learning.	6

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 Hall of India Pvt. Ltd., New Delhi, 1997
- 5) Artificial Intelligence: A Modern Approach, Russel & Norvig, Pearson Education
- 6) Introduction to Machine Learning, Ethem Alpaydin, PHI



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IV	BCA-292-MN-PR	MN	Lab Course on BCA-291-MN-TH	PR	2	4

Course Objectives:

- To learn various types of algorithms useful in Artificial Intelligence (AI).
- To study various searching techniques.

Course Outcomes:

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

- Apply the suitable algorithms to solve AI problems
- Use searching algorithms
- Design a simple Expert system

Assignment No.	Title of Assignment	No. of Sessions
1	Implementation of List Operations	2
2	Implementation of Set Operations	2
3	Implementation of Breadth First Search Traversal.	2
4	Implementation of Depth First Search Traversal.	2
5.	Implementation of A* and AO* algorithms	4
6.	Design of an Expert System for popular domains such as Medical Diagnosis	3
Total Number of Sessions		15



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Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
IV	OE-251-BCA-PR	OE-BCA	Software Tools for Office Administration	PR	2	4

Course Objectives:

- To help students to acquire knowledge on the environment of GUI in Ms-Word and its features.
- To introduce the fundamentals concepts of using Ms-Word and its features to make it more useful and provide hands on use of Word, Excel and PowerPoint.

Course Outcomes:

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

- Summarize the working of various application softwares such as MS Word, MS Excel and MS PowerPoint.
- Apply the various features and functionalities of MS Word, MS Excel and MS PowerPoint.
- Design and develop various Word files, spreadsheets and PowerPoint presentations.
- To use the advanced features of Ms-Word to make day to day usage easier.
- To work comfortably with Ms-Excel Environment.
- To create worksheets and user advanced features of Excel.
- To create presentations and insert multimedia in them.

Unit	Title and Contents	No. of Practicals in Clock Hours
1	Create and save a document using MS WORD - Create and save a document using MS WORD - Deletion of Character, Word, line and block of text - Undo and redo process - Moving, Copying and renaming.	2
2	Format the Text document - Format the Text document Character formatting - Paragraph formatting - Page formatting	2
3	Spell check the document - Spell Check in Document: finding and replacing of text-Bookmarks - Checking spelling and grammar automatically - Checking spelling and grammar using dictionary	2
4	Mail Merge in MS-word - Mail Merge - create main document and data file for mail merging - merging the files-mailing label using mail merging - Print the Document - Print preview - Print dialog box Steps and Procedure	3
5.	Table creation in MS-word - Create a table in the document - - Add row, column to a table - Changing column width and row height - Merge, split cells of table - Use formulae in tables - Sorting data in a table - Formatting a table.	3
6.	Create and save a new workbook in Excel Entering Data into Worksheet - Create and save a new work book in Excel - Entering Data - Editing-Formatting - formatting Cells - Copying format of cell along with the data - Save created workbook	3
7.	Freezing Titles, splitting screen - Freezing Titles, splitting Screen - Freezing Titles and splitting screen Steps and Procedure: Freezing Titles, splitting Screen	2

8.	Enter formulae for calculation in the cells a) Enter formulae for calculation in the cell-copying formula over range of a cell- b) inserting built-in functions into the cell	2
9	Create graphs for the data using ChartWizard a) create graphs for the data using Chartwizard b) Format graphs in Excel printing of worksheet	3
10	Create and save a new presentation using MS- Powerpoint a) Insert text and pictures into a blank slide and Insert new slide into the presentation	2
11	Apply slide transition effects and Slide show a) Apply Different Transition Effects- Slide Show	3
12	Create and save a new presentation using MS- PowerPoint a) Insert text and pictures into a blank slide and Insert new slide into the presentation b) Use aesthetic features c) Presentations based on topic and theme	3
Online Resources: https://www.tutorialspoint.com/cprogramming/index.html https://www.learn-c.org/ https://www.programiz.com/c-programming https://www.w3schools.in/c-tutorial/ https://www.cprogramming.com/tutorial/c-tutorial.html https://www.tutorialspoint.com/cplusplus/index.html https://www.programiz.com/cpp-programming http://www.cplusplus.com/doc/tutorial/ https://www.learn-cpp.org/ https://www.javatpoint.com/cpp-tutorial		