SYLLABUS

for

Bachelor of Computer Applications

Programme

As Per

New Education Policy (NEP-2020)

PROGRAMME OUTCOMES (POs)

Upon completion of the BCA program:

PO1. Students gain a solid understanding of fundamental computer science concepts, including programming languages (such as C, C++, and Java), data structures, algorithms, computer organization, and operating systems.

PO2. BCA graduates develop proficiency in programming and software development. They learn to write, debug, and maintain code for various applications and scenarios.

PO3. Students learn about database concepts, database design, and management. This includes understanding SQL (Structured Query Language) for querying and manipulating databases.

PO4. BCA programs often cover web technologies, including HTML, CSS, JavaScript, and web development frameworks. Graduates can create dynamic and interactive web applications.

PO5. Students are exposed to software engineering principles such as software development life cycles, requirements analysis, software testing, and project management.

PO6. BCA graduates develop strong problem-solving and critical-thinking skills, which are essential for identifying and solving technical challenges.

PO7. Students learn about ethical considerations in the field of computing, including issues related to privacy, security, and intellectual property.

PO8. Many BCA programs include group projects that foster teamwork and collaboration, preparing students for real-world work environments.

PO9. Students are prepared for various entry-level roles in the IT industry, such as software developer, web developer, database administrator, system analyst, and more.

PO10. Effective communication is emphasized throughout the program. Graduates are equipped to explain complex technical concepts to both technical and non-technical audiences.

PO11. BCA can serve as a stepping stone for further education, such as pursuing a master's degree in computer science or related fields, to specialize in a specific area of interest.

BCA SEMESTER I										
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA101	Computer Fundamental	4	0		4	30	70	100
2	MAJOR	BCA102	Programming in 'C'	4	0		4	30	70	100
3	MINOR	BCA103	Internet Technologies	4	0		3	30	70	100
4	MINOR	BCA104	Mathematical Foundation	2	0		2	20	30	50
5	MINOR	BCA105	Life Skills and Personality development	2	0		2	20	30	50
6	MINOR	BCA106	Computer Fundamental Lab		0	2	2	20	30	50
7	MINOR	BCA107	Programming in 'C' Lab		0	2	2	20	30	50
8	MINOR	BCA108	HTML Lab		0	2	2	20	30	50
TOTAL				17	0	5	22	190	360	550

BCA SEMESTER II										
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA201	Programming in C++	4	0		4	30	70	100
2	MAJOR	BCA202	Computer Architecture and Digital Electronics	4	0		4	30	70	100
3	MINOR	BCA203	Computer Based Numerical Techniques	4	0		3	30	70	100
4	MINOR	BCA204	Business Intelligence	2	0		2	20	30	50
5	MINOR	BCA205		2	0		2	20	30	50
6	MINOR	BCA206	Programming in C++ Lab	0	0	2	2	20	30	50
7	MINOR	BCA207	Computer Architecture and Digital Electronics LAB		0	2	2	20	30	50
8	MINOR	BCA208	Computer Based Numerical Techniques Lab		0	2	2	20	30	50
TOTAL				18	0	6	22	190	360	550

BCA SEMESTER III										
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA301	Data Structure & File Organization	4	0		4	30	70	100
2	MAJOR	BCA302	Operating System	4	0		4	30	70	100
3	MINOR	BCA303	Python Programming	4	0		3	30	70	100
4	MINOR	BCA304	Graph Theory	2	0		2	20	30	50
5	MINOR	BCA305	CommunicationSkill I	2	0		2	20	30	50
6	MINOR	BCA306	Data Structure & File Organization lab		0	2	2	20	30	50
7	MINOR	BCA307	Operating System Lab		0	2	2	20	30	50
8	MINOR	BCA308	Python Programming		0	2	2	20	30	50
TOTAL				18	0	4	22	190	360	550

BCA SEMESTER Iv										
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA401	Computer Networks	4	0		4	30	70	100
2	MAJOR	BCA402	Database Management System	4	0		4	30	70	100
3	MINOR	BCA303	R Programming	4	0		3	30	70	100
4	MINOR	BCA404	Software Testing	2	0		2	20	30	50
5	MINOR	BCA405	Software Engineering	2	0		2	20	30	50
6	MINOR	BCA406	Computer Networks lab		0	2	2	20	30	50
7	MINOR	BCA407	Database Management System Lab		0	2	2	20	30	50
8	MINOR	BCA408	R Programming lab		0	2	2	20	30	50
TOTAL				18	0	4	22	190	360	550

BCA SEMESTER V										
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA501	Compiler Design	4	0		4	30	70	100
2	MAJOR	BCA502	Computer Graphics	4	0		4	30	70	100
3	MINOR	BCA503	ASP.Net	4	0		3	30	70	100
4	MINOR	BCA504	Multimedia Application	2	0		2	20	30	50
5	MINOR	BCA505	Indian Constitution	2	0		2	20	30	50
6	MINOR	BCA506	Compiler Design lab		0	2	2	20	30	50
7	MINOR	BCA507	Computer Graphics Lab		0	2	2	20	30	50
8	MINOR	BCA508	ASP.Net Lab		0	2	2	20	30	50
TOTAL				18	0	4	22	190	360	550

BCA SEMESTER VI										
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA601	Cryptography & Network Security	4	0		4	30	70	100
2	MAJOR	BCA602	Design and Analysis of Algorithm	4	0		4	30	70	100
3	MINOR	BCA603	Parallel Programming	4	0		3	30	70	100
4	MINOR	BCA604	E-Commerce	2	0		2	20	30	50
5	MINOR	BCA605	Cryptography & Network Security lab	0	0	2	2	20	30	50
6	MINOR	BCA606	Design and Analysis of Algorithm Lab		0	2	2	20	30	50
7	MINOR	BCA607	Project		0	4	4	30	70	100
TOTAL				14	0	8	22	180	370	550

		BCA SEMESTER VII								
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA701	Artificial Intelligence	4	0	0	4	30	70	100
2	MAJOR	BCA702	Cloud Computing	4	0	0	4	30	70	100
3	MINOR	BCA703	Internet of Things	4	0	0	4	30	70	100
4	MINOR	BCA704	Fundamental of Data Science	2	0	0	2	20	30	50
5	MINOR	BCA705	Business Communication	2	0	0	2	20	30	50
6	MINOR	BCA706	Artificial Intelligence lab	0	0	2	2	20	30	50
7	MINOR	BCA707	Cloud Computing Lab		0	2	2	20	30	50
8	MINOR	BCA708	Internet of Things Lab		0	2	2	20	30	50
TOTAL				16	0	6	22	190	360	550

		BCA SEMESTER VIII								
SR. No.	COURSE TYPE	COURSE CODE	COURSE NAME	LECTURE (Hrs.)	TUTORIAL	PRACTICAL (Hrs.)	CREDIT POINTS	EXAMINATION		TOTAL
								INTERNAL	EXTERNAL	
1	MAJOR	BCA801	Deep Learning	4	0	0	4	30	70	100
2	MAJOR	BCA802	Wireless and Mobile Computing	4	0	0	4	30	70	100
3	MAJOR	BCA803	Thesis/Dissertation	0	0	6	6	30	70	100
4	MINOR	BCA804	Blockchain Technology	2	0	0	2	20	30	50
5	MINOR	BCA805	Entrepreneurship Development	2	0	0	2	20	30	50
6	MINOR	BCA806	Deep learning lab	0	0	2	2	20	30	50
7	MINOR	BCA807	Wireless and Mobile Computing Lab		0	2	2	20	30	50
TOTAL				16	0	6	22	190	360	550

FIRST SEMESTER

Course Code : BCA101
Course: Computer Fundamental

Course Objective: This course aims to provide a comprehensive understanding of computer hardware components and functions, covering disk storage, memory, input/output devices, and peripherals. It introduces basic operating system concepts including MS-DOS and Windows, along with networking fundamentals such as internet basics, TCP/IP, and client-server architecture. Students will grasp number systems, logic operations, and programming fundamentals, while also gaining insights into language generation, assembly languages, and high-level languages.

Course Outcome: On successful completion of the course, students will be able to:

1. Understand the concept of hardware and software.
2. Acquainting with input and output devices.
3. Understand networking concepts and models.
4. Learn and aware of Internet activities.

Course Content:

Unit 1 Computer Hardware Components and Functions

Introduction to Computers: Computer hardware Components, Disk Storage, memory, keyboard, mouse, printers, monitors, CD etc., and their functions, Comparison Based analysis of various hardware components.

Unit 2 Basic Operating System Concepts and Networking

Basic Operating System Concepts: MS-DOS, WINDOWS, Functional knowledge of these operating systems. Introduction to Basic Commands of DOS, Managing File and Directories in various operating Systems, Introduction to internet, Basic terms related with Internet, TCP/IP. Network Topologies, Client-server Architecture, IoT, Cloud Computing

Unit 3 Number Systems, Logic Operations, and Programming Fundamentals

Binary, Hexadecimal Number System; Basic Binary Logic Operations; Binary Addition and Subtraction; Generation of Languages, Assembly Language, High level language; Translators, Interpreters, Compilers, Algorithm, Flow Charts, Dataflow Diagram,

Unit 4 Elements of a Computer Processing System and Software

Element of a computer processing system: Hardware CPU, storage devices and media, VDU, input-output devices, data communication equipment software-system software, application software.

Unit 5 NICNET, ERNET, E-commerce, and Multimedia Introduction

Basic Awareness of NICNET and ERNET; E Commerce, E governance; Brief Introduction to Different Formats of Image, Audio, Video. Data Concepts and Data Processing, Data Science, Data Representation, Application of IT to E-commerce, Electronic Governance, Multimedia, Entertainment, Introduction to Information System

Recommended Books:

1. Sinha, Sinha, “Computer Fundamentals”
2. Yadav R. P. , “Information Technology”

Course Code BCA102
Course: Programming in C

Course Objective: The Programming in C course aims to provide students with a solid foundation in programming using the C language. Participants will start by learning the basics of C syntax, data types, and control structures, progressing to more advanced topics like functions, pointers, and memory management. The course focuses on developing problem-solving skills through hands-on coding exercises and projects, enhancing participants' ability to translate real-world problems into C programs.

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

1. Understand the basic programming concepts and syntax of the C language.
2. Design and implement algorithms to solve simple programming problems.
3. Write, compile, and execute C programs using integrated development environments (IDEs).

Course Content:

Unit 1 Introduction to C Programming

Basics of C programming language, Structure of C program, Data types, Variables, Constants, Input and Output functions, Operators, Expressions, Control structures: if, if-else, switch.

Unit 2 Loops and Functions

Looping constructs: while, do-while, for, Nested loops, Arrays, Strings, Pointers, Functions: declaration, definition, call, return, and recursion.

Unit 3 Storage Classes and Preprocessor

Storage Classes: auto, extern, static, register, Scope and lifetime of variables, Introduction to the Preprocessor, Macros, Conditional compilation.

Unit 4 User-defined Data Types

Structures and Unions, Introduction to user-defined data types, Structures: declaration, initialization, accessing members, Arrays of structures, Pointers to structures, Unions: declaration, accessing members.

Unit 5 File Handling and Command-line Arguments

File operations: Opening, Reading, Writing, and Closing files, Random Access to files, Command-line arguments, File handling functions, Error handling.

Recommended Books:

1. "C Programming Absolute Beginner's Guide" by Greg Perry and Dean Miller.
2. "The C Programming Language" by Brian W. Kernighan

Course Code BCA103
Course: Internet Technologies

Course Objective: The Internet Technologies course aims to provide participants with a comprehensive understanding of the foundational concepts and technologies that underpin the modern internet. Participants will explore the layers of the internet stack, from networking protocols and web technologies to security and emerging trends. The course covers web development essentials including HTML, CSS, and JavaScript, enabling participants to create interactive and responsive web pages. Participants will gain insights into server-side scripting languages, database integration, and server deployment.

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

1. Understand the working principles of the internet and its protocols.
2. Develop static web pages using HTML and CSS.
3. Implement interactive features on web pages using JavaScript.

Course Content:

Unit 1 Introduction to Internet Technologies

Overview of the Internet and its evolution, Internet protocols: TCP/IP, HTTP, DNS, SMTP, etc., IP addressing and subnetting, Domain Name System (DNS), Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS).

Unit 2 Client-Side Web Technologies

JavaScript programming fundamentals, Document Object Model (DOM) manipulation, Client-side form validation, Introduction to Web development frameworks (e.g., React, Angular).

Unit 3 Server-Side Web Technologies

Server-side scripting languages (e.g., PHP, Python, Node.js), Handling HTTP requests and responses, Database connectivity and management, Session and cookies management.

Unit 4 Web Security and Emerging Technologies

Web security fundamentals: Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), etc., Secure Socket Layer (SSL) and Transport Layer Security (TLS), Introduction to Web services and APIs, Emerging technologies and trends in Internet Technologies.

Recommended Books:

1. "HTML and CSS: Design and Build Websites" by Jon Duckett.
2. "JavaScript and JQuery: Interactive Front-End Web Development" by Jon Duckett.

Course Code BCA104
Course: Mathematical Foundation

Course Objective: The objective of the "Mathematical Foundations of Computer Science" course is to introduce students to the mathematical concepts and techniques that underpin various areas of computer science. The course aims to help students develop a strong foundation in mathematical reasoning and problem-solving skills that are essential for understanding algorithms, data structures, and theoretical aspects of computer science.

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

1. Understand fundamental mathematical concepts and their applications in computer science.
2. Analyze algorithms and data structures using mathematical techniques.
3. Formulate and solve problems in computer science using mathematical modeling.
4. Apply mathematical reasoning to analyze the efficiency and correctness of algorithms.
5. Gain a deeper appreciation of the theoretical underpinnings of computer science.

Course Content:

Unit 1 Mathematical Logic

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers

Unit 2 Set Theory

Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams

Unit 3 Functions

Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.

Unit 4 Combinatorics

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems

Unit 5 Number Theory

Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems

Recommended Books:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.

Course Code BCA105
Course: Life Skills and Personality Development

Course Objective: The Life Skills and Personality Development Course aims to equip participants with essential skills and knowledge to enhance their personal growth, interpersonal relationships, and overall well-being. The course is designed to empower individuals to navigate various life situations effectively, develop a positive self-image, and foster the traits necessary for a successful and fulfilling life.

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

1. Develop effective communication skills, including active listening and empathetic expression.
2. Enhance emotional intelligence to manage emotions, empathize with others, and navigate social situations.
3. Cultivate resilience and stress management techniques to cope with challenges and setbacks.
4. Master time management and goal-setting, enabling efficient task prioritization and achievement.

Course Content:

UNIT 1 Career and Professional Skills

Career and Professional Skills: Listening Skills, Reading Skills, Writing Skills, Effective Resume preparation, Interview Skills, Group Discussion Skills, Exploring Career Opportunities, Psychometric Analysis and Mock Interview Sessions

Team Skills: Cognitive and Non-Cognitive Skills, Presentation Skills, Trust and Collaboration, Listening as a Team Skill, Brainstorming, Social and Cultural Etiquettes

Digital Skills: Computer skills, Digital Literacy and Social Media, Digital Ethics and Cyber Security

UNIT 2 Attitude and Motivation

Attitude: Concept, Significance, Factors affecting attitudes, Positive attitude - Advantages, Negative attitude- Disadvantages, Ways to develop positive attitude, Difference between personalities having positive and negative attitude.

Motivation: Concept, Significance, Internal and external motives - Importance of self- motivation- Factors leading to de-motivation, Maslow's Need Hierarchy Theory of Motivation

UNIT 3 Stress-management and Development of Capabilities

Development of will power, imagination through yogic lifestyle, Development of thinking, emotion control and discipline of mind through Pranayama, Improvement of memory through meditation-Stress: meaning, causes, and effects of stress in life management, Stress: psycho-physical mechanism, management of stress through Yoga.

UNIT 4 Other Aspects of personality Development

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills -Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics – Good manners and etiquette.

UNIT 5 Health and Hygiene

Health and Hygiene- Meaning and significance for Healthy Life, Exercise and Nutrition and Immunity. Obesity- Meaning, Types and its Hazards. - Physical Fitness and Health Related Physical Fitness- Concept, Components and Tests, Adventure Sports.

Recommended Books:

1. Barun K. Mitra, "Personality Development & Soft Skills", Oxford Publishers, Third impression, 2017.
2. Ghosh, Shantikumar. 2004. Universal Values. Kolkata: The Ramakrishna Mission Larry James, "The First Book of Life Skills"; First Edition, Embassy Books, 2016.

SECOND SEMESTER

Course Code BCA201
Course: Object Oriented Programming using C++

Course Objective: The objective of this course is to introduce students to the principles and concepts of object-oriented programming using the C++ programming language. The course aims to develop students' skills in designing and implementing object-oriented solutions to real-world problems.

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

1. Understand the fundamental concepts of object-oriented programming.
2. Design and implement C++ programs using classes, objects, and inheritance.
3. Apply polymorphism and templates to develop reusable code.
4. Utilize advanced features of C++ to develop efficient and modular programs.

Course Content:

Unit 1 Introduction to Object-Oriented Programming (OOP)

OOP concepts: Abstraction, Encapsulation, Inheritance, Polymorphism, Procedural Vs. Object-Oriented Programming, Principles of OOP and their benefits.

Unit 2 C++ Programming Basics

Program structure and basic syntax in C++, Namespaces, Identifiers, Variables, Constants, Enums, Operators and typecasting in C++.

Unit 3 Classes and Objects

Classes and Objects in C++, Access specifiers: Public, Private, Protected, Constructors and Destructors in classes.

Unit 4 Inheritance and Polymorphism

Concept of Inheritance and its types, Polymorphism and function overloading, Virtual functions and abstract classes.

Unit 5 Exception Handling and File I/O

Introduction to exception handling, try-catch blocks, Exception propagation, File input and output operations in C++.

Recommended Books:

1. "C++ Primer" by Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo.
2. "Effective C++: 55 Specific Ways to Improve Your Programs and Designs" by Scott Meyers.

Course Code BCA202
Course: Computer Architecture and Digital Electronics

Course Objective: The objective of this course is to introduce students to the fundamental principles and concepts of computer organization, architecture, and digital electronics. The course aims to provide students with a solid understanding of how computers are designed and how digital circuits operate, enabling them to comprehend the interactions between hardware and software components.

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

1. Understand the architecture and organization of a computer system, including the CPU, memory, and I/O devices.
2. Comprehend the basic principles of digital electronics, including logic gates, flip-flops, and combinational and sequential circuits.
3. Analyze and design digital circuits using Boolean algebra and logic gate representations.
4. Explain the functioning of various computer components, such as registers, ALU, control unit, and memory hierarchy.
5. Evaluate the performance of computer systems and understand the trade-offs involved in hardware design.

Course Content:

Unit 1 Introduction to Digital Electronics

Number systems and binary arithmetic, Boolean algebra and logic gates, Combinational logic circuits, Sequential logic circuits and flip-flops.

Unit 2 Combinational Logic Design

Multiplexers and demultiplexers, Encoders and decoders, Adders, subtractors, and ALU design.

Introduction to HDL (Hardware Description Language) for circuit design.

Unit 3 Sequential Logic Design

Latches and flip-flops, Counters and shift registers, Finite State Machines (FSMs) and their design.

Unit 4 Computer Organization and Architecture

Von Neumann architecture, CPU organization and instruction execution cycle, Memory hierarchy and caching, Input and output devices and interfaces, DMA.

Unit 5 Advanced Topics

Pipeline architecture and instruction pipelining, Introduction to parallel processing and multi-core systems, Introduction to RISC (Reduced Instruction Set Computer) and CISC (Complex Instruction Set Computer) architectures, Overview of emerging trends in computer architecture.

Recommended Books:

1. Mano, M. M., & Ciletti, M. D. (2017). Digital Design.
2. Patterson, D. A., & Hennessy, J. L. (2017). Computer Organization and Design: The Hardware/Software Interface.

Course Code BCA203
Course: Computer Based Numerical Techniques

Course Objective: The objective of this course is to provide students with an understanding of numerical techniques and algorithms for solving mathematical problems encountered in computer-based applications. The course aims to develop students' skills in applying numerical methods to practical problems.

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

1. Understand the principles and importance of numerical techniques.
2. Apply numerical methods for solving mathematical problems.
3. Implement algorithms for numerical differentiation and integration.
4. Use interpolation techniques for data analysis and approximation.
5. Solve ordinary differential equations numerically.

Course Content:

Unit 1 Introduction to Numerical Techniques

Overview of numerical methods and their applications, Errors in numerical computations and methods to reduce them.

Unit 2 Solving Equations

Bisection method, Newton-Raphson method, Secant method, Root-finding techniques and convergence criteria.

Unit 3 Interpolation and Approximation

Interpolation methods: Lagrange interpolation, Newton's divided difference, Curve fitting techniques: Least squares approximation.

Unit 4 Numerical Integration and Differentiation

Numerical integration methods: Trapezoidal rule, Simpson's rule, Numerical differentiation techniques.

Unit 5 Linear Algebraic Equations and Eigenvalue Problems

Solving systems of linear equations: Gaussian Elimination, LU Decomposition, Eigenvalues and Eigenvectors using numerical methods.

Recommended Books:

1. "Numerical Methods: Principles, Analysis, and Algorithms" by Roland W. Freund and Gene H. Golub.
2. "Numerical Recipes: The Art of Scientific Computing" by William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery.

Course Code BCA204
Course: Business Intelligence

Course Objective: The objective of this course is to provide students with an understanding of business intelligence concepts, tools, and techniques. The course aims to develop students' skills in analyzing and interpreting data to support decision-making and business performance.

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

1. Understand the fundamentals of business intelligence and data analytics.
2. Analyze and interpret data using business intelligence tools and techniques3. Design and develop data warehouses and data marts.
3. Apply data visualization techniques to present insights effectively.
4. Understand the ethical and legal considerations in business intelligence.

Course Content:

Unit 1 Introduction to Business Intelligence (BI)

Definition and scope of Business Intelligence, Components and architecture of BI systems, Data warehousing and data integration.

Unit 2 Data Analysis and Reporting

Data visualization techniques, Reporting tools and dashboards, Online Analytical Processing (OLAP).

Unit 3 Data Mining and Predictive Analytics

Data mining techniques and algorithms, Predictive modeling and forecasting, Pattern recognition and association rules.

Unit 4 Business Performance Management

Key Performance Indicators (KPIs), Balanced Scorecard approach, Performance monitoring and benchmarking.

Recommended Books:

1. "Business Intelligence: A Managerial Approach" by Ramesh Sharda, Dursun Delen, Efraim Turban, and David King.
2. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and Margy Ross.

COURSE CODE: BCA205

COURSE NAME: COMMUNICATION SKILLS-I

Course Objectives:

- To enable students to communicate effectively in both oral and written forms.
- To enhance vocabulary, grammar, and fluency in English.
- To develop interpersonal skills through group discussions, role-plays, and presentations.
- To familiarize students with professional communication formats (emails, reports, resumes).
- To promote the use of technology for communication and collaboration.

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

CO1	Apply principles of effective communication in interpersonal and professional contexts.
CO2	Demonstrate listening skills and comprehend spoken English in formal and informal settings.
C03	Construct grammatically correct sentences and organize ideas in written communication.
C04	Develop confidence in public speaking and presentations.

Unit	Content	Credit	Weightage
I	**Foundations of Communication** **Topics:** • **Introduction to Communication** o Process, types (verbal, non-verbal), barriers, and principles of effective communication. • **Listening Skills** o Types of listening, barriers, active listening techniques. • **Grammar and Vocabulary Building** o Tenses, articles, prepositions, common errors. o Word formation, synonyms, antonyms, contextual vocabulary. • **Reading Comprehension** o Skimming, scanning, inferring meaning from texts. • **Spoken English Basics** o Pronunciation, intonation, everyday conversations.	1	50%

II	**Applied and Professional Communication Topics:**
	• **Professional Writing**
	  o Emails, memos, notices, formal letters.
	• **Presentation Skills**
	  o Structure, body language, visual aids, handling Q&A.
	• **Group Discussion and Public Speaking**
	  o Techniques, coherence, persuasion, and fluency.
	• **Digital Communication Tools**
	  o Online meeting etiquette, collaborative platforms, netiquette.
	• **Introduction to Soft Skills**
	  o Teamwork, time management, interpersonal skills.
		1	50%

Textbooks:

- *Technical Communication* by Meenakshi Raman & Sangeeta Sharma (Oxford).

Reference books:

- *Communication Skills* by Sanjay Kumar & Pushp Lata (Oxford).
- *English for Engineers* by C. Muralikrishna & Sunita Mishra (Cambridge).
- *Essential Grammar in Use* by Raymond Murphy.

Online Platforms:

1. Grammar & Writing:
   - Grammarly, Purdue OWL, British Council Learn English.
2. Speaking & Listening:
   - BBC Learning English, TED Talks, Coursera (Communication Courses).
3. Collaboration & Presentations:
   - Google Workspace (Docs, Slides), Canva, Zoom/Teams for practice.
4. Self-Assessment:

Kahoot! (quizzes), Duolingo English Test, YouTube channels for pronunciation

THIRD SEMESTER

Course Code BCA301
Course: Data Structure & File Organization

Course Objective: The objective of this course is to familiarize students with fundamental data structures and their applications in solving computational problems. The course aims to develop students' skills in designing, implementing, and analysing various data structures.

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

1. Understand the concepts of data structures and their importance in computing.
2. Implement and use common data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
3. Analyze the time and space complexity of algorithms related to data structures.
4. Apply data structures to efficiently solve real-world problems.

Course Content:

Unit 1 Introduction to Data Structures

Overview of data organization and data types, Arrays, Linked Lists, and Stacks, Queues and their implementations.

Unit 2 Trees and Graphs

Binary Trees and Binary Search Trees, AVL Trees and Red-Black Trees, Graph representation and traversal.

Unit 3 Hashing

Introduction to hashing and its applications. Hash functions and collision resolution techniques. Hash tables and their implementation. Understanding the efficiency of hash-based data structures.

Unit 4 Sorting and Searching Algorithms

Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Linear and Binary Search.

Unit 5 File Organization and Indexing

Fundamentals of file organization: sequential, direct, and indexed. Primary and secondary indexing techniques. B+-tree index structure and its role in efficient data retrieval. Case studies of file organization in database systems.

Recommended Books:

1. "Data Structures and Algorithms in Java" by Robert Lafore.
2. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.

Course Code BCA302
Course: Operating System

Course Objective: The objective of this course is to provide students with a comprehensive understanding of operating systems and their functionalities. The course aims to develop students' knowledge of process management, memory management, file systems, and device management in an operating system environment.

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

1. Understand the basic concepts and components of operating systems.
2. Explain the functionalities and mechanisms of process management in an operating system.
3. Understand memory management techniques and algorithms.
4. Demonstrate knowledge of file systems and file management in an operating system.
5. Understand the principles of device management and I/O operations in an operating system.

Course Content:

Unit 1 Introduction to Operating Systems

Overview of operating systems and their role, Types of operating systems: batch processing, time-sharing, real-time, distributed, Operating system components and architecture

Unit 2 Process Management & Deadlock

Process concept and process control block, Process scheduling algorithms: FCFS, SJF, Round Robin, etc., Inter-Process communication and synchronization, Deadlock, Deadlock prevention, avoidance, detection, and recovery, Resource allocation graphs and deadlock handling algorithms, Banker's algorithm for resource allocation and safety

Unit 3 Memory Management

Memory hierarchy and memory management techniques, Paging, segmentation, and virtual memory, Memory allocation and deallocation strategies, Page Replacement algorithms

Unit 4 File Systems

File concepts and file organization, File operations: creation, deletion, read, write, File allocation methods: contiguous, linked, indexed

Unit 5 Device Management

I/O devices and device controllers, I/O operations and I/O scheduling, Disk scheduling algorithms

Recommended Books:

1. "Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne.
2. "Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos.

Course Code BCA303
Course: Python Programming

Course Objective: This course is designed as the first course that introduces programming concepts using Python to Computer Science students. The course focuses on the development of Python programming to solve problems of different domains. It also introduces the concept of object-oriented programming

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

1. Understand the basics of programming language
2. Develop, document, and debug modular Python programs.
3. Apply suitable programming constructs and built-in data structures to solve a problem.
4. Use and apply various data objects in Python.
5. Use classes and objects in application programs and handle files.

Unit 1 Introduction to Programming

Problem solving strategies; Structure of a Python program; Syntax and semantics; Executing simple programs in Python.

Unit 2 Creating Python Programs

Identifiers and keywords; Literals, numbers, and strings; Operators; Expressions; Input/output statements; Defining functions; Control structures (conditional statements, loop control statements, break, continue and pass, exit function), default arguments.

Unit 3 Built-in data structures

Mutable and immutable objects; Strings, built-in functions for string, string traversal, string operators and operations; Lists creation, traversal, slicing and splitting operations, passing list to a function; Tuples, sets, dictionaries and their operations.

Unit 4 Object Oriented Programming

Introduction to classes, objects and methods; Standard libraries

Unit 5 File and exception handling

File handling through libraries; Errors and exception handling.

Recommended Books:

1. "Effective Python: 90 Specific Ways to Write Better Python" by Brett Slatkin
2. ""Python Crash Course" by Eric Matthes.

Course Code BCA304
Course: Graph Theory

Course Objective: The objective of this course is to introduce students to the concepts and algorithms of graph theory and their applications in various domains. The course aims to develop students' skills in analysing and solving problems related to graphs and networks.

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

1. Understand the fundamentals of graph theory and its terminology.
2. Analyze and represent problems using graph models.
3. Apply graph algorithms to solve problems such as shortest paths, minimum spanning trees, and network flows.
4. Apply graph theory concepts to solve real-world problems in different domains.
5. Understand the applications of graph theory in computer science, operations research, and other fields.

Course Content:

Unit 1 Introduction to Graph Theory

Basic concepts: Graphs, Vertices, Edges, Types of graphs: Directed, Undirected, Weighted, etc., Graph representation: Adjacency matrix, Adjacency list.

Unit 2 Graph Traversal and Shortest Paths

Breadth-First Search (BFS) and Depth-First Search (DFS), Dijkstra's algorithm for single-source shortest path, Bellman-Ford algorithm for single-source shortest path.

Unit 3 Spanning Trees and Connectivity

Minimum Spanning Tree (MST) algorithms: Prim's, Kruskal's, Connected components and Strongly Connected Components (SCC).

Unit 4 Network Flows and Matching

Maximum Flow and Minimum Cut problem, Bipartite matching and applications, Applications of graph theory in various fields.

Unit 5 Graph Algorithms

Topological sorting, Eulerian and Hamiltonian cycles, Traveling Salesman Problem (TSP), Introduction to NP-completeness.

Recommended Books:

1. "Introduction to Graph Theory" by Douglas B. West.
2. "Graph Theory and Its Applications" by Jonathan L. Grossand Jay Yellen.

COURSE CODE: BCA305

COURSE NAME: COMMUNICATION SKILLS-II

Course Objectives:

- To equip students with advanced written and oral communication skills for professional excellence.
- To foster critical thinking and persuasive communication abilities.
- To develop technical writing proficiency for reports, proposals, and research documentation.
- To enhance digital literacy and online professional networking skills.
- To cultivate ethical, inclusive, and empathetic communication practices.

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

CO1	Analyze and apply advanced professional communication strategies in academic and workplace scenarios.
CO2	Design and deliver persuasive presentations using digital tools and visual aids.
C03	Compose complex professional documents, technical reports, and research-based content.
C04	Demonstrate leadership communication, negotiation, and interpersonal skills in group settings.

Unit	Content	Credit	Weightage
I	**Advanced Professional & Technical Communication** **Topics:** 1. **Technical Writing Essentials** o Structure, style, and clarity in technical reports, proposals, and project documentation. 2. **Research-Based Communication** o Summarizing, paraphrasing, citing sources, avoiding plagiarism. o Writing abstracts, literature reviews, and brief research articles. 3. **Persuasive Communication** o Principles of persuasion, rhetoric, and argumentation.	1	50%

	○ Writing persuasive emails, cover letters, and statements of purpose. 4. **Interpersonal and Leadership Communication** ○ Conflict resolution, negotiation, feedback delivery, and assertiveness. 5. **Ethical and Inclusive Communication** ○ Bias-free language, cultural sensitivity, and ethical considerations in professional contexts.		
II	**Digital & Multimedia Communication Topics:** 1. **Digital Presentation Mastery** ○ Advanced presentation tools (Canva, Prezi, PowerPoint), storytelling with data, and virtual presentation skills. 2. **Online Professional Presence** ○ LinkedIn profile optimization, digital networking, and professional blogging. 3. **Collaborative Digital Tools** ○ Using platforms like Slack, Trello, Google Workspace for team projects. 4. **Visual Communication & Infographics** ○ Design principles, creating infographics, and visual storytelling. 5. **Media Literacy & Critical Communication** ○ Evaluating digital sources, fact-checking, and responsible sharing of information.	1	50%

Textbooks:

- *Advanced Technical Communication* by Dr. APJ Abdul Kalam (Based on NEP guidelines, McGraw Hill).

Reference books:

- *Business Communication Today* by Courtland L. Bovée & John V. Thill (Pearson).
- *Technical Communication: Principles and Practice* by Meenakshi Raman & Sangeeta Sharma (Oxford).
- *Digital Communication and Media Literacy* by R. S. Talwar.

Online Platforms:

1. Writing & Research:
    - Grammarly (Premium features), Turnitin, Mendeley/Zotero, Purdue OWL.
2. Presentation & Visual Tools:
    - Canva, Prezi, Piktochart, Visme.
3. Professional Networking:
    - LinkedIn Learning, Coursera (courses on persuasive communication, digital literacy).
4. Collaboration Platforms:
    - Slack, Trello, Google Jamboard, Microsoft Teams.
5. Practice & Assessment:
    - TED-Ed for critical thinking, Flipgrid for video presentations, MindTools for soft skills.

FOURTH SEMESTER

Course Code BCA401
Course: Computer Network

Course Objective: The objective of this course is to provide students with an understanding of data communication and computer networks. The course aims to develop students' knowledge of network protocols, architectures, and technologies.

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

1. Understand the fundamentals of data communication and networking concepts.
2. Analyze and design network architectures and topologies.
3. Configure and troubleshoot network devices and protocols.
4. Apply network security measures to protect data transmission.
5. Understand emerging trends and technologies in data communication and networks.

Course Content:

Unit 1 Introduction to Data Communication & Networks

Components of a data communication system, Types of networks, Network topologies and communication protocols.

Unit 2 Network Architecture and OSI Model

Network architecture: client-server, peer-to-peer, OSI model layers and their functions, TCP/IP protocol suite.

Unit 3 Data Link Layer and Network Devices

Data link layer: framing, error detection, flow control, Network devices: switches, routers, bridges, etc., MAC addressing and Ethernet standards.

Unit 4 Network Security and Wireless Networks

Network security concepts: encryption, firewalls, VPN, Wireless networks and technologies.

Unit 5 Network Management and Emerging Technologies

Network management and monitoring tools, Cloud computing and virtualization, Internet of Things (IoT).

Recommended Books:

1. "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross.
2. "Data Communications and Networking" by Behrouz A.Forouzan and Sophia Chung Fegan.

Course Code 402
Course: Database Management System

Course Objective: The objective of this course is to provide students with a comprehensive understanding of database management systems (DBMS) and their role in modern information management. The course aims to develop students' skills in designing, querying, and managing relational databases.

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

1. Understand the concepts and principles of database management systems.
2. Design and create relational databases using SQL.
3. Query and manipulate data using SQL commands.
4. Apply normalization techniques to ensure data integrity.
5. Understand the principles of database administration and security.

Course Content:

Unit 1 Introduction to Database Management System

Overview of database systems and their components, Data models: hierarchical, network, relational, and object-oriented, Relational database concepts: tables, tuples, attributes, keys, etc.

Unit 2 Entity-Relationship Diagrams and Normalization

Entity-Relationship (ER) modeling, Functional dependencies and normalization, Normal forms: 1NF, 2NF, 3NF, BCNF.

Unit 3 Query Languages and Transactions

SQL fundamentals: SELECT, INSERT, UPDATE, DELETE, Joins and subqueries, ACID properties and transaction management.

Unit 4 Indexing and Concurrency Control

Indexing techniques: B-trees, hash indexes, etc., Concurrency control methods: locking, timestamping, etc., Database recovery and backup strategies.

Recommended Books:

1. "Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan.
2. "SQL Performance Explained" by Markus Winand.

Course Code BCA403
Course: R Programming

Course Objective: The R Programming course aims to provide participants with a comprehensive understanding of the R programming language and its applications in data analysis and statistical computing. Participants will start by gaining proficiency in the basics of R syntax, data structures, and control flow. As the course progresses, they will delve into data manipulation, visualization, and statistical analysis using R's extensive ecosystem of packages.

Course Outcome: By the end of this course, students:

1. be able to use and program in the programming language R
2. be able to use R to solve statistical problems
3. be able to implement and describe Monte Carlo the technology
4. be able to minimize and maximize functions using R

Course Content:

Unit 1: Getting Started with R

Introduction to R Programming, Setting Up R Studio, Basics of R Syntax, Storing Data with Variables, Displaying Data: Input and Output

Unit 2: Working with Data

Different Data Types in R, Organizing Data: Vectors and Matrices, Cleaning and Transforming Data, Basic Data Analysis, Creating Simple Charts

Unit 3: Coding Control and Functions

Making Choices with if and else, looping with for and while, Building Own Functions, Using Functions Effectively, Handling Mistakes: Debugging

Unit 4: Creating Visuals

Introduction to Data Visualization, Simple Plots with R, Customizing Graphics, Creating More Advanced Plots, Interactive Visualizations

Unit 5: Understanding Data Patterns

Exploring Data Stats, Basics of Hypothesis Testing, Understanding Regression, Introduction to Machine Learning, Practical Applications: Classification and Clustering

Recommended Books:

1. R Programming for Data Science by Roger D. Peng
2. The Art of R Programming by Prashanth Singh, Vivek Mourya, Cengage Learning India.

Course Code BCA404
Course: Software Testing

Course Objective: The objective of this course is to provide students with an understanding of software testing principles, techniques, and methodologies. The course aims to develop students' skills in designing test cases, executing tests, and reporting defects.

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

1. Understand the importance of software testing in the software development life cycle.
2. Apply different testing techniques and methodologies.
3. Design and execute test cases to verify software functionality.
4. Identify and report software defects effectively.
5. Understand the role of automated testing tools in software testing.

Course Content:

Unit 1 Introduction to Software Testing

Fundamentals of software testing, Testing life cycle and testing methodologies, Types of testing: functional, non-functional, etc.

Unit 2 Test Planning and Test Case Design

Test planning and test strategy development, Test case design techniques: black-box, white-box, etc., Test data preparation and test environment setup.

Unit 3 Test Execution and Defect Management

Test execution and defect reporting, Test automation and test scripts, Defect management and tracking.

Unit 4 Performance and Security Testing

Performance testing: load, stress, and scalability testing, Security testing: vulnerabilities and penetration testing, Usability testing and user experience evaluation.

Unit 5 Test Automation Tools and Emerging Trends

Introduction to test automation tools (e.g., Selenium, JUnit), Continuous integration and continuous testing, Emerging trends in software testing.

Recommended Books:

1. "Foundations of Software Testing" by Dorothy Graham, Erik Van Veenendaal, Isabel Evans, and Rex Black.
2. "The Art of Software Testing" by Glenford J. Myers.

Course Code BCA405
Course: Software Engineering

Course Objective: The objective of this course is to provide students with an understanding of software engineering principles, processes, and methodologies. The course aims to develop students' skills in software requirements analysis, design, implementation, and testing.

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

1. Understand the principles and practices of software engineering.
2. Apply software engineering processes and methodologies to develop software systems.
3. Perform requirements analysis and software design.
4. Implement software using appropriate programming languages and development tools.
5. Apply software testing and quality assurance techniques.

Course Content:

Unit 1 Introduction to Software Engineering

Software development life cycle (SDLC) models, Requirements engineering and analysis, Software project management.

Unit 2 Software Design and Architecture

Software design principles and patterns, Architectural styles: layered, client-server, etc., UML and design documentation.

Unit 3 Software Development Methodologies

Agile software development: Scrum, Kanban, etc., Waterfall and iterative development approaches, Quality assurance and software testing.

Unit 4 Software Maintenance and Configuration Management

Software maintenance and its challenges, Version control and configuration management, Software re-engineering and refactoring.

Unit 5 Software Metrics and Emerging Practices

Software metrics and measurement, Software documentation and knowledge management, Emerging practices in software engineering: DevOps, etc.

Recommended Books:

1. "Software Engineering: A Practitioner's Approach" by Roger S. Pressman.
2. "Software Engineering: Principles and Practice" by Hans van Vliet.

FIFTH SEMESTER

Course Code 501
Course: Compiler Design

Course Objective: The course aims to provide participants with a comprehensive understanding of compiler construction principles, enabling them to design, implement, and optimize compilers for programming languages.

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

1. Explain the phases of compilation and their role in transforming source code.
2. Define context-free grammars and construct parse trees.
3. Perform semantic analysis to catch programming errors.
4. Apply optimization techniques to improve code efficiency.
5. Implement code generation for various target architectures.

Course Content:

Unit 1 Introduction to Compiler Design

Introduction to compilers: Role, importance, and phases of compilation. Overview of lexical analysis, syntax analysis, semantic analysis, code generation, and optimization. Compiler architecture and its components.

Unit 2 Syntax Analysis and Parsing Techniques

Formal language grammars: Regular, context-free, and context-sensitive grammars. Parsing techniques: Top-down parsing (LL parsing) and bottom-up parsing (LR parsing). Construction of parse trees and abstract syntax trees.

Unit 3 Semantic Analysis and Type Checking

Semantic analysis: Role and importance in error detection and correction. Symbol tables: Organization, scope, and management of symbols. Type systems and type checking: Static and dynamic type checking, type inference.

Unit 4 Code Generation and Optimization

Intermediate code generation: Three-address code, quadruples, and intermediate representations. Basic block representation and control flow graphs. Code optimization techniques: Constant folding, common subexpression elimination, loop optimization.

Unit 5 Compiler Design Tools and Debugging

Lexical analysis using tools like Lex. Syntax analysis using tools like Yacc (Bison). Debugging techniques for compilers and tools. Hands-on exercises to implement a basic compiler using Lex and Yacc.

Recommended Books:

1. **"Modern Compiler Implementation in C/Java/ML"** by Andrew W. Appel
2. **"Engineering a Compiler"** by Keith D. Cooper and Linda Torczon.

Course Code BCA502
Course: Computer Graphics

Course Objective: The objective of this course is to provide students with a solid foundation in computer graphics principles and techniques. The course aims to develop students' skills in designing and rendering 2D and 3D graphics, understanding graphics algorithms, and applying graphics concepts in interactive applications.

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

1. Understand the fundamentals of computer graphics and its applications.
2. Design and render 2D and 3D graphics using appropriate tools and libraries.
3. Implement graphics algorithms for transformations, rasterization, and shading.
4. Apply computer graphics concepts in interactive applications and virtual environments.
5. Analyse and optimize graphics performance in real-time applications.

Course Content:

Unit 1 Introduction to Computer Graphics

Overview of computer graphics and its applications, Graphics hardware and software, Graphics pipeline and rendering techniques

Unit 2 2D Graphics and Transformations

2D coordinate systems and transformations, Clipping and windowing techniques, 2D viewing and projection transformations

Unit 3 3D Graphics and Transformations

3D coordinate systems and transformations, Viewing and projection in 3D space, Hidden surface removal and visibility algorithms

Unit 4 Rasterization and Shading

Rasterization techniques: scanline, polygon filling, Shading models and illumination techniques, Texture mapping and image-based rendering

Unit 5 Interactive Graphics and Virtual Environments

User interaction techniques in computer graphics, Virtual reality and augmented reality concepts, Real-time graphics programming and optimization

Recommended Books:

1. "Computer Graphics: Principles and Practice" by John F. Hughes, Andries van Dam, James D. Foley, Steven K. Feiner, and Kurt Akeley.
2. "OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5" by John Kessenich, Graham Sellers, and Dave Shreiner.

Course Code BCA503
Course: ASP.Net

Course Objective: The ASP .NET course aims to equip student with a strong foundation in developing dynamic web applications using the ASP .NET framework. Through the course, participants will learn how to design and build interactive web pages, utilizing languages like C# for server-side logic. They will grasp concepts of model-view-controller (MVC) architecture, essential for creating scalable and maintainable web applications.

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

1. To learn fundamentals of. net framework
2. To enrich knowledge about Windows Forms, Controls and ASP.NET based applications.
3. To acquire skills to create web-based applications and Reports using.net technologies

Course Content:

Unit 1 Introduction to .NET Framework and Managed Code

Introduction to .NET Framework: Managed Code and the CLR- Intermediate Language, Metadata and JIT Compilation - Automatic Memory Management

Unit 2 Language Concepts, CLR, and Framework Class Library

Language Concepts and the CLR: Visual Studio .NET - Using the .NET Framework. The Framework Class Library: NET objects - ASP .NET - .NET web services – Windows Forms

Unit 3 ASP.NET Features and Web Services

ASP.NET Features: Change the Home Directory in IIS - Add a Virtual Directory in IIS- Set a Default Document for IIS - Change Log File Properties for IIS - Stop, Start, or Pause a Web Site.

Unit 4 Web Controls and Creating Web Forms

Creating Web Controls: Web Controls - HTML Controls, Using Intrinsic Controls, Using Input Validation Controls, Selecting Controls for Applications - Adding web controls to a Page. Creating Web Forms: Server Controls - Types of Server Controls - Adding ASP.NET Code to a Page.

Recommended Books:

1. "Professional ASP.NET 4.5 in C# and VB" by Jason N. Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, and Scott Hanselman
2. "ASP.NET Core 5 for Beginners" by Jonas Fagerberg

Course Code BCA504
Course: Multimedia Application

Course Objective: The objective of this course is to provide students with an understanding of multimedia technology and its applications in various domains. The course aims to develop students' skills in designing and developing multimedia content, integrating multimedia elements, and applying multimedia technologies.

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

1. Understand the concepts and components of multimedia technology.
2. Design and develop multimedia content using appropriate tools and techniques.
3. Integrate various multimedia elements such as text, images, audio, and video.
4. Apply multimedia technologies in interactive applications and presentations.
5. Evaluate and optimize multimedia content for different platforms and devices.

Course Content:

Unit 1 Introduction to Multimedia Technology

Overview of multimedia technology and its components, Multimedia elements: text, images, audio, video, Multimedia file formats and compression techniques

Unit 2 Multimedia Authoring Tools and Techniques

Multimedia authoring software and tools, Design principles for multimedia content, Multimedia scripting and programming languages

Unit 3 Image and Video Processing in Multimedia

Image and video acquisition and editing, Image and video compression techniques, Image and video enhancement and effects

Unit 4 Audio and Animation in Multimedia

Digital audio concepts and formats, Audio editing and processing techniques, Animation principles and techniques

Unit 5 Multimedia Integration and Application Development

Integration of multimedia elements in interactive applications, Multimedia in web design and development, Optimization and delivery of multimedia content

Recommended Books:

1. "Multimedia: Making It Work" by Tay Vaughan.
2. "Multimedia Systems: Algorithms, Standards, and Industry Practices" by Parag Havaldar and Gerard Medioni.

COURSE CODE: BCA505

COURSE NAME: INDIAN CONSTITUION (IC)

Course Objectives:

- To impart foundational knowledge of the Indian Constitution's framework and principles.
- To develop critical understanding of rights, duties, and governance structures.
- To foster constitutional morality, secularism, and respect for diversity.
- To enable students to engage with legal and political systems as informed citizens.
- To integrate digital tools for accessing constitutional resources and updates.

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

CO1	Explain the historical context, philosophy, and salient features of the Indian Constitution.

CO2	Analyze the structure, functions, and interrelationships of the three organs of the Indian government.
C03	Interpret Fundamental Rights, Directive Principles, and Fundamental Duties and their application in contemporary society.
C04	Evaluate the electoral process, federal structure, and constitutional mechanisms for social justice.

Unit	Content	Credit	Weightage
I	**Foundations and Framework of the Indian Constitution** **Topics:** 1. **Historical Background and Making of the Constitution** o Constituent Assembly, philosophical influences (Indian and Western), Preamble, and its significance. 2. **Salient Features and Basic Structure** o Federalism, parliamentary system, secularism, sovereignty, socialist, democratic republic. o Basic structure doctrine (Kesavananda Bharati case). 3. **Fundamental Rights (Part III)** o Detailed study of Articles 14-32: Right to Equality, Freedom, against Exploitation, Religion, Cultural & Educational Rights, Constitutional Remedies. 4. **Directive Principles of State Policy (Part IV) & Fundamental Duties (Part IV-A)** o Nature, significance, and relationship with Fundamental Rights. o Duties of citizens (Article 51A).	1	50%
II	**Governance, Democracy, and Contemporary Issues** **Topics:** 1. **Union and State Executive, Legislature, and Judiciary**	1	50%

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	○ President, Prime Minister, Parliament; Governor, Chief Minister, State Legislature. ○ Supreme Court and High Courts: powers, jurisdiction, and judicial review. 2. **Federalism and Centre-State Relations** ○ Division of powers (Union, State, Concurrent Lists), emergency provisions. 3. **Electoral Process and Democratic Institutions** ○ Election Commission, electoral reforms, participation, and challenges. 4. **Constitutional Mechanisms for Social Justice** ○ Reservations, Scheduled Castes/Tribes, Other Backward Classes, Women, and Minorities. 5. **Contemporary Constitutional Debates and Amendments** ○ Major amendments, recent issues (privacy, CAA, federal disputes), digital governance, and e-courts.		

Textbooks:

- *Introduction to the Constitution of India* by Dr. D.D. Basu (LexisNexis).

Reference books:

- *Indian Polity* by M. Laxmikanth (McGraw Hill).
- *The Constitution of India* (Bare Act, latest edition).
- *Our Constitution: An Introduction to India's Constitution and Constitutional Law* by Subhash C. Kashyap.

Online Platforms:

- SWAYAM/NPTEL: "Introduction to Indian Constitution" courses.
- Coursera: "Constitutional Interpretation" (adapted for Indian context).

SIXTH SEMESTER

Course Code BCA601
Course: Cryptography & Network Security

Course Objective: The objective of this course is to provide students with a comprehensive understanding of network security concepts and techniques. The course aims to develop students' skills in identifying network vulnerabilities, implementing security measures, and ensuring the confidentiality, integrity, and availability of networked systems.

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

1. Understand the principles and concepts of network security.
2. Identify potential security threats and vulnerabilities in networked systems.
3. Implement security measures to protect network infrastructure.
4. Apply encryption and authentication techniques to secure network communication.
5. Analyze and respond to security incidents in networked environments.

Course Content:

Unit 1 Introduction to Network Security

Basics of network security: confidentiality, integrity, availability, Security threats and vulnerabilities, Security controls and defense mechanisms.

Unit 2 Cryptography and Encryption

Cryptographic algorithms and techniques, Symmetric and asymmetric encryption, Digital signatures and certificates.

Unit 3 Network Security Protocols

Secure Socket Layer (SSL) and Transport Layer Security (TLS), IPsec and Virtual Private Networks (VPNs), Secure Shell (SSH) and Secure File Transfer Protocol (SFTP).

Unit 4 Network Access Control and Firewalls

Access control mechanisms: authentication, authorization, accounting, Network firewalls: types and configurations, Intrusion Detection and Prevention Systems (IDPS).

Unit 5 Network Security Management and Emerging Technologies

Security policy and risk management, Security incident response and handling, Emerging technologies in network security: AI-based security, etc.

Recommended Books:

1. "Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner.
2. "Principles of Computer Security: CompTIA Security+ and Beyond" by Wm. Arthur Conklin, Greg White, Dwayne Williams, Chuck Cothren, and Roger L. Davis.

Course Code BCA602
Course: Design and Analysis of Algorithm

Course Objective: The objective of this course is to provide students with a solid foundation in algorithm analysis and design techniques. The course aims to develop students' skills in solving computational problems, analysing algorithm complexity, and designing efficient algorithms.

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

1. Understand the fundamentals of algorithm analysis and design.
2. Analyse the time and space complexity of algorithms.
3. Apply algorithmic techniques to solve computational problems.
4. Design and implement efficient algorithms for real-world scenarios.
5. Evaluate and compare different algorithmic approaches for problem solving.

Course Content:

Unit 1 Introduction to Algorithms

Basics of algorithms and problem-solving techniques, Asymptotic analysis: Big-O notation, time and space complexity, Algorithm design paradigms.

Unit 2 Sorting and Searching Algorithms

Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Linear and Binary Search.

Unit 3 Divide and Conquer Algorithms

Binary search, Merge sort, Closest pair problem, Karatsuba multiplication.

Unit 4 Dynamic Programming and Greedy Algorithms

Fibonacci series, Knapsack problem, Dijkstra's algorithm, Prim's algorithm, Huffman coding.

Unit 5 Graph Algorithms and NP-Completeness

Depth-First Search (DFS) and Breadth-First Search (BFS), Shortest path algorithms, Introduction to NP-Completeness and the P vs. NP problem.

Recommended Books:

1. "Introduction to the Design and Analysis of Algorithms" by Anany Levitin.
2. "Algorithm Design Manual" by Steven S. Skiena.

Course Code BCA603
Course: Parallel Programming

Course Objective: This course aims to provide students with a comprehensive understanding of parallel computing. Starting with the need for high-speed computing and historical context, it explores diverse strategies to enhance computer speed through temporal and data parallelism. Students will grasp the structure and classifications of parallel computers, including vector supercomputers, shared memory systems, and distributed architectures. The course delves into operating systems for parallel environments, covering resource management, synchronization, and performance evaluation. Additionally, it introduces the concept of GPU computing and CUDA, discussing applications and development tools.

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

1. Solve the Problems in Parallel
2. Have knowledge on Different Structures of Parallel Computers
3. Understand the Performance Evaluation of Parallel Computers
4. Get acquaintance on CUDA
5. Develop Parallel Programs in CUDA C

Course Content:

Unit 1 Introduction to Parallel Computing and Speed Enhancement

Need of High-Speed Computing, How we increase the Speed of Computers, History of Parallel Computers, Solving problems in parallel: Utilizing Temporal Parallelism, Utilizing Data Parallelism, Comparison of Temporal and Data Parallel Processing, Data Parallel Processing with Specialized Processors.

Unit 2 Structure and Classification of Parallel Computers

Structure of parallel computers: A Generalized Structure of a Parallel Computer, Classification of Parallel Computers, Vector Computers, A Typical Vector Super Computer, Array Processors, Shared Memory Parallel Computers, Distributed Shared Memory Parallel Computers, Message Passing Parallel Computers.

Unit 3 Operating Systems and Performance Evaluation for Parallel Computers

Operating systems for parallel computers: Resource Management, Process Management, Process Synchronization, Inter-process Communication, Memory Management, Input/output (Disk Arrays), Basics of Performance Evaluation, Performance Measurement Tools.

Unit 4 Computer Unified Device Architecture (CUDA)

Computer unified device architecture: The age of parallel processing, The rise of GPU computing, CUDA, Applications of CUDA, Development Environment-CUDA Enabled Graphics Processors, NVIDIA Device driver, CUDA Development Tool kit, Standard C compiler.

Unit 5 Introduction to CUDA C and Parallel Programming

Introduction to CUDA C: First program, Querying Devices, Using Device Properties, Parallel Programming in CUDA C: CUDA Parallel Programming- Summing Vectors program

Recommended Books:

1. Parallel Computers Architecture and Programming, V. Rajaraman, C. Siva Ram Murthy,PHI.
2. CUDA By Example, Jason Sanders, Edward Kandrot, Addison_Wesley.

Course Code BCA604
Course: E-Commerce

Course Objective: The objective of this course is to provide students with an understanding of e-commerce principles, technologies, and strategies. The course aims to develop students' skills in designing, developing, and managing e-commerce systems for online business operations.

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

1. Understand the fundamentals of e-commerce and its impact on business.
2. Analyze and evaluate different e-commerce models and technologies.
3. Design and develop e-commerce websites and applications.
4. Apply security and privacy measures in e-commerce systems.
5. Understand the legal and ethical considerations in e-commerce.

Course Content:

Unit 1 Introduction to E-Commerce

Types of E-Commerce, E-Commerce business models. E-Commerce Framework

Unit 2 E-Commerce Infrastructure and Payment Systems

Electronic payment systems and security, Mobile payment and digital wallets.

Unit 3 E-Commerce Website Development

Building E-Commerce websites, Product catalogue management and online shopping cart, Customer registration and authentication.

Unit 4 E-Commerce Security and Legal Issues

Web security in E-Commerce, Legal and regulatory issues in E-Commerce, Consumer protection and privacy.

Unit 5 E-Commerce Marketing and Emerging Trends

E-Commerce marketing strategies, Social media and E-Commerce, Emerging trends in E-Commerce.

Recommended Books:

1. "E-Commerce 2021" by Kenneth C. Laudon and Carol Traver.
2. "E-Commerce: Business, Technology, Society" by Kenneth C. Laudon and Carol Guercio Traver.

SEVENTH SEMESTER

Course Code BCA701
Course: Artificial Intelligence

Course Objective: The objective of this course is to provide students with an understanding of artificial intelligence and its various techniques and applications. The course aims to develop students' skills in designing and implementing AI systems, solving AI problems, and exploring the ethical considerations of AI.

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

1. Understand the fundamental concepts and techniques of artificial intelligence.
2. Apply AI algorithms and methodologies to solve real-world problems.
3. Design and develop AI systems using appropriate tools and frameworks.
4. Evaluate and optimize AI models for performance and accuracy.
5. Recognize and analyse the ethical implications of AI technologies.

Course Content:

Unit 1 Introduction to Artificial Intelligence

Overview of artificial intelligence and its applications, History and foundations of AI, Ethical considerations in AI development and deployment

Unit 2 Problem Solving and Search Algorithms

Problem-solving techniques and algorithms, Search algorithms: uninformed and informed search, Heuristic search and optimization algorithms

Unit 3 Knowledge Representation and Reasoning

Knowledge representation techniques: logic, semantic networks, and frames, Inference mechanisms and reasoning algorithms, Uncertainty and probabilistic reasoning in AI

Unit 4 Machine Learning and AI Models

Introduction to machine learning algorithms, Supervised, unsupervised, and reinforcement learning, Deep learning and neural networks for AI applications

Unit 5 AI Systems and Applications

Natural language processing and understanding, Computer vision and image recognition, AI in robotics and autonomous systems

Recommended Books:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig.
2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy.

Course Code BCA702
Course: Cloud Computing

Course Objective: The objective of this course is to provide graduate students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations.

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

1. Understand the key dimensions of the challenges and benefits of Cloud Computing.
2. Describe the principles of Parallel and Distributed Computing and evolution of cloud computing from existing technologies
3. Implement different types of Virtualization technologies and Service Oriented Architecture systems.
4. Choose among various cloud technologies for implementing applications.
5. Install and use current cloud technologies.

Course Content:

Unit 1 Introduction to Cloud Computing

Introduction: Cloud-definition, benefits, usage scenarios, History of Cloud Computing, Cloud Architecture, Types of Clouds, Players in Cloud Computing, issues in Clouds

Unit 2 Types of Cloud Services and Providers

Types of Cloud services, Software as a Service, Platform as a Service, Infrastructure as a Service, Database as a Service, Monitoring as a Service, Communication as services. Service Providers-Google, Amazon, Microsoft Azure, IBM, Sales force.

Unit 3 Collaborating Using Cloud Services

Collaborating Using Cloud Services Email Communication over the Cloud, CRM Management, Project Management, Event Management, Task Management, Calendar, Schedules, Word Processing, Presentation, Spreadsheet, Databases, Desktop, Social Networks and Groupware

Unit 4 Virtualization for Cloud and Cloud Security

Virtualization for Cloud Need for Virtualization, Pros and cons of Virtualization, Types of Virtualizations, System VM, Process VM, Virtual Machine monitor, Virtual machine properties, HLL VM, Hypervisors, Xen, KVM, VMWare, Virtual Box, Hyper-V

Unit 5 Future Trends in Mobile Communication

Cloud Security: Infrastructure Security- Network level security, Host level security, Application-level security, Data security, Authentication in cloud computing, Cloud security challenges.

Recommended Books:

1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood
2. "Cloud Computing: A Practical Approach" by Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter

Course Code
Course: Internet of Things

Course Objective: The course aims to equip the students to understand the basics of Internet of Things (IoT) and its applications. IoT primarily refers to the connected and smarter world having physical and virtual objects with some unique identities. IoT applications spans across domains of industrial control, retail, energy, agriculture, etc.

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

1. Understand how connected devices work together to update other applications.
2. Acquire knowledge to interface sensors and actuator with microcontroller-based Arduino platform.
3. Writing C programs in Arduino IDE.
4. Build IoT based applications and understand how data flows between things.

Course Content:

Unit 1 Introduction to IoT and IoT Design

Introduction - Overview of Internet of Things (IoT), the characteristics of devices and applications in IoT ecosystem, building blocks of IoT, Various technologies making up IoT ecosystem, IoT levels, IoT design methodology, The Physical Design/Logical Design of IoT, Functional blocks of IoT and Communication Models.

Unit 2 Controlled Systems and Connectivity Models

Working of Controlled Systems, Real-time systems with feedback loop e.g., thermostat in refrigerator, AC, etc. Connectivity models – TCPIP versus OSI model, different type of modes using wired and wireless methodology, the process flow of an IoT application

Unit 3 Sensors, Actuators, and Microcontrollers

Sensor - Measuring physical quantities in digital world e.g., light sensor, moisture sensor, temperature sensor, etc. Actuator – moving or controlling system e.g., DC motor, different type of actuators Controller – Role of microcontroller as gateway to interfacing sensors and actuators, microcontroller vs microprocessor, different type of microcontrollers in embedded ecosystem.

Unit 4 Embedded "C" Language Basics and Control Structures

Building IoT applications: Embedded “C” Language basics - Variables and Identifiers, Built-in Data Types, Arithmetic operators and Expressions, Constants and Literals, assignment. Conditional Statements and Loops - Decision making using Relational Operators, Logical Connectives - conditions, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement.

Unit 5 Interfacing Sensors, Functions, and Practical Implementations

Arrays – Declaring and manipulating single dimension arrays Functions - Standard Library of C functions in Arduino IDE, Prototype of a function: Formal parameter list, Return Type, Function call. Interfacing sensors – The working of digital versus analog pins in Arduino platform, interfacing LED, Button, Sensors-DHT, LDR, MQ135. Display the data on Liquid Crystal Display (LCD), interfacing keypad, Serial communication – interfacing HC-05(Bluetooth module) Control/handle 220v AC supply – interfacing relay module.

Recommended Books:

1. Internet Of Things: A Hands-On Approach by Arsheep Bahga (Author), Vijay Madisetti (Author)
2. Internet Of Things: Key Applications and Protocols by Olivier Hersent and David Boswarthick, John Wiley

Course Code BCA704
Course: Fundamental of Data Science

Course Objective: The objective of this course is to introduce students to the fundamentals of data science and its applications in various domains. The course aims to develop students 'knowledge and skills in data manipulation, data analysis, and data visualization techniques.

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

1. Understand the fundamental concepts and principles of data science.
2. Apply data manipulation techniques using appropriate tools and libraries.
3. Analyse and visualize data to extract insights and make data-driven decisions.
4. Apply statistical methods and machine learning algorithms to analyse data.
5. Communicate data findings effectively through data visualization and storytelling.

Course Content:

Unit 1 Introduction to Data Science

Overview of data science and its significance, Data science process and lifecycle, Ethical considerations in data science

Unit 2 Data Manipulation and Preparation

Data acquisition and data cleaning techniques, Data pre-processing: handling missing data, outliers, and data normalization, Exploratory data analysis and data profiling

Unit 3 Data Analysis and Statistical Methods

Descriptive statistics and summary measures, Hypothesis testing and statistical inference, Regression analysis and correlation

Unit 4 Machine Learning for Data Science

Introduction to machine learning algorithms, Supervised and unsupervised learning techniques, Model evaluation and selection

Unit 5 Data Visualization and Communication

Principles of data visualization and visual perception, Data visualization techniques and tools, Communicating data findings and storytelling

Recommended Books:

1. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney.
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett.

COURSE CODE: BCA705

COURSE NAME: BUSINESS COMMUNICATION-I (BC-I)

Course Objectives:

- To develop professional communication competencies for workplace success.
- To enhance writing, speaking, listening, and presentation skills in business settings.
- To foster critical thinking and problem-solving through case-based learning.
- To integrate technology for efficient and impactful business communication.
- To cultivate ethical, cross-cultural, and audience-aware communication practices.

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

CO1	Apply principles of effective business communication in professional contexts.
CO2	Design and deliver structured business presentations using appropriate tools and techniques.
C03	Compose clear, concise, and professional business documents (emails, reports, proposals).
C04	Demonstrate effective interpersonal, teamwork, and negotiation skills in business scenarios.

Unit	Content	Credit	Weightage
I	**Foundations of Business Communication** **Topics:** 1. **Introduction to Business Communication** o Process, importance, 7 Cs (Clarity, Conciseness, etc.), barriers, and ethics. 2. **Professional Writing Essentials** o Business emails, memos, notices, and circulars. o Layout, tone, formality, and netiquette. 3. **Interpersonal Communication Skills** o Listening skills, feedback, assertiveness, and conflict resolution. 4. **Business Presentations: Basics** o Planning, structuring, visual aids, and overcoming stage fear. 5. **Non-verbal Communication in Business**	1	50%

	○ Body language, gestures, eye contact, and professional appearance.		
II	**Applied Business Communication & Digital Tools** **Topics:** 1. **Advanced Business Writing** ○ Formal reports, project proposals, executive summaries. 2. **Negotiation and Persuasion Skills** ○ Techniques, role-plays, and persuasive presentations. 3. **Meeting Management** ○ Agendas, minutes, chairing meetings, and virtual meeting etiquette. 4. **Digital Communication Platforms** ○ Effective use of Slack, Microsoft Teams, Zoom for business collaboration. 5. **Cross-cultural and Ethical Communication** ○ Cultural sensitivity in global business, ethical dilemmas, and inclusive language.	1	50%

Textbooks:

- *Business Communication: Process and Product* by Mary Ellen Guffey & Dana Loewy (Cengage).

Reference books:

- *Effective Business Communication* by Herta A. Murphy et al. (McGraw Hill).
- *Business Communication Today* by Bovee, Thill, & Raina (Pearson).
- *Professional Communication* by Aruna Koneru (Oxford).

Online Platforms:

1. Writing & Grammar Enhancement:
   - Grammarly Business, Hemingway App, Purdue OWL.
2. Presentation & Design Tools:
   - Canva for Business, Prezi, Visme, Microsoft Sway.
3. Collaboration & Project Management:
   - Trello, Asana, Google Workspace, Slack.
4. Learning & Simulation Platforms:
   - LinkedIn Learning (Business Communication courses), Coursera ("Business English Communication" by UW).

EIGHTH SEMESTER

Course Code BCA801
Course: Deep Learning

Course Objective: The objective of this course is to provide students with an in-depth understanding of deep learning principles, algorithms, and applications. The course aims to develop students' skills in designing and implementing deep neural networks for solving complex machine learning tasks.

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

1. Understand the principles and architectures of deep neural networks.
2. Implement and train deep neural networks using appropriate frameworks and libraries.
3. Apply deep learning techniques to solve real-world problems in various domains.
4. Evaluate and optimize deep learning models for performance and accuracy.
5. Stay updated with the latest advancements and trends in deep learning research.

Course Content:

Unit 1 Introduction to Deep Learning

Overview of deep learning concepts and its significance, Basics of neural networks and gradient-based optimization, Activation functions and loss functions in deep learning

Unit 2 Deep Neural Network Architectures

Feedforward neural networks and backpropagation algorithm, Convolutional neural networks (CNNs) for image processing, Recurrent neural networks (RNNs) for sequential data analysis

Unit 3 Deep Learning Frameworks and Libraries

Introduction to popular deep learning frameworks (e.g., TensorFlow, PyTorch), Building and training deep neural networks using frameworks, Transfer learning and pre-trained models

Unit 4 Advanced Deep Learning Techniques

Generative adversarial networks (GANs) for data generation, Autoencoders and variational autoencoders (VAEs), Reinforcement learning with deep neural networks

Unit 5 Applications of Deep Learning

Deep learning for image classification and object detection, Natural language processing and sentiment analysis with deep learning, Deep learning in recommendation systems and autonomous vehicles

Recommended Books:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
2. "Deep Learning with Python" by Francois Chollet.

Course Code BCA802
Course: Wireless and Mobile Computing

Course Objective: The Wireless and Mobile Computing course aims to provide students with a comprehensive understanding of the principles, technologies, and applications in the field of wireless and mobile computing. Participants will learn about wireless communication fundamentals, network protocols, and mobile device architectures. The course covers topics like cellular networks, Wi-Fi, Bluetooth, and emerging wireless technologies. Participants will explore mobile application development and optimization techniques, including responsive design and app performance considerations.

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

1. Explain the basics of mobile telecommunication systems
2. Illustrate the generations of telecommunication systems in wireless networks
3. Determine the functionality of MAC, network layer and identify a routing protocol for a given Ad hoc network
4. Explain the functionality of Transport and Application layers

Course Content:

Unit 1 Existing Wireless Systems

Introduction, Global System for Mobile Communications (GSM), Personal Communications Services (PCS), International Mobile Telecommunications 2000 (IMT-2000). Wireless local area networks. Wireless local loops.

Unit 2 Wireless and Mobile Computing

Overview of the history, evolution, and compatibility of wireless standards; the special problems of wireless and mobile computing.

Unit 3 Mobile Communication Systems

Introduction, mobile Internet protocol; mobile aware adaptation; extending the client-server model to accommodate mobility; mobile data access; the software packages to support mobile and wireless computing; Mobile/Cellular System Infrastructure, Registration, Handoff Parameters and Underlying Support. Roaming Support Using System Backbone. The role of middleware

Unit 4 Satellite Systems

Introduction, Types of Satellite Systems, Characteristics of Satellite Systems, Satellite System Infrastructures, Call Setup, Global Positioning System.

Unit 5 Recent Advances

Introduction, Ultra-Wideband Technology, Multimedia Services Requirements. Mobility Management for Integrated Systems; Multicast in Wireless Networks; MANET Route Maintenance/Repair; Design Issues in Sensor Networks; Bluetooth Networks; Threats and Security Issues.

Recommended Books:

1. Introduction to Wireless and Mobile Systems, Dharma P. Agrawal.
2. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture, 4/e, Comer, Douglas E., Prentice Hall.

Course Code BCA804
Course: Blockchain Technology

Course Objective: The objective of this course is to provide students with a comprehensive understanding of blockchain technology and its applications. The course aims to develop students' skills in designing, implementing, and evaluating blockchain solutions for various industries.

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

1. Understand the underlying concepts and principles of blockchain technology.
2. Design and develop blockchain applications using appropriate frameworks and tools.
3. Analyze and evaluate the security and privacy aspects of blockchain systems.
4. Apply smart contracts and decentralized applications (DApps) in blockchain development.
5. Explore the potential use cases and implications of blockchain technology in different industries.

Course Content:

Unit 1 Introduction to Blockchain Technology

Overview of blockchain concepts, decentralized systems, and consensus algorithms, Blockchain types: public, private, and consortium, Cryptography fundamentals for blockchain

Unit 2 Blockchain Development Platforms and Tools

Introduction to blockchain development frameworks (e.g., Ethereum, Hyperledger), Setting up the blockchain development environment, Smart contracts and programming languages (e.g., Solidity)

Unit 3 Blockchain Security and Privacy

Blockchain security challenges and attacks, Cryptographic techniques for securing blockchain transactions, Privacy and anonymity considerations in blockchain systems

Unit 4 Smart Contracts and Decentralized Applications (DApps)

Smart contract development and testing, Interacting with smart contracts using web interfaces and APIs, Building and deploying decentralized applications (DApps)

Unit 5 Blockchain Applications and Industry Use Cases

Blockchain applications in finance, supply chain, healthcare, and other domains, Regulatory and legal considerations for blockchain adoption, Evaluating the potential impact of blockchain on various industries

Recommended Books:

1. "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications" by Imran Bashir.
2. "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher.

COURSE CODE: BCA805

COURSE NAME: ENTREPRENEURSHIP DEVELOPMENT

Course Objectives:

- To cultivate an entrepreneurial mindset and innovation capabilities among students.
- To provide practical tools for opportunity identification, business modeling, and validation.
- To develop skills in business planning, financial management, and legal-regulatory compliance.
- To foster understanding of marketing, operations, and scaling strategies for startups.
- To encourage ethical, sustainable, and socially responsible entrepreneurship.

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

CO1	Analyze entrepreneurial opportunities and evaluate market potential using design thinking and innovation frameworks.
CO2	Develop a comprehensive business model and validate it through lean startup methodologies.
C03	Prepare financial projections, funding strategies, and legal compliance plans for a new venture.
C04	Design marketing, operations, and growth strategies for scalable and sustainable ventures.

Unit	Content	Credit	Weightage
I	**Entrepreneurial Mindset & Opportunity Identification** **Topics:** 1. **Introduction to Entrepreneurship** o Evolution, types of entrepreneurship (social, tech, green), role in economic development. 2. **Entrepreneurial Mindset & Characteristics** o Traits, motivation, risk-taking, creativity, and resilience. 3. **Opportunity Recognition & Ideation** o Sources of ideas, environmental scanning, problem-solution fit, design thinking. 4. **Market Research & Validation** o Primary & secondary research, customer discovery, MVP concept, feedback loops.	1	25%

		5. **Innovation & Intellectual Property** o Types of innovation, IPR basics (patents, trademarks, copyrights).		
	II	**Business Modeling & Lean Startup Approach** **Topics:** 1. **Business Model Canvas (BMC)** o Detailed analysis of all 9 components: Value Proposition, Customer Segments, Channels, etc. 2. **Lean Startup Methodology** o Build-Measure-Learn loop, pivot vs. persevere, iterative development. 3. **Competitive Analysis & SWOT** o Analyzing competitors, strategic positioning, SWOT analysis. 4. **Value Proposition Design** o Creating compelling value propositions, product-market fit. 5. **Feasibility Analysis** o Technical, economic, legal, and operational feasibility.	1	25%
	III	**Business Planning & Financial Management** **Topics:** 1. **Components of a Business Plan** o Executive summary, company description, market analysis, marketing plan, operations plan. 2. **Financial Planning & Projections** o Startup costs, revenue models, sales forecasting, break-even analysis. 3. **Funding & Investment** o Bootstrapping, angel investors, venture capital, crowdfunding, government schemes (Startup India, MUDRA). 4. **Legal & Regulatory Framework** o Business structures (sole proprietorship, LLP, Pvt. Ltd.), GST, compliances, licensing. 5. **Pitching & Investor Communication**	1	25%

		• Elements of a pitch deck, elevator • pitch, investor negotiation basics.		
IV		**Launch, Growth & Sustainability** **Topics:** 1. **Marketing Strategies for Startups** o Digital marketing, branding, pricing strategies, customer acquisition. 2. **Operations & Supply Chain Management** o Sourcing, inventory, quality control, logistics for startups. 3. **Scaling & Growth Strategies** o Franchising, diversification, strategic alliances, internationalization. 4. **Entrepreneurial Leadership & Team Building** o Hiring, team dynamics, leadership styles, conflict management. 5. **Ethics, CSR & Sustainable Entrepreneurship** o Ethical dilemmas, social responsibility, sustainable business models, exit strategies.	1	25%

Textbooks:

- *Entrepreneurship: A South-Asian Perspective* by Kuratko & Rao (Cengage).

Reference books:

- *The Lean Startup* by Eric Ries (Penguin).
- *Business Model Generation* by Osterwalder & Pigneur (Wiley).
- *Entrepreneurship Development* by Dr. C.B. Gupta & Dr. N.P. Srinivasan (Sultan Chand).
- *Startup Secrets from the Ramayana* by G. P. Rao (NEP-aligned Indian context).

Online Platforms:

- Coursera: "Entrepreneurship Specialization" (Wharton), "Startup Entrepreneurship" (MIT).
- edX: "Entrepreneurship in Emerging Economies" (Harvard).
- Startup India Learning Portal.