

Curriculum Framework

Bachelor of Computer Application

As per NEP 2020 and Learning Outcomes-based National Curriculum Framework
(Aligned with NCrF and NHEQF)

Effective From Academic Year 2026-2027



GUJARAT VIDYAPITH: AHMEDABAD

Curriculum Framework of Bachelor of Computer Application

Published by:

Dr. Himanshu Patel

Registrar

Gujarat Vidyapith

Near Income Tax Office, Ashram Road, Ahmedabad - 380009.

From the Desk of Vice Chancellor...



Dear All,

Any curriculum, at any level, must be firmly grounded in the objectives and goals that an educator or an educational institution aspires to achieve for its students. A course that trains students to solve mathematical equations must be very different from one that teaches them how to play a musical instrument, practice yoga, or conduct social research. Each subject requires its own methods, activities, and learning goals, which is why curriculum design is so important.

Therefore, curriculum is of utmost importance, as it determines how teachers and students will spend their time—in laboratories, in clinical practice, in creative endeavors, or in interactive lectures. It also reflects what a class, a department, a school, or an institution values; what it defines as its mission; and what it expects its graduates to accomplish. In this sense, the curriculum is the map that guides the essentials of learning from the classroom level to the institutional level.

The true success of any curriculum must be judged by its ability to achieve its intended objectives. It is a test of how well an institution—or an individual teacher—understands and articulates those objectives, and how effectively a pathway is created for students to attain success as defined by them. Curriculum is, in fact, a continuous chain of activities designed to translate broad educational goals into concrete practices, learning materials, and observable changes in behavior. A lesson plan, for instance, is curriculum at the classroom level, answering the critical questions: *What do I want my students to know? How can I engage them meaningfully? How will I measure what they have learned?*

For a society to achieve its educational aspirations, the curriculum must be both functional and relevant to its needs. Through careful management of curriculum, effective use of resources, and policies that bring systemic improvements, education can move society toward a more promising future. Indeed, curriculum is the very foundation of any academic institution—without it, the institution would lose its purpose and direction.

At Gujarat Vidyapith, established by Mahatma Gandhi in 1920 with its rich cultural and educational heritage, we remain committed to these ideals and we work with well-defined objectives to prepare our students for a brighter academic and social future.

It gives me immense pride and joy to announce the unveiling of the latest curriculum of Gujarat Vidyapith. This curriculum has been carefully designed in alignment with the objectives and guiding principles of the National Education Policy (NEP) 2020. I take this opportunity to place on record my deep appreciation for the efforts of the teaching faculty of Gujarat Vidyapith, the Members of the Board of Studies, and the Members of the Academic Council. Their dedication and vision have given shape to this comprehensive neo-curriculum, which will guide our students and our institution toward continued excellence.

With best wishes,

Dr. Harshad Patel
Vice Chancellor
Gujarat Vidyapith

Curriculum Framework

Bachelor of Computer Application

Effective From Academic Year 2026-2027

Department of Computer Science

Faculty of Information, Communication and Technology

Gujarat Vidyapith

Board of Studies

Chairperson:

Prof. Ajay Parikh

Professor & Dean, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

External Experts:

1) **Prof. Rajeev Wankar**

Professor, University of Hyderabad

2) **Prof. Nilesh Modi**

Professor, Babasaheb Ambedkar Open University

Members from the Department:

1) **Prof. Dhiren Patel**

Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

2) **Dr. Neepa Shah**

Associate Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

3) **Mr. Kamaleshkumar Salunke**

Assistant Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

4) **Dr. Ruchita Shah**

Assistant Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

Curriculum Framework - Bachelor of Computer Application - 2026

PROGRAMME STRUCTURE							
Course Code	Course Name	Hours			Credit	Evaluations	
		Theory	Practical	Total		CCE	TEE
SEMESTER-1							
264510345037	Computational Thinking, Problem Solving and Logic Building	45	0	45	3	40	60
264510345038	Fundamental of Digital Systems and Intelligent Computing	45	0	45	3	40	60
264510245039	Web Design (Lab Based)	0	60	60	2	40	60
264510145040	Data Literacy for Dashboard Building	15	0	15	1	40	60
264510145041	Lab based on Data Literacy for Dashboard Building	0	30	30	1	40	60
264510345903	SEC-Prompt Engineering and AI Tools-Appendix -A	0	90	90	3	40	60
264510345803	MDC-Fundamentals of Mathematics-Appendix-B	30 (Theory)	15 (Tutorial)	45	3	40	60
254510238701	VAC-Environmental Education	30	0	30	2	40	60
254510203601	AEC-English	30	0	30	2	40	60
	Community Living	0	0	0	2*	40	60
Total		195	195	390	20+2*	400	600
SEMESTER-2							
254510345005	Web Design-II	45	0	45	3	40	60
254510345006	Computer Programming (C)	45	0	45	3	40	60
254510245007	Lab Based on Computer Programming	0	60	60	2	40	60
254510245008	Lab Based on Web Design-II	0	60	60	2	40	60
SEC	University Offered	0	90	90	3	40	60
264510345802	MDC-Mathematics – I-Appendix - A	30 (Theory)	15 (Tutorial)	45	3	40	60
VAC	University Offered	30	0	30	2	40	60
AEC	University Offered	30	0	30	2	40	60
	Community Living	0	0	0	2*	40	60
Total		180	225	405	20+2*	360	540
SEMESTER-3							
265010245042	Fundamentals of Database Management System	30	0	30	2	40	60
265010445043	Object Oriented Programming using Java	60	0	60	4	40	60
265010345044	System Analysis and Design	45	0	45	3	40	60
265010145045	Lab Based on Fundamentals of Database Management System	0	30	30	1	40	60
265010245046	Lab Based on Object Oriented Programming using Java	0	60	60	2	40	60
SEC	University Offered	0	90	90	3	40	60
264510345804	MDC-Mathematics – II-Appendix - A	30 (Theory)	15 (Tutorial)	45	3	40	60
AEC	University Offered	30	0	30	2	40	60
	Community Living	0	0	0	2*	40	60
Total		195	195	390	20+2*	360	540
SEMESTER-4							
255010345014	Data Structures	45	0	45	3	40	60
255010345015	Web Application Development	45	0	45	3	40	60
255010345016	Computer Network	45	0	45	3	40	60
255010345017	Search Engine Optimization (Lab Based)	0	90	90	3	40	60
255010245018	Lab Based on Data Structures	0	60	60	2	40	60
255010245019	Lab Based on Web Application Development	0	60	60	2	40	60
VAC	University Offered	30	0	30	2	40	60
AEC	University Offered	30	0	30	2	40	60
	Community Living	0	0	0	2*	40	60
Total		195	210	405	20+2*	360	540

Curriculum Framework - Bachelor of Computer Application - 2026

SEMESTER-5							
265510445015	Mobile Application Development	60	0	60	4	40	60
265510345016	Operating System	45	0	45	3	40	60
265510245017	Lab Based on Mobile Application Development	0	60	60	2	40	60
265510245018	Lab Based on Operating System	0	60	60	2	40	60
265520245047	MOOC-Python for Data Science Appendix-A	30	0	30	2	40	60
265520245050	MOOC- Python Essentials: Learn, Build & Apply Appendix-D						
265510245048	MOOC-Lab Based on Python for Data Science Appendix-B	0	60	60	2	40	60
265510245051	MOOC-Lab Based on Python Essentials: Learn, Build & Apply Appendix-E						
265510145049	Case Study Based on MOOC-265520245047-Appendix-C	0	30	30	1	40	60
265510145052	Case Study Based on MOOC-Appendix-F						
265510445022	Internship	0	120	120	4	40	60
	Community Living	0	0	0	2*	40	60
Total		135	330	465	20+2*	360	540
SEMESTER-6							
255510245030	Advanced Data Structures-Elective-I	30	60	90	4	40	60
255510245031	Lab Based on Advanced Data Structures						
265520445036	MOOC*- Elective-II	0	480	480	16	40	60
265511645035	Internship						
Total		30	540	570	20	80	120
GRAND TOTAL		930	1695	2625	120*12	1920	2880

*CCE- Continuous Comprehensive Evaluation; **TEE- Term End Evaluation

* Students can select a MOOC Course from the list of MOOCs approved and declared by the department at the beginning of every semester.

Programme Summary								
Broad Category of Course	Sem-1	Sem-2	Sem-3	Sem-4	Sem-5	Sem-6	Total	Required
Major (Core)	3+2=5	3+2=5	2+1+4+2=9	3+2+3+2=10	3+2+4+2=11	4+16=20	60	60
Minor	3+2=5	3+2=5	3	3+3=6	3+2=5	-	24	24
Multidisciplinary	3	3	3	-	-	-	9	9
Ability Enhancement Course	2	2	2	2	-	-	8	8
Skill Enhancement Course	3	3	3	-	-	-	9	9
Value Added Courses	2	2	-	2	-	-	6	6-8
Internship	-	-	-	-	4	-	4	4
Total	20	20	20	20	20	20	120	120

Collaborating Organisations

- Tiny ERP (Odoo)
- Tecblic India
- Complitech Solution Pvt. Ltd.
- CMExpertise Infotech Pvt.Ltd
- Yudiz Solutions Pvt Ltd
- Qurious Tech
- PLUSINFOSYS
- Addon Solutions
- PerceptionCare
- Raimptech Solutions Pvt. Ltd
- Xomic infotech
- Confidosoft
- Serpent Consulting Pvt. Ltd.
- Maxgen Technologies Ltd.
- Vowels digitech software Pvt. Ltd
- IncDesign Agency LLP
- Esfina Technology & Solution Pvt. Ltd.
- Infoware
- Mday Consultancy
- MV Clouds Private Limited
- NUWAVE COMMUNICATION Inc.
- Emerging Five
- Neela Spaces Limited
- TRENTIUM SOLUTION PRIVATE LIMITED
- Echobitz IT Solutions Pvt Ltd
- Macdroid Solutions PVT. LTD.
- Restrosoft Solutions Pvt. Ltd.
- Cilans System
- Wibit Solutions LLP
- Whitestork software solutions

Programme Outcomes (POs)

After successful completion of the BCA program, students will be able to:

PO-1	Discipline Specific Knowledge	To provide a strong foundation in the principles and practices of computer applications, including programming, databases, networking, web development, operating systems, and advanced (current) topics in the vernacular language.
PO-2	Problem Analysis	To develop students' ability to identify, define, and analyze computational problems using logical and algorithmic thinking, relevant especially for solving local and rural challenges.
PO-3	Experimental Skills	Graduates will develop the ability to design, implement, and evaluate experiments and projects in the field of computer applications, applying theoretical knowledge to practical scenarios using modern tools and technologies.
PO-4	Environment And Sustainability	Develop sustainable IT solutions mindful of environmental impact, aligning with Gandhian principles of simplicity and ecological balance.
PO-5	Ethics and Values	Demonstrate ethical decision-making, and commitment to truth, non-violence, simplicity and service in the practice and application of computer science.
PO-6	Communication	Communicate technical information effectively in Gujarati and English, enabling outreach to local communities as well as participation in national/global digital initiatives.
PO-7	Modern Tool Usage	To train students in using current technologies, software tools, and computing platforms, along with emerging digital practices like Cloud Computing, AI, Data Science, Data Analytics and mobile development.
PO-8	Teamwork and Leadership	Communicate technical concepts effectively through written reports and oral presentations, and demonstrate leadership and teamwork skills in multidisciplinary and multicultural settings.
PO-9	Lifelong Learning	Encourages continuous learning and adaptability, ensuring graduates stay updated with scientific advancements and societal changes.
PO-10	Project Management	Develop organizational and economic skills to effectively plan, manage, and execute software projects, IT operations, and system development tasks in academic, industrial, or field-based environments.
PO-11	Innovation and Entrepreneurship	Demonstrate entrepreneurial mindset and innovative thinking by applying computing knowledge to identify real-world problems, design IT-based solutions, and explore startup opportunities in the tech industry.
PO-12	Societal Contribution	Apply computing skills and ethical practices to develop technology solutions that address societal needs, promote digital inclusion, and contribute to community development

Programme Specific Outcomes (PSOs)

After successful completion of the BCA program with a specialization in Computer Application, students will be able to:

PSO-1	Apply logic, core computing principles, and programming skills (C, Java, web development, data structures) to model, analyze, and solve complex problems in software development, data analysis, and computer-based applications.	Aligns with PO1 (Discipline Specific Knowledge), PO2 (Problem Analysis), and Gujarat Vidyapith's emphasis on rigorous academic foundations.
PSO-2	Integrate computational skills (Python, Excel, Google Sheets) and simulations to solve scientific problems, visualize data, and prepare structured reports for research and practice.	Supports PO7 (Modern Tools), Digital Skills, and NEP 2020's emphasis on digital integration
PSO-3	Demonstrate independent and team-based work using scientific methods, fieldwork, and interdisciplinary approaches that promote simplicity, sustainability, and societal relevance in line with Gandhian principles.	Fulfills PO4 (Environment & Sustainability) and Gujarat Vidyapith's mission of rural service and value-based education.
PSO-4	Communicate computing concepts effectively in oral and written forms using technical, ethical, and culturally sensitive language, upholding professional values and the spirit of community engagement.	Connects with PO5 (Ethics and Value), PO6 (Communication), PO12 (Societal Contribution), and Gandhian ideals.

CO Attainment Levels (OBE & NEP 2020 Aligned)

COs Attainment Levels	Level	Description	Attainment Criteria			
	Level 3	High	$\geq 80\%$ of students score above a set performance benchmark			
	Level 2	Moderate	60%–79% of students meet the performance benchmark			
	Level 1	Low	40%–59% of students meet the performance benchmark			
	Level 0	Not Attained	< 40% of students achieve the desired learning outcome			
Target Attainment (Benchmark)	Cos		CO-1	CO-2	CO-3	CO-4
	Target Level (%)		60	60	60	60

Program - BCA (Faculty of Information, Communication and Technology)
Semester- 1

Course Code 264510345037	Name of Course Computational Thinking, Problem Solving & Logic Building	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Apply logical reasoning to analyse real-world problems.
 CO-2: Use computational thinking techniques to design systematic solutions.
 CO-3: Represent solutions using algorithms, pseudocode, and flowcharts.
 CO-4: Understand the role of problem solving in programming, AI systems, and ethical decision-making.

Detailed Syllabus

Unit-1. Computational Thinking Foundations

- 1.1. Concept of problem solving
- 1.2. Introduction to computational thinking
- 1.3. Components of computational thinking: Decomposition, Pattern recognition, Abstraction, Algorithmic thinking
- 1.4. Problem analysis techniques
- 1.5. Identifying inputs, processes, and outputs
- 1.6. Examples from everyday problem solving
- 1.7. Role of computational thinking in modern technologies

Tutorials:

- Breaking down complex everyday scenarios using decomposition.
- Identifying specific inputs, processes, and outputs for given problem statements.
- Group exercises on applying abstraction to filter out unnecessary data in real-world cases.

Unit-2. Logic and Analytical Reasoning

- 2.1 Introduction to logical reasoning
- 2.2 Propositions and logical statements
- 2.3 Logical operators: AND, OR, NOT
- 2.4 Truth tables
- 2.5 Conditional statements and logical equivalence
- 2.6 Pattern recognition and sequences
- 2.7 Logical puzzles and reasoning problems

Tutorials:

- Constructing and verifying truth tables for complex logical statements.
- Solving sequence and pattern recognition exercises.
- Engaging in guided logical puzzles and analytical reasoning challenges.

3. Algorithmic Thinking & Solution Design

- 3.1. Concept of algorithms
- 3.2. Characteristics of a good algorithm
- 3.3. Steps in algorithm design
- 3.4. Writing algorithms for simple problems
- 3.5. Flowcharts and standard symbols
- 3.6. Pseudocode representation
- 3.7. Stepwise refinement and modular problem solving

Tutorials:

- Writing step-by-step algorithms for mathematical and logic problems.
- Drawing flowcharts using standard symbols for predefined scenarios.
- Converting algorithmic steps into standard pseudocode formats.

Unit-4. Problem Solving in the AI Era

- 4.1 Debugging and logical error detection
- 4.2 Efficiency in problem solving
- 4.3 Introduction to decision-making logic
- 4.4 Iterative and recursive thinking (conceptual overview)
- 4.5 Problem solving with digital tools
- 4.6 Introduction to AI-assisted problem solving
- 4.7 Ethics and responsible use of AI tools
- 4.8 Case studies of real-world problem solving in technology

Tutorials:

- Dry-running pseudocode to identify and debug logical errors.
- Formulating structured prompts for AI tools to assist in solving logic problems.
- Case study discussions on the ethical implications of AI-generated solutions.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	2	3	1	-	1	-	1	-	1	-	1	1	0.92	3	1	1	1	1.25
CO-2	3	3	2	-	-	-	2	-	1	1	2	1	1.25	3	2	1	1	1.75
CO-3	3	3	2	-	-	1	2	-	1	-	1	-	1.08	3	1	-	2	1.5
CO-4	2	2	1	-	3	1	2	-	2	-	2	2	1.42	2	2	1	3	2
Avg	2.5	2.75	1.5	0	1	0.5	1.75	0	1.25	0.25	1.5	1		2.75	1.5	0.75	1.75	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

CO-1 (Unit: 1)

CO-2 (Unit: 2)

CO-3 (Unit: 3)

CO-4 (Unit: 4)

- Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Assessment Pattern						
Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation/ Seminar	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- How to Solve It by Computer – R. G. Dromey
- Fundamentals of Computers – V. Rajaraman
- Programming and Problem Solving with C – E. Salagrama
- Computer Fundamentals – P. K. Sinha and Priti Sinha

Web & Other Study Resources:

- NPTEL – Programming and Problem Solving
- SWAYAM – Computational Thinking
- Coursera – Computational Thinking courses
- edX – Problem Solving and Algorithms

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 264510345038	Name of Course Foundations of Digital Systems & Intelligent Computing	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand the architecture of modern digital computing platforms.
- CO-2: Explain how digital systems represent and process different types of data.
- CO-3: Describe computing hardware and infrastructure used in modern applications.
- CO-4: Identify emerging computing technologies shaping the future of IT.

Detailed Syllabus

Unit-1. Digital Computing Ecosystem & Platforms

- 1.1 **Evolution of Computing:** Traditional computing to digital ecosystems, Digital transformation and connected systems
- 1.2 **Computing Platforms and Environments:** Personal computing, Mobile computing, Cloud computing, Edge computing
- 1.3 **Digital Platforms and Services:** Platform-based business models, Software as a Service (SaaS)
- 1.4 **Digital Economy and Computing:** Role of computing in digital businesses, Digital transactions and online services
- 1.5 **Digital Infrastructure:** Internet fundamentals, Data centres, Cloud platforms
- 1.6 **Modern Digital Applications:** E-commerce systems, Social media platforms, Digital governance and e-services
- 1.7 **Introduction to Intelligent Digital Systems:** Smart applications, Intelligent assistants and recommendation systems

Unit-2. Digital Data, Information & Media

- 2.1 **Data and Information Concepts:** Data, information, and knowledge, Characteristics of digital data
- 2.2 **Digital Data Types:** Numeric data, Text data, Multimedia data
- 2.3 **Binary Representation of Data:** Number systems, Binary arithmetic, Data representation fundamentals
- 2.4 **Multimedia Data Representation:** Text representation, Image representation, Audio representation, Video representation
- 2.5 **Character Encoding Standards:** ASCII, Unicode
- 2.6 **Data Compression Fundamentals:** Need for compression, Lossless and lossy compression
- 2.7 **Data Storage Technologies:** Magnetic storage, Optical storage, Solid-state storage
- 2.8 **Introduction to Big Data and Data Pipelines:** Data generation and collection, Data processing workflow

Unit-3. Digital Hardware & Computing Infrastructure

- 3.1 **Fundamentals of Computer Architecture:** Functional units of a computer, Von Neumann architecture overview
- 3.2 **Central Processing Unit (CPU):** Components and functions, Instruction execution cycle
- 3.3 **Multi-Core Processors:** Parallel processing concepts, Performance advantages
- 3.4 **Graphics Processing Units (GPU):** GPU architecture overview, Applications in AI and graphics
- 3.5 **Memory Hierarchy:** Cache memory, Main memory (RAM), Secondary storage
- 3.6 **Storage Technologies:** Solid State Drives (SSD), Network and cloud storage
- 3.7 **Input and Output Devices:** Common I/O devices, Human-computer interaction devices
- 3.8 **Sensors and Embedded Systems:** Sensor technologies, Embedded computing applications
- 3.9 **Energy-Efficient Computing:** Green computing concepts, Sustainable computing practices

Unit-4. Emerging Intelligent Technologies

- 4.1. **Operating Systems Overview:** Functions and types of operating systems,
- 4.2. **Computer Networking Fundamentals:** Network concepts, Communication models
- 4.3. **Internet Architecture and Web Technologies:** Internet structure, Web services and applications
- 4.4. **Cloud Computing Concepts:** Service models, Deployment models
- 4.5. **Artificial Intelligence Overview:** AI concepts and applications, Machine learning basics
- 4.6. **Internet of Things (IoT):** IoT architecture, Smart devices and applications
- 4.7. **Cybersecurity Fundamentals:** Security threats, Basic protection mechanisms
- 4.8. **Responsible and Ethical Computing:** Privacy and data protection, Ethical issues in AI and digital technologies
- 4.9. **Future Trends in Computing:** Industry 4.0, Smart cities, Autonomous systems, Quantum computing introduction

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	1	1	---	---	3	---	2	1	1	1	1.67	3	2	1	-	1.5
CO-2	3	3	2	---	---	1	2	---	2	---	1	1	1.89	3	3	-	1	1.75
CO-3	3	2	2	3	1	---	3	---	2	1	1	1	1.9	2	2	3	-	1.75
CO-4	2	2	1	2	3	1	3	1	3	1	2	2	1.9	2	3	2	3	2.5
Avg	2.75	2.25	1.5	2.5	1	0.5	2.75	0.25	2.25	0.75	1.25	1.25		2.5	2.5	1.5	1	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Assignment, Examples, Questioning, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation/ Seminar	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- V. Raja Raman, Fundamentals of Computers, PHI Learning Pvt. Ltd, 2014
- Pradeep K. Sinha & Priti Sinha, Computer Fundamentals, BPB, 2020
- Anita Goel, Computer Fundamentals, Pearson Education, 2010
- Alexis Leon, Mathews Leon, Fundamentals of Information Technology, Vijay Nicole, 2019

Online Resources & Tools:

- NPTEL – Introduction to Computing
- SWAYAM – Digital Systems courses
- Coursera – Computer Basics and Digital Systems
- edX – Introduction to Computer Science

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 264510245039	Name of Course Web Design (Lab Based)	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand and apply fundamental concepts of web technologies, including Internet, WWW, web browsers, and create structured web pages using semantic HTML5 elements, multimedia, and forms.
- CO-2: Develop responsive and interactive web pages using advanced HTML5 features, form validation techniques, HTML APIs, and responsive design principles such as mobile-first approach.
- CO-3: Design visually appealing and responsive layouts using CSS3, including selectors, box model, Flexbox, Grid, animations, and media queries.
- CO-4: Build dynamic and interactive web applications using modern JavaScript (ES6+), DOM manipulation, events, and integrate development tools, APIs, AJAX, JSON, and UI/UX best practices.

Detailed Syllabus

1. Unit-1.

1.1. Web Fundamentals & HTML5

- 1.1.1.Introduction to Internet, WWW, Web Browsers and Web Server
- 1.1.2.Structure of Web Pages
- 1.1.3.**HTML5 Basics:** Doctype, head, body, Semantic tags: <header>, <nav>, <section>, <article>, <footer> , Text formatting, lists, tables
- 1.1.4.Hyperlinks, images, audio, video
- 1.1.5.Forms (HTML5 input types: email, date, range, etc.)
- 1.1.6.Meta tags & SEO basics

1.2. Advanced HTML5 & Responsive Design

- 1.2.1.Multimedia elements (audio, video, iframe)
- 1.2.2.Forms validation (required, pattern, placeholder)
- 1.2.3.HTML APIs: Geolocation API, Local Storage & Session Storage
- 1.2.4.Introduction to responsive design - Mobile-first approach

Unit-2.

2.1 CSS3

- 1.1.1.Introduction to CSS3
- 1.1.2.Types of CSS (inline, internal, external)
- 1.1.3.Selectors (class, id, attribute, pseudo-classes)
- 1.1.4.Box Model (margin, padding, border)
- 1.1.5. Colours, fonts, typography

2.2 Advanced CSS3

- 2.1.1.Flexbox (modern layout system)
- 2.1.2.CSS Grid
- 2.1.3.Positioning (relative, absolute, fixed, sticky)
- 2.1.4.Transitions & Animations
- 2.1.5.Media Queries (Responsive design)

Unit-3.

3.1. JavaScript (Modern ES6+)

- 3.1.1. Introduction to JavaScript
- 3.1.2. Variables (var, let, const ...)
- 3.1.3. Data types & operators
- 3.1.4. Control statements (if, loops)

3.2. Advanced JavaScript

- 3.2.1 Functions and Arrow functions \
- 3.2.2 Arrays & Objects
- 3.2.3 DOM Manipulation
- 3.2.4 Events & Event Handling
- 3.2.5 Form validation

3.3 ES6+ Features

- 3.3.1 Template literals
- 3.3.2 Destructuring
- 3.3.3 Spread & Rest operators
- 3.3.4 Modules (import/export basics)

Unit-4.

4.1. Modern Web Development Tools

- 4.1.1 Bootstrap (latest version for responsive design)
- 4.1.2 Git & GitHub basics
- 4.1.3 Browser Developer Tools
- 4.1.4 Debugging techniques

4.2. Advanced Topics

4.3. AJAX (Asynchronous JavaScript)

4.4. JSON (Data exchange format)

- 3.2.2. Introduction to APIs
- 3.2.3. Basic UI/UX principles
- 3.2.4. Web accessibility

Mapping Matrix of POs, PSOs, and COs

COs	POs														PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg	
CO-1	3	2	1	-	-	2	2	-	1	-	1	1	1.1	3	2	-	2	1.75	
CO-2	3	2	2	-	-	2	3	-	1	1	2	1	1.4	3	2	1	2	2	
CO-3	3	2	3	-	-	2	3	-	1	1	2	1	1.5	3	2	1	2	2	
CO-4	3	3	3	-	1	2	3	1	2	2	3	2	2.1	3	3	1	2	2.25	
Avg	3	2.25	2.25	0	0.25	2	2.75	0.25	1.25	1	2	1.25		3	2.25	0.75	2		

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)

CO-2 (Unit: 2)

CO-3 (Unit: 3)

CO-4 (Unit: 4)

- Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Quiz	Practical Test	Assignment	Involvement
	CO-1	10	5	5	13	7
	CO-2	10				
	CO-3	10	5	5		
	CO-4	10				

Curriculum Framework - Bachelor of Computer Application - 2026

Term-End Evaluation 60 Marks	COs	Marks	Exam Component
	CO-1	15	Term End Examination
	CO-2	15	
	CO-3	15	
	CO-4	15	

References

Books:

- Ivan Bayross, Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB, 2010
- Bruce Lawson, Remy Sharp, Introducing HTML5, New Riders, 2012
- Introducing HTML5 (Voices That Matter) by Bruce Lawson, Remy Sharp
- Ivan Bayross, HTML5 and CSS3 Made Simple, BPB, 2012
- Laura Lemay, Rafe Colburn, Jennifer Kyrnin, Mastering Html, CSS & JavaScript Web Publishing, BPB Publication, 2016
- Laura Lemay, Rafe Colburn, Jennifer Kyrnin, Mastering Html, CSS & JavaScript Web Publishing, BPB Publication, 2016
- Ethan Brown, Learning JavaScript Essentials for Modern Application Development 3e, O'Reilly Media, 2016
- DT Editorial Service, HTML5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, DreamTech Press, 2016

Online Resources & Tools:

- HTML5- <https://www.tutorialspoint.com/html5/index.htm>
- CSS- <https://www.tutorialspoint.com/css/index.htm>
- CSS3- <https://www.tutorialspoint.com/article/advance-css-layout-with-flexbox>
- ES6- <https://www.tutorialspoint.com/es6/index.htm>
- Bootstrap - <https://www.tutorialspoint.com/bootstrap/index.htm>
- AJAX and JSON- https://www.tutorialspoint.com/json/json_ajax_example.htm

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 264510145040	Name of Course Data Literacy for Dashboard Building	Compulsory
Credit: 01	Teaching Scheme: Theory (15) - Practical (0)	Lab Hours: 15

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Interpret and analyse tabular and graphical data in appropriate context.
- CO-2: Clean, organize, and prepare datasets using spreadsheet tools.
- CO-3: Understand the principles of dashboard design and data visualization using appropriate tools.
- CO-4: Apply data literacy skills to real-world cases and communicate insights effectively through data storytelling.

Detailed Syllabus

Unit-1. Thinking with Data

- 1.1. Types of data (structured, unstructured, semi-structured).
- 1.2. Reading and interpreting tables, charts, and KPIs.
- 1.3. Understanding data context, reliability, and sources.
- 1.4. Identifying inconsistencies, missing values, outliers, and biases.

Unit-2. Data Preparation using Spreadsheet Tools

- 2.1. Data cleaning and structuring techniques
- 2.2. Spreadsheet functions and formulas
- 2.3. Basic statistical analysis in spreadsheets
- 2.4. Generating initial insights from cleaned data

Unit-3. Dashboard Building using Visualization Tools

- 3.1 Fundamentals of dashboard design and layout
- 3.2 Data import and connection methods
- 3.3 Creating charts, KPIs, filters, and slicers
- 3.4 Principles of effective visual communication

Unit-4. Case Studies & Data Storytelling

- 4.1 Handling messy data in real scenarios
- 4.2 Data storytelling and report writing
- 4.3 Ethical considerations in data visualization and communication

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	2	3	1	-	1	2	1	-	1	-	1	1	1.1	2	3	1	2	2
CO-2	2	2	3	-	1	1	3	-	1	1	1	1	1.3	2	3	1	1	1.75
CO-3	3	2	2	-	-	2	3	-	1	1	2	1	1.45	2	3	1	2	2
CO-4	1.75	1.75	1.5	0	0.5	1.25	1.75	0	0.75	0.5	1	0.75	0.96	2	3	2	3	2.5
Avg	2	3	1	0	1	2	1	-	1	-	1	1		2	3	1.25	2	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Lecture, examples, case discussions - Concept explanation, tool demonstration - Visual design principles, guided examples - Case studies, group discussions
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Curriculum Framework - Bachelor of Computer Application - 2026

Continuous Comprehensive e Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation /Seminar	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Data Literacy: What It Is and Why It Matters – Ben Jones
- Storytelling with Data – Cole Nussbaumer Knafl
- Practical Statistics for Data Scientists – Peter Bruce & Andrew Bruce
- Microsoft Power BI Cookbook – Brett Powell
- Excel Data Analysis for Dummies – Stephen L. Nelson

Online Resources & Tools:

- Coursera – Data Literacy Specializations (various universities)
- edX – Data Science Essentials / Data Literacy courses
- Khan Academy – Statistics & data interpretation basics
- Coursera – Excel Skills for Business (Macquarie University)
- Microsoft Learn – Excel + Power Query modules
- Udemy – Excel Data Analysis / Advanced Excel

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 264510145041	Name of Course Lab based on Data Literacy for Dashboard Building	Compulsory
Credit: 01	Teaching Scheme: Theory (0) - Practical (30)	Lab Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Interpret and analyze tabular and graphical data in appropriate context.

CO-2: Clean, organize, and prepare datasets using spreadsheet tools.

CO-3: Understand the principles of dashboard design and data visualization using appropriate tools.

CO-4: Apply data literacy skills to real-world cases and communicate insights effectively through data storytelling.

Mapping Matrix of POs, PSOs, and COs

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	1	2	2	1	2	1	1	1	1.67	2	3	1	2	2
CO-2	3	2	3	1	1	1	3	1	2	1	1	1	1.67	2	3	1	1	1.75
CO-3	3	2	3	1	1	2	3	2	2	2	1	1	1.92	2	3	2	2	2.25
CO-4	3	3	3	2	1	3	3	2	2	2	1	2	2.25	2	3	2	3	2.5
Avg	3	2.25	3	1.25	1	2	2.75	1.5	2	1.5	1	1.25		2	3	1.5	2	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Lecture, examples, case discussions - Concept explanation, tool demonstration - Visual design principles, guided examples - Case studies, group discussions
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Appendix-A

Program - BCA (Faculty of Information, Communication and Technology) Semester- 1

Course Code 26451345903	Name of Course SEC-Prompt Engineering and AI Tools (Lab Based)	Compulsory
Credit: 03	Teaching Scheme: Theory (0) - Practical (90)	Lab Hours: 90

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Prompt Engineering & Generative AI Foundations Students will be able to understand the fundamentals of Generative AI and apply effective prompt engineering techniques for responsible, ethical, and structured AI-assisted problem-solving.
- CO-2: AI-Assisted Data Analysis Students will be able to perform data cleaning, analysis, visualization, and automation using AI-assisted spreadsheet tools for informed decision-making and data interpretation.
- CO-3: AI-Based Content Creation & Presentation Design Students will be able to generate, edit, summarize, translate, and present academic, professional, and creative content using AI-powered text and presentation tools.
- CO-4: AI-Generated Multimedia & Responsible Media Production Students will be able to create AI-assisted audio, video, and multimedia content while applying ethical practices, copyright awareness, and responsible AI media usage.

Detailed Syllabus

Unit-1. Prompt Engineering & Generative AI Foundations

- 1.1 Overview of Generative AI & LLMs
 - 1.1.1. What is generative AI; how large language models (LLMs) work
 - 1.1.2. Understanding tokens, context windows, and temperature settings
 - 1.1.3. Survey of major AI platforms: ChatGPT, Claude, Gemini, Copilot, Perplexity AI
- 1.2 Anatomy of a Prompt
 - 1.2.1. Core components: Role, Context, Task, and Format
 - 1.2.2. Writing clear, structured, and unambiguous prompts
 - 1.2.3. Common prompt anti-patterns and how to avoid them
- 1.3 Prompting Techniques
 - 1.3.1. Zero-shot, one-shot, and few-shot prompting
 - 1.3.2. Chain-of-thought (CoT) and step-by-step reasoning prompts
 - 1.3.3. Prompt chaining: feeding one output as the next prompt's input
- 1.4 Prompt Refinement & Iteration
 - 1.4.1. Identifying prompt weaknesses and failure modes
 - 1.4.2. Iterative improvement: refine, test, and compare outputs
 - 1.4.3. Using prompt templates for academic and professional use cases
- 1.5 Ethics, Hallucinations & Limitations
 - 1.5.1. Recognising AI hallucinations and verifying factual accuracy
 - 1.5.2. Ethical use of AI: plagiarism, attribution, and academic integrity
 - 1.5.3. Understanding AI limitations and responsible output evaluation

Unit-2. AI-Assisted Data Analysis with Excel & Google Sheets

- 2.1 Excel & Google Sheets Basics Review
 - 2.1.1. Formulas, functions (VLOOKUP, SUMIF, COUNTIF), and named tables
 - 2.1.2. Preparing and structuring raw data for AI-assisted operations
 - 2.1.3. Understanding data types: numbers, text, dates, and categories
- 2.2 AI-Assisted Data Cleaning
 - 2.2.1. Removing duplicates, fixing inconsistent entries, handling missing values
 - 2.2.2. Using AI to identify data quality issues via natural language queries
 - 2.2.3. Standardising formats: dates, phone numbers, currency, and text case
- 2.3 Formula Generation with AI
 - 2.3.1. Generating complex Excel / Google Sheets formulas from plain-language prompts
 - 2.3.2. Explaining existing formulas using AI; debugging formula errors
 - 2.3.3. I-suggested conditional formatting and data validation rules
- 2.4 Data Analysis: Sorting, Filtering & Pivot Tables
 - 2.4.1. Sorting and multi-level filtering with AI assistance
 - 2.4.2. Building pivot tables and interpreting aggregate results
 - 2.4.3. Using AI to suggest analysis angles and insights from raw data
- 2.5 Charts, Dashboards & Task Automation\
 - 2.5.1. AI-generated bar, line, pie, and scatter charts with proper labelling
 - 2.5.2. Building interactive dashboards with slicers and dynamic tables
 - 2.5.3. Automating repetitive tasks using AI suggestions and macro recommendations

Unit-3. Text Generation, Content Creation & AI Presentations

Part A — Text Generation & Content Creation

- 3.1 Academic & Professional Writing
 - 3.1.1. Text generation for reports, essays, and formal documents
 - 3.1.2. Email drafting, editing, and tone adjustment with AI
 - 3.1.3. Structuring long-form content: introductions, body, conclusions, transitions
- 3.2 Creative & Social Media Content
 - 3.2.1. Blog posts, articles, and social media copy generation
 - 3.2.2. Story, script, and creative writing workflows with AI
 - 3.2.3. Adapting tone and register for different audiences and platforms
- 3.3 Multilingual Generation & Translation
 - 3.3.1. Translation and multilingual text generation (Hindi to English and vice versa)
 - 3.3.2. Using DeepL and AI tools for accurate, contextual translation
 - 3.3.3. Localisation: cultural context, idiomatic accuracy, and formatting
- 3.4 Document Summarisation & Fact-Checking
 - 3.4.1. Summarising long documents and PDFs; extracting key information
 - 3.4.2. Verifying AI output for factual accuracy using cross-referencing
 - 3.4.3. Practising responsible citation and attribution in AI-assisted writing

Part B — AI Presentation Design

- 3.5 Auto-Generating Slide Decks
 - 3.5.1. Generating full presentations from text prompts
 - 3.5.2. Transforming Word/PDF content directly into structured slides
 - 3.5.3. Reviewing and editing AI-generated decks for accuracy and coherence
- 3.6 Design Principles & Visual AI
 - 3.6.1. Layout, typography, and colour theory for presentations
 - 3.6.2. Using AI-generated icons, illustrations, and infographics
 - 3.6.3. Maintaining brand consistency and visual hierarchy
- 3.7 Speaker Notes & Export
 - 3.7.1. Generating presenter notes and speaker scripts with AI
 - 3.7.2. Exporting AI-generated presentations to PowerPoint and Google Slides
 - 3.7.3. Customising themes, layouts, and animations post-export

Unit-4. AI-Generated Audio, Video & Integrated Project

- .1 Text-to-Speech & AI Voiceover
 - 4.1.1.AI voiceover generation for educational and professional media
 - 4.1.2.Podcast creation with AI-scripted and AI-voiced content
 - 4.1.3.Using Eleven Labs and Murf.ai for natural-sounding voices and language cloning
- .2 AI Video Generation
 - 4.2.1.Generating video clips from text prompts using Runway ML and Sora (OpenAI)
 - 4.2.2.Understanding AI video workflows: script to storyboard to rendered footage
 - 4.2.3.Combining AI-generated video segments into coherent narratives
- .3 Automated Video Editing
 - 4.3.1.Adding auto-captions, smart cuts, and B-roll using AI editing tools
 - 4.3.2.Producing YouTube Shorts and Instagram Reels via AI pipelines
 - 4.3.3.Noise reduction, colour grading, and scene transitions with AI assistance
- .4 Avatar-Based & Explainer Video Content
 - 4.4.1.Creating explainer videos with AI avatars using Synthesia
 - 4.4.2.Scripting, avatar selection, and background customisation
 - 4.4.3.Use cases: tutorials, onboarding, and educational video production
- .5 Ethics, Copyright & Responsible AI Media Use
 - 4.5.1.Understanding copyright, deepfakes, and consent in AI-generated media
 - 4.5.2.Watermarks, licensing, and attribution best practices
 - 4.5.3.Responsible distribution of AI audio-visual content

Teaching Pedagogy

CO-1 (Unit: 1)	Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Quiz	Practical Test	Journal	Participation/ Performance
	CO-1	10	5	5	13	7
	CO-2	10				
	CO-3	10	5	5		
	CO-4	10				

References

Books:

- Jay Alammar & Maarten Grootendorst, Hands-On Large Language Models, O'Reilly Media.
- Chris Fregly & Antje Barth, Generative AI on AWS, O'Reilly Media.
- Paul McFedries, Excel Data Analysis For Dummies, Wiley

Appendix-B

Program - BCA (Faculty of Information, Communication and Technology) Semester- 1

Course Code 26451345803	Name of Course MDC-Fundamentals of Mathematics	Compulsory
Credit: 03	Teaching Scheme: Theory (30) – Tutorial (15)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Apply the principles of propositional logic, truth tables, logical connectives, and basic logic gates to analyse statements and formulate Boolean expressions used in programming and digital systems.
- CO-2: Construct and interpret predicate logic expressions, apply quantifiers and rules of inference, and model real-world problems in programming, databases, and intelligent systems using logical reasoning.
- CO-3: Utilize set theory concepts, operations, Venn diagrams, Cartesian products, and counting techniques to represent, analyse, and solve problems in computing, databases, and data analytics.
- CO-4: Organize, analyse, and visualize data using statistical measures and spreadsheet tools to derive meaningful insights from real-world datasets.

Detailed Syllabus

Unit-1. Logic

- 1.1 **Introduction:** Statement, negation, conjunction, disjunction
- 1.2 **Statement formulas and truth table:** Conditional and bi-conditional, well-formed formula, tautology, equivalence of formulas, duality law, tautological implications,
- 1.3 **Connectives:** functionally complete set of connectives, other connectives
- 1.4 **Applications of Logic in Programming:** if-else conditions, Boolean expressions
- 1.5 **Introduction to Logic Gates:** AND, OR, NOT

Unit-2. Theory of Inference and the Predicate Calculus

- 2.1 **Introduction to Predicates**
- 2.2 **Variables and Statement Functions**
- 2.3 **Universal and Existential Quantifiers**
- 2.4 **Predicate Formulae**
- 2.5 **Universe of Discourse**
- 2.6 **Basic rules of inference :** Modus Ponens, Modus Tollens, Hypothetical Syllogism
- 2.7 **Translating English Statements into Predicate Logic**
- 2.8 **Applications in:** Programming Conditions, Database Queries, Search and Filtering Operations, AI and Expert Systems (overview)

Unit-3. Set Theory

- 3.1. **Introduction to Sets**
- 3.2. **Representation of Sets:** Roster Form, Set Builder Form
- 3.3. **Types of Sets:** Empty Set, Finite and Infinite Sets, Universal Set, Singleton Set
- 3.4. **Subsets and Power Sets**
- 3.5. **Venn Diagrams**
- 3.6. **Set Operations:** Union, Intersection, Difference, Complement, Symmetric Difference
- 3.7. **Cartesian Product**
- 3.8. **Counting Elements in Sets**
- 3.9. **Applications of Sets in:** Databases, Programming, Data Analytics.

Unit-4. Basics of Statistics and Data Handling

- 4.1 Meaning, scope and importance of statistics**
- 4.2 Types and sources of data:** Primary & Secondary
- 4.3 Classification of data:** Qualitative, Quantitative
- 4.4 Data representation:** Tables, Graphs (Bar, Pie, Line), Diagrams
- 4.5 Use of Excel for tabulation and graphs**
- 4.6 Practical:** Enter and clean real data in Excel, Create frequency tables and charts
- 4.7 Measures of Central Tendency:** Mean, Median, Mode
- 4.8 Measures of Dispersion:** Range, Standard Deviation, Variance
- 4.9 Excel formulas and functions for statistical measures**
- 4.10 Data visualization using Excel:** Histogram, Box Plot
- 4.11 Practical:** Calculate measures using Excel, Visualize a real survey dataset

Teaching Pedagogy

CO-1 (Unit: 1)

CO-2 (Unit: 2)

CO-3 (Unit: 3)

CO-4 (Unit: 4)

- Seminar, Assignment, Examples, Questioning

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Class Test	Assignment/ Presentation	Involvement
	CO-1	10	5	Assignment 8 + seminar 3	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References**Books:**

- J. P. Trembly and R. Manohar, Discrete Mathematical Structure with application to computer science , Tata McGraw-Hill,1997
- Uwe Schoning, Logic for computer science, Birkhauser Boston, 2008
- C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics – A computer oriented approach, mcgraw hill education, 2016
- N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics (Third Edition), PHI, 2022
- T. Sengadir, Discrete Mathematics & Combinatorics, Pearson, 2009
- Willem Conradie and Valentin Goranko, Logic and Discrete Mathematics, A concise Introduction, Wiley, 2015
- પ્રો. મોહનભાઈ સુથાર અને પ્રો.જયંતિભાઈ મ. પટેલ, ઉચ્ચતર માધ્યમિક સંદર્ભસાહિત્ય શ્રેણી પુસ્તિકા ૧૯૮ વિધેય,યુનિવર્સીટી ગ્રંથ નિર્માણ બોર્ડ
- S. Barnard and J. M. Child અનુવાદક સ્વ.શંભુપ્રસાદ ત્રિવેદી, ઉચ્ચતર બીજગણિત ભાગ-૧ Higher

Algebra, યુનિવર્સિટી ગ્રંથ નિર્માણ બોર્ડ

- S. Barnard and J. M. Child અનુવાદક સ્વ.શંભુપ્રસાદ ત્રિવેદી, ઉચ્ચતર બીજગણિત ભાગ-૨ Higher Algebra. યુનિવર્સિટી ગ્રંથ નિર્માણ બોર્ડ
- Dr. A. P. Shah, Standard-11 Mathematics (Semester-1), Gujarat State Board of School Textbooks, 2013
- Dr. A. P. Shah, Standard-11 Mathematics (Semester-2), Gujarat State Board of School Textbooks, 2013
- Dr. A. P. Shah, Standard-12 Mathematics (Semester-1), Gujarat State Board of School Textbooks, 2013
- Dr. A. P. Shah, Standard-12 Mathematics (Semester-2), Gujarat State Board of School Textbooks, 2013

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 254510345005	Name of Course Web Design-II	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Use JavaScript to manipulate the Document Object Model (DOM), implement control structures, handle events, and utilize built-in objects and functions to create interactive client-side web pages.
- CO-2: Create dynamic web content by controlling element positioning, visibility, and behavior, as well as implement form validation and sanitization using JavaScript.
- CO-3: Utilize the jQuery library for simplified DOM manipulation, event handling, and effects, and apply Bootstrap framework concepts to design responsive web page layouts and content.
- CO-4: Integrate Bootstrap components and utilities to enhance UI/UX and implement asynchronous web communication using AJAX to develop faster and more interactive web applications.

Detailed Syllabus

Unit-1. DHTML and Client-side scripting language

- 1.1 JavaScript:** Static and Dynamic webpage, Introduction to JavaScript and DHTML, Object-Oriented and JavaScript, Client-Side Dynamic Mechanism/Behavior, DOM, Variables and Datatypes, Statements and Operators, Control Structures: Conditional, Branching and Loop Statements.
- 1.2 Array:** Introduction to Array and Array Creation, Built-in Objects, and its properties: Document, Math, Date, History, Windows, Form, Location etc., Built-in Functions, User Define Functions/Methods, Message Boxes: Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes.
- 1.3 Events and Event Handling:** Handling events from the Body elements, Button elements, Text box and Password elements; The DOM 2 event model.

Unit-2.

- 2.1 JavaScript:** Dynamic Documents with JavaScript: Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor; Reacting to a mouse click; Slow movement of elements; Dragging and dropping elements.
- 2.2 Form Handling:** Form Attributes, onSubmit Event, Validation, Sanitization

Unit-3. HTML5

- 3.1 jQuery:** JavaScript Library
- 3.2 jQuery:** Introduction, Installation and Configuration, jQuery Syntax, jQuery Selectors: Element Selector, Id Selector, Class Selector, jQuery Events, jQuery Effects, jQuery Methods/API
- 3.3 Bootstrap Framework**
 - 3.3.1 Introduction to Bootstrap:** Introduction, Bootstrap Layout (Container, Row, Columns, Responsive, classes, Offset Column, Reordering Columns), Bootstrap Content (Typography, Tables, Images, Forms)

Unit-4. Bootstrap Framework

- 4.1 Introduction to Bootstrap:** Bootstrap Components (Navbar, Navs and tabs, Dropdowns, Buttons, Button Groups, Breadcrumb, Pagination, Labels, Alerts, Progress Bars, Accordion, Card, Modal), Bootstrap Utilities (Colors, Background, Borders, Display, Overflow, Position, Spacing, Text, Vertical align)
- 4.2 Creating better, faster, and more interactive web pages**
- 4.3 AJAX:** Introduction, Introduction to XML, How AJAX Works- An event occurs in a web page (the page is loaded; a button is clicked), An XMLHttpRequest object is created by JavaScript, The XMLHttpRequest object sends a request to a web server, The server processes the request and Processing and Response status, The server sends a response back to the web page, The response is read by JavaScript, AJAX with jQuery.

Curriculum Framework - Bachelor of Computer Application - 2026

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	--	1	3	1	2	1	2	--	1.88	3	2	2	2	2.25
CO-2	3	2	2	--	--	1	3	1	2	1	2	--	1.88	3	2	2	2	2.25
CO-3	3	2	2	--	--	1	3	1	2	1	2	--	1.88	3	2	2	2	2.25
CO-4	3	2	2	--	--	1	3	1	2	2	3	--	2.11	3	3	3	2	2.75
Avg	3	2	2	0	0	1	3	1	2	1.25	0	0	1.94	3	2.25	2.25	2.25	2.38

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Tutorial
CO-2 (Unit: 2)	Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- DT Editorial Service, HTML5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, DreamTech Press, 2016
- Ivan Bayross, Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB, 2010
- Ivan Bayross, HTML5 and CSS3 Made Simple, BPB, 2012
- Richard Y, JavaScript and CSS Development using jQuery, Wrox, 2009
- Laura Lemay, Rafe Colburn, Jennifer Kyrnin, Mastering Html, CSS & JavaScript Web Publishing, BPB Publication, 2016
- [Ethan Brown](#), Learning JavaScript Essentials for Modern Application Development 3e, O'Reilly Media, 2016

Online Resources & Tools:

- SWAYAM Courses: <https://swayam.gov.in>
- e-PG Pathshala
- <https://www.w3schools.com/>
- <https://www.tutorialspoint.com/index.htm>

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 2**

Course Code 254510345006	Name of Course Computer Programming (C)	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Manipulate character arrays and strings using built-in functions, and implement structured data types like structures, unions, and enumerated data types for efficient data representation.
- CO-2: Design modular programs by creating and utilizing user-defined functions, including passing arrays and strings as arguments, and apply recursion and macro definitions effectively.
- CO-3: To implement pointer operations including pointer to arrays, functions, and structures, and manage memory efficiently using dynamic memory allocation techniques.
- CO-4: To perform file handling operations using text and binary files in C, including reading, writing, insertion, and deletion of data.

Detailed Syllabus**Unit-1.**

- 1.1 Character Array and String handling:** Introduction of character array, Declaration and initialization of 1-D and 2-D, Programming of character array using 1-D, Declaration and initialization of character array, String management and functions of string.h
- 1.2 Enumerated Data Type:** using typedef, structure and union, Dot operator and access of member of structure,

Unit-2.

- 2.1 Functions:** Concept of modular programming, Elements of function, Type of Function, Declaration, Calling, and Defining a function, Passing Array and string as function argument, Built-in library for I/O, String, Maths, standard library, Recursion.
- 2.2 Simple macro implementation**

Unit-3.

- 3.1 Pointer and Dynamic Memory Allocation:** Introduction to pointers and different types of pointers, Pointer to array and Array of pointers, pointer to function, Dynamic memory Allocation, malloc, calloc, realloc, free, Arrow operator and access of members of structure

Unit-4.

- 4.1 File and Data Handling:** Simple File and its Concepts, Input – Output operation using File, Binary File, Operations for Binary files-Insert and Delete.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	--	-	1	3	1	2	2	1	--	2	3	2	2	2	2.25
CO-2	3	3	3	--	-	2	2	2	2	2	2	--	2.33	3	3	2	2	2.5
CO-3	3	2	3	--	-	1	3	1	2	2	2	--	2.22	3	2	3	2	2.5
CO-4	3	3	3	--	-	1	2	1	2	2	1	--	1.88	3	2	2	2	2.25
Avg	3	2.5	3	0	0	1.25	2.5	1.25	2	2	1.5	0	2.11	3	2.25	2.25	2.25	2.38

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Curriculum Framework - Bachelor of Computer Application - 2026

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Tutorial
CO-2 (Unit: 2)	Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Programming in ANSI 'C' – Balaguruswamy: TMH
- Let Us C By Yasvant Kanitkar
- Computer Based Problem Solving by Patrick Coxall
- Mulish Cooper: The Spirit of C, Jaico Pub. House, 19th Edition-1999
- Programming in C by Reema Thareja
- Introduction to Problem Solving by NCERT
- Introduction to Problem Solving Techniques by IGNOU
- નીપાશાહ, “ફ્લોચાર્ટથી પ્રોગ્રામીંગ સુધી”, યુનિ. ગ્રંથનિર્માણબોર્ડ, 2024

Online Resources & Tools:

- UGC Swayam Portal (Swayam Central), e-PGPathshala (e-PGPathshala (inlibnet.ac.in))

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 254510245007	Name of Course Lab Based on Computer Programming	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Demonstrate the use of character arrays, strings, and user-defined data types (structures, unions, enums) for structured programming.
- CO-2: Apply modular programming concepts using functions, recursion, and macros to design structured and reusable code.
- CO-3: Implement pointer operations and dynamic memory allocation techniques for efficient memory management.
- CO-4: Use file handling operations to perform data storage, retrieval, and manipulation using text and binary files in C.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	--	1	2	1	2	2	1	1	1.6	3	2	2	1	2
CO-2	3	3	3	--	--	1	3	2	2	2	2	1	2.2	3	3	2	2	2.5
CO-3	3	3	3	--	--	1	3	1	2	2	2	1	2.1	3	2	3	2	2.5
CO-4	3	2	2	--	--	1	3	1	2	2	2	1	2	3	2	2	2	2.25
Avg	3	2.5	2.5	0	0	1	2.75	1.25	2	2	1.75	1	1.98	3	2.25	2.25	1.75	2.31

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning - Demonstration and Guided Practice - Project-Based Learning - Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 2**

Course Code 254510245008	Name of Course Lab Based on Web Design-II	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Apply client-side scripting using JavaScript and DHTML to create dynamic and interactive web pages.
- CO-2: Design and manage dynamic web documents with JavaScript for enhanced user interaction and data validation.
- CO-3: Develop responsive and interactive web interfaces using jQuery and Bootstrap frameworks.
- CO-4: Implement AJAX for asynchronous web communication and integrate it with Bootstrap to enhance web performance and user experience.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	--	2	3	1	2	1	2	2	2	3	2	2	2	2.25
CO-2	3	2	2	--	--	2	3	1	2	2	2	2	2.1	3	2	2	2	2.25
CO-3	3	2	2	--	--	2	3	1	2	2	3	2	2.2	3	3	2	2	2.5
CO-4	3	2	3	--	--	2	3	1	2	2	3	2	2.3	3	3	2	2	2.5
Avg	3	2	2.25	0	0	2	3	1	2	1.75	2.5	2	2.15	3	2.5	2	2	2.38

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning - Demonstration and Guided Practice - Project-Based Learning - Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Appendix-A

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 264510345802	Name of Course MDC-Mathematics – I	Compulsory
Credit: 03	Teaching Scheme: Theory (30) – Tutorial (15)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand and represent relations and functions using appropriate diagrams and notation, and analyze their properties, such as domain, range, and function types.
- CO-2: Identify and graph different types of real-valued functions and perform operations such as addition, subtraction, multiplication, and composition on them.
- CO-3: Distinguish between different types of sequences and series, including arithmetic and geometric progressions, and compute related terms, sums, and means.
- CO-4: Explain the concept of limits both intuitively and formally, and apply limit laws to evaluate limits of various algebraic and composite functions.

Detailed Syllabus

Unit 1 Relations and Functions

1.1. Relation

Relation, Domain, Range, Universal Relation, Visual Representation of Relations, Arrow Diagram.

1.2. Function

Function, Domain, Co-domain, Graph, Function of a Real Variable, Graph of the function in plane, Equal Functions, Image, Pre-image, Identity Function, Constant Function, Modulus Function, Signum Function

Unit 2 Function

2.1 Function

Polynomial Function, Rational Function, Greatest Integer Function, Floor Function, Ceiling Function, Algebra of Real Function, Addition, Subtraction, Multiplication, Quotient of two real functions, Composition Function

Unit 3 Sequence and Series

- 3.1. Sequence, Series, Arithmetic Progression (A.P.), Common Difference, Arithmetic Series, Spiral, Geometric Progression (G.P.), Geometric Series, Mean, Arithmetic Mean, Geometric Mean, Sequence of power of Natural Numbers.

Unit 4 Limits

- 4.1 Introduction, Intuitive Idea of Limit, Formal Definition of Limit, Limit of a function, Left limit of a function, Right limit of a function, Algebra of Limits, Limit of a Polynomial, Limit of Relational Functions, An Important Limit, Rule of Substitution or Rule of Limit of a Composite Function.

Teaching Pedagogy

CO-1 (Unit: 1)	●Seminar, Activity, Assignments, Examples
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks			Exam Component		
	COs	Marks	Class Test	Assignment/ Seminar	Involvement
	CO-1	10	5	8 Assignment + 5 Seminar	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- પ્રો. મોહનભાઈ સુથાર, પ્રો.જયંતિભાઈમ. પટેલ ઉચ્ચતર માધ્યમિક સંદર્ભ સાહિત્યશ્રેણી પુસ્તિકા ૧૯૮ વિધેય, યુનિવર્સીટી ગ્રંથનિર્માણ બોર્ડ.
- S. Barnard and J. M. Child અનુવાદક સ્વ.શંભુપ્રસાદ ત્રિવેદી, ઉચ્ચતરબીજગણિતભાગ-૧ Higher Algebra, યુનિવર્સીટીગ્રંથનિર્માણબોર્ડ
- S. Barnard and J. M. Child અનુવાદક સ્વ.શંભુપ્રસાદ ત્રિવેદી, ઉચ્ચતરબીજગણિતભાગ-૨ Higher Algebra, યુનિવર્સીટીગ્રંથનિર્માણબોર્ડ
- Dr. A. P. Shah, Standard-11 Mathematics (Semester-1), Gujarat State Board of School Textbooks, 2013
- Dr. A. P. Shah, Standard-11 Mathematics (Semester-2), Gujarat State Board of School Textbooks, 2013
- Dr. A. P. Shah, Standard-12 Mathematics (Semester-1), Gujarat State Board of School Textbooks, 2013
- Dr. A. P. Shah, Standard-12 Mathematics (Semester-2), Gujarat State Board of School Textbooks, 2013

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 265010245042	Name of Course Fundamentals of Database Management System	Compulsory
Credit: 02	Teaching Scheme: Theory (30) - Practical (0)	Teaching Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand DBMS fundamentals, architecture, data models, and basic database languages.
- CO-2: Apply relational model concepts, constraints, SQL basics, and relational algebra operations for data handling.
- CO-3: Apply ER modelling concepts and write SQL queries using joins, sub queries, and aggregate functions
- CO-4: Apply functional dependency and normalization techniques, and understand decomposition, concurrency control, and recovery concepts.

Detailed Syllabus

Unit-1. Introduction to Database System

- 1.1 Database System vs. File System
- 1.2 Characteristics of DBMS
- 1.3 Components of DBMS
- 1.4 Data Models (Hierarchical, Network, Relational,Etc)
- 1.5 Schema, Instance, Data Independence
- 1.6 DBMS Architecture (3-level architecture)
- 1.7 DBMS Languages: DDL, DML, DCL

Unit-2. Relational Model & Algebra and SQL (Structured Query Language)

- 2.1 SQL Basics & Data Types
- 2.2 Commands:
 - 2.2.1 DDL (CREATE, ALTER, DROP)
 - 2.2.2 DML (INSERT, UPDATE, DELETE)
 - 2.2.3 DQL (SELECT).
- 2.3 Entity, Attributes, Entity Set
- 2.4 Relational Model concepts
- 2.5 Constraints: Entity Integrity ,Referential Integrity
- 2.6 Relational Algebra operations:
 - 2.6.1 Selection, Projection, Join
 - 2.6.2 Union, Intersection, Difference

Unit-3. SQL (Structured Query Language) and Data Modelling & ER Model

- 3.1 Keys (Primary, Candidate, Foreign Key)
- 3.2 Relationships (1:1, 1:M, M:N)
- 3.3 ER Diagram notation
- 3.4 Weak Entity, Generalization, Aggregation
- 3.5 Clauses: WHERE, GROUP BY, ORDER BY
- 3.6 Joins (Inner, Outer)
- 3.7 Sub queries
- 3.8 Aggregate Functions (COUNT, SUM, AVG, DISTINCT (used with aggregates), MIN(),MAX())

Unit-4. Database Design & Normalization, Transaction Processing & Advanced Topics

- 4.1 Functional Dependency
- 4.2 Definition and concept
- 4.3 Types of Functional Dependency:
 - 4.3.1 Full Dependency
 - 4.3.2 Partial Dependency
 - 4.3.3 Transitive Dependency
- 4.4 Normal Forms:
 - 4.4.1 1NF, 2NF, 3NF
 - 4.4.2 BCNF
- 4.5 Decomposition (Introduction)
- 4.6 Overview of: Concurrency Control ,Database Recovery

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	1	1	2	1	1	1	1	1	1.42	3	2	2	1	2
CO-2	3	3	3	1	1	1	3	1	2	1	1	1	1.75	3	3	2	2	2.5
CO-3	3	3	3	1	1	2	3	2	2	2	2	1	2.08	3	2	3	2	2.5
CO-4	3	3	3	1	1	1	2	1	2	2	2	1	1.83	3	3	2	2	2.5
Avg	3.0	2.75	2.75	1.0	1.0	1.25	2.50	1.25	1.75	1.50	1.5	1.0		3	2.5	2.25	1.75	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Tutorial, Presentation, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Mynani MadhuBala, Introduction to DBMS, Theory and Practicals, AICTE, 2022
- RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Publication, 2018
- Ramkrishnan, Gehrke: Database Management Systems, 3rd Edition, McGrawHill Publication, 2002
- Ivan Bayross, SQL, PL/SQL – The programming Language Oracle,BPB Publication, 2010
- Silberschatz, Korth, Sudarshan, Database System Concepts, 5th Edition, McGraw Hill, 2005
- S. K. Singh, Database Systems: Concepts, Design and Applications, Pearson Education, 2009
- C.J.Date, a Kannan, S Swaminathan : An Introduction to Database Systems, 8th Edition, Pearson Education, 2003
- Peter Rob, Carlos Coronel, Database Systems: Design, Implementation and Management, 7th Edition, Cengage Learning, 2007.

Online Resources & Tools:

- http://docs.oracle.com/cd/A97335_02/apps.102/a81358/05_dev1.htm [For ER Diagram]
- <http://plsql-tutorial.com/> [For PL/SQL]
- http://www.microsoftvirtualacademy.com/trainingcourses/databasefundamentals#?fbid=tbZ92pOp_Tt [For overall subject]
- http://www.ntu.edu.sg/home/ehchua/programming/sql/Relational_Database_Design.html [for relational database design]

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 265010445043	Name of Course Object Oriented Programming using Java	Compulsory
Credit: 04	Teaching Scheme: Theory (60) - Practical (0)	Teaching Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand and explain the fundamentals of Java programming, including its history, features, environment (JDK, JRE, JVM), program structure, data types, operators, control statements, and basic object-oriented concepts such as classes, objects, methods, and constructors.
- CO-2: Apply object-oriented programming principles in Java by implementing concepts like inheritance, polymorphism, encapsulation, abstraction, interfaces, and access control mechanisms to develop structured and reusable programs.
- CO-3: Utilize Java packages and exception handling mechanisms to organize code effectively and handle runtime errors, including creating user-defined exceptions and using built-in packages such as java.lang and java.util.
- CO-4: Develop Java applications using file handling, streams, serialization, and multithreading concepts, including thread creation, lifecycle management, and synchronization to build efficient and concurrent programs.

Detailed Syllabus

Unit-1. Introduction to Java

1.1 Java History, Features, Environment, Program Structure:

- 1.1.1. History, Features (Simple, Platform Independent, Secure, etc.) and Environment (JDK, JRE, JVM) of Java, Program Structure, Java Environment, Structure of Java Program- Class, main() method.
- 1.1.2. **Java Programming Constructs:** Data Types, Variables & Constants, Operators, Precedence Rules and Associativity, Object Reference, Wrapper classes, Arrays and Strings, Type Conversion & Type Casting, Autoboxing, Unboxing, Command Line Arguments.
- 1.1.3. Overview of Control Statements (if, switch, loops)

1.2 Java Programming Building Block:

- 1.2.1 **Object Oriented Overview and Concepts:** Need of object-oriented programming, Object Oriented Programming vs other Paradigms, Class and Objects, four pillars of OOPs (Encapsulation, Inheritance, Abstraction and Polymorphism)
- 1.2.2 **Class:** Definition, Creation.
- 1.2.3 **Object:** Definition, Creation, Instantiating and Initializing an Object.
- 1.2.4 **Constructors:** Declaration, Default & Parameterized constructor.
- 1.2.5 Garbage Collection and Finalization.
- 1.2.6 **Methods:** Declaration, Invocation & Overloading.

Unit-2. Object-Oriented Programming (OOP)

- 2.1 **Access control/protection:** Types of Access Specifiers- Public, Private, Protected, Default, Modifiers- static, final, abstract, synchronized, volatile\
- 2.2 **Inheritance:** Types: Single, Multilevel, Hierarchical, super and final
- 2.3 **Polymorphism:** Types of polymorphism, Method Overloading (Compile-time), Method Overriding (Runtime)
- 2.4 **Encapsulation:** Data hiding using private variables
- 2.5 **Abstraction:** Abstract class and methods
- 2.6 **Interface:** Declaration, Need, implementation, Multiple inheritance using interface.

Unit-3. Java Package, Exception Handling**3.1 Java Package:**

- 3.1.1 Introduction, Advantages of package, Types of Packages- Built-in, User-defined,
 3.1.2 Creating package (package keyword) and Using package (import keyword), Access Protection, Importing Package,
 3.1.3 Some built-in packages: java.lang Package-Object, Wrapper Classes, String, StringBuffer and StringBuilder Classes. java.util Package- Date, Calendar, Arrays etc. classes

3.2 Exception and Error in Java:

- 3.2.1 **Types of Errors:** Compile-time, Runtime, Logical errors
 3.2.2 Exception and Error
 3.2.3 **Types of Exceptions:** Checked and Unchecked
 3.2.4 **Exception Handling Mechanism:** try, catch, finally blocks Keywords- throw and throws.
 3.2.5 **User-defined Exception:** Creating custom exception class, Exception Encapsulation and Enrichment

Unit-4 Java Stream, File Handling and Multithreading**4.1 Java Stream, File Handling**

- 4.1.1. **Streams:** Definition, concepts, advantages
 4.1.2. **Types of streams:** Byte Streams, Character Streams
 4.1.3. Byte and Character stream class hierarchy
 4.1.4. File class
 4.1.5. **File Operations:** Read, write, copy files (both stream)
 4.1.6. **Serialization:** definition, need and serialize class

4.2 Multithreading and Multi-Thread Programming

- 4.2.1. **Thread Concept:** Introduction, Definition and advantages (Process Vs. Thread)
 4.2.2. **Java Thread Model:** Main Thread, Thread class, and Runnable interface, Thread priorit
 4.2.3. **Thread Life Cycle Stages:** New, Runnable, Running, Waiting, Dead
 4.2.4. **Creating Threads:** By extending Thread class, by implementing Runnable interface
 4.2.5. **Thread Methods:** sleep(), join(), start(), run() etc.
 4.2.6. **Synchronization:** Avoiding thread conflict

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	1	1	2	1	1	1	1	1	1.42	3	2	1	1	1.75
CO-2	3	3	3	1	1	1	3	2	2	2	2	1	2.00	3	2	2	1	2.00
CO-3	3	3	3	1	1	2	3	2	2	2	2	1	2.08	3	3	1	2	2.25
CO-4	3	3	3	1	1	2	3	2	2	3	3	1	2.25	3	3	2	2	2.50
Avg	3.00	2.75	2.75	1.00	1.00	1.50	2.75	1.75	1.75	2.00	2.00	1.00		3.00	2.50	1.50	1.50	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation/ Seminar	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			

Curriculum Framework - Bachelor of Computer Application - 2026

Term-End Evaluation 60 Marks	COs	Marks	Exam Component
	CO-1	15	Term End Examination
	CO-2	15	
	CO-3	15	
	CO-4	15	

References

Books:

- Herbert Schild, Java: The Complete Reference, - McGraw Hill Education, Eleventh Edition 2018.
- E. Balagurusamy, Programming with Java: A Primer, The McGraw Hill, 2006.
- Herbert Schildt, Dale Skrien, Java Fundamentals A comprehensive introduction By McGraw Hill Education, 2017.
- James Rumbaugh, Michael Blaha, Object-Oriented Modelling and Design, Pearson Education India, 2007.

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 265010345044	Name of Course System Analysis and Design	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand and apply modern SDLC and AI driven system development concepts
 CO-2: Analyze requirements and design system models using traditional and AI based techniques
 CO-3: Design and develop secure, scalable and intelligent system architectures
 CO-4: Implement, test, evaluate and maintain systems

Detailed Syllabus

Unit 1 Introduction to System Concept and Analysis

- 1.1 Introduction to system, Characteristics and elements of system. Types of system, Cloud and AI enabled system, System users, System analysis, Requirement analysis, System analyst and its role, Fact finding techniques, Feasibility study, System flow chart, Project planning and AI based project estimation

Unit 2 System Development Strategies

- 2.1. System development life cycle, Structured system analysis and design, Prototype models, Agile development, Development operations, Continuous integration, Continuous deployment, AI driven life cycle, AI generated models

Unit-3. System Design, Architecture and Security

- 3.1 System design basics, Logical design and physical design, Context diagram, Data flow diagram, E-R Diagram, Data dictionary, Input design, Input guidelines, Output design, Output guidelines, Report design, Report guidelines, Sample reports, Database design, Future architecture: Cloud, Edge and Quantum

Unit-4. Implementation, Testing, Deployment and Future Trends

- 4.1 Implementation: Coding practices, AI generated code, Version control systems. Testing and Quality Assurance: Unit, Integration, System testing, Test data, Automated testing, AI based testing and debugging, Development operations pipelines, Types of user, Use manual, User training, System monitoring, Maintenance, Future Trends: Artificial intelligence systems, Sustainable and Green computing

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	1	2	-	1	2	1	3	1	1	-	1	1.6	3	2	2	2	2.25
CO-2	3	2	2	1	1	1	-	2	2	1	-	1	1.6	3	2	2	2	2.25
CO-3	3	1	3	-	-	1	1	2	1	1	2	-	1.66	3	2	2	2	2.25
CO-4	3	1	2	1	1	3	1	3	1	1	2	2	1.75	3	3	2	2	2.50
Avg	3	1.25	2.25	1	1	1.75	1	2.5	1.25	1	2	1.33		3	2.25	2	2	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Lecture, Examples, Problem Solving, Case Study, Assignments
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method						
Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
CO-4	10	5				
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				
References						
Books: • System Analysis and Design by James and Senn, McGraw Hill Publications • System Analysis and Design by Manish Soni, Poorav Publications • Systems Analysis and Design by Gary B. Shelly, Cengage Learning Publication • Systems Analysis and Design by Alan Dennis, Wiley Publication • Modern Systems Analysis and Design by Joseph Valacich, Pearson Publication Online Resources & Tools: • www.swayam.gov.in • www.w3schools.com • www.tutorialspoint.com						

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 265010145045	Name of Course Lab Based on Fundamentals of Database Management System	Compulsory
Credit: 01	Teaching Scheme: Theory (0) - Practical (30)	Lab Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Create and manage databases using SQL Data Definition Language (DDL) commands and demonstrate understanding of database concepts, architecture, and relational models.
- CO-2: Perform data manipulation and retrieval operations using SQL commands and relational algebra concepts for solving real-world data processing problems.
- CO-3: Design Entity-Relationship (ER) diagrams, identify keys and relationships, and implement database queries using joins, subqueries, and aggregate functions.
- CO-4: Analyze database schemas using functional dependencies and normalization techniques up to BCNF and explain basic concepts of transaction processing, concurrency control, and recovery.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	1	1	2	1	1	1	1	1	1.50	3	2	1	1	1.75
CO-2	3	3	3	1	1	1	3	1	1	1	1	1	1.67	3	3	1	1	2.00
CO-3	3	3	3	1	1	2	2	2	1	2	1	1	1.83	3	2	2	2	2.25
CO-4	3	3	2	1	1	1	2	1	2	2	1	1	1.67	3	2	2	1	2.00
Avg	3	2.75	2.75	1	1	1.25	2.25	1.25	1.25	1.5	1	1		3	2.25	1.5	1.25	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 3**

Course Code 265010245046	Name of Course Lab Based on Object Oriented Programming using Java	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Develop Java programs using basic programming constructs, object-oriented concepts, classes, objects, constructors, arrays, strings, and control statements to solve computational problems.
- CO-2: Implement object-oriented programming concepts such as inheritance, polymorphism, encapsulation, abstraction, interfaces, and access control mechanisms to build modular and reusable Java applications.
- CO-3: Design Java applications using packages, built-in libraries, and exception handling mechanisms including custom exceptions to ensure robust and structured program development.
- CO-4: Develop advanced Java applications using file handling, streams, serialization, and multithreading concepts including thread creation, synchronization, and thread lifecycle management.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	3	3	1	1	1	3	1	2	1	1	1	1.75	3	2	1	1	1.75
CO-2	3	3	3	1	1	1	3	2	2	2	2	1	2.00	3	2	2	1	2.00
CO-3	3	3	3	1	1	2	3	2	2	2	2	1	2.08	3	3	1	2	2.25
CO-4	3	3	3	1	1	2	3	2	2	3	3	1	2.25	3	3	2	2	2.50
Avg	3	3	3	1	1	1.50	3	1.75	2	2	2	1		3	2.50	1.50	1.50	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Assignment	Participation/ Performance
	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Appendix – A

Program - BCA (Faculty of Information, Communication and Technology)		
Semester- 3		
Course Code 26451345804	Name of Course MDC-Mathematics – II	Compulsory
Credit: 03	Teaching Scheme: Theory (30) – Tutorial (15)	Teaching Hours: 45
Course Outcomes (COs)		
After completing this course, students will be able to		
CO-1:	Apply the concepts and techniques of differentiation, including partial derivatives, to analyze rates of change, solve optimization problems, and interpret applications in machine learning and data analytics.	
CO-2:	Demonstrate proficiency in vector operations such as vector addition, scalar multiplication, dot product, and cross product, and utilize vectors to solve problems in computer graphics, robotics, and gaming.	
CO-3:	Analyze determinants and their properties to evaluate determinants, compute minors and cofactors, solve systems of linear equations using Cramer's Rule, and apply determinants in mathematical and computational contexts.	
CO-4:	Perform matrix operations, determine inverses and row-reduced echelon forms, solve systems of linear equations, and explain the role of matrices, eigenvalues, and eigenvectors in artificial intelligence, machine learning, image processing, and data science.	
Detailed Syllabus		
Unit-1. Derivative		
1.1. Introduction to Functions and Rate of Change		
1.2. Concept of Derivative, Rules of Differentiation (Product, Quotient and Chain Rule)		
1.3. Derivatives of Polynomial and Rational Functions		
1.4. Optimization Problems		
1.5. Introduction to Partial Derivatives		
1.6. Applications in Machine Learning and Data Analytics.		
Unit 2: Vector Algebra: Addition and Multiplication		
2.1 Introduction vector		
2.2 Vectors in 2D and 3D		
2.3 Vector Representation		
2.4 Magnitude and Direction, Unit Vectors		
2.5 Addition and Scalar Multiplication		
2.6 Dot Product, Cross Product		
2.7 Angle Between Vectors, Position Vectors		
2.8 Applications in Computer Graphics		
2.9 Robotics and Gaming.		
Unit-3. Determinants		
3.1. Determinants of Second and Third Order		
3.2. Properties of Determinants		
3.3. Minors and Cofactors		
3.4. Cramer's Rule (Introduction)		
3.5. Application of Determinant		
3.6. Algebra of Determinant		
Matrices-I		
3.7. Introduction, Definition of Matrix		
3.8. Difference between Determinant and a Matrix		

3.9. Equality of Matrices, Type of Matrices

3.10. Row Matrix, Column Matrix, Square Matrix, Diagonal Matrix, Zero Matrix

Unit-4 Matrices-II

4.1 Matrix Addition, Matrix Multiplication, Transpose, Identity Matrix, Inverse of Matrix

4.2 Singular and Non-Singular Matrices

4.3 Row-Reduced Echelon Form

4.4 Matrix Representation of Data

4.5 Solving Systems of Linear Equations

4.6 Introduction to Eigenvalues and Eigenvectors

4.7 Matrix Applications in AI, Machine Learning and Recommendation Systems, Applications in Image Processing and Data Science

Teaching Pedagogy

CO-1 (Unit: 1)

CO-2 (Unit: 2)

CO-3 (Unit: 3)

CO-4 (Unit: 4)

- Seminar, Activity, Assignments, Examples

Assessment Method

Continuous Comprehensive Evaluation 40 Marks			Exam Component		
	COs	Marks	Class Test	Assignment/ Seminar	Involvement
	CO-1	10	5	8 Assignment + 5 Seminar	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- પ્રો. મોહનભાઈ સુથાર, પ્રો. જયંતિભાઈ મ. પટેલ, ઉચ્ચતર માધ્યમિક સંદર્ભસાહિત્ય શ્રેણી પુસ્તિકા ૧૯૮ વિષય, યુનિવર્સિટી ગ્રંથ નિર્માણ બોર્ડ
- S. Barnard and J. M. Child અનુવાદક સ્વ.શંભુપ્રસાદ ત્રિવેદી, ઉચ્ચતર બીજગણિત ભાગ-૧ Higher Algebra, યુનિવર્સિટી ગ્રંથ નિર્માણ બોર્ડ
- S. Barnard and J. M. Child અનુવાદક સ્વ.શંભુપ્રસાદ ત્રિવેદી, ઉચ્ચતર બીજગણિત ભાગ-૨ Higher Algebra, યુનિવર્સિટી ગ્રંથ નિર્માણ બોર્ડ

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 4**

Course Code 255010345014	Name of Course Data Structures	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Classify data structures as linear and non-linear, and demonstrate memory allocation techniques along with recursive programming concepts.
- CO-2: Apply linear data structures like arrays, structures, and stacks to solve problems, including expression conversion and factorial computation.
- CO-3: Implement and compare various sorting and searching algorithms, and apply queue structures to real-life applications such as process scheduling.
- CO-4: Implement linked lists and perform operations on singly and doubly linked lists, and evaluate the performance of sorting and searching techniques.

Detailed Syllabus**Unit-1.**

- 1.1 Introduction to Data Structure:** Introduction and Definition of Data Structure, Classification of Data Types – Primitive and Non-primitive, Types of Data Structures- Linear & Non Linear Data Structures, Static and Dynamic Memory Allocation, Function, Recursion.
- 1.2 Array:** Single dimensional & its addressing function, Multidimensional arrays: two- & three-dimensional arrays, Row major & column major representation & addressing functions.

Unit-2. Linear Data Structure

- 2.1 Structure:** Definition & Concept, Operations on structure, Array of Structure, Structure of array.
- 2.2 Strings:** Definition & Concept, Library Functions of Strings.
- 2.3 Stack:** Definition & Concept, Operations on stack, Multiple stacks, Applications of stacks, Conversion from infix to postfix without parentheses, Implementing factorial with stack.

Unit-3.

- 3.1 Queue:** Definition & Concepts, Operations on queue, D-queue, Circular queue, Applications of queue, Priority queue, Process queue.
- 3.2 Sorting:** Introduction, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Two-Way Merge Sort.
- 3.3 Searching Methods:** Introduction, Linear (Sequential) Search, Binary Search, Comparison of linear & binary searching.

Unit-4.

- 4.1 Linked list representation:** Introduction to link list, Insertion in linked list, deletion in linked list, Traverse in linked List, Doubly Linked list – Insert, Delete operations
- 4.2 Stack using Linked list:** implementation using linked list
- 4.3 Performance analysis:** Performance analysis and comparison of different sorting and searching methods.

Curriculum Framework - Bachelor of Computer Application - 2026

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	--	--	--	2	1	1	--	--	--	1.71	3	2	2	1	2
CO-2	3	3	2	--	--	1	2	1	1	--	--	--	1.67	3	2	2	1	2
CO-3	3	3	3	--	--	--	3	1	1	1	1	--	2	3	3	3	2	2.75
CO-4	3	2	3	--	--	--	3	1	1	1	1	--	1.83	3	2	3	2	2.5
Avg	3	2.5	2.75	0	0	0.25	2.5	1	1	0.5	0.5	0	1.80	3	2.25	2.5	1.5	2.31

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Group Discussion, Assignment, Examples, Questioning
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Paul Gordon Sorenson, Jean-Paul Tremblay, An introduction to Data Structures with Applications, Tata McGrawHill, 1984
- A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, Data Structures using C, PHI-Pearson Education, 2008
- YashwantKanetkar, Data Structures Through C, 4th Edition, BPB Publications, 2022
- N.B. Venkateswarlu, Data Structures, Theory & Practical, AICTE e-Kumbh, 2022
- Samanta Debasis, Classical Data Structures, 2nd Edition, PHI, 2009
- IGlenn W. Rowe, Introduction to Data Structure and algorithm with C, Printice Hall, 1997
- Horowitz, Sahni, and Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, OrientBlackswan, 2008
- નીપા શાહ, “ફ્લોચાર્ટથી પ્રોગ્રામીંગ સુધી”, યુનિ. ગ્રંથનિર્માણબોર્ડ, 2024

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 4**

Course Code 255010345015	Name of Course Web Application Development	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)**After completing this course, students will be able to**

- CO-1: Explain the fundamentals of web development, differentiate between static and dynamic pages, and write basic PHP scripts using correct syntax, data types, and embedded HTML.
- CO-2: Apply conditional structures, loops, and arrays in PHP and effectively use built-in and user-defined functions to structure and modularize code.
- CO-3: Design interactive web forms and implement data handling mechanisms using GET and POST methods, handling HTTP requests and responses for dynamic web applications. as well as managing user data across multiple pages using sessions and cookies.
- CO-4: Integrate PHP with MySQL to perform basic CRUD operations and utilize PHP utilities such as file uploading etc. Reading and Writing data from file and handling files.

Detailed Syllabus**Unit-1. Basics of Web Development**

- 1.1 Introduction of Web development:** Introduction, open source vs. closed source software, Introduction to Webpage and Website, Static and Dynamic Webpage, Client & Server-Side Scripting, Introduction to other server-side languages.
- 1.2 PHP Configurations and Basics**
- 1.2.1 Introduction to PHP:** Introduction, Installation and configuration of Apache, MySQL and PHP, How PHP code is parsed, Embedding PHP and HTML, Executing PHP and viewing in Browser, Data types, Operators, PHP variables: static and global variables, Comments in PHP

Unit-2. Control Structures

- 2.1 Conditional Statements:** If...Else, Switch, Ternary operator.
- 2.2 Looping Statements:** While, Do. While, for, foreach.
- 2.3 Branching Statements:** break and continue, die, exit, return.
- 2.4 Array:** Introduction, Types of arrays, array functions.
- 2.5 Functions**
- 2.5.1 Built in Functions:** Overview of built in functions of PHP, string, date, calendar, maths functions, file system and file handling functions, CSV function, include files- Include Vs Required.
- 2.5.2 User Defined Functions:** Create and use functions

Unit-3. Working With Data

- 3.1 Form Handling:** FORM attributes, INPUT elements and its attributes, validating the user input, Submitting and getting form parameter: Passing variables through GET and POST, GET vs POST, Query string.
- 3.2 Session Management:** Cookies and Sessions: Cookies Handling, Concept of Session, Session handling methods, starting session, modifying session variables, Unregistering and deleting session variables.

Unit-4.

- 4.1 PHP and Database connectivity (MySQL):** CRUD operations.
- 4.2 PHP Utilities**
- 4.3 File Uploading:** Upload Single and Multiple files using PHP script, Understanding HTTP requests, Exploring and modifying HTTP responses, Getting information from web server.

Curriculum Framework - Bachelor of Computer Application - 2026

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	--	1	3	1	1	1	--	1	1.67	3	2	2	1	2
CO-2	3	3	2	--	--	--	3	2	1	2	--	--	2.28	3	3	2	2	2.5
CO-3	3	3	3	--	--	2	3	2	1	2	--	2	2.33	3	3	3	2	2.75
CO-4	3	2	3	1	1	--	3	2	1	2	2	2	2	3	2	3	2	2.5
Avg	3	2.5	2.5	1	1	1.5	3	1.75	1	1.75	2	1.67	2.07	3	2.5	2.5	1.75	2.44

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Tutorial
CO-2 (Unit: 2)	Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- DT Editorial Service, HTML5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, DreamTech Press, 2016
- Ivan Bayross, Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB, 2010
- Steven Holzner, The Complete Reference PHP, McGraw Hill, 2017
- Kelvin Tetroe, Peter Moulding, Programming PHP, 4th Edition, O'Reilly, 2016
- Sharanam Shah, Vaishali Shah LAMP Programming for Professionals, Shroff Publishers, 2009
- Jason Garner, Morgan Owens, Elizabeth Naramore, Matt Warden, Jeremy Stolz, Professional LAMP: Linux, Apache, MySQL and PHP Web Development, Wrox, 2005.

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 4**

Course Code 255010345016	Name of Course Computer Network	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Describe the fundamental concepts of computer networks, including network types, topologies, and reference models, and explain physical and data link layer functionalities such as error detection and data framing.
- CO-2: Analyze medium access control protocols, understand Ethernet technologies, and explain network layer design issues along with routing algorithms and internetworking concepts.
- CO-3: Explain transport layer services and protocols, including connection management, flow control, and the characteristics of UDP and TCP protocols.
- CO-4: Describe application layer protocols such as DNS, email systems, HTTP, FTP, and DHCP, and understand their roles in network communication.

Detailed Syllabus**Unit-1. Introduction to Computer Network**

- 1.1 Computer Network:** Definition, Essential, Uses, Objectives, Advantages, Network Utility, Network Hardware and Software, Types of networks, Network Topologies, Reference Models: OSI, TCP/IP.
- 1.2 Physical Layer:** Bandwidth, Signal Data Rate, And Transmission Media: Guided and Unguided.
- 1.3 Data Link Layer**
- 1.3.1 Design issues:** Services provided to network layer, Framing, Error control, Flow control.
- 1.3.2 Error detection and correction:** Error correcting codes, Error detecting codes, Elementary.
- 1.3.3 Data Link protocols:** Simplex, stop and wait, Sliding window protocol, Overview of HDLC.

Unit-2. Medium Access Control Sublayer

- 2.1 Channel allocation and Protocols:** Channel allocation problem, Multiple access protocols- ALOHA, CSMA, Collision free protocols, Limited contention protocols.
- 2.2 Ethernet:** Traditional Ethernet, Switched Ethernet.
- 2.3 Network Layer**
- 2.3.1 Introduction:** Design issues, Role and Responsibility, Comparison of virtual circuit and datagram subnets.
- 2.3.2 Algorithms:** Routing algorithms, Optimality principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing.
- 2.3.3 Internetworking:** Tunneling, Network Layer in the Internet, IP protocol-IPV4 and IPV6, IP addresses, Internet Control Protocol, OSPF, and BGP.

Unit-3. Transport Layer

- 3.1 Transport Service and Primitives:** Upper Layer Service Base, Transport, Service Primitives, Socket
- 3.2 Protocols:** Elements of Transport protocols, Addressing, Connection Establishment, and Connection release, Flow control, Multiplexing, Transport protocol - UDP, TCP

Unit-4. Application Layer

- 4.1 DNS:** The DNS namespace, Resource records, Name servers
- 4.2 Electronic Mailing System:** Architecture and services, User agent, Message formats, Message transfer, Final delivery.
- 4.3 Protocols:** World Wide Web - Architecture overview, HTTP, FTP and DHCP.

Curriculum Framework - Bachelor of Computer Application - 2026

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	--	1	2	1	2	1	--	--	1.75	3	2	2	1	2
CO-2	3	3	2	--	--	1	2	1	2	2	--	--	2	3	3	2	2	2.5
CO-3	3	2	2	--	--	1	2	1	2	2	--	--	1.87	3	2	2	1	2
CO-4	3	2	1	--	--	1	2	1	2	1	--	--	1.62	3	2	1	1	1.75
Avg	3	2.25	1.75	0	0	1	2	1	2	1.5	0	0	1.81	3	2.25	1.75	1.25	2.06

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Classroom Teaching, Tutorial
CO-2 (Unit: 2)	• Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	• Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	• Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Andrew S. Tanenbaum, Computer Network, Prentice Hall, 2011
- Behrouz Forouzan, Introduction to Data Communication and Networking, Mc-Graw Hill, 2007
- Natalia Olifer and Victor Olifer, Computer Network, John Wiley and Sons, 2005
- William Stallings, Data and Computer Communication, Pearson Education, 2007

Online Resources & Tools:

- NPTEL, Swayam

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 4**

Course Code 255010345017	Name of Course Search Engine Optimization (Lab Based)	Compulsory
Credit: 03	Teaching Scheme: Theory (90) - Practical (0)	Teaching Hours: 90

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Explain the fundamentals of Search Engine Optimization, including its types, query classifications, and search engine result structures, and apply basic search operators for information retrieval.
- CO-2: Analyze the web search process, evaluate web content using SEO metrics, and implement keyword research and URL rewriting strategies to improve search rankings.
- CO-3: Differentiate between white hat and black hat SEO techniques and apply technical and organic SEO strategies—including link building and page rank optimization etc.—to enhance website visibility.
- CO-4: Develop search engine-friendly content using canonicalization, content optimization, and scripting methods, and demonstrate techniques to optimize for voice search.

Detailed Syllabus**Unit-1. Search Engine Optimization Basics**

- 1.1 Introduction To SEO:** Introduction, Need, Site Architecture, advantages and disadvantages, SEO Myths.
- 1.2 Optimization Types:** On-page, Off-page and Technical SEO.
- 1.3 Search Query Types:** Navigational, Informational, and Transactional.
- 1.4 Search Types:** Narrow, Broad, Local, And Global.
- 1.5 Search Operators:** Basic and Advanced.
- 1.6 Search Engine Result Page Layout:** Introduction, Result Types.

Unit-2. Web Search Process

- 2.1 Web Page Content Evaluation: Need, SEO Metrics**
- 2.2 Search Engine Types:** Crawler-based, Human Powered Directories, Meta Search Engine and Hybrid Search Engine, Search Engine.
- 2.3 Architecture: Components and Functions.**
- 2.4 Ranking Factors:** Visible On-Page Factors, Invisible Off-Page Factors, Time-Based Factors, and External Factors
- 2.5 URL Rewriting**
- 2.5.1 URL:** Introduction, Importance, Types, URL Rewriting-Need and Implementation, Redirection Approaches, Process.
- 2.5.2 Keyword Research:** Introduction and Importance, Keyword value determination: High-value keyword and Low-value keyword, Keyword Demand and Long Tail Approach.

Unit-3.

- 3.1 Technical SEO:** Introduction, Definition, Overview and Importance
- 3.2 Organic SEO:** Internal and External links, Website content, Link Equity
- 3.3 Page Ranks:** Overview, Algorithm
- 3.4 Search Engine Optimization Techniques**
- 3.4.1 SEO Techniques:** Introduction and Importance of Search Engine Optimization Techniques
- 3.4.2 White Hat:** Web Feed, Social Bookmarking, Traditional and Search Engine Sitemaps, Link Bait
- 3.4.3 Black Hat:** Introduction and Overview
- 3.4.4 Overview:** Foreign language optimization for foreign applications

Unit-4. Search Engine-Friendly Content Management

- 4.1 Duplicate Content:** Causes, Effects, and Approaches, URL Canonicalization: Overview, Usage and Implementation, Content Optimization: Text, Image, and Hyperlink, Search Engine Scripting.
- 4.2 Voice Search:** Introduction, Optimization techniques.

Curriculum Framework - Bachelor of Computer Application - 2026

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	1	2	3	1	--	--	--	2	2	3	2	2	1	2
CO-2	3	3	2	1	1	2	3	1	1	2	2	2	1.91	3	3	2	2	2.5
CO-3	3	3	2	1	2	2	3	1	1	2	2	2	2	3	3	3	2	2.75
CO-4	3	2	3	2	2	2	3	2	1	2	2	3	2.25	3	3	3	2	2.75
Avg	3	2.5	2.25	1.33	1.5	2	3	1.25	1	2	2	2.25	2.04	3	2.75	2.5	1.75	2.5

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks			Exam Component			
	COs	Marks	Quiz	Practical Test	Assignment	Participation/ Performance
	CO-1	10	2.5	2.5	13	7
	CO-2	10	2.5	2.5		
	CO-3	10	2.5	2.5		
	CO-4	10	2.5	2.5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- CristianDarie, JaimieSirovich, Wrox-Wiley, Professional Search Engine Optimization with ASP.NET Developer's Guide to SEO, Wrox, 2007
- Eric Enge, Stephan Spencer, Rand Fishkin and Jessie Stricchiol, The Art of SEO: Mastering Search Engine Optimization, O'Reilly, 2015
- Jerri L. Ledford, SEO: Search Engine Optimization Bible, Wiley India, 2007
- JaimieSirovich and CristianDarie, Professional Search Engine Optimization with PHP, WroxWiley, 2007
- Jennifer Grappon and GradivaCouzin, Search Engine Optimization An Hour a Day, Sybex, 2006

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 4**

Course Code 255010245018	Name of Course Lab Based on Data Structures	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand the fundamentals of data structures and memory management including arrays, functions, pointers and recursion.
- CO-2: Apply concepts of structures, strings, and stacks in solving real-time problems like expression conversion.
- CO-3: Apply graph theory and multi-linked structures to solve Implement various types of queues and apply appropriate sorting and searching algorithms effectively.
- CO-4: Develop and analyze linked list implementations and compare performance of different searching and sorting techniques.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	--	1	2	2	--	--	--	--	--	1.58	3	2	2	1	2
CO-2	3	3	3	--	1	1	2	--	1	--	--	--	1.67	3	3	2	2	2.5
CO-3	3	3	3	--	1	--	2	2	2	1	1	1	1.83	3	3	3	2	2.75
CO-4	3	2	3	--	1	1	1	2	2	1	1	--	1.58	3	2	3	2	2.5
Avg	3	2.5	3	0	1	1	1.75	1.5	1.25	0.75	0.75	0.25	1.67	3	2.5	2.5	1.75	2.44

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning - Demonstration and Guided Practice - Project-Based Learning - Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks			Exam Component		
	COs	Marks	Class Test	Assignment	Participation/ Performance
	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 4**

Course Code 255010245019	Name of Course Lab Based on Web Application Development	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Install and configure PHP environment and apply basic PHP scripting to create dynamic web pages.
 CO-2: Develop logic using PHP control structures, arrays, and functions, both built-in and user-defined.
 CO-3: Handle user data using forms, GET/POST methods, and manage session and cookies securely.
 CO-4: Integrate PHP with MySQL for data-driven applications and manage file uploads and HTTP responses effectively.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	--	1	3	--	2	1	2	1	1.88	3	2	2	1	2
CO-2	3	2	2	--	--	1	3	--	2	2	2	1	2	3	3	2	2	2.5
CO-3	3	3	2	--	1	1	3	1	2	2	2	2	2	3	3	3	2	2.75
CO-4	3	3	3	--	--	1	3	1	2	3	3	2	2.4	3	3	3	2	2.75
Avg	3	2.5	2.25	0	--	1	3	1	2	2	2.25	1.5	2.07	3	2.75	2.5	1.75	2.5

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Classroom Teaching, Tutorial
CO-2 (Unit: 2)	• Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	• Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	• Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Presentation
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	5	-
	CO-2	10	5	5	-
	CO-3	10	5	2.5	2.5
	CO-4	10	5	2.5	2.5
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265510445015	Name of Course Mobile Application Development	Compulsory
Credit: 04	Teaching Scheme: Theory (60) - Practical (0)	Teaching Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Demonstrate understanding of the fundamental components of Android applications and apply Kotlin programming concepts to build basic Android functionalities.
- CO-2: Configure the Android Manifest file, manage application resources, and set appropriate permissions to ensure proper app functionality and deployment readiness.
- CO-3: Design effective and responsive user interfaces using Android layout components and apply basic animation techniques to enhance user experience.
- CO-4: Utilize Android APIs for data storage, implement SQLite for local data management, and explore the basics of Flutter and mobile application testing methodologies.

Detailed Syllabus

Unit-1. Android Application Design Essentials

- 1.1 **Introduction to Android Application:** Anatomy of an Android applications, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Kotlin Overview, Basic, Control Flow, Array & String, Functions, Collections, OOPs Concept, Exception Handling, Null Safety, Regex & Ranges.

Unit-2. Android Application Prerequisite

- 2.1 **Prerequisite:** Android Manifest File and its common settings, Using Intent Filter, Permissions, Managing Application resources in a hierarchy, working with different types of resources, Introduction of Google Play store.

Unit-3. Android User Interface Design Essentials

- 3.1 **UI Design:** User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Unit-4. Android APIs

- 4.1 **APIs:** Android Data and Storage APIs, managing data using SQLite.
- 4.2 **Notification:** Type of notifications.
- 4.3 **Android Framework and Testing**
- 4.3.1 Introduction to Flutter
- 4.3.2 Introduction to Mobile Application Testing

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	1	2	--	1	1	3	2	2	2	2	2	2	3	2	2	2	2.25
CO-2	3	2	2	1	1	--	3	1	2	2	2	2	1.91	3	2	2	1	2
CO-3	3	2	3	1	--	2	3	2	2	2	2	2	2.18	3	3	2	2	2.5
CO-4	3	3	3	2	--	--	3	2	2	2	2	2	2.3	3	3	3	2	2.75
Avg	3	2	2.5	1	0.5	0.75	3	1.75	2	2	2	2	2.10	3	2.5	2.25	1.75	2.37

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Tutorial, Presentation, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Curriculum Framework - Bachelor of Computer Application - 2026

Assessment Method					
Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Class Test	Assignment	Presentation
	CO-1	10	5	5	-
	CO-2	10	5	-	5
	CO-3	10	5	2.5	2.5
	CO-4	10	5	2.5	2.5
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- Joseph Annuzzi, Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson, Education, 4th ed., 2014
- Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2014
- Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009
- Sujit Kumar Mishra, “Fundamentals of Android App Development”, BPB Publication, 2020
- Michael Burton, “Android App Development for Dummies”, 3ed, a Wiley Brand, 2015

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 5**

Course Code 265510345016	Name of Course Operating System	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Explain fundamental operating system concepts, including different types of systems, memory management techniques, and virtual memory with page replacement policies.
- CO-2: Understand File system structures, access methods, and device management techniques for efficient storage and input/output operations.
- CO-3: Understand process concepts, implement CPU scheduling algorithms, and apply synchronization techniques to manage concurrent processes.
- CO-4: Write UNIX shell scripts, use essential shell commands, and manage processes including creation, execution, and inter-process communication.

Detailed Syllabus**Unit-1.**

- 1.1 **Operating System Concepts:** Introduction, what is an operating system, Multiprogram processing systems, Multiuser System, Time- Sharing Systems, Personal - Computer Systems, Parallel systems, Distributed systems & Real- Time system
- 1.2 **Memory Management:** Background of Memory Management, Logical versus physical Address space, swapping, Contiguous allocation, Paging, Segmentation
- 1.3 **Virtual Memory:** Demand Paging, Page Replacement

Unit-2.

- 2.1. **Introduction to File System and File Management:** Information Management, Introduction to a Simple File system, General Model of a File System, Symbolic File System, Basic File System, Access Control Verification, Logical File System.
- 2.2. **Physical File system File:** System Interface, File Concept, Access, Methods, Directory Structure, Protection
- 2.3. **Device access and management:** Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices, Input or Output Devices, Storage Devices, Buffering

Unit-3.

- 3.1 **Introduction to Process:** Process Concept, Process Scheduling, Operations on Processes
- 3.2 **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling
- 3.3 **Process synchronization**

Unit-4.

- 4.1 **Unix Shell script and Process Programming:** Introduction to shell programming, different types of shell and kernel, 'vi' Editor, Environment variables and user defined variables
- 4.2 **shell commands:** pwd, ls, cd, mv, cat, rm, mkdir, rmdir, head, tail, grep, cut, who, ps, wc, find, sort, uniq, merge, let, expr, & (background process).
- 4.3 **The process:** process creation, parent and child process, process related commands

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	1	1	2	1	1	1	1	1	1.42	3	2	1	1	1.75
CO-2	3	2	2	1	1	1	2	1	1	1	1	1	1.42	3	2	2	1	2
CO-3	3	3	3	1	1	1	2	2	2	2	1	1	1.83	3	3	2	2	2.5
CO-4	3	3	3	1	1	2	3	2	2	2	2	1	2.08	3	2	2	2	2.25
Avg	3.00	2.50	2.50	1.00	1.00	1.25	2.25	1.50	1.50	1.50	1.25	1.00		3	2.25	1.75	1.5	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	Classroom Teaching, Group Discussion, Assignment, Examples, Questioning
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Operating system concept by Silberschatz and Galvin –Pearson.
- Operating Systems by Madnick E. and Donovan J. –Tata McGraw Hill.
- UNIX and Shell programming by B.M. Harwani – OXFORD
- The Unix Programming Environment, Kernigham & Pike –PHI.
- The Design of the UNIX OS, M. J. Bach – Prentice Hall.
- Working with UNIX, Vijay Mukhi –BPB Publications.
- UNIX Shells, Vijay Mukhi –BPB Publications.

Online Resources & Tools:

UGC Swayam Portal(Swayam Central)

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 5**

Course Code 265510245017	Name of Course Lab Based on Mobile Application Development	Elective
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand the structure and lifecycle of Android applications and apply Kotlin programming concepts in app development.
- CO-2: Configure essential components like manifest file, intent filters, permissions, and resources in Android apps.
- CO-3: Design responsive and user-friendly Android interfaces using layouts, widgets, and animations.
- CO-4: Implement data handling using Android APIs, utilize SQLite, notifications, and explore emerging tools like Flutter and testing frameworks.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	--	2	2	3	--	--	1	2	2	2.11	3	2	2	2	2.25
CO-2	3	2	2	--	2	2	3	--	--	1	2	2	2.11	3	2	2	2	2.25
CO-3	3	2	2	1	--	2	3	2	--	--	1	2	2	3	2	3	2	2.5
CO-4	3	2	3	--	--	2	3	2	1	1	2	2	2.1	3	3	3	2	2.75
Avg	3	2	2.25	0.25	1	2	3	1	0.25	0.5	1.75	2		3	2.25	2.5	2	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning - Demonstration and Guided Practice - Project-Based Learning - Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
CO-4	10				
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - BCA (Faculty of Information, Communication and Technology)**Semester- 5**

Course Code 265510245018	Name of Course Lab Based on Operating System	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Understand the basic structure of modern operating systems and simulate key memory management techniques like paging and segmentation.
- CO-2: Explain and simulate file system organization, directory structures, file access methods, and device management strategies.
- CO-3: Implement and analyze process management concepts using process sub system calls.
- CO-4: Develop and execute shell scripts for automation, file management, and demonstrate process-related commands and system programming in UNIX/Linux.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	1	1	2	--	--	--	--	--	1.58	3	2	2	1	2
CO-2	3	2	3	--	1	1	2	--	--	--	--	--	1.58	3	2	2	1	2
CO-3	3	3	3	--	1	--	2	1	1	1	--	--	1.67	3	3	2	2	2.5
CO-4	3	2	3	--	1	1	3	1	1	1	1	--	1.83	3	2	3	2	2.5
Avg	3	2.25	3	0.25	1	0.75	2.25	0.50	0.50	0.50	0.25	--		3	2.25	2.25	1.5	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
CO-4	10				
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265510445022	Name of Course Internship	Compulsory
Credit: 4	Teaching Scheme: Theory (0) - Practical (120)	Hours: 120

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Apply theoretical knowledge of programming, databases, web development, and software engineering to real-world projects in industry, NGOs, or campus-based environments.
- CO-2: Demonstrate problem-solving, critical thinking, and teamwork skills through the design, development, and documentation of socially responsible software solutions.
- CO-3: Integrate professional tools, industry-standard practices, and ethical computing principles in the planning, execution, and delivery of ICT-based systems or applications.
- CO-4: Communicate project outcomes effectively through structured documentation, presentations, and code repositories, while reflecting on the societal impact and future scope of the solution developed.

Mapping Matrix of POs, PSOs, and Cos

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	--	1	2	3	2	2	3	2	2	2.27	3	2	3	2	2.5
CO-2	2	3	2	2	2	2	2	3	2	3	3	3	2.42	2	3	2	3	2.5
CO-3	3	2	3	1	3	2	3	2	2	3	3	2	2.42	3	3	3	2	2.75
CO-4	2	2	2	2	3	3	2	2	3	2	2	3	2.33	2	2	3	3	2.5
Avg	2.50	2.25	2.50	1.67	2.25	2.25	2.50	2.25	2.25	2.75	2.50	2.50	2.36	2.5	2.5	2.75	2.5	2.56

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Assessment Method

As per the BCA Internship guideline

Appendix - A**Program - BCA (Faculty of Information, Communication and Technology)****Semester- 5**

Course Code 265520245047	Name of Course MOOC-Python for Data Science	Compulsory MOOC
Credit: 02 NCrF Level: 4.5 – 8.0	Teaching Scheme: Theory (30) - Practical (0)	Teaching Hours: 4 weeks

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: To introduce students to the principles, scope, and significance of Data Science and its interdisciplinary nature.
- CO-2: To familiarize students with statistical and machine learning methods for deriving insights from data.
- CO-3: To understand the applications of Data Science in business, industry, and scientific domains for informed decision-making and research.
- CO-4: To provide hands-on experience with programming environments and tools commonly used for Data Science applications.

Detailed Syllabus**Week 1: BASICS OF PYTHON SPYDER (TOOL)**

- 1.1. Introduction Spyder
- 1.2. Setting working Directory
- 1.3. Creating and saving a script file
- 1.4. File execution, clearing console, removing variables from environment, clearing environment
- 1.5. Commenting script files
- 1.6. Variable creation
- 1.7. Arithmetic and logical operators
- 1.8. Data types and associated operations

Week 2: Sequence data types and associated operations

- 2.1. Strings
- 2.2. Lists
- 2.3. Arrays
- 2.4. Tuples
- 2.5. Dictionary
- 2.6. Sets
- 2.7. Range
- 2.8. NumPy
- 2.9. ndarray

Week 3: Pandas dataframe and dataframe related operations on Toyota Corolla dataset

- 3.1. Reading files
- 3.2. Exploratory data analysis
- 3.3. Data preparation and preprocessing
- Data visualization on Toyota Corolla dataset using matplotlib and seaborn libraries**
- 3.4. Scatter plot
- 3.5. Line plot
- 3.6. Bar plot
- 3.7. Histogram
- 3.8. Box plot
- 3.9. Pair plot
- Control structures using Toyota Corolla dataset**
- 3.10. if-else family
- 3.11. for loop
- 3.12. for loop with if break
- 3.13. while loop

Curriculum Framework - Bachelor of Computer Application - 2026

3.14.	Functions
Week 4: CASE STUDY	
	Regression
4.1.	Predicting price of pre-owned cars
	Classification
4.2.	Classifying personal income

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	1	1	1	1	2	1	2	1	2	1	1.50	2	2	2	1	1.75
CO-2	3	3	3	1	1	1	3	1	2	1	2	2	1.92	3	3	2	1	2.25
CO-3	2	3	2	2	2	1	2	1	2	2	3	3	2.08	3	2	3	2	2.50
CO-4	3	2	3	1	1	1	3	2	2	2	2	1	1.92	3	3	2	1	2.25
Avg	2.75	2.50	2.25	1.25	1.25	1	2.50	1.25	2	1.50	2.25	1.75		2.75	2.50	2.25	1.25	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	As per MOOC Instructor
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1		As per MOOC			
	CO-2					
	CO-3					
	CO-4					
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Introduction to linear algebra - by Gilbert Strang
- Applied statistics and probability for engineers – by Douglas Montgomery
- Mastering python for data science, Samir Madhavan

Online Resources & Tools:

- UGC Swayam Portal(Swayam Central), e-PGPathshala(e-PGPathshala (inflibnet.ac.in))

Course Link: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs107

Course Instructor: Prof. Ragunathan Rengasamy, IIT Madras

Appendix - B

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265510245048	Name of Course MOOC- Lab Based Python for Data Science	MOOC
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Collect, clean, transform, and organize datasets using appropriate Data Science tools and programming techniques.
- CO-2: Apply statistical methods and basic machine learning algorithms to analyze data and extract useful patterns and knowledge.
- CO-3: Create effective visualizations and interpret results for solving problems in business, industry, and scientific applications.
- CO-4: Demonstrate proficiency in using modern Data Science platforms, libraries, and programming environments for real-world data analysis projects.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	3	3	1	1	1	3	1	2	2	1	2	1.92	3	3	2	1	2.25
CO-2	3	3	3	1	1	1	3	1	2	1	2	2	1.92	3	3	2	1	2.25
CO-3	2	3	2	2	2	2	2	2	2	2	3	3	2.25	2	3	3	2	2.50
CO-4	3	2	3	1	1	1	3	2	3	2	2	2	2.08	3	3	2	2	2.50
Avg	2.75	2.75	2.75	1.25	1.25	1.25	2.75	1.50	2.25	1.75	2	2.25		2.75	3	2.25	1.50	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
	CO-1		10	13	7
	CO-2				
	CO-3		10		
	CO-4				
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Appendix-C

Program – BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265510145049	Name of Course MOOC-Case Study based on Python for Data Science	MOOC
Credit: 01	Teaching Scheme: Theory (0) - Practical (30)	Teaching Hours: 30
Course Outcomes (COs)		
CO-1: Apply Python programming fundamentals, Spyder IDE, built-in data types, operators, and control structures to develop and debug programs for solving real-world data processing problems.		
CO-2: Analyze and preprocess structured datasets using NumPy and Pandas, perform exploratory data analysis (EDA), and create meaningful visualizations to interpret patterns and trends in the Toyota Corolla dataset.		
CO-3: Develop and evaluate a regression model to predict the price of pre-owned cars by applying appropriate data preprocessing, feature selection, model building, and performance evaluation techniques.		
CO-4: Build and assess a classification model for personal income prediction by implementing suitable machine learning algorithms, interpreting classification results, and comparing model performance using relevant evaluation metrics.		

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	-	-	-	3	-	1	-	-	1.00	3	2	-	-	1.25
CO-2	3	2	3	1	-	-	-	3	1	1	-	-	1.17	3	3	-	-	1.50
CO-3	3	2	3	1	-	-	-	3	1	2	-	-	1.33	3	2	1	-	1.75
CO-4	3	3	3	2	-	1	-	3	-	2	-	-	1.50	3	3	2	-	2.00
Avg	3	2.25	3	1.50	0	0.25	0	3	0.75	1.50	0	0		3	2.75	0.75	0	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component
	CO-1		AS per MOOC Guidelines
	CO-2		
	CO-3		
	CO-4		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component
	CO-1	15	Term End Examination
	CO-2	15	
	CO-3	15	
	CO-4	15	

Appendix - D

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265520245050	Name of Course MOOC- Python Essentials: Learn, Build & Apply	Compulsory MOOC
Credit: 02 NCrF Level: 4.5 – 7.0	Teaching Scheme: Theory (30) - Practical (0)	Teaching Hours: 8 weeks

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Explain and apply Python fundamentals, syntax, input/output, control-flow constructs, and core data types including strings, lists, tuples, dictionaries, and sets to develop basic Python programs.
- CO-2: Develop modular and reusable Python programs using functions, arguments, lambda functions, modules, packages, and object-oriented programming concepts such as classes, inheritance, polymorphism, encapsulation, and abstraction.
- CO-3: Implement and analyze linear data structures, file-handling operations, exception-handling mechanisms, regular expressions, and advanced Python techniques to solve practical programming problems.
- CO-4: Develop data-driven Python applications using NumPy, Pandas, Matplotlib, and Tkinter for numerical computation, data manipulation, visualization, basic data analysis, and graphical user-interface development.

Detailed Syllabus

Week 1: Python Fundamentals

- 1.1 Introduction to Python and its applications
- 1.2 Structure of a Python program
- 1.3 Python syntax and core elements:
- 1.4 Development environments: Jupyter Notebook, Google Colab
- 1.5 Input and Output
- 1.6 Control flow statements: Conditional statements (if, elif, else), Looping constructs (for, while), Loop control statements (break, continue, pass), use of exit()

Week 2: Strings and Lists

- 2.1 String creation and indexing
- 2.2 String slicing and traversal
- 2.3 Common string operations
- 2.4 Built-in string functions and methods
- 2.5 Introduction to lists and list indexing
- 2.6 List operations
- 2.7 Working with nested lists
- 2.8 Built-in list functions and methods

Week 3: Tuples, Dictionaries, and Sets

- 3.1 Introduction, immutability, and applications
- 3.2 Accessing and operating on tuples
- 3.3 Tuple methods
- 3.4 Key-value pairs and dictionary creation
- 3.5 Accessing, modifying, and iterating over dictionaries
- 3.6 Dictionary properties and methods
- 3.7 Introduction to sets
- 3.8 Set operations

Week 4: Functions, Modules, and Packages

- 4.1 Defining and calling functions
- 4.2 Types of functions: built-in functions, user-defined functions
- 4.3 Function arguments: Positional arguments, Keyword arguments, Default arguments, Variable-length

Curriculum Framework - Bachelor of Computer Application - 2026

arguments

4.4 Lambda (anonymous) functions

4.5 Scope of variables

4.6 Creating and importing packages and modules

Week 5: Object-Oriented Programming and Exception Handling

5.1 Classes and objects

5.2 Constructors

5.3 Encapsulation and abstraction

5.4 Inheritance and polymorphism

5.5 Method overriding

5.6 Types of exceptions

5.7 try, except, else, and finally blocks

5.8 User-defined exceptions

Week 6: Data Structures and File Handling

6.1 Introduction to linear data structures

6.2 Linked Lists

6.3 Stacks

6.4 Queues

6.5 Reading and writing text files

6.6 Practical demonstrations and applications

Week 7: Advanced Python Concepts

7.1 Pattern matching

7.2 Text processing using regular expressions

7.3 NumPy: Arrays and Vectorized operations

7.4 Matplotlib: Data visualization

Week 8: GUI Programming and Data Analysis

8.1 Introduction to GUI programming using Tkinter

8.2 Creating simple GUI applications

8.3 Introduction to Pandas: Data Frames and Data manipulation

8.4 Basic data analysis using Python

8.5 Simple data visualization using Pandas and Matplotlib

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	1	1	1	1	2	1	2	1	2	1	1.5	2	2	2	1	1.75
CO-2	3	3	3	1	1	1	1	3	1	2	1	2	1.92	3	3	2	1	2.25
CO-3	2	3	2	2	2	1	2	1	2	2	3	3	2.08	3	2	3	2	2.5
CO-4	3	2	3	1	1	1	3	2	2	2	2	1	1.92	3	3	2	1	2.25
Avg	2.75	2.5	2.25	1.25	1.25	1	2.5	1.25	1.75	1.75	2	1.75		2.75	2.5	2.25	1.25	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	As per MOOC Instructor
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1		As per MOOC			
	CO-2					
	CO-3					
	CO-4					
Term-End	COs	Marks	Exam Component			

Curriculum Framework - Bachelor of Computer Application - 2026

Evaluation 60 Marks	CO-1	15	Term End Examination
	CO-2	15	
	CO-3	15	
	CO-4	15	

References

Books:

- Géron, A. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. O'Reilly Media.
- Rao, R. N. Introduction to Machine Learning with Python. Dreamtech Press.
- Rao, R. N. Core Python Programming. Dreamtech Press.
- McKinney, W. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter. O'Reilly Media.
- Sridhar, S., Indumathi, J., & Hariharan, V. M. Python Programming. Pearson Education.
- Deitel, P., & Deitel, H. Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and The Cloud. Pearson Education.

Course Link: https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_cs03

Course Instructor: By Dr Manoj Kumar Mishra | Banaras Hindu University

Appendix - E

Program - BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265510245051	Name of Course MOOC- Lab Based Python Essentials: Learn, Build & Apply	MOOC
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

- CO-1: Develop Python programs using fundamental programming constructs, including input/output, conditional statements, loops, strings, lists, tuples, dictionaries, and sets to solve computational problems.
- CO-2: Design modular and reusable Python solutions using functions, lambda expressions, modules, packages, object-oriented programming concepts, and appropriate exception-handling techniques.
- CO-3: Implement and evaluate Python-based data structures and file-processing applications using linked lists, stacks, queues, file handling, regular expressions, and NumPy for efficient data processing.
- CO-4: Develop interactive and data-driven Python applications using Tkinter, Pandas, Matplotlib, and related tools to perform data manipulation, analysis, visualization, and practical problem solving.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	3	2	1	1	1	3	–	2	–	1	1	1.58	3	2	1	1	1.75
CO-2	3	3	3	1	1	1	3	2	3	2	2	1	2.08	3	2	1	1	1.75
CO-3	3	3	3	2	1	1	3	2	3	2	1	2	2.17	3	3	2	1	2.25
CO-4	3	3	3	2	1	2	3	2	3	2	2	2	2.33	3	3	2	2	2.5
Avg	3	3	2.75	1.5	1	1.25	3	2	2.75	2	1.5	1.5	2.03	3	2.5	1.5	1.25	2.06

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
	CO-1		10	13	7
	CO-2				
	CO-3		10		
CO-4					
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Appendix-F

Program – BCA (Faculty of Information, Communication and Technology)

Semester- 5

Course Code 265510145052	Name of Course MOOC-Case Study based on Python Essentials: Learn, Build & Apply	MOOC
Credit: 01	Teaching Scheme: Theory (0) - Practical (30)	Teaching Hours: 30
Course Outcomes (COs)		
CO-1: Develop a Python-based Student Academic Management System by applying Python fundamentals, input/output operations, conditional and looping constructs, strings, lists, tuples, dictionaries, and sets to efficiently store, process, search, and summarize student academic information..		
CO-2: Design and implement a Python-based Community Service Management System using functions, modules, packages, object-oriented programming, inheritance, polymorphism, encapsulation, and exception handling to manage community-oriented services and handle real-world operational errors effectively.		
CO-3: Develop a Python-based Data Processing and Analysis System by applying linear data structures, file handling, regular expressions, NumPy, Pandas, and Matplotlib to collect, validate, transform, analyze, and visualize structured and semi-structured datasets..		
CO-4: Develop an interactive Python-based application for a real-world problem using Tkinter GUI, modular programming, data analysis, and visualization techniques, demonstrating appropriate use of Python tools to produce user-friendly, reliable, and socially relevant computing solutions.		

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	3	3	0	0	2	3	0	2	2	0	2	1.67	3	3	0	2	2
CO-2	3	3	3	0	3	2	3	3	2	3	3	3	2.58	3	3	2	3	2.75
CO-3	3	3	3	0	0	2	3	0	3	2	2	2	1.92	3	3	0	2	2
CO-4	3	3	3	3	2	2	3	2	2	3	3	3	2.67	3	3	3	3	3
Avg	3	3	3	0.75	1.25	2	3	1.25	2.25	2.5	2	2.5	2.21	3	3	1.25	2.5	2.44

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	- Experimental Learning, Demonstration and Guided Practice - Project-Based Learning, Reflective Practice
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component
	CO-1		AS per MOOC Guidelines
	CO-2		
	CO-3		
	CO-4		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component
	CO-1	15	Term End Examination
	CO-2	15	

Curriculum Framework - Bachelor of Computer Application - 2026

	CO-3	15	
	CO-4	15	