

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

Faculty of Science and Technology

B.C.A. Program



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

**Choice Based Credit System (CBCS)
Syllabus Under National Education Policy (NEP)
with effect from Academic Year 2026-27**

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), Program Elective (PEC), 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.

The Poona Gujarati Kelvani Mandal's
Haribhai V. Desai College of Arts, Science and Commerce, Pune
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Structure of UG Program as per NEP-2020

Program Name:- 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		20	30	50
	BCA-102-PR	Lab Course on BCA-101 TH		2		4	20	30	50
BSC	BCA-103-TH	Computer Organization & Architecture	2		2		20	30	50
	BCA-104-PR	Lab Course on BCA-103 TH		2		4	20	30	50
BSC	BCA-105-TH	Discrete Mathematics and Statistics	2		2		20	30	50
	BCA-106-PR	Lab Course on BCA-105 TH		2		4	20	30	50
IKS	IKS-101-TH	Introduction to Indian Knowledge System (Generic)	2		2		20	30	50
GE/OE*	OE-101-BCA-TH	Introduction to Data Science (Offering to other stream students)	2		2		20	30	50
VSEC	SEC-101-BCA-PR	HTML and Web Page Designing		2		4	20	30	50
AEC	AEC-104-ENG-TH	Professional Communication Skills-I	2		2		20	30	50
VEC	VEC-101-ENV-TH	Environmental Education	2		2		20	30	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.

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Structure of UG Program as per NEP-2020

Program Name:- 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		20	30	50
	BCA-152-PR	Lab Course Based on BCA-151-TH		2		4	20	30	50
BSC	BCA-153-TH	Introduction to Microcontrollers	2		2		20	30	50
	BCA-154-PR	Lab Course Based on BCA-153-TH		2		4	20	30	50
BSC	BCA-155-TH	Linear Algebra	2		2		20	30	50
	BCA-156-PR	Lab Course Based on BCA-155-TH		2		4	20	30	50
GE/OE*	OE-151-BCA-PR	Data Science using Spreadsheets (Offered to other stream students)		2		4	20	30	50
VSEC	SEC-151-BCA-PR	Software Tools for Business Communications		2		4	20	30	50
AEC	AEC-154-ENG-TH	Professional Communication Skills-II	2		2		20	30	50
VEC	VEC-152-POL-TH	Fundamentals of Indian Constitution	2		2		20	30	50
CC	CC	From College CC Basket	2		2		20	30	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.

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Structure of UG Program as per NEP-2020

Program Name:- 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		40	60	100
	BCA-202-MJ-PR	Lab Course Based on BCA-201-MJ-TH		2		4	20	30	50
VSEC	BCA-221-VSEC-TP	C++ Programming	1	1	1	2	20	30	50
FP	BCA-231-FP-PR	SEM-III Field Project		2		4	20	30	50
MN	BCA-241-MN-TH	Python Programming	2		2		20	30	50
	BCA-242-MN-PR	Lab Course on BCA-241-MN-TH		2		4	20	30	50
OE	OE-201-BCA-TH	Introduction to Artificial Intelligence	2		2		20	30	50
IKS	IKS-201-BCA-TH	Vedic Mathematics in Algorithm Optimization	2		2		20	30	50
EEM	EEM-221-COM-TH	Banking, Finance and Insurance	2		2		20	30	50
CC	CC	From College Basket	2		2		20	30	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.*

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Structure of UG Program as per NEP-2020

Program Name:- 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		40	60	100
	BCA-252-MJ-PR	Lab course on BCA-251-MJ-TH		2		4	20	30	50
VSEC	BCA-271-VSEC-TP	Advanced Python Programming	1	1	1	2	20	30	50
CEP	BCA-281-CEP-PR	SEM-IV Community Project		2		4	20	30	50
MN	BCA-291-MN-TH	Introduction to Artificial Intelligence and Machine Learning	2		2		20	30	50
	BCA-292-MN-PR	Lab course on BCA-291-MN-TH		2		4	20	30	50
OE	OE-251-BCA-PR	Software Tools for Office Administration		2		4	20	30	50
EEM	EEM-271-BCA-PR	Startup and Entrepreneurship		2		4	20	30	50
AEC	AEC	From College Basket	2		2		20	30	50
CC	CC	From College Basket	2		2		20	30	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.

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Structure of UG Program as per NEP-2020

Program Name:- B.C.A.

Major Course: - Computer Applications

SEMESTER-V

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- 301- PCC-TH	Software Engineering and Testing	4		4		30	70	100
	BCA- 302- PCC-TH	Core Java Programming	2		2		20	30	50
	BCA- 303- PCC-PR	Lab course on BCA-302 – PCC-TH		2		4	20	30	50
	BCA- 304- PCC-TH	Fundamentals of Data Science	2		2		20	30	50
	BCA-305- PCC-PR	Lab course on BCA-304- PCC-TH		2		4	20	30	50
PEC	BCA- 310- PEC-TH	User Interface and User Experience(UI-UX) Design	2		2		20	30	50
	BCA- 311- PEC-PR	Lab course on BCA - 310- PEC-TH		2		4	20	30	50
	OR								
	BCA- 312- PEC-TH	Cloud Computing	2		2		20	30	50
	BCA-313- PEC-PR	Lab course on BCA-312 – PEC-TH		2		4	20	30	50
	OR								
	BCA-314- PEC-TH	Cyber Security	2		2		20	30	50
	BCA-315- PEC-PR	Lab course on BCA-314 – PEC-TH		2		4	20	30	50
VSEC	BCA-321- VSEC-PR	Web Programming I		2		4	20	30	50
FP	BCA-331- FP-PR	Field Project		2		4	20	30	50
MN	BCA-341- MN-PR	Introduction to AR-VR		2		4	20	30	50
TOTAL			10	12	10	24	165	385	550

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Structure of UG Program as per NEP-2020

Program Name:- B.C.A.

Major Course: - Computer Applications

SEMESTER-VI

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- 351-PCC-TH	Software Project Management	2		2		20	30	50
	BCA- 352-PCC-TH	Advanced Java	2		2		20	30	50
	BCA- 353-PCC-PR	Lab course on BCA-352-PCC-TH		2		4	20	30	50
	BCA- 354-PCC-TH	Operating system Design	4		4		40	60	100
	BCA-355- PCC-PR	Lab course on BCA-354-PCC-TH		2		4	20	30	50
PEC	BCA- 360-PEC-TH	Introduction to Prompt & Gen AI	2		2		20	30	50
	BCA- 361-PEC-PR	Lab course on BCA-360-PEC-TH		2		4	20	30	50
	OR								
	BCA- 362-PEC-TH	Big Data and Analytics	2		2		20	30	50
	BCA-363- PEC-PR	Lab course on BCA-362-PEC-TH		2		4	20	30	50
	OR								
	BCA-364- PEC-TH	Mobile Application Development	2		2		20	30	50
	BCA-365- PEC-PR	Lab course on BCA-364-PEC-TH		2		4	20	30	50
VSEC	BCA-371-VSEC-PR	Web Programming II		2		4	20	30	50
OJT	BCA-381- OJT-PR	On-Job Training/ Internship		4			40	60	100
TOTAL			10	12	10	24	165	385	550

Exit option: Award of Bachelor of Computer Application (BCA) with multidisciplinary minor with 132 credits OR else Continue with Major and Minor

SEM-V

Syllabus

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-301- PCC-TH Subject: Software Engineering and Testing		
Teaching Scheme 4 hours / Week	No. of Credits 4	Examination Scheme CE: 40 marks EE: 60 marks
Course Hours: 60		
Course Objectives: • To learn and understand the principles of System and Software Engineering • To be acquainted with methods of capturing, specifying, visualizing and analysing software requirements. • To learn design processes and software quality parameters. • To provide the knowledge of software testing techniques • To understand how testing methods can be used as an effective tool in quality assurance of software.		
Course Outcomes: (COs) After successful completion of this course, learner will be able to • Compare and contrast various Software Engineering models • Decide on appropriate process model for a developing a software project • Classify software applications and identify unique features of various domains • To understand various software testing methods and strategies. • To understand a variety of software metrics, identify defects and managing those defects for improvement in quality for given software. • To design test cases and test plans, review reports of testing for qualitative software.		
Course Content		
Chapter 1	Introduction to System and Software Engineering	11 Hours
1.1 Definition 1.2 Basic Components 1.3 Elements of the system 1.4 System Components 1.5 Types of System 1.6 Definition of Software 1.7 Characteristics of Software 1.8 Software Application Domain 1.9 Definition of Software Engineering 1.9.1 Need for software Engineering 1.9.2 Mc Call's Quality factors 1.9.3 The Software Process 1.9.4 Software Engineering Practice		
Chapter 2	SDLC Methodologies and Requirement Engineering	12 Hours
2.1 Introduction 2.2 Activities of SDLC 2.3 A Generic Process Model 2.4 Prescriptive Process models 2.4.1 Waterfall Model 2.4.2 Incremental Process Models 2.4.3 Evolutionary process Models (Prototyping and Spiral Model)		

2.5 Concurrent Models and its Types. 2.6 Introduction 2.7 Requirement Engineering Tasks 2.8 Requirement Gathering 2.8.1 Feasibility study 2.8.2 Fact Finding Techniques		
Chapter 3	Analysis and Design Engineering	10 Hours
3.1 Introduction to UML & ER diagram 3.2 Decision Tree and Decision Table 3.3 Data Dictionary 3.3.1 Elements of DD 3.3.2 Advantages of DD 3.4 Input and Output Design 3.5 Pseudo Code 3.6 Case Studies on above topics		
Chapter 4	Agile Development	7 Hours
4.1 Agility 4.2 Agile Process 4.2.1 Principles 4.2.2 The Politics Of Agile Development 4.2.3 Human Factors 4.3 Extreme Programming(XP) 4.4 Adaptive Software Development(ASD)		
Chapter 5	Introduction to Software Testing	8 Hours
5.1 Basics of Software Testing – faults, errors and failures 5.2 Testing objectives 5.3 Principles of testing 5.4 Testing and debugging 5.5 Testing metrics and measurements 5.6 Verification and Validation 5.7 Testing Life Cycle 5.8 Test Case Design for Desktop, Mobile, Web application using Excel 5.9 White Box Testing 5.10 Black Box Testing 5.11 Differences between BBT & WBT		

Chapter 6	Levels of Testing	12 Hours
6.1 Test strategies for conventional Software 6.1.1 Unit testing 6.1.2 Integration testing- 6.1.2.1 Top-down Integration 6.1.2.2 Bottom-Up Integration 6.1.3 System Testing 6.1.4 Acceptance Testing 6.1.5 Performance Testing 6.1.6 Regression Testing 6.1.7 Load Testing, 6.1.8 Stress Testing 6.2 Alpha and Beta Testing 6.3 Usability and Acceptability Testing		
Reference Books:		
1. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7 thEdition, Tata McGraw Hill, 20 2. Ken Schwaber, “Agile Project Management”, MicrosoftPress,2004 3. Walker Royce, “Software Project Management”, Addison-Wesley,1998. 4. Jalote Pankaj, “Software Project Management in Practice”, Addison-WesleyProfessional,2002		
E- Books and Online Learning Material		
https://www.kornevonline.net/ITIL/Mcgraw.Hill.Software_Project_Management_2nd_Edition.pdf		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-302 – PCC-TH Subject: Core Java Programming		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: - List the basics of object-oriented programming. - To learn implementation of object-oriented concepts - To introduce the principles of inheritance and polymorphism and demonstrate how they relate to the design of abstract classes - Implement file handling and exception Handling. - Design GUI based applications using swing.		
Course Outcomes: (COs) - Identify classes, objects, class members and relationships for a given problem. - Implement different types of object-oriented concepts. - Handle File and directories. - Handle abnormal termination of a program using exception handling - Use Java APIs for GUI development		
Chapter 1	Fundamentals of Java Programming	7 Hours
1.1 Introduction to Object Oriented Programming concepts, 1.2 java Basics 1.2.1. History of Java, 1.2.2. features of java, 1.2.2. java environment – JVM, JRE, JDK. 1.2.3. Basic syntax – data types, variables, operators and Control flow statements 1.2.4. Java keywords, 1.2.5. java Garbage Collection 1.3 Java Tools – javac, java, jdb, javap, Javadoc, javah, javap and jar. 1.4 Simple Java program, 1.5 Structure(anatomy) of Java program, 1.6 Arrays and its application, 1.7 accepting input using command line argument and from console (Using		

BufferedReader and Scanner class) 1.8 Simple programs demo. 1.9 Integrated Development Environments (IDEs)		
Chapter 2	Classes and packages	4 Hours
2.1 Classe- built-in and user define classes, 2.2 Encapsulation - Access Specifies (public, protected, private, default), Access modifiers, 2.3 Array of Objects 2.4 Constructor, Overloading Constructors 2.5 use of 'this' and 'static' Keyword 2.6 Package- creation, uses, types and access. 2.7 Wrapper Classes, autoboxing/unboxing 2.8 type conversion/casting -Widening casting, Narrowing casting		
Chapter 3	Inheritance	4 Hours
3.1 Inheritance -Basics (extends Keyword) and Types of Inheritance, 3.2 Super class and Subclass 3.3 use of Super Keyword 3.4 Polymorphism 3.4.1 Method Overloading (compile time polymorphism/early binding) 3.4.2 Method Overriding (runtime polymorphism/ Dynamic Method Dispatch), 3.5 Use of final, 3.6 Use of abstract class and abstract methods, 3.7 Interfaces 3.7.1 Defining and Implementing Interfaces 3.7.2 Runtime polymorphism using interface 3.7.3 Functional and Marker Interfaces		
Chapter 4	String, Streams and File Handling	4 Hours
4.1 String class and String Buffer Class, 4.2 Using the File class 4.3 Stream classes, Byte Stream classes, Character Stream Classes, 4.4 Creation of files, Reading/Writing characters and bytes,		
Chapter 5	Exception Handling	4 Hours
5.1 Errors and Exception, Exception class, 5.2 Exception Types-Checked and Unchecked exception, 5.3 Exception handling using try, catch, throw, throws and finally keywords. 5.4 Creating user defined exceptions		
Chapter 6	Swing and Event Handling	7 Hours
6.1 What is GUI?, AWT (Abstract Window Toolkit), Comparison between AWT and Swing. 6.2 The MVC Architecture and Swing,		

6.3 The JComponent class, Components – JButton, JLabel, JText, JTextArea, JCheckBox and JRadioButton, JList, JComboBox, JMenu and JPopupMenu Class, JMenuItem and JCheckBoxMenuItem, JRadioButtonMenuItem, JScrollBar, Dialogs (Message, confirmation, input), JFileChooser, JColorChooser, 6.4 Layout Manager and Layouts, 6.5 Event Handling: Event sources, Listeners, Mouse and Keyboard Event Handling, Adapters		
Reference Books:		
1. E. Balagurusamy, Programming with Java, A primer, Fourth edition, Tata McGraw Hill Education Private Limited, 2009 2. Herbert Schildt, “Complete reference Java (5th edition)”, Tata McGraw Hill Edition, 2005		
E- Books and Online Learning Material		
• https://www.tutorialspoint.com • http://www.javatpoint.com • https://www.geeksforgeeks.com		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-303-PCC-PR Subject: Lab course on BCA-302 - PCC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 4	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: - List the basics of object-oriented programming. - To learn implementation of object-oriented concepts - To introduce the principles of inheritance and polymorphism and demonstrate how they relate to the design of abstract classes - Implement file handling and exception Handling. - Design GUI based applications using swing.		
Course Outcomes: (COs) - Identify classes, objects, class members and relationships for a given problem. - Implement different types of object-oriented concepts. - Handle File and directories. - Handle abnormal termination of a program using exception handling - Use Java APIs for GUI development		
Practical List		
Exp 1	Fundamentals of Java Programming	
Objectives: To get familiar with Java environment Task: ➤ Introduction to the java environment ➤ Use of java tools like java, javac, jdb and javadoc ➤ Defining simple classes and creating objects.		
Exp 2	Classes and packages	
Objectives: To understand basics of classes and packages Task: ➤ Defining a class. ➤ Creating an array of objects. ➤ Creating a package.		
Exp 3	Inheritance	
Objectives: To understand basics of inheritance Task: ➤ To implement inheritance in java. ➤ To define abstract classes. ➤ To define and use interfaces and Functional Interface		

Exp 4	String, Streams and File Handling	
Objectives: To understand concepts of string, stream and file handling. Task: ➤ Creation of files ➤ String methods implementation ➤ demonstration of I-O operations		
Exp 5	Exception Handling	
Objectives: Perform exception handling using try, catch and finally block. Task : ➤ Demonstrate Exception Handling Mechanism in Java. ➤ Use of try, catch, throw, throws, finally blocks ➤ Defining User defined Exception classes.		
Exp 6	Swing and Event Handling	
Objectives: To develop pages using GUI Task: ➤ To demonstrate GUI creation using Swing Package and Layout managers. ➤ To understand Event handling mechanism in Java. ➤ Using Event classes, Event Listeners and Adapters		
Reference Books:		
1. E. Balagurusamy, Programming with Java, A primer, Fourth edition, Tata McGraw Hill Education Private Limited, 2009 2. Herbert Schildt, “Complete reference Java (5th edition)”, Tata McGraw Hill Edition, 2005		
E- Books and Online Learning Material		
➤ https://www.tutorialspoint.com ➤ http://www.javatpoint.com ➤ https://www.geeksforgeeks.com		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-304- PCC-TH Subject: Fundamentals of Data Science		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
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 • 4. Be better trained professionals to cater the growing demand for data scientists in industry.		
Course Outcomes: (Cos) On completion of the course, student will be able to– • 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.		
Chapter 1	Introduction to Data Science	6 Hours
1.1 Introduction to data science, The 3 V's: Volume, Velocity, Variety 1.2 Why learn Data Science? 1.3 Applications of Data Science 1.4 The Data Science Lifecycle 1.5 Types of Data - Structured, semi-structured, Unstructured Data, 1.5.1 Problems with unstructured data 1.6 Data sources: Open Data, Social Media Data, Multimodal Data, standard datasets 1.7 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/or Compressed		

Chapter 2	Statistical Data Analysis	8 Hours
2.1 Role of Statistics in data science 2.2 Descriptive statistics: Measuring the Frequency Measuring the Central Tendency: Mean, Median, and Mode Measuring the Dispersion: Range, Standard deviation, Variance, Interquartile Range 2.3 Inferential Statistics Hypothesis testing, Multiple hypothesis testing, Parameter Estimation methods, 2.4 Measuring Data Similarity and Dissimilarity – Proximity Measures for Nominal Attributes Proximity Measures for Binary Attributes Dissimilarity of Numeric Data: Euclidean, Manhattan, and Minkowski distances Proximity Measures for Ordinal Attributes 2.5 Concept of Outlier, types of outliers, outlier detection methods		
Chapter 3	Data Preprocessing	8 Hours
3.1 Data Objects and Attribute Types: What Is an Attribute?, Nominal , Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes 3.2 Data Quality: Why Preprocess the Data? 3.3.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 3.4 Data Transformation – Rescaling, Normalizing, Binarizing, Standardizing, Label and One Hot Encoding, Data reduction, Data discretization		
Chapter 4	Data Visualization	8 Hours
4.1 Introduction to Exploratory Data Analysis 4.2 Data visualization and visual encoding 4.3 Data visualization libraries 4.4 Basic data visualization tools: Histograms, Bar charts/graphs, Scatter plots, Line charts, Area plots, Pie charts, 4.5 Specialized data visualization tools: Boxplots, Bubble plots, Heat map, Dendrogram, Venn diagram, Treemap, 3D scatter plots Advanced data visualization tools- Wordclouds, 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 Kamber, Jian Pei, Morgan Kaufmann, 2012. 4. A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press
E- Books and Online Learning Material
https://www.w3schools.com/datascience/ds_linear_functions_graphic.asp https://github.com/Adwait197/Data-Science-Practical https://www.scaler.com/topics/data-mining-tutorial/measures-of-similarity-and-dissimilarity/

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-305- PCC-PR Subject: Lab course on BCA-304-PCC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: - To apply statistical techniques on data sets - To apply data preprocessing techniques on data sets 3. To apply data visualization techniques on data sets		
Course Outcomes: (Cos) - Prepare data for use with a variety of statistical methods - Recognize how the quality of the data may affect conclusions 3. Perform exploratory data analysis		
Practical List		
Exp 1	The Data Science environment	
Objectives: To be familiar with required tools Task: ➤ Getting introduced to Python IDLE, command line, online tools like google colab and essential packages like NumPy, SciPy, pandas, scikit-learn, matplotlib, jupyter, beautiful-soup, etc.		
Exp 2	Loading the dataset	
Objectives: To load data and describe it in brief Task: ➤ Select a dataset from a list of publicly available datasets at UCI Machine Learning Repository and load it using Pandas. (Import different dataformat files like .CSV,.htm,.json etc. ➤ Briefly describe what the dataset is about and size of the dataset (e.g. number of tables, number of instances and attributes, etc.)		
Exp 3	Basic statistical operations	
Objectives: To apply statistical techniques on data sets. Task: ➤ Apply basic statistical operations on a dataset. For example – compute the mean, median, mode, range, quartiles, and variance for one or more attributes.		

Exp 4	Data preprocessing	
Objectives: To apply data preprocessing techniques on data sets Task: ➤ Apply data preprocessing techniques that are likely required for the dataset. ➤ Partition them into appropriate number of bins by equal-frequency as well as equal-width partitioning. ➤ Use smoothing by bin means to smooth the data based on the above partitioning, ➤ Normalize the attribute based on min-max normalization and z-score normalization..		
Exp 5	Data Visualization with matplotlib	
Objectives: To apply data visualization techniques on data sets Task: • View the data using various 2-D, 3-D plots and charts, setting styles, saving the figures, customizing the legends, multiple subplots,		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-310- PEC-TH Subject: User Interface and User Experience		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: - Understand the principles and processes of UI/UX design. - Differentiate between UI and UX design and their respective roles in the design process. - Develop skills in divergent and convergent thinking. - Gain proficiency in creating wireframes, and prototypes, and conducting usability tests. - Apply design thinking methodologies to solve user centric.		
Course Outcomes: (Cos) - Explain design thinking concept. - Interpret user requirements. - Select appropriate visual design for given problem. - Analyze and address user needs and the relationship between UI and UX. - Create interactions using design tool. - Create innovative design prototype for given applications.		
Chapter 1	Design Thinking Fundamentals	5 Hours
1.1 Introduction to Design thinking – Concept, Purpose, 5 stages of design thinking – Empathize, Define, Ideate, Prototype, Test 1.2 Introduction to User Interface / User Experience (UI/UX) – Definition of Design with respect to digital media, User Interface, User experience, Difference between UI and UX. 1.3 History of UX. Need of UI and UX		
Chapter 2	User Requirements and its Analysis	6 Hours
2.1 Introduction to research and analysis tool (freeware) such as Figma 2.2 User requirements – Definition, 2.2.1 Types of user research – Qualitative research, Quantitative research. 2.2.2 Tools to collect user requirements – personal observation, interviews, questionnaire, User/ Expert reviews 2.3 User requirement analysis – Understanding target audience and client requirements, 2.4 Competitive analysis, Affinity mapping, Defining User Persona		

Chapter 3	User Interface Design	7 Hours
3.1 Storyboarding, User journey mapping 3.2 Gestalt principles of design – Aesthetics in UI design – Using Light, Color and Contrast Effectively in UI Design 3.3 Introduction to any freeware design tool such as Figma 3.4 Visual Communication Design – effective visual communication for graphical user interface		
Chapter 4	User Experience Design Tool	7 Hours
4.1 Introduction to User Experience design 4.2 UX design open source tool such as – Figma features – Navigations, interactions, Buttons Creating library 4.3 Gamification, micro-animation Creating visual identity of the project – design system, design theme		
Chapter 5	Prototyping and Testing	5 Hours
5.1 Introduction to Wireframing – Purpose of wireframing, Types – low fidelity, medium fidelity, high fidelity 5.2 Basics of sketching, Creating low fidelity wireframes, medium fidelity and high fidelity in Figma 5.3 Basic considerations in wireframing – device, size, behavior, interaction 5.4 Elements used in wireframing – visual design, high fidelity elements Prototyping and Testing		
Reference Books:		
1. The Elements of User Experience: User-Centered Design for the Web and Beyond, Jesse James Garrett 2. Design Thinking: The Handbook, Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef 3. Designing and Prototyping Interfaces with Figma, Fabio Staiano 4. Design Thinking for Beginners, Kilian Langenfeld		
E- Books and Online Learning Material		
• https://aim.gov.in/pdf/Design_Thinking.pdf • https://www.ideou.com/pages/design-thinking-resources • https://www.figma.com/resource-library/what-is-design-thinki/		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-311- PCC-PR Subject: Lab course on BCA – 310- PEC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: The student, after successfully completing the course will be able to, - Summarize all stages of the UI/UX development process - Experiment with various visual design aspects - Theme the visual look and feel of the user experiences - Create effective and compelling screen-based experiences		
Practical List		
Exp 1	Getting Started with Figma	
Exp 2	Interface Connectivity	
Exp 3	Front-End and Back-End Integration	
Exp 4	Interaction Design and Functional Layout	
Exp 5	Navigation Design Fundamentals	
Exp 6	UI/UX Prototyping	
Exp 7	Sharing and Exporting Designs	
Exp 8	Custom and Operational Controls	
Exp 9	Advanced Navigation Design	
Exp 10	Social Media Creative Design	

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-312- PEC-TH Subject: Cloud Computing		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: • To understand the principles and paradigm of Cloud Computing • To appreciate the role of Virtualization Technologies • Ability to design and deploy Cloud Infrastructure • Understand Advanced Techniques and cloud security issues and solutions		
Course Outcomes: (COs) • Understand the different Cloud Computing environment • Analyze virtualization technology and install virtualization software • Develop and deploy applications on Cloud • Use advance techniques and apply security in Cloud Computing		
Chapter 1	Introduction to Cloud Computing	8 Hours
1.1 Overview 1.2 Layers and Types of Cloud 1.3 Desired Features of a Cloud 1.4 Benefits and Disadvantages of Cloud Computing 1.5 Cloud Infrastructure Management 1.6 Infrastructure as a Service Providers 1.7 Platform as a Service Providers 1.8 Multitenant Technology. 1.9 Cloud-Enabling Technology: Broadband Networks and Internet Architecture		
Chapter 2	Virtualization	6 Hours
2.1 Data Center Technology, Virtualization Technology. Cloud Deployment Models. 2.2 Introduction to Virtualization Technologies 2.3 Load Balancing and Virtualization 2.4 Understanding Hyper visors 2.5 Virtual Machines Provisioning and Manageability 2.6 Virtual Machine Migration Services 2.7 Provisioning in the Cloud Context.		

Chapter 3	Programming, Environments and Applications	8 Hours
3.1 Features of Cloud and Grid Platforms 3.2 Programming Support of Google App Engine 3.3 Programming on Amazon AWS and Microsoft Azure 3.4 Emerging Cloud Software Environments 3.5 Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications		
Chapter 4	Advanced Techniques	4 Hours
4.1 Future Trends in Cloud Computing 4.2 Mobile Cloud, Comet Cloud. 4.3 Containers, Docker, and Kubernetes 4.4 Introduction to DevOps.		
Chapter 5	Security in The Cloud	4 Hours
5.1 Security Overview – Cloud Security Challenges and Risks 5.2 Security Governance 5.3 Software-as-a-Service Security 5.4 Risk Management : Security Monitoring 5.5 Security Architecture Design 5.6 Data Security, Application Security, Virtual Machine Security 5.7 Identity Management and Access Control 5.8 Disaster Recovery in Clouds.		
Reference Books:		
1. Brian J.S. Chee and Curtis Franklin, “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, CRC Press, ISBN:9781439806128 2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, ISBN-13:978-1-25-902995-0 3. Dr. Kris Jamsa, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more”, Wiley Publications, ISBN: 978-0-470-97389-9		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-313-PEC-PR Subject: Lab course on BCA-312 – PEC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: • Gain a thorough understanding of core cloud computing concepts, models, and operational paradigms. • Recognize and evaluate the importance of virtualization technologies within cloud environments. • Develop the skills required to plan, design, and implement cloud-based infrastructures. • Learn modern cloud technologies, advanced practices, and security challenges and solutions		
Course Outcomes: (COs) • Comprehend various cloud computing environments and their characteristics. • Evaluate virtualization concepts and set up appropriate virtualization tools or platforms. • Create, configure, and deploy applications within cloud-based ecosystems. • Implement modern cloud techniques and enforce essential security measures in cloud systems.		
Practical Lists		
Exp 1	Cloud Computing Introduction	
Objectives: To provide a comprehensive understanding of cloud computing concepts and technologies. Task: ➤ Working and Implementation of Infrastructure as a service ➤ Working and Implementation of Software as a service ➤ Working and Implementation of Platform as a services		
Exp 2	Virtualization In Cloud	
Objectives: To enable students to understand virtualization technologies, hypervisors, virtual machine provisioning, migration, and load balancing within modern cloud environments. Task: ➤ Analyse how multitenancy works using Google Cloud Projects. ➤ Practical Implementation of Storage as a Service		

Exp 3	Programming, Environments and Applications	
Objectives: To understand the features, programming models, and application deployment practices and emerging cloud environments. Task: ➤ Working on Google drive to make spreadsheets and notes. ➤ Write a program for web feed. ➤ Execute the step to Demonstrate an implementation of cloud on single sign on.		
Exp 4	Advanced Techniques In Cloud Computing	
Objectives: To explore advanced cloud computing trends, containerization, DevOps practices. Task: ➤ Installing and Developing Application Using Google App Engine ➤ Create a Simple mini Google Cloud project using a Gmail account. ➤ Implement Containers and DevOps concepts using Google Cloud service. ➤ Implement mobile-accessible cloud applications using Google Cloud & Gmail services. ➤ Write a basic Python function and trigger it using an event or API Gateway. ➤ Create an automated build-test pipeline for a small cloud-based application.		
Exp 5	Security in The Cloud	
Objectives: To learn comprehensive cloud security mechanisms. Task: ➤ Demonstrate SaaS security using Google Drive by creating a document and applying access controls (view, comment, edit). ➤ Demonstrate data security and encryption in cloud computing by creating a Google Cloud Storage bucket and uploading data using a Gmail account.		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-314- PEC-TH Subject: Fundamentals of Cyber Security		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: - To introduce students to the fundamental concepts and importance of cyber security and the evolving cyber threat landscape. - To provide understanding of network security principles and common network attacks. - To familiarize students with operating system security mechanisms, malware protection, and encryption techniques. - To develop knowledge of web application security, secure browsing practices, and web security tools. - To make students aware of cyber security best practices, incident response, cloud security, and emerging trends.		
Course Outcomes: (COs) : After successful completion of this course, students will be able to: - Explain the basic concepts of cyber security, cyber threats, and risk management strategies. - Identify common network attacks and networking security mechanisms used to protect systems and data. - Describe operating system security features, malware protection techniques, and encryption methods. - Analyze web application vulnerabilities and implement secure web practices including HTTPS and security tools. - Apply cyber security best practices and understand modern trends such as cloud security and threat intelligence.		
Chapter 1	Introduction to Cyber security	6 Hours
1.1 Overview of Cyber security: Definition and significance of cyber security Evolution and historical context of cyber security 1.2 Cyber Threat Landscape Understanding the current threat landscape. 1.3 Types of cyber threats: malware, phishing, ransom ware, etc. 1.4 Defense-in-depth and layered security Risk Management in Cyber security 1.5 Identifying and assessing cyber security risks Strategies for risk mitigation and management 1.6 Legal and Ethical Considerations 1.7 Overview of cyber security laws and regulations 1.8 Ethical responsibilities in Cyber security		
Chapter 2	Virtualization	6 Hours
Topics Covered: 2.1 Essentials Fundamentals: Overview of networking principles Fundamentals of network protocols and TCP/IP		

2.2 Types of Network Attacks, Eaves dropping, man-in-the-middle, and real-world instances and case studies are some examples of network attack types 2.3 Common Network Attacks: Technologies for Network Security, Security of Wireless Networks. 2.4 Wireless Network Security: Wireless network risks, Protecting wireless networks against unwanted access, Protecting Network Equipment 2.5 Securing Network Devices: Best practices for securing routers, switches, and other devices Implementing access controls and monitoring 2.6 Key Principles of Cyber security Confidentiality, integrity, Availability (CIA Triad)		
Chapter 3	System Security for Operating Systems	6 Hours
3.1 Fundamentals of Security for Operating Systems: Important operating system security features, Access controls and user account management Patch Administration. 3.2 Antivirus and Malware: The significance of software upgrades techniques for handling patches in an efficient manner Antivirus and Malware Protection Defense Antivirus software's function in cyber security Assessing and choosing antiviral medicines 3.3 Secure Boot and Encryption: Using encryption to secure data establishing a safe boot procedure Security of Endpoints		
Chapter 4	Web Application Security	6 Hours
4.1 Web Application Security Basics: online application vulnerabilities, The best methods for safe coding 4.2 Secure Web Browsing: safeguards and safe browsing practices, Identifying and preventing phishing attempts 4.3 HTTPS and SSL/TLS: Importance of encrypted communication on the web, Configuring and implementing SSL/TLS for websites 4.4 Web Security Policies and Compliance: Developing and enforcing web security policies Compliance with industry standards (e.g., PCI DSS) 4.5 Web Security Tools and Testing: Introduction to web security tools (e.g., OWASP ZAP) Conducting security assessments and penetration testing		
Chapter 5	Security Best Practices and Emerging Trends	6 Hours
5.1 Training and Awareness of Security: The importance of cyber security education in creating security- conscious organizational culture 5.2 Response to and Management of Incidents, formulating a plan for responding to incidents carrying out simulations and drills for incident response. 5.3 Basics of Cloud Security: Understanding the security implications in cloud environments, The shared responsibility concept and best practices. 5.4 Information Exchange and Threat Intelligence: The role of threat intelligence in cyber security Participating in information-sharing communities. 5.5 Cyber security's Future Trends: Examining new technology and issues Learning new things constantly and changing to counter threats.		
Reference Books:		
1. Computer Security Basics by by Rick Lehtinen , Publisher : O'Reilly Media; 2nd edition 2. Fundamentals of Computer Security by Josef Pieprzyk ,Thomas Hardjono, Jennifer Seberry, Publisher: Springer; Softcover reprint of hardcover 1st ed. 2003 edition (1 December 2010) 3. Cryptography and Network Security, Publisher: Mc Graw Hill 4. Computer Networking and the Internet, Publisher: Harshall Kulkarni 5. Data Communication and Computer Networks Publisher: Rajnesh Agrawal, Bharat Bhushan Tiwari 6. Cyber Cops, Cyber Criminal & Internet. Publisher: Deepti Chopra & Keith Merrill		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-315-PEC-PR Subject: Lab course on BCA-314 – PEC-TH					
Teaching Scheme 4 hours / Week		No. of Credits 2		Examination Scheme CE: 20 marks EE: 30 marks	
V	BCA-315-PEC-PR	Lab course on BCA-314 – PEC-TH	02	PR	CIE-20 SEE-30
Course Hours: 60 Hours					
Course Objectives:					
- Understand basic cyber security concepts and terminology used in protecting digital systems and networks. - Identify different types of cyber threats, attacks, and vulnerabilities that affect computer systems and networks. - Understand cyber laws, cyber ethics, and legal aspects related to cyber crimes and information security. - Learn network and system security practices including Wi-Fi security, router protection, and OS security. - Develop awareness of data protection techniques, encryption, and security tools used to safeguard digital information.					
Course Outcomes: (COs)					
- Identify various types of cyber attacks such as malware, phishing, and network attacks and describe their prevention methods. - Demonstrate understanding of cyber laws, cyber ethics, and legal issues related to cyber crimes. - Apply basic security practices in networking, operating systems, and wireless environments. - Use basic cyber security tools and techniques such as antivirus scanning, encryption, and vulnerability scanning for protecting systems. - Identify various types of cyber attacks such as malware, phishing, and network attacks and describe their prevention methods.					
Exp 1		Understanding Cyber Security Concepts			
Objectives: Understand basic cyber security terminology. Task: ➤ Search and list definitions of the following terms: ○ Cyber Security ○ Malware ○ Phishing ○ Ransomware ○ Firewall ➤ Identify two recent cyber attacks from news and summarize them in 4–5 lines.					
Exp 2		Identifying Types of Cyber Threats			

Objectives: Recognize different cyber threats.

Task:

- Prepare a table showing the following cyber threats:
 - Virus
 - Worm
 - Trojan
 - Phishing
 - Ransomware
- For each threat write:
 - Description
 - How it spreads
 - Prevention method

Exp 3	Study of Cyber Security Laws	
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Objectives: Understand legal aspects of cyber security.

Task:

- Study IT Act 2000 (India).
- List 5 cyber crimes defined under the IT Act.
- Write short notes on cyber ethics

Exp 4	Understanding Defense-in-Depth	
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Objectives: Learn layered security

Task:

- Draw a **Defense-in-Depth diagram** showing layers such as:
 - Physical Security
 - Network Security
 - System Security
 - Application Security
 - Data Security
- Explain each layer with **one real-life example**.

Exp 5	Network Configuration and TCP/IP Study	
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Objectives: Understand networking basics

Task:

- Open **Command Prompt / Terminal**.
- Run the following commands:
 - ipconfig / ifconfig
 - ping google.com
- Record:
 - IP Address
 - Default Gateway
 - DNS Server
- Explain the purpose of each command.

Exp 6	Study of Network Attacks	
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Objective: Learn common network attacks.

Task:

- Study the following attacks:
 - Eavesdropping
 - Man-in-the-Middle
 - Denial of Service
- Draw a **simple diagram** showing how a **Man-in-the-Middle attack works**.

Exp 7	Wireless Network Security	
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Objective: Understand Wi-Fi security.

Task:

- Check your Wi-Fi settings and identify:
 - Network name (SSID)
 - Security type (WPA2/WPA3)
- Write **5 best practices to secure Wi-Fi networks**

Exp 8	Router and Network Device Security	
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Objective: Learn device security basics.

Task:

- Study default router settings.
- List 5 security steps to protect routers:
 - Change default password
 - Firmware update
 - Disable remote access etc.
- Explain why each step is important

Exp 9	Understanding CIA Triad	
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Objective: Understand fundamental security principles

Task:

- Explain the CIA Triad:
 - Confidentiality
 - Integrity
 - Availability
- Give two real-life examples for each principle

Exp 10	Operating System Security	
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Objective: Learn OS security features.

Task:

- Explore your computer's **User Account settings**.
- Identify:
 - Administrator account
 - Standard user account
- Write the importance of **access control and password protection**

Exp 11	Antivirus and Malware Protection	
Objective: Understand antivirus tools Task: ➤ Open installed antivirus software (Windows Defender or other). ➤ Perform: ○ Quick scan ➤ Record: ○ Scan result ○ Threats detected ➤ Explain how antivirus protects systems		
Exp 12	Data Encryption Basics	
Objective: Understand encryption concepts Task: ➤ Use 7-Zip / WinRAR / built-in encryption to create a password protected file. ➤ Steps: ○ Create a folder ○ Compress it ○ Apply password ➤ Explain how encryption protects data		
Exp 13	Identifying Phishing Websites	
Objective: Recognize phishing attacks. Task: ➤ Visit websites explaining phishing examples. ➤ Identify 5 signs of phishing emails or websites, such as: ○ Suspicious links ○ Spelling mistakes ○ Urgent requests ➤ Prepare a table comparing legitimate vs phishing website characteristics		
Exp 14		
Objective: Learn basic web security testing tools. Task: ➤ Install OWASP ZAP. ➤ Scan a sample website (test environment). ➤ Record: ○ Number of alerts ➤ Types of vulnerabilities detected		
Exp 15	Cyber Security Awareness and Incident Response	
Objective: Learn incident response basics. Task:		

- Prepare a **basic incident response plan** for a small organization.
- Include steps:
 - Identify the incident
 - Contain the attack
- Recover systems

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA- 321-VSEC-PR Subject: Web Programming I		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Prerequisites:		
HTML basics for form designing		
Course Objectives: - Understand the fundamentals of web programming and server-side scripting concepts. - Apply PHP functions and strings real-world programming problems. - Apply arrays to solve real-world programming problems. - Implement file handling techniques for reading, writing, and managing server-side data. - Design and interact with databases using PHP and MySQL. - Develop web applications with email handling and form processing capabilities.		
Course Outcomes: (COs) On successful completion of the course, students will be able to: - Explain the concepts of web architecture and server-side scripting using PHP. - Develop dynamic web pages using PHP basics such as variables, operators, control structures, and forms. - Implement user-defined and built-in PHP functions for modular programming and use indexed, associative, and multidimensional arrays for efficient data management. - Perform file handling operations such as create, read, write, append, and delete files using PHP. - Connect PHP applications with databases and perform CRUD operations using MySQL. 6. Implement email handling features and validate user inputs in web applications.		
Chapter 1	Introduction to HTTP and PHP	7 Hours
1.1 Introduction to Web server and Web browser 1.2 HTTP basics. 1.3 PHP Basics 1.3.1 Use of PHP 1.3.2 Lexical structure 1.3.3 Language basics .		

Chapter 2	Function and String	8 Hours
2.1 Defining and calling a function 2.1.1 Default parameters Variable parameters, Missing parameters 2.1.2 Variable function, Anonymous function 2.2 Types of strings in PHP 2.2.1 Printing functions 2.2.2 Encoding and escaping 2.2.3 Comparing strings 2.2.4 Manipulating and searching strings 2.2.5 Regular expressions		
Chapter 3	Arrays	7 Hours
3.1 Indexed Vs Associative arrays 3.1.1 Identifying elements of an array 3.1.2 Storing data in arrays 3.2 Multidimensional arrays 3.3 Extracting multiple values 3.4 Converting between arrays and variables 3.5 Traversing arrays 3.6 Sorting 3.7 Action on entire array		
Chapter 4	Files and database handling	6 Hours
4.1 Working with files and directories 4.1.1 Opening and Closing 4.1.2 Getting information about file 4.1.3 Read/write to file 4.1.4 Splitting name and path from file 4.1.5 Rename and delete files 4.1.6 Reading and writing characters in file 4.1.7 Reading entire file 4.1.8 Random access to file data 4.1.9 Getting information on file 4.1.10 Ownership and permissions 4.2 Using PHP to access a database Relational databases and SQL 4.2.1 PEAR DB basics 4.1.8 4.2.3 Advanced database techniques		
Chapter 5	Handling email with PHP	2 Hours
5.1 Email background 5.1.1 Internet mail protocol 5.1.2 Structure of an email message 5.1.3 Sending email and validation of Email-id with PHP		

Reference Books:

1. HTML & CSS: The Complete Reference, Fifth Edition Author: Thomas A. Powell First published: 01 Jan 2010.
2. Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
3. Beginning PHP 5 , Wrox publication
4. PHP web sevice, Wrox publication
5. Mastering PHP , BPB Publication
6. PHP cookbook, O'Reilly publication
7. PHP for Beginners, SPD publication
8. Programming the World Wide Web , Robert W Sebesta(3rd Edition)
9. HTML 5 Black Book : Covers Css3, Javascript, XML, XHTML, Ajax, PHP And JQuery by Kogent Learning Solutions Inc, Published November 2011 by Dreamtech Press
10. Spurlock Jake, Bootstrap: Responsive Web development. O'Reilly Media, Inc

E- Books and Online Learning Material

- www.php.net.in
- www.W3schools.com
- www.wrox.com
- <https://coreui.io/docs/layout/grid/#grid-options>
- <https://www.tutorialrepublic.com/twitter-bootstrap-tutorial/bootstrap-grid-system.php>

Practical Lists**Guidelines:**

Operating Environment for web technologies: HTML5.0, PHP 5.0 and above , Webserver on Linux/Windows

Exp 1	Basics of PHP	
Exp 2	Function and String	
Exp 3	Array	
Exp 4	Files	
Exp 5	Databases	

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-331- FP-PR Subject: Project		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: • Apply computer science principles to build real-world systems. • Demonstrate project planning, design, and development skills. • Use modern technologies, frameworks, and tools effectively. • Communicate technical work clearly in written and oral form. • Work collaboratively and professionally in a team environment. • Evaluate ethical, social, and security impacts of computing solutions.		
Course Outcomes: (COs) • Analyse a real-world problem and define clear technical requirements. • Design an effective system architecture and development plan. • Implement the system using appropriate tools and technologies. • Evaluate, test, and refine the solution based on performance and feedback. • Apply project management practices and maintain documentation. • Communicate project ideas and results through reports and presentations.		
Project Implementation Guidelines for Students: 1. Students shall choose any topic for project work in consultation with project guide, Project In-charge. 2. The students shall work on a Project in a group with at least three students. 3. Students are expected to work on the chosen project during the entire semester. 4. Students shall undertake application oriented/web-based with database /Survey based work. 5. Students shall successfully implement the chosen work. Only a hypothetical / theoretical study shall not be accepted. 6. Students shall choose any appropriate programming language/ platform, computational techniques and tools in consultation with the guide, In-charge. 7. The project work shall be evaluated based on the novelty of the topic, scope of the work, relevance to computer science, adoption of emerging techniques/technologies and its real-world application etc. 8. Students shall prepare a project report with prescribed format provided by Project Guide. 9. The Project report should be prepared in a spiral bound form with adequate number of copies. 10. The Project work and report shall be certified by the concerned Project guide and Head of the department.		

Recommended Documentation contents:		
Sr. No.	Index Name	Page No.
1.	Acknowledgement	
2.	College Certificate	
3.	Introduction I. Existing System Limitation of Existing System	
4.	Problem Definition	
5.	Proposed System: I. Explanation II. Methodology used Scope of the System	
6.	Hardware and Software Requirement	
7.	Fact Finding Techniques	
8.	Feasibility Study I. Operational II. Technical Economical	
9.	Diagrams: I. E-R Diagram UML Diagrams	
10.	Data Dictionary	
11.	Database Designing	
12.	Screen Designing I. I/O Screen Designing Output Formats	
13.	Test Cases Design	
14.	Conclusions and Future Enhancements	
15.	Bibliography, References and Published work (Paper/Book Chapter/Copyright/Patent etc.)	

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-341- MN-TH Subject: Introduction to AR-VR		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30		
Prerequisites:		
• Basic understanding of computer graphics concepts such as 2D/3D coordinates, transformations, and rendering. • Knowledge of mathematics fundamentals, including vectors, matrices, and basic trigonometry. • Awareness of web or application development concepts is desirable. • Basic familiarity with software development tools and IDEs.		
Course Objectives:		
• To know basic concepts of virtual reality • To understand visual computation in computer graphics • To understand interaction between system and computer • To know application of VR in Digital Entertainment • 5. To know basic concepts of augmented reality		
Course Outcomes: (COs) On completion of the course, student will be able to–		
• To explore the research issues in Augmented Reality and Virtual Reality (AR & VR) • Know the basic concept and framework of virtual reality • Know the computer-human interaction		
Chapter 1	Introduction of Virtual Reality	9 Hours
1.2 Introduction of Virtual Reality 1.2.1 Applications 1.2.2 Types of Reality 1.3 Fundamental Concept 1.4 Components of Virtual Reality 1.4.1 Field of View, Field of Regard & degree of freedom 1.5 Primary Features and Present Development on Virtual Reality 1.6 Multiple Models of Input and Output Interface in Virtual Reality 1.6.1 Input Devices – Tracker and Sensor, Digital Glove, Movement Capture 1.6.2 Video-based Input - 3D Menus & 3DScanner 1.7 Output Devices – Visual display, Auditory, Haptic Devices.		

Chapter 2	Visual Computation in Virtual Reality	8 Hours
2.1 Fundamentals of Computer Graphics 2.1.1 3D object representation 2.1.2 3D transformations 2.1.3 3D projections 2.2 Software and Hardware Technology on Stereoscopic Display 2.2.1 Advanced Techniques in CG 2.3 Modelling and Rendering 2.4 Management of Large-Scale Environments & Real Time Rendering.		
Chapter 3	Interactive Techniques in Virtual Reality	6 Hours
3.1 Body Track with examples 3.2 Hand Gesture with simulation video 3.3 3D Manus & Object Grasp 3.4 Development Tools and Frameworks in Virtual Reality 3.5 Frameworks of Software Development Tools in VR 3.6 X3D Standard 3.7 Vega		
Chapter 4	Augmented and Mixed Reality	7 Hours
4.1 Taxonomy of Augmented Reality 4.2 Technology and features of augmented reality 4.3 Difference between AR and VR; Challenges with AR 4.4 AR systems and functionality; Augmented reality methods 4.5 Visualization techniques for augmented reality 4.5.1 Wireless displays in educational augmented reality applications 4.6 Evaluating AR systems - Mixed reality		
Reference Books:		
1. Craig, A. B., (2013), "Understanding Augmented Reality, Concepts and Applications," 2. Morgan Kaufmann, ISBN: 9780240824086 3. Craig, A. B., Sherman, W. R., Will, J. D., (2009), "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann, ISBN: 780123749437 4. John Vince, J., (2002), "Virtual Reality Systems," Pearson, ISBN: 9788131708446 5. Anand, R., "Augmented and Virtual Reality," Khanna Publishing House 6. Kim, G. J., (2005), "Designing Virtual Systems: The Structured Approach", ISBN: 9781852339586		

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| 7. O'Connell, K., (2019), "Designing for Mixed Reality: Blending Data, AR, and the Physical World," O'Reilly, ISBN: 9789352138371 |
| |
| E- Books and Online Learning Material |
| <ul style="list-style-type: none">• Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras,• https://nptel.ac.in/courses/121106013• Misra, S., (2019), "Industry 4.0: Augmented Reality and Virtual Reality," IIT Kharagpur,• https://www.youtube.com/watch?v=zLMgdYI82IE• Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL• Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqlZ9Q• http://cambum.net/course-2.htm |

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-351- PCC-TH Subject: Software Project Management		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours:30 Hours		
Course Objectives: • To understand the fundamentals of Software Project Management. • To introduce Software project planning and management tools. • To study software project scheduling and tracking. • To know the agile project management. • To learn managing people in software project.		
Course Outcomes: (COs) After successful completion of this course, learner will be able to • Comprehend Software Project Management Concepts • Use various tools for Software Project Management Schedule various activities in software projects. • Track a project and manage changes. • Apply Agile Project Management concepts • Analyse staffing process for team building and decision making		
Chapter 1	Introduction to Software Project Management and Tools	10 Hours
1.1 Project Definition 1.2 Project versus Flow type work 1.3 Project Lifecycle 1.4 Processes and Knowledge Areas in Project Management (PM) 1.5 Build or Buy decision, 1.6 Work Breakdown Structure (WBS) and its types 1.7 Introduction to PMBOK 1.8 Program and Portfolio Management. 1.9 Project Planning 1.9.1 Steps for Project Planning. 1.9.2 PERT and Gantt Charts 1.9.3 Introduction to Project Management using Gantt Project 1.9.4 Objectives of Activity planning		

Chapter 2	Activity based Scheduling	6 Hours
2.1 Introduction 2.2 Objectives of Activity Planning 2.3 Activity relationships (FS, SF, SS, FF) 2.4 Forward Pass technique 2.5 Backward Pass techniques		
Chapter 3	Project Tracking and Control	6 Hours
3.1 Introduction 3.2 Collection of Project data 3.3 Visualizing progress 3.4 Cost monitoring 3.5 Earned Value Analysis 3.6 Project tracking 3.7 Change Control 3.8 Software Configuration Management.		
Chapter 4	Agile Project Management	4 Hours
4.1 Predictive versus Empirical Management 4.2 Comparison between Non-Agile and Agile Project 4.3 Three stages of Agile Project 4.4 Estimation 4.5 Scope Management		
Chapter 5	Staffing in Software Projects	4 Hours
5.1 Managing People Organizational behaviour 5.2 Best methods of Staff Selection 5.3 Motivation 5.4 The Oldham Hackman job characteristic Model 5.5 Stress, Health and Safety 5.6 Ethical and Professional Concerns 5.7 Working in Teams, Decision Making		
Reference Books:		
1. Bob Hughes, Mike Cotterell and Rajib Mall, 2. “Software Project Management”, Sixth Edition, Tata McGraw Hill, New Delhi, 2012. Walker Royce, 3. “Software Project Management”, Addison-Wesley, 1998.		
E- Books and Online Learning Material		
https://www.kornev-online.net/ITIL/Mcgraw.Hill.Software Project Management 2nd Edition.pdf		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-352-PCC-TH Subject: Advanced Java		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: • To learn database programming using Java • To study web development concept using Servlet and JSP • To develop applications using multithreading • To implement various Collections.		
Course Outcomes: (Cos): On completion of the course, student will be able to– • To access open database through Java programs using Java Data Base Connectivity (JDBC) and develop the application • Understand and create dynamic web pages, using Servlets and JSP. • Work with basics of framework to develop secure web applications • Understand the use of collections in various applications.		
Chapter 1	Java Database Programming-JDBC	6 Hours
1.1 The design of jdbc, jdbc configuration 1.2 Types of drivers 1.3 Executing sql statements, query execution 1.4 Scrollable and updatable result sets 1.5 Metadata – DatabaseMetadata, ResultSetMetadata 1.6 Transactions – commit(), rollback(), SavePoint (Database : PostgreSQL)		
Chapter 2	Collections	4 Hours
2.1 Introduction to the Collection framework 2.2 List – ArrayList, LinkedList and Vector, Stack, Queue 2.3 Set - HashSet, TreeSet, and LinkedHashSet 2.4 Map – HashMap, LinkedHashMap, Hashtable and TreeMap 2.5 Interfaces such as Comparator, Iterator, ListIterator, Enumeration		
Chapter 3	Multithreading	4 Hours
3.1 What are threads? 3.2 Life cycle of thread 3.3 Running and starting thread using Thread class 3.4 Thread priorities 3.5 Running multiple threads 3.6 The Runnable interface Synchronization and interthread communication		

Chapter 4	Servlet and JSP	10 Hours
4.1 Introduction to Servlet and Hierarchy of Servlet 4.1.1 Life cycle of servlet 4.1.2 Handling get and post request (HTTP) 4.1.3 Handling data from HTML to servlet 4.1.4 Retrieving data from database to servlet 4.2 Session tracking – User Authorization, URL rewriting, Hidden form fields, Cookies and HttpSession 4.3 Introduction to JSP, 4.3.1 Life cycle of JSP 4.3.2 Implicit Objects 4.3.3 Scripting elements - Declarations, Expressions, Scriptlets, Comments 4.4 JSP Directives - Page Directive, include directive 4.5 Mixing Scriptlets and HTML 4.6 JSP Actions - jsp:forward , jsp:include, jsp:useBean, jsp:setProperty and jsp:getProperty		
Chapter 5	Introduction to Spring framework	6 Hours
5.1 Introduction of Spring framework 5.2 Spring Modules / Architecture 5.3 Spring Applications 5.4 Spring MVC 5.5 Spring MVC Forms, Validation		
Reference Books:		
1. Java 2 programming black books, Steven Horlizer 2. Herbert Schildt, “Complete reference Java (5th edition)”, Tata McGraw Hill Edition, 2005 3. Getting started with Spring Framework: covers Spring 5 by J Sharma and Ashish Sarin		
E- Books and Online Learning Material		
1. https://www.tutorialspoint.com 2. http://www.javatpoint.com 3. https://spring.io/projects/spring-framework 4. https://docs.oracle.com/javase/tutorial/		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-353- PCC-PR Subject: Lab course on BCA-352- PCC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: - To learn database programming using Java. - To study web development concept using Servlet and JSP. - To develop applications using multithreading. - To implement various Collections.		
Course Outcomes: (COs) On completion of the course, student will be able to– - To access open database through Java programs using Java Data Base Connectivity (JDBC) and develop the application. - Understand and create dynamic web pages, using Servlets and JSP. - Work with basics of framework to develop secure web applications. - Understand the use of collections in various applications.		
Prcatical Lists		
Exp 1	Java Database Programming-JDBC	
Objectives: To study database connectivity Task: ➤ To communicate with a database using java. ➤ To execute queries on tables. ➤ To obtain information about the database and tables.		
Exp 2	Collections	
Objectives: To get familiar with collection framework Task: ➤ Study the Collection framework in java. ➤ To Implement various Interfaces and classes through algorithms. ➤ To Demonstrate Cursor Objects (Enumeration, Iterator, ListIterator, Comparator)		
Exp 3	Multithreading	
Objectives: To get familiar with threads Task: ➤ To create and use threads in java. ➤ To demonstrate multithreading using Thread Synchronization, ➤ Inter-thread Communication, ➤ Thread Priorities.		

Exp 4	Servlet	
Objectives: To understand concepts of server side programming Topics Covered: ➤ To understand server-side programming. ➤ Simple steps to create and execute servlets. ➤ How to pass parameters using doGet and doPost methods. ➤ Handling data from HTML to servlet. ➤ How to connect servlet to a database. ➤ Use of various session tracking methods like Cookies		
Exp 5	JSP	
Objectives: To understand concept of JSP Topics Covered: ➤ JSP life cycle. Use of JSP implicit objects. JSP Directives. ➤ Use of Scripting Elements. ➤ To understand action tags in JSP. Understanding flow of JSP custom tags		
Exp 6	Spring	
Objectives: To develop application using spring boot Topics Covered: ➤ To create and understand the steps to develop Spring application.		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-354- PCC-TH Subject: Operating system Design		
Teaching Scheme 4 hours / Week	No. of Credits 4	Examination Scheme CE: 40 marks EE: 60 marks
Course Hours: 60 Hours		
Prerequisites: • Basic knowledge of fundamental of Computer. • Basic algorithms and data structure concepts.		
Course Objectives: • To Understand the basic concepts of operating system and its principle. • To study algorithms for CPU-scheduling, process creation and termination. • To understand the notion of a Multithreading and Inter-process communication. • To learn critical-section problems and classical process-synchronization problems. • To know the concept of deadlock, different methods for preventing or avoiding deadlocks and techniques for memory management. • To learn and understand file system, directory structure, file allocation methods and disk scheduling algorithms.		
Course Outcomes: (COs): On successful completion of the course, students will be able to: • Explain basic concepts of operating system and its principle. • Describe algorithms for process, memory and disk scheduling • Apply technique for inter-process communication and Multithreading. • Implement concept of critical-section. • Compare and contrast deadlock avoidance and prevention. • Use functions for file system management.		
Chapter 1	Introduction to Operating System	6 Hours
1. Introduction to Operating Systems 2. Types of Operating Systems 2.1 Batch OS 2.2 Multiprogramming OS 2.3 Time Sharing OS 2.4 Real-Time OS 2.5 Distributed OS 3. Different services provided by Operating System to Users. 4. Introduction to Linux Operating System 3.1 Features of Linux 3.2 Architecture of the Linux 5. User and operating system interface 6. Booting 7. System calls		

Chapter 2	Process Scheduling and Multithreaded Programming	12 Hours
1. Process Scheduling 1.1 Scheduling queues 1.2 Schedulers, 1.3 Context switch 2. Operations on Process 2.1 Process creation with program using fork() 2.2 Process termination 3. Interprocess Communication 3.1 Shared memory system 3.2 Message passing systems 4. Multithreaded Programming 4.1 Overview 4.2 Multithreading Models 5. Basic Concept 5.1 CPU-I/O burst cycle, CPU Scheduler, Pre-emptive Scheduling, Dispatcher 6. Scheduling Criteria 7. Scheduling Algorithms 7.1 FCFS 7.2 SJF, 7.3 Priority scheduling 7.4 Round-robin scheduling, 7.5 Multiple queue scheduling 7.6 Multilevel feedback queue scheduling		
Chapter 3	Process Synchronization	8 Hours
1. Background 2. Critical Section Problem 3. Semaphores: Usage, Implementation 4. Classic Problems of Synchronization 4.1 The bounded buffer problem, 4.2 The reader writer problem 4.3 The dining philosopher problem		
Chapter 4	Deadlocks	8 Hours
1. System Model 2. Deadlock Characterization 2.1 Necessary Conditions 2.2 Resource Allocation Graph 3. Deadlock Prevention 4. Deadlock Avoidance 4.1 Safe state 4.2 Resource-Allocation-Graph Algorithm 4.3 Banker's Algorithm 5. Deadlock Detection 6. Recovery from Deadlock 6.1 Process Termination 7. Resource Pre-emption		

Chapter 5	Memory Management	10 Hours
1. Background 1.1 Basic Hardware 1.2 Address Binding 1.3 Logical Versus 1.4 Physical Address Space 1.5 Dynamic Loading 1.6 Dynamic Linking and Shared Libraries 1.7 Overlays 2. Swapping 3. Contiguous Memory Allocation 3.1 Memory mapping and protection, 3.2 Memory allocation, Fragmentation 4. Paging – Basic Method, Protection, Shared Pages 5. Segmentation – Basic concept 6. Virtual Memory Management 6.1 Demand paging 6.2 Performance of demand paging, 7. Page replacement 7.1 FIFO 7.2 Optimal 7.3 LRU 7.4 Second Chance Algorithm		
Chapter 6	File System	8 Hours
1. File Concept, File Attribute, File Operations, File Types, File Structure 2. Access Methods - Sequential Access Method, Direct Access Method, Other Access Methods 3. Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory 4. File System Structure and Implementation - Partitions and Mounting, Virtual File Systems 5. Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation 6. Free Space Management – Bit vector, Linked list, Grouping, Counting, Space maps		
Chapter 7	Disk Scheduling	8 Hours
1. Overview 2. Disk Structure 3. Disk Scheduling, FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling, LOOK Scheduling 4. Disk Management		
Reference Books:		
1. Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, 8th Edition, Wiley Asia 2. Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India. 3. The Design of the UNIX Operating System By Maurice J. Bach., PHI publication		
E- Books and Online Learning Material		
• Operating System Tutorial - GeeksforGeeks • Operating System Tutorial • Operating System Concepts - slides		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-355-PCC-PR Subject: Lab course on BCA-354- PCC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Prerequisites:		
Basic knowledge of 'C Programming' and Data Structure.		
Course Objectives:		
- Understand and apply fundamental concepts of Operating Systems through hands-on practical work. - Gain practical experience with process management, CPU scheduling, memory management, and file systems. - Implement basic OS algorithms using system calls and programming techniques. - Enhance problem-solving, debugging, and analytical skills related to operating system concepts. - Bridge the gap between theoretical OS concepts and real-world system implementation.		
Course Outcomes: (COs): On successful completion of the course, students will be able to:		
- Demonstrate the use of Linux/Unix commands and shell scripting for file and process management. - Implement and analyse CPU scheduling algorithms such as FCFS, SJF, Priority, and Round Robin. - Apply concepts of process creation, synchronization, and inter-process communication using system calls. - Implement memory management techniques including paging and page replacement algorithms. - Analyse and implement disk scheduling and file allocation strategies.		
Practical Lists		
Exp 1	Operations on processes	
Exp 2	CPU Scheduling	
Exp 3	Demand Paging using page replacement algorithm	
Exp 4	Deadlock detection and avoidance	
Exp 5	Page Replacement Algorithms:FIFO, Optimal, LRU	

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-360- PEC-TH Subject: Introduction to Prompt & Gen AI		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Prerequisites:		
• Basic understanding of artificial intelligence and machine learning concepts. • Knowledge of data handling concepts including text, images, and basic datasets. • Understanding of logical reasoning and problem-solving techniques. • Awareness of web technologies or APIs is an added advantage. • Basic familiarity with command-line tools and development environments.		
Course Objectives:		
• To introduce students to the concepts, tools, and applications of Generative AI. • To develop skills in writing effective prompts for text, image, audio, and video generation. • To provide an understanding of how Large Language Models (LLMs) work and how they can be used for productivity, automation, coding, and creativity • To familiarize students with ethical, safe, and responsible AI practices • To equip students with hands-on practical experience using real AI tools and creating small AI-driven projects.		
Course Outcomes: (COs)		
• After completing this course, students will be able to: • Understand fundamental concepts of Generative AI and prompt engineering. • Write optimized prompts for various tasks such as text generation, summarization, and code assistance. • Use multimodal AI tools for generating images, audio, and video. • Apply AI tools to academic, business, and software development tasks. • 6. Develop simple AI-based mini projects and use automation tools responsibly.		
Chapter 1	Basics of Prompt Engineering and Generative AI	5 Hours
1.1 What is Generative AI? 1.2 Traditional AI vs. Generative AI 1.3 Applications: Education, Business, Marketing, IT		

1.4 Introduction to prompts: 1.4.1 Types: Instruction, descriptive, structured 1.4.2 Components: context, task, constraints, examples, output format 1.5 Zero-shot, One-shot, Few-shot prompting 1.6 Ethics: safe prompting, bias, responsible use		
Chapter 2	Large Language Models (LLMs) & Text Generation	6 Hours
2.1 What are LLMs? 2.2 Transformer architecture 2.3 Overview of LLM examples (GPT, LLaMA, Gemini) 2.4 Text generation tasks: 2.4.1 Summaries, paraphrasing, translation 2.4.2 Creative writing 2.4.3 Table/list generation 2.5 Code generation basics: 2.5.1 Writing small programs 2.5.2 Debugging with prompts 2.5.3 Risks: hallucinations, plagiarism, misinformation		
Chapter 3	Image, Audio & Video Generation	7 Hours
3.1 Image generation concepts (diffusion models) 3.2 Image prompting: style, lighting, camera, composition 3.3 Tools: DALL·E, Stable Diffusion, Midjourney 3.4 Audio generation: 3.4.1 Text-to-speech 3.4.2 Music generation basics 3.5 Video generation: 3.5.1 Storyboard prompts 3.5.2 Scene creation prompts 3.6 Deepfakes, media ethics, copyright issues		
Chapter 4	Applied Generative AI for Productivity & Automation	6 Hours
4.1 Productivity with AI: 4.1.1 Email writing, reports, summaries 4.1.2 Resume building, document analysis 4.2 AI tools: ChatGPT, Gemini, Copilot, Claude 4.3 No-code automation concepts: 4.3.1 Zapier, Make.com (overview) 4.3.2 AI workflows (conceptual) 4.4 AI in software development: 4.4.1 Code suggestions 4.4.2 Documentation generation		

Chapter 5	APIs, Custom AI, and AI Applications	6 Hours
5.1 APIs: basic understanding 5.2 Request-response structure using JSON 5.3 Concept of using AI APIs (theory) 5.4 Customizing AI behavior: 5.4.1 System instructions 5.4.2 Prompt templates 5.5 RAG (Retrieval-Augmented Generation) basics 5.6 Real-world applications: Chatbots, Content generation systems, AI assistants 5.7 Future trends: AI agents & AGI concepts		
Reference Books:		
1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach" 3 rd Edition, Pearson Education 2010 2. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014. 3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) “The Handbook of Computational Linguistics and Natural Language Processing”, July 2010 4. Navveen Balani, Prompt Engineering: Unlocking Generative AI: Ethical Creative AI for All”, Amazon Digital Services LLC – Kdp, 2023 5. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. Cambridge, MA: MIT, Press. ISBN: 9780262035613. 6. Langr, J., & Bok, V. (2019). GANs in Action: Deep Learning with Generative Adversarial Networks. Manning Publications. ISBN: 9781617295560.		
E- Books and Online Learning Material		
1. Elements of AI – https://www.elementsofai.com 2. CS50's Introduction to Artificial Intelligence with Python – Harvard https://cs50.harvard.edu/ai/ 3. Google Machine Learning Crash Course – https://developers.google.com/machine-learning/crash-course 4. Learn Prompting (Open-Source Guide) – https://learnprompting.org 5. Google AI – Learn with Google AI https://ai.google/education/ Coursera – Machine Learning by Andrew Ng (Stanford University) https://www.coursera.org/learn/machine-learning		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-361- PCC-PR Subject: Lab course on BCA-360 – PEC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: - Understand the principles of prompt engineering and generative AI concepts for various modalities (text, code, audio, and images). - Gain practical experience in creating, testing, and refining prompts for AI models to produce desired outputs. - Apply AI tools for Text Generation, Code Generation, Summarization, Debugging, TTS, and Visual Generation. - Develop skills in evaluating AI-generated outputs for accuracy, creativity, style, and usability. - Explore real-world applications of generative AI in multimedia, programming, education, and creative industries		
Course Outcomes: (COs) -After successfully completing this practical course, students will be able to: - Design and implement zero-shot, one-shot, and few-shot prompts for effective AI interaction. - Generate structured outputs (tables, JSON, or formatted text) using AI for practical - applications. - Perform code generation, debugging, and optimization using AI tools. - Summarize, paraphrase, and manipulate textual content efficiently with AI assistance. - Generate natural-sounding speech and audio outputs from text using AI TTS tools. 6. Produce images and visual content using style-based, persona-based, or context-based prompts in AI visual generation platforms.		
Exp 1	Zero-shot, One-shot & Few-shot Prompting	
Objectives: Develop practical skills in task formulation using Zero-shot, One-shot, and Few-shot prompts. Build the ability to guide AI models with examples. Task: ➤ Zero-Shot Prompting, One-Shot Prompting, Few-Shot Prompting		

Exp 2	Structured Output Prompting (Tables/JSON)	
Objectives: Understand the concept of structured output prompting for AI Task: ➤ Common Structured Formats: Table, JSON Nested and complex structured data. ➤ Structured Output Prompting		
Exp 3	Persona & Role-based Prompting	
Objectives: Understand the concept of persona and role-based prompting for AI. Apply role-based prompts in real-world applications like chatbots, interactive learning, and professional communication. Task: ➤ Persona & Role-based Prompting		
Exp 4	Summarization & Paraphrasing using AI	
Objectives: Understand the concepts of summarization and paraphrasing in AI Apply AI for content simplification, academic writing, and creative rewriting Topics Covered: ➤ Summarization & Paraphrasing		
Exp 5	Code Generation using AI	
Objectives: Apply AI to solve programming problems, automate tasks Task: ➤ Code Generation Using AI		
Exp 6	Debugging Code using AI	
Objectives: Apply debugging AI to different programming languages and problem scenarios Task: ➤ AI Assisted debugging		
Exp 7	Text-to-Speech & Audio Generation	
Objectives: Apply Text To Seech for multilingual content, voice modulation, and audio outputs. Task: ➤ Text-To-Speech (Tts) And Audio Processing		
Exp 8	Style-based Visual Prompting	
Objectives: Apply prompt engineering techniques to control style, color, mood, and composi Task : Style-Based Visual Prompting using AI		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-362- PEC-TH Subject: Big Data and Analytics		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: - 30 Hours		
Course Objectives: - To enable learners to develop expert knowledge and analytical skills in current and developing areas of analysis statistics, and machine learning - To enable the learner to identify, develop and apply detailed analytical, creative, problem solving skills - Provide the learner with a comprehensive platform for career development, innovation and further study		
Course Outcomes: (COs) - Explain the fundamentals of Big Data, its types, analytics concepts, and applications - Apply data analytics techniques including descriptive, predictive, and prescriptive analytics - Analyze statistical concepts such as probability, distribution, correlation, and regression 4. Implement machine learning algorithms for supervised and unsupervised learning problems - Analyze machine learning models and regression techniques for real-world data - Use R / WEKA tools to perform data manipulation		
Chapter 1	Introduction to BIG DATA	6 Hours
1.2 Types of Digital Data 1.3 Big Data Analytics 1.4 Application of Big data		
Chapter 2	Introduction to Data Analytics	8 Hours
2.1. Basics of Data Analytics 2.2 Types of Analytics – 2.2.1 Descriptive, 2.2.2 Predictive, 2.2.3 Prescriptive 2.2.4 Statistical Inference 2.3 Populations and samples 2.3.1 Statistical modelling, 2.3.2 Probability 2.3.3 Distribution 2.3.4 Correlation 2.3.5 Regression		

Chapter 3	Introduction to Machine Learning	8 Hours
3.1. Basics of Machine Learning 3.2 Supervised Machine Learning 3.2.1 K- Nearest-Neighbours, 3.2.2 Naïve Bayes 3.2.3 Decision tree 3.2.4 Support Vector Machines 3.3 Unsupervised Machine Learning 3.3.1 Cluster analysis 3.3.2 K means 3.3.3 EM Algorithm 3.3.4 Association Rule Mining 3.3.5 Apriori algorithms 3.4 Regression Analysis 3.4.1 Linear Regression 3.4.2 Nonlinear Regression		
Chapter 4	Data Analytics with R/ WEKA Machine Learning	8 Hours
4.1 Introduction 4.2 Data Manipulation 4.3 Data Visualization 4.4 Data Analysis		
Reference Books:		
1.SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015. 2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013) 3. ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press, 2012		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-363- PEC-PR Subject: Lab course on BCA- 362 – PEC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: - 60 Hours		
Course Objectives: • To enable learners to develop expert knowledge and analytical skills in current and developing areas of analysis statistics, and machine learning • To enable the learner to identify, develop and apply detailed analytical, creative, problem solving skills • Provide the learner with a comprehensive platform for career development, innovation and further study		
Course Outcomes: (COs) • Explain the fundamentals of Big Data, its types, analytics concepts, and applications • Apply data analytics techniques including descriptive, predictive, and prescriptive analytics • Analyze statistical concepts such as probability, distribution, correlation, and regression 4. Implement machine learning algorithms for supervised and unsupervised learning problems • Analyze machine learning models and regression techniques for real-world data • Use R / WEKA tools to perform data manipulation		
Exp 1	Basic R Programming	
Objectives: To be familiar with R Programming Task : ➤ Installation ➤ Basics of R Programming – Variable Declaration , Display Data etc. .		
Exp 2	Decision making and loop control structures	
Objectives: To understand and learn the Decision making and loop control structures using R programming Task: ➤ Decision-Making Statements ➤ Loop Control		

Exp 3	String and Function in R Programming	
Objectives: To understand and learn the string and functions in R programming.		
Task: 1. String and Strings' inbuilt functions. 2. Function		
Exp 4	Vector and List in R programming	
Objectives: To learn the vectors and List in R programming		
Task: 1. Vector, types of vectors and those operations 2. List and list operations		
Exp 5	Arrays and Matrices in R programming	
Objectives: To learn and understand the array concept in R programming		
Task: ➤ Array, array types and operations		
Exp 6	Factor and Data Frame in R language	
Objectives: To learn and understand the Factor and Data Frame in R programming		
Task: ➤ Factors ➤ Data Frame		
Exp 7	Data Analysis	
Objectives: To learn and understand the Data Analysis using R programming		
Task: ➤ File handling ➤ Operations on file data		
Assignment 8 : Data Visualization		
Objectives: To learn and understand the Data Visualization in R programming		
Topics Covered: ➤ Bar chart ➤ Scatter plot, Histogram, Etc different visualization tools.		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-364- PEC-TH Subject: Mobile Application Development		
Teaching Scheme 2 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Course Objectives: • To understand the Android Operating System • To study Android Apps Development Cycle • To learn to create Android Applications • To understand the basic Android UI design • To Develop SQLite database Android Application.		
Course Outcomes: (COs) • Describe the process of developing mobile applications. • Create mobile applications on the Android Platform. • Design and implement basic mobile applications. • Developing android applications using menu. • Developing SQLite database Android Application.		
Chapter 1	Introduction to Android	4 Hours
1.1. Overview 1.2. History 1.3. Features of Android 1.4. Architecture of Android • Linux Kernel • Native Libraries • Android Runtime • Application Framework • Applications 1.5. SDK Overview • Platforms • Tools – (JDK, SDK, Eclipse/Android Studio, ADT,AVD, Android Emulator), Versions		

Chapter 2	Activities, Toast and Intents	
2.1. Introduction to components of Android OS 2.2. Introduction to Activities 2.3. Activity Lifecycle 2.4. Creating your first Android Application 2.5. Introduction to Intents 2.6. Linking Activities using Intents 2.7. Calling built-in applications using Intents 2.8. Toast		
Chapter 3	Android User Interface with layouts	6 Hours
3.1. Understanding the components of a screen 3.2. Views and View Groups • Linear Layout • Absolute Layout • Table Layout • Relative Layout • Frame Layout • Scroll View • Constraint Layout 3.3. Adapting to Display Orientation • Anchoring Views • Resizing and Repositioning		
Chapter 4	Designing Your User Interface with Views	5 Hours
4.1. Using Basic Views • TextView • Button, ImageButton, EditText, CheckBox • Switch, ToggleButton, RadioButton, and RadioGroup Views • ProgressBar View • AutoCompleteTextView View 4.2. Using Picker Views • TimePicker View • DatePicker View 4.3. Using List Views to Display Long Lists • ListView View Using the Spinner View		

Chapter 5	Adapter and Menus	4 Hours
5.1. Adapter and its types • Base Adapter • Array Adapter 5.2. Using Menus with Views • Options Menu • Context Menu • Popup menu		
Chapter 6	Databases – SQLite, Messaging	5 Hours
6.1 Introduction to SQLite 6.2 SQLite Open Helper and SQLite Database 6.3 Creating , opening and closing database 6.4 Working with cursors, Insert, Update, Delete 6.5 Building and executing queries		
Reference Books:		
1. Beginning Android4 Application Development, By Wei-Meng Lee WILEY India Edition WROX Publication 2. Professional Android 4 Application Development, By Reto Meier WROX Publication 3. Head First Android Development: A Brain-Friendly Guide, By David Griffiths and Dawn Griffiths 4. Mobile App Development Technologies M.Sc.(C.S.)-Sem-II by Monica Deshmane-Dhotre , Nirali Publication(2023).		
E- Books and Online Learning Material		
• https://enos.itcollege.ee/~jpoial/allalaadimised/reading/Android-Programming-Cookbook.pdf • https://www.programming-book.com/download/?file=10988 • 3) http://projanco.com/Library/Android%20App%20Development%20in%20Android%20Studio%20-%20Java%20plus%20Android%20edition%20for%20beginners.pdf • https://www.programmer-books.com/professional-android-4th-edition-pdf/		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-365- PEC-PR Subject: Lab Course on BCA-364-PEC-TH		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 60 Hours		
Course Objectives: • To understand the Android Operating System • To study Android Apps Development Cycle • To learn to create Android Applications • To understand the basic Android UI design • To build SQLite database Application		
Course Outcomes: (COs) • Describe the process of developing mobile applications. • Create mobile applications on the Android Platform. • Design and implement basic mobile applications. • Developing android applications using menu. • 5. Design and implement mobile applications involving data storage in SQLite database		
Exp 1	Introduction to Android	
Objectives: 1. To learn Features of Android. 2. To understand architecture of the Android. 3. To understand setup Tools for Android OS. Task: ○ SDK Overview ▪ Platforms ▪ Tools – (JDK, SDK, Eclipse/Android Studio, ADT,AVD, Android Emulator), Versions ▪ Install Android Studio and build		
Exp 2	Activities	
Objectives: 1. To understand the Activity Lifecycle 2. To create first Android Application Topics Covered: ➤ Demo for Activity Lifecycle for each state. ➤ Creating your first Android Application		
Exp 3	Toast	2 Hours
Objectives: To create Android Application with Toast Task: ➤ Create application with Toast		

Exp 4	Intents	
Objectives: 1. To use Intent. 2. To link Activities using Intents Task : ➤ Create Implicit Intents ➤ Linking Activities using Intents ➤ Calling built-in applications using Intents ➤ Gives message on next Activity		
Exp 5	Android User Interface with layouts	
Objectives: • To learn different View Groups. • To compare different layouts. Topics Covered: ➤ Linear Layout ➤ Absolute Layout ➤ Table Layout ➤ Relative Layout		
Exp 6	Android User Interface with layouts	
Objectives: 1. To learn different View Groups. 2. To compare different layouts. Task: ➤ Frame Layout ➤ Scroll View ➤ Constraint Layout ➤ Grid Layout		
Exp 7		8 Hours
Objectives: To understand Basic Views Task: ➤ Using Basic Views ➤ TextView ➤ Button, ImageButton, EditText, CheckBox ➤ Switch, ToggleButton, RadioButton, and RadioGroup Views ➤ ProgressBar View ➤ AutoCompleteTextView View ➤ Using Picker Views ➤ TimePicker View ➤ DatePicker View ➤ Designing Your User Interface with View		

Exp 8	Designing Your User Interface with Views	
Objectives: To use List Views to Display Long Lists Topics Covered: ➤ Using List Views to Display Long Lists, ListView View ➤ Using the Spinner View		
Exp 9	Adapter	
Objectives: To learn Adapter. Topics Covered: ➤ Adapter and its types ➤ Base Adapter ➤ Array Adapter		
Exp 10	Menus	
Objectives: To learn different types of Menus. Topics Covered: ➤ Using Menus with Views ➤ Options Menu ➤ Context Menu ➤ Popup menu		
Exp 11	Databases-SQLite	
Objectives: To learn SQLite database Topics Covered: ➤ 11.1. Use a SQLite database. ➤ 11.2. Creating , opening and closing database		
Exp 12	: Databases-SQLite II	
Objectives: To learn different CRUD operations. Topics Covered: ➤ Working with cursors, Insert, Update, Delete ➤ Building and executing queries		

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-VSEC-371-PR Subject: Web Programming II		
Teaching Scheme 4 hours / Week	No. of Credits 2	Examination Scheme CE: 20 marks EE: 30 marks
Course Hours: 30 Hours		
Prerequisites:		
• HTML5 • CSS • Core PHP • Bootstrap framework utility		
Course Objectives:		
• To understand modern web technologies and client–server interaction models. • To learn XML for data representation, storage, and exchange in web applications. • To develop interactive and dynamic web pages using JavaScript and apply jQuery for simplified DOM manipulation, event handling, and effects. • To implement AJAX techniques for asynchronous web application communication. • 5. To understand the MVC architecture and develop web applications using the CodeIgniter framework.		
Course Outcomes: (COs): On successful completion of the course, students will be able to:		
• Explain web techniques, client–server architecture, and data exchange mechanisms • Create and validate XML documents for structured data representation. • Develop dynamic, interactive web pages using JavaScript fundamentals and use jQuery to manipulate DOM elements, handle events, and implement visual effects. • Implement AJAX to perform asynchronous data transfer between client and server. • 5. Develop web applications using the CodeIgniter framework following MVC architecture.		
Chapter 1	Introduction to Web Techniques	6 Hours
1.1 Variables 1.2 Server information 1.3 Processing forms 1.4 Setting response headers 1.5 Maintaining state 1.6 PHP error handling		

Chapter 2	XML	6 Hours)
2.1 What is XML? 2.2 XML document Structure 2.3 PHP and XML 2.4 XML parser 2.5 The document object model 2.6 The simple XML extension 2.7 Changing a value with simple XML		
Chapter 3	Java Script and JQuery	8 Hours
3.1 Overview of JavaScript 3.2 Object Orientation and JavaScript Basic Syntax(JS datatypes, JS variables) 3.3 Primitives, Operations and Expressions 3.4 Screen Output and keyboard input(Verification and Validation) 3.5 JS Control statements and JS Functions 3.6 JavaScript HTML DOM Events(onmouseup, onmousedown, onclick, onload, onmouseover, onmouseout). 3.7 JS Strings and JS String methods 3.8 JS popup boxes(alert, confirm, prompt). 3.9 JQuery library , Including jquery library in page 3.10 JQuery selector , DOM manipulation using jquery		
Chapter 4	AJAX	6 Hours
4.1 Introduction of AJAX 4.2 AJAX web application model 4.3 AJAX –PHP framework 4.4 Performing AJAX validation 4.5 Handling XML data using php and AJAX 4.6 Connecting database using php and AJAX		
Chapter 5	PHP framework CodeIgniter	4 Hours
5.1 CodeIgniter - Overview, Installing CodeIgniter 5.2 Application Architecture MVC Framework, Basic concept of CodeIgniter, Libraries 5.3 Working with databases 5.4 Load external JS and CSS page & redirecting from controller, Adding JS and CSS, Page redirection. 5.5 Loading dynamic data on page & session management, cookies management		

Reference Books:		
1. Programming PHP By Rasmus Lerdorf and Kevin Tatroe O'Reilly publication 2. Beginning PHP 5, Wrox publication 3. AJAX Black Book Kogent solution 4. Mastering PHP BPB Publication 5. Professional Codeigniter By Thomas Myer ,Wrox Publication, 6. Codeihniter 2 CookBook By Rob Foster ,PACKT Publication , 7. JQuery CookBook, O'reilly Publication.		
E- Books and Online Learning Material		
1. www.php.net.in 2. www.W3schools.com 3. https://www.tutorialspoint.com/codeigniter/index.htm 4. https://api.jquery.com/ 5. http://codeigniter.com/docs <i>link</i>		
Practical Assignments		
Guidelines: Operating Environment for web technologies: HTML5.0, PHP 5.0 and above ,Webserver, Codeigniter on Linux/Windows		
Exp 1	Self Processing Forms, Sticky Forms, File Upload	
Exp 2	COOKIES and SESSIONS	
Exp 3	XML documents and DOM	
Exp 4	JavaScript	
Exp 5	Ajax	
Exp 6	PHP framework CodeIgniter	

Haribhai V. Desai College of Arts, Science and Commerce, Pune (Autonomous) T.Y.B.C.A. Subject Code: BCA-381- OJT-PR Subject: On-Job Training/ Internship		
Teaching Scheme 4 hours / Week	No. of Credits 4	Examination Scheme CE: 40 marks EE: 60 marks
Course Hours: 120 Hours		
Course Objectives: • Apply theoretical computer science knowledge in real-world work environments. • Develop software solutions using appropriate tools and technologies. • Demonstrate professional ethics, teamwork, and communication skills. • Analyse problems and propose effective technical solutions. • Prepare technical documentation and present project outcomes.		
Course Outcomes: (COs) • Apply concepts in real projects. • Develop and test applications. • Demonstrate professional skills. • Solve industry-based problems. • 5. Document and present work.		
OJT Guidelines for Students:		
1. Eligibility & Duration • Minimum 120 hours of OJT is compulsory. • OJT must be completed in a recognized organization with prior college approval. 2. Before Joining OJT • Obtain approval from the OJT Coordinator / Internal Mentor. • Submit organization acceptance letter. • Understand working hours, rules, and assigned supervisor. 3. During OJT • Maintain discipline, punctuality, and professionalism. • Follow organization rules and confidentiality norms. • Maintain a weekly logbook signed by the Internal Mentor. • Communicate regularly with the internal mentor. 4. After Completion of OJT • Obtain completion certificate and evaluation form from organization. • Submit OJT report, logbook, and certificates within deadline. • Attend presentation and viva-voce. 5. Code of Conduct • Misconduct, plagiarism, or false reporting will lead to disqualification. • Students are responsible for their own conduct and safety during OJT. 6. Mandatory Documents to submit • Offer Letter • Relieving Letter by College Completion certificate		

The Poona Gujarati Kelvani Mandal's
Haribhai V. Desai College of Arts, Science and Commerce, Pune
(Autonomous)

Structure of UG Program as per NEP-2020

Program Name: - B.C.A.

Major Course: - Computer Application

Eligibility:

- Higher secondary (10 + 2) or equivalent examination (10+3) of any recognized Board with satisfying the conditions to pass a common All India Entrance test (MAH-BCA CET) conducted by CETCELL. The final admission is based solely on the merit of CET.

Objectives:

- To prepare the youth to take up positions as system analysts, system engineers, software engineers and programmers.
- To aim at developing 'systems thinking' 'abstract thinking', 'skills to analyze and synthesize', and 'skills to apply knowledge', through 'extensive problem solving sessions', 'hands on practice under various hardware/software environments' and ' projects developed'.
- To prepare students with 'social interaction skills', 'communication skills', 'life skills', 'entrepreneurial skills', and 'research skills' which are necessary for career growth and for leading quality life are also imparted

The Poona Gujarati Kelvani Mandal's
Haribhai V. Desai College of Arts, Science and Commerce,
Pune
(Autonomous)

Structure of UG Program as per NEP-2020

Program Name: - B.C.A.

Major Course: - Computer Application

Workload

1. Each theory credit is equivalent to 15 clock hours of teaching (i.e. for 2 Credits – 30 Clock Hours) and each practical credit is equivalent to 30 clock hours (i.e. for 2 Credits – 60 Clock Hours) of teaching in a semester.
2. There is 15 weeks of teacher-student interaction during the semester.
3. The 15 week is divided into 12 weeks teaching and 3 weeks for continuous assessment including preparation time to students during the semester.
4. The workload will be calculated based on 12 weeks teaching only.
5. For the purpose of computation of work-load the following mechanism may be adopted as per UGC guidelines.
6. Workload as per credit is as follows:
 - i. 1 Credit = 1 Theory period of one hour duration per week.
 - ii. 1 Credit = 1 Tutorial period of one hour duration per week.
 - iii. 1 Credit = 1 Practical period of two-hour duration per week.
7. Each theory Lecture time for FY, SY, TY is of 60 min. (2 Lectures per week for 2 credit courses)
8. Each practical session time for FY/ SY /TY is of 4 hour i.e. 240 min.

Level /Difficulty	Sem	Subject-1				Subject-2	Subject-3	GE/ OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(T)	2(T/P)	2(T) Generic	2(T)	2	-	22
	II	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(P)			2(T/P)	-	2(T)	2
Exit Option: Award of UG <i>Certificate</i> in Major with 44 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor														
Continue Option: Student will select one subject among the (Subject-1, Subject-2, and Subject-3) as major and another as minor and third subject will be dropped.														
Level /Difficulty	Sem	Credits related to major				Minor		GE/ OE	SEC	IKS	AEC	VEC	CC	Total
		Discipline Specific Core (DSC) Major Core	Discipline Specific Elective (DSE) Major Elective	VSC	FP/ OJT /CEP									
5.0/200	II	4(T)+2(P)	-	2(T/P)	2 (FP)	2(T)+2(P)	-	2(T)	-	2(T)	2(T)	-	2	22
	I	4(T)+2(P)	-	2(T/P)	2(CEP)	2(T)+2(P)	-	2(P)	2(T/P)	-	2(T)	-	2	22
Exit Option: Award of UG <i>Diploma</i> in Major and Minor with 88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor.														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2(T/P)	4(FP/ CEP)	2(T)	-	-	-	-	-	-	-	22
	VI	8(T)+4(P)	2(T)+2(P)	2(T/P)	4(OJT)	-	-	-	-	-	-	-	-	22
Total 3 Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exit Option: Award of UG <i>degree</i> in Major with 132 credits OR Continue with Major and Minor.														
6.0/400	VII	6(T)+4(P)	2(T)+2(P)	-	4(RP)	4(T)(RM)	-	-	-	-	-	-	-	22
	VIII	6(T)+4(P)	2(T)+2(P)	-	8(RP)	-	-	-	-	-	-	-	-	22
Total 4 Years		64	16	8	22	22	8	8	6	4	8	4	6	176
Exit Option: Award of UG <i>Honors with Research</i> Degree in Major and Minor with 176 credits.														
-OR-														
6.0/400	VI	10(T)+4(P)	2(T)+2(P)	-	-	4(T)(RM)	-	-	-	-	-	-	-	22
	VI	10(T)+4(P)	2(T)+2(P)	-	4(OJT)	-	-	-	-	-	-	-	-	22
Total 4 Years		72	16	8	14	22	8	8	6	4	8	4	6	132
Exit Option: Award of UG <i>Honors Degree</i> in Major and Minor with 176 credits.														

The Poona Gujarati Kelvani Mandal's
Haribhai V. Desai College of Arts, Science and Commerce,
Pune
(Autonomous)

Structure of UG Program as per NEP-2020

Program Name: - B.C.A.

Major Course: - Computer Application

Reference Books

1. Software Engineering and Testing

1. *Software Engineering* – Ian Sommerville – Pearson – 10th Ed.
2. *Software Engineering: A Practitioner's Approach* – Roger S. Pressman & Bruce Maxim – McGraw-Hill – 7th/9th Ed.
3. *Fundamentals of Software Engineering* – Rajib Mall – PHI – 5th Ed.
4. *The Art of Software Testing* – Glenford J. Myers et al. – Wiley – 3rd Ed.
5. *Software Testing and Quality Assurance* – Kshirasagar Naik & Priyadarshi Tripathy – Wiley – 2nd Ed.

2. Software Project Management

1. *Software Project Management* – Bob Hughes & Mike Cotterell – McGraw-Hill – 6th Ed.
2. *The Mythical Man-Month* – Frederick P. Brooks Jr. – Addison-Wesley – Anniversary Ed.
3. *Effective Project Management* – Robert K. Wysocki – Wiley – 7th Ed.
4. *Applied Software Project Management* – Andrew Stellman & Jennifer Greene – O'Reilly 1st Ed.
5. *Agile Project Management with Scrum* – Ken Schwaber – Microsoft Press – 1st Ed.

3. Core and Advanced Java

1. *Core Java Volume I* – Cay S. Horstmann – Pearson – 11th Ed.
2. *Core Java Volume II* – Cay S. Horstmann – Pearson – 11th Ed.
3. *Effective Java* – Joshua Bloch – Addison-Wesley – 3rd Ed.
4. *Java: The Complete Reference* – Herbert Schildt – McGraw-Hill – 11th Ed.
5. *Head First Java* – Kathy Sierra & Bert Bates – O'Reilly – 2nd Ed.

4. Fundamentals of Data Science

1. *Fundamentals of Data Science* – Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare – CRC Press (Taylor & Francis) – 1st Ed. (2021/2025)
2. *Fundamentals of Data Science: Theory and Practice* – Jugal K. Kalita, Dhruva K. Bhattacharyya, Swarup Roy – Academic Press (Elsevier) – 1st Ed. (2023)
3. *Data Science from Scratch* – Joel Grus – O'Reilly Media – 2nd Ed.
4. *Introduction to Data Science* – Laura Igual, Santi Seguí – Springer – 1st Ed.
5. *Doing Data Science* – Cathy O'Neil, Rachel Schutt – O'Reilly Media – 1st Ed.

5. Operating System Design

1. *Operating System Concepts* – Abraham Silberschatz, Peter B. Galvin, Greg Gagne – Wiley – 10th Ed.
2. *Modern Operating Systems* – Andrew S. Tanenbaum, Herbert Bos – Pearson – 4th Ed.
3. *Operating Systems: Internals and Design Principles* – William Stallings – Pearson – 9th Ed.
4. *Operating Systems: Three Easy Pieces* – Remzi H. Arpaci-Dusseau, Andrea C.

Arpaci-Dusseau – Arpaci-Dusseau Books – 1st Ed.

5. *Design of the UNIX Operating System – Maurice J. Bach – Pearson – 1st Ed..*

7. Web Programming

1. *Jon Duckett, HTML and CSS: Design and Build Websites*
2. *David Sawyer McFarland, CSS: The Missing Manual*
3. *Rich Finelli, Mastering CSS: A Beginner's Guide*
4. *Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development*
5. *David Flanagan, JavaScript: The Definitive Guide*
6. *Valentin Bojinov et al., Node.js: The Complete Reference Guide, Packt Publishing*
7. *Sandro Pasquali, Mastering Node.js, Packt Publishing*
8. *Guillermo Rauch, Smashing Node.js: JavaScript Everywhere, John Wiley & Sons*
9. *Ethan Brown, Web Development with Node and Express*
10. *Greg Lim, Beginning Node.js, Express & MongoDB Development*

8. Cloud Computing

1. *Cloud Computing: Concepts, Technology & Architecture – Thomas Erl et al. – Pearson – 1st Ed.*
2. *Cloud Computing: A Practical Approach – Anthony T. Velte & Toby J. Velte – McGraw-Hill – 1st Ed.*
3. *Cloud Computing (SaaS, PaaS, IaaS) – Kris Jamsa – Jones & Bartlett – 1st Ed.*
4. *Cloud Security and Privacy – Tim Mather et al. – O'Reilly – 1st Ed.*
5. *The Cloud Computing Book – Douglas Comer – Pearson – 1st Ed.*

9. Mobile Computing

1. *Mobile Computing – Raj Kamal – Oxford University Press – 2nd Ed.*
2. *Mobile Computing: Principles, Designing and Developing Mobile Applications – Asoke K. Talukder, Roopa R. Yavagal, Hasan Ahmed – McGraw-Hill – 2nd Ed.*
3. *Mobile Communications – Jochen Schiller – Pearson – 2nd Ed.*
4. *Wireless Communications & Networks – William Stallings – Pearson – 2nd Ed.*
5. *Fundamentals of Mobile Computing – Prasant Kumar Pattnaik, Rajib Mall – PHI – 2nd Ed.*

The Poona Gujarati Kelvani Mandal's
Haribhai V. Desai College of Arts, Science and Commerce,
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Structure of UG Program as per NEP-2020

Program Name: - B.C.A.

Major Course: - Computer Application

Examination Pattern

1. Exam pattern is 60-40 i.e. Semester End Examination (SEE) is of 60 % and Continuous Internal Assessment is of 40 %.

Theory, Practical/Project: -

Continuous Internal Assessment (CIA): 40 % [20 Marks]

1. Written Test- 50 % [10 Marks]
2. Presentation/Assignment: - 25% [5 Marks]
3. Project/Activity Oriented Learning: -25 % [05 Marks]

Semester End Examination (SEE): - 60 % [30 Marks]

2. For Internal examination, written test should be conducted of 10 marks for 2 credits.

Paper Pattern

Internal Examination

Que-1: Answer the following questions (Short answer questions) (any 4 out of 5) – **4 Marks.**

Que-2: Answer the following questions (Short answer questions) (any 2 out of 3)- **4 Marks**

Que-3: Answer the following questions (Logical Question) (any 1 out of 2)– **2 Marks.**

External Examination

Que-1: [06 Marks]

Answer the following questions (Short answer/Definition/Problems/Diagram, etc.) (Any 6 out of 8)

Que-2: [08 Marks]

A] Answer the following questions (Short answer questions- 2 Que out of 3) [6 Marks]

B] Answer the following questions (Long answer questions/Problems- 1 Que out of 2) [2 Marks]

Que-3: [08 Marks]

A] Answer the following questions (Short answer questions- 1 Que out of 2 [3 Marks]

B] Answer the following questions (Long answer questions/Problems- 1 Que out of 2) [5 Marks]

Que-4: [08Marks]

A] Answer the following questions (Short answer questions- 1 Que out of 2 [3 Marks]

B] Answer the following questions (Long answer questions/Problems- 1 Que out of 2) [5 Marks]

The Poona Gujarati Kelvani Mandal's
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Structure of UG Program as per NEP-2020

Program Name: - B.C.A.

Major Course: - Computer Application

Completion of Degree

1. A student who earns 44 credits at First year with additional 4 credits core NSQF Course/Internship shall be eligible for the award of UG Certificate in Major subject. OR May continues with Major and Minor.
2. A student who earns 88 credits at Second year with additional 4 credits core NSQF Course/Internship shall be eligible for the award of UG Diploma in Major subject with Minor (Selected at SY). OR May continues with Major and Minor.
3. A student who earns 132 credits at Third year shall be eligible for the award of UG Degree in Major subject with Minor (Selected at SY). OR May continues with Major and Minor.
4. A student who earns 176 credits in Four years shall be eligible for the award of UG Honors or Honors with Research in Major subject with Minor (Selected at SY).

Award of Degree:

CGPA will be calculated for students who completed 132/176 credits, grades are given as per the following table.

Sr. No.	Grade Letter	Grade Point	Marks
1.	O (Outstanding)	10	90<= Marks <= 100
2.	A+ (Excellent)	9	75<= Marks <= 89
3.	A (Very Good)	8	60<= Marks <= 74
4.	B+ (Good)	7	55<= Marks <= 59
5.	B (Above Average)	6	50<= Marks <= 54
6.	C (Average)	5	45<= Marks <= 49
7.	D (Pass)	4	40<= Marks <= 40
8.	F (Fail)	0	Marks <40
9.	AB (Absent)	0	-