I Semester

Programme/Class: Bachelor of Computer Application	**Year: I**	**Semester: I**
Subject: Major 1		
Course Code: C-101	**Course Title: Introduction to Programming using C**	
Course Outcomes: After successful completion of this course, students will be able to: **CO1:** Understand basic concepts of C including data types, variables, arrays, expressions, and operators. **CO2:** Apply decision-making and looping constructs along with arrays to solve problems. **CO3:** Develop modular programs using functions and parameter passing techniques. **CO4:** Use strings, pointers, and dynamic memory allocation effectively. **CO5:** Implement structures, unions, and file handling concepts in programs.		
Credit: 6	**Core compulsory**	
Max Marks: 75	**Min Passing Marks:**	
Total No. of Lectures- Tutorials – Practical (In hours per week): (4-2-0)		

Unit	**Topic**	**No. of Lectures**
1	**C basics**: C character set, Identifiers and keywords, Data types, constants, variables and arrays, declarations, expressions statements, symbolic constants, compound statements, arithmetic operators, unary operators, relational and logical operators, assignment operators, conditional operators, bit operators.	7
2	**Decision Control Structures:** If Statement, If-else statement, Nested if (), If () ladder, Switch, case statement, Iterative statements: For loop, While loop, Do-while () loop, Conditional statements: Break, Continue, Storage Classes, Array: Declaration of an Array, Initialization of Array, Types of Array: Single Dimension Array, Two-Dimensional Array, Address Calculation of an Element of a 2-D Array	8
3	**Functions:** Library Functions, User Defined Functions, Function Declaration, Prototype Declaration, Types of Arguments: Actual Arguments, Formal Arguments, Function Definition, Passing Arrays as Parameters, Methods to Call a Function: Call by Value, Call by Reference.	7

4	**String & Pointers: String:** Definition, function of string and Maths Functions (Predefined Functions)**Pointers:** Declaration of Pointer Variables, Pointer Arithmetic, Returning Multiple Output Values through a Function Strings. Introduction to dynamic memory allocation (malloc, calloc, realloc, free)	5
5	Structures, Unions, Array of Structures, Enumerations, File Handling: Opening a File, Closing a File, File, Opening Modes, Reading from and Writing to a File, Copying Content of an Existing File to another, Command Line Arguments, argc and argv Parameters, Pre-processor Directives.	6

Suggested Readings:

1. E. Balagurusamy, Programming in ANSI C, 9th Edition, McGraw Hill Education (India), 2026.
2. Yashavant Kanetkar, Let Us C, 21st Edition, BPB Publications, 2020.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Pearson Education, 1988.
4. E. Balagurusamy, Computing Fundamentals and C Programming, 2nd Edition, McGraw Hill Education (India), 2018

Course Prerequisites: Basic knowledge of computers and problem-solving skills is required. Familiarity with fundamental concepts of mathematics and logical thinking will help students understand programming constructs effectively.

Programme/Class: Bachelor of Computer Application	Year: I	Semester: I
Subject: Major 2		
Course Code: C-102	**Course Title: Data Base Management System**	

Course Outcomes:

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

CO1: Understand database concepts, DBMS architecture, data independence, database users, and advantages over traditional file systems.

CO2: Design database models using ER diagrams, entities, attributes, relationships, and constraints.

CO3: Apply relational model concepts, constraints, and perform queries using relational algebra operations.

CO4: Develop database queries using SQL and apply normalization techniques to design efficient relational schemas.

CO5: Analyze transaction management, concurrency control techniques, and distributed database concepts.

Credit: 6	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-2-0)

Unit	Topic	No. of Lectures
1	**Database System Concepts:** Database Users, and Architecture Introduction to Database System with example, Introduction to Traditional File Oriented System, Characteristics of the Database Approach, Components of Database System, Database Users, Advantages and disadvantages of Using a DBMS, Structure of DBMS, Database Schemas and Instances, DBMS Architecture, Data Independence, Database Languages and Interfaces, Classification of Database Management Systems.	7
2	**Data Modelling & Relational Database Management System:** Data Modelling Using the Entity Relationship Model: Entity Types, Entity Sets, Attributes, Keys, Relationships, Relationship Types, Roles, and Structural, Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, Design Issues.	8

3	**The Relational Data Model**: Relational Constraints and the Relational Algebra: Relational Model Concepts, Relational Constraints and Relational Database Schemas Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations, Additional Relational Operations and Examples of Queries in Relational Algebra.	7
4	**SQL:** SQL and Database Design Theory and Methodology Structured Query Language the Relational Database Standard: Data Definition, Constraints and Schema Changes in SQL, Types of SQL Commands, SQL Operators and their Procedure, Insert, Delete, and Update Statements in SQL Queries and Sub Queries, Aggregate Functions, Joins, Unions, Intersection, Minus, Views (Virtual Tables) in SQL. Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Armstrong Rules, Closure of Attributes, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce Codd Normal Form.	7
5	**Transaction Processing:** Concurrency Control and Distributed Database Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Concurrency Control Techniques, Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering.	5
Suggested Readings: 1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 7th Edition, McGraw Hill Education, 2019. 2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2016. 3. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education, 2003.		
Course Prerequisites: Basic understanding of computer fundamentals and data organization is required. Familiarity with file systems, basic programming concepts, and logical thinking will help students grasp database concepts effectively.		

Programme/Class: Bachelor of Computer Application	Year: I	Semester: I
Subject: Minor		
Course Code: C-103	**Course Title: Elementary Mathematics**	

CO1: Apply concepts of set theory, relations, functions, and basic graph theory to solve mathematical problems.

CO2: Perform operations on matrices and determinants, and apply concepts such as eigenvalues, eigenvectors, and matrix inversion.

CO3: Apply probability concepts, including conditional probability and Bayes' theorem, to analyze uncertain events.

CO4: Organize and represent data using statistical methods and compute measures of central tendency.

CO5: Analyze data using measures of dispersion and correlation techniques for interpretation of relationships.

Credit: 5	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Set Theory, Relations and Functions:** Elements of set theory, methods of describing sets, types of sets, Venn diagrams, operations on sets (union, intersection, difference), and applications. Properties of relations, equivalence relations, partial order relations, functions (domain, range, onto, into, one-to-one), composite and inverse functions, trigonometric, logarithmic and exponential functions. Basic Concept of Graph Theory.	7
2	**Determinants and Matrices:** Definition, Minors, Cofactors and Properties of Determinants. Introduction to matrices, types of matrices (row, column, rectangular, square, diagonal, etc.), scalar multiplication, matrix addition and subtraction, matrix multiplication, and transpose of a matrix. Inverse and Rank of Matrix, Linear dependence of Vectors,	8

	Eigen Values and Eigen vectors of a Matrix, Caley-Hamilton Theorem (without proof).	
3	**Probability:** Introduction, sample space and events, Axioms of probability, Addition and multiplication theorems, conditional probability, Bayes' Theorem, problems.	7
4	**Statistics:** Classification of data, Tabulation of data, Preparation of frequency distribution, Presentation of data through histogram, frequency polygon and frequency curve. Computation of Arithmetic mean, median and mode for ungrouped data and grouped data.	7
5	**Measures of dispersion and Correlation:** Computation of Range, Quartile-deviation, mean-deviation and Standard -deviation, coefficient of variation. (Numerical Applications Only). Meaning of Correlation, types of correlation, correlation coefficient, Karl Pearson, spearman's rank correlation coefficient. (Numerical Applications Only)	5

Suggested Readings:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2018.
2. Seymour Lipschutz and Marc Lipson, Discrete Mathematics (Schaum's Outline), 3rd Edition, McGraw Hill Education, 2009.
3. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons, 2012.

Course Prerequisites: Basic knowledge of school-level mathematics (algebra, arithmetic, and trigonometry) is required. Familiarity with fundamental concepts such as equations, functions, and basic statistics will help students understand the course effectively.

Programme/Class: Bachelor of Computer Application	Year: I	Semester: I
Subject: AEC		
Course Code: C-104	**Course Title: Business Communication and Ethical Values**	

CO1: Understand the process, types, principles, barriers, and 7C's of effective communication.

CO2: Apply oral and written communication skills including presentations, listening, report writing, and business correspondence.

CO3: Draft business letters and utilize modern communication technologies such as email, teleconferencing, and multimedia tools.

CO4: Develop self-management, creativity, motivation, goal setting, and interpersonal skills for professional growth.

CO5: Understand ethical principles, professionalism, cultural values, and ethical issues in IT and society.

Credit: 2	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (2-0-0)

Unit	Topic	No. of Lectures
1	**Means of Communication**: Meaning and Definition, Process, Functions, Objectives, Importance, Essentials of good communication, Communication barriers, 7C's of Communication, Types of Communication: Meaning, nature and scope.	7
2	**Oral communication**: Principle of effective oral communication Techniques of effective speech, Media of oral communication (Face, to, face conversation, Teleconferences, Press Conference, Public address system, Grapevine, Group Discussion, Oral report, Closed circuit TV). The art of listening, Principles of good listening. **Written Communication** Purpose of writing, Clarity in Writing, Principle of Effective writing, Writing Techniques, Electronic Writing Process. **Business Letters & Reports**: Need and functions of business letters, Planning & layout of business letter, Kinds of business letters, Essentials of effective correspondence, Purpose, Kind and Objective of Reports, Writing Reports.	8
3	**Drafting of business letters:** Enquiries and replies, Placing and fulfilling orders, Complaints and follow, up Sales letters, Circular letters Application for employment and resume. **Information**	7

	Technology for Communication: Word Processor, Telex, Facsimile (Fax), E-mail, Voice mail, Internet Multimedia, Teleconferencing, Mobile Phone Conversation, Video Conferencing, SMS, Advantages and limitations of these types. **Self-Analysis:** SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem. Creativity: Out of box thinking, Lateral Thinking**.**	
4	**Attitude:** Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette. Motivation: Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators. Goal Setting: Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals. **Interpersonal Skills:** Gratitude: Understanding the relationship between Leadership Networking & Team work.	7
5	**Introduction to Ethics and Values: Basic Concepts:** Defining ethics, values, and morality. **Importance of Values:** Understanding the role of values in decision-making and behaviour. **Sources of Values:** Exploring different sources of values, including personal, cultural, and societal influences. **Professionalism and Professional Ethics:** Defining professionalism and its ethical dimensions. **Indian Values and Ethics:** Exploring specific Indian values such as respect for elders, hierarchy, and holistic relationships, and their relevance to the workplace. **Values across Cultures:** Examining how values differ across cultures and the implications for globalized IT work. **Impact of Technology on Society:** Examining the social, cultural, and environmental impacts of technology. **Ethical Practices in IT:** Exploring ethical considerations specific to the IT field, such as data privacy, intellectual property, and cybersecurity.	5

Suggested Readings:

1. K. K. Sinha, Business Communication, 2nd Edition, Galgotia Publishing Company, 2012.
2. Meenakshi Raman and Prakash Singh, Business Communication, 2nd Edition, Oxford University Press, 2012.
3. C. S. Rayudu, Communication, 2nd Edition, Himalaya Publishing House, 2010.
4. A. K. Jain, Business Communication: Principles, Methods and Techniques, 1st Edition, Khanna Publishers, 2014.

Course Prerequisites: Basic understanding of language and communication skills is required. Familiarity with reading, writing, and general awareness of social and ethical values will help students grasp the course effectively.

Programme/Class: Bachelor of Computer Application	Year: I	Semester: I
Subject: SEC		
Course Code: C-105	Course Title: Computer Fundamental and MS Office	

Course Outcomes:

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

CO1: Understand basic computer concepts, types, memory, I/O devices, data organization, and number system conversions.

CO2: Develop algorithms and flowcharts to solve computational problems effectively.

CO3: Understand operating system concepts, DOS commands, file management, and types of operating systems.

CO4: Use Windows operating environment features, system tools, and basic applications effectively.

CO5: Apply MS Office tools (Word, Excel, Access, PowerPoint) for document creation, data handling, and presentations.

Credit: 3	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (3-0-0)

Unit	Topic	No. of Lectures
1	**Introduction to Computers:** Introduction, Characteristics of Computers, Block diagram of computer. Types of computers and features, Mini Computers, Micro Computers, Mainframe Computers, Super Computers. Types of Programming Languages (Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories. Types of Memory (Primary and Secondary) RAM ROM, PROM, and EPROM. Secondary Storage Devices (FD, CD, HD, Pen drive) I/O Devices (Scanners, Plotters, LCD, Plasma Display) Number Systems Introduction to Binary, Octal, Hexadecimal system Conversion, Simple Addition, Subtraction, Multiplication.	7
2	**Algorithm and Flowcharts Algorithm**: Definition, Characteristics, Advantages and disadvantages, Examples Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples	8

3	**Operating System:** Services in O.S., DOS, History, Files and Directories, Internal and External Commands, Batch Files, Types of O.S.	7
4	**Windows Operating Environment:** Features of MS-Windows, Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush.	7
5	**Editors and Word Processors Basic Concepts:** MS-Word, Introduction to desktop publishing. Spreadsheets and Database packages Purpose, usage, command, MS-Excel, Creation of files in MS-Access, Switching between application, MS-PowerPoint.	5

Suggested Readings:

1. P. K. Sinha and Priti Sinha, Computer Fundamentals, 6th Edition, BPB Publications, 2013.
2. V. Rajaraman, Fundamentals of Computers, 6th Edition, PHI Learning, 2014.
3. Reema Thareja, Fundamentals of Computers, 1st Edition, Oxford University Press, 2014.

Course Prerequisites: Basic knowledge of computers and general awareness of digital devices is desirable. Familiarity with basic operations such as using a keyboard, mouse, and simple applications will help students learn effectively.

Programme/Class: Bachelor of Computer Application	Year: I	Semester: I
Subject: Practical		
Course Code: C 106	**Course Title: Lab**	

Course Outcomes:

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

CO1: Understand the basic concepts of C programming including character set, data types, variables, operators, expressions, and program structure.

CO2: Apply decision control structures and looping techniques to develop logical and efficient C programs.

CO3: Design and implement modular programs using functions, including parameter passing methods (call by value and call by reference).

CO4: Utilize arrays, strings, and pointers effectively, including dynamic memory allocation for solving computational problems.

CO5: Develop programs using structures, unions, enumerations, file handling, command line arguments, and preprocessor directives for real-world applications.

Credit: 2	Core compulsory
Max Marks: 100	**Min Passing Marks:40**

Total No. of Lectures- Tutorials – Practical (In hours per week): (0-0-2)

Unit	Topic	No. of Lectures
1	**Q1.** Write a C program to demonstrate arithmetic operators. **Q2.** Write a C program using relational and logical operators. **Q3.** Write a C program to demonstrate unary operators. **Q4.** Write a C program using conditional operator. **Q5.** Write a C program using bitwise operators. **Q6.** Write a C program to display array elements.	7
2	**Q1.** Write a C program using if-else ladder. **Q2.** Write a C program using switch-case. **Q3.** Write a C program using for loop. **Q4.** Write a C program using while loop. **Q5.** Write a C program for 1D array. **Q6.** Write a C program for 2D array.	8
3	**Q1.** Write a C program using function to find sum of two numbers. **Q2.** Write a C program using function with return value. **Q3.** Write a C program to demonstrate call by value. **Q4.** Write a C program to demonstrate call by reference. **Q5.** Write a C program to pass array to function. **Q6.** Write a C program using recursion.	7
4	**Q1.** Write a C program using string functions. **Q2.** Write a C program using math functions.	5

	Q3. Write a C program using pointers. **Q4.** Write a C program for pointer arithmetic. **Q5.** Write a C program using malloc/calloc. **Q6.** Write a C program to return multiple values using pointers.	
5	**Q1.** Write a C program using structure. **Q2.** Write a C program using union. **Q3.** Write a C program to write data into file. **Q4.** Write a C program to copy file. **Q5.** Write a C program using command line arguments. **Q6.** Write a C program using preprocessor directive.	5

Suggested Books:

1. E.Balagurusamy, “Programming in ANSI C”, TMH
2. PeterNorton’s, “Introduction to Computers”, TMH
3. YashwantKanetkar, “Let us C”, BPB

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic understanding of computers and their operation
- Familiarity with fundamental concepts of mathematics (such as arithmetic and logic)
- Basic problem-solving and logical thinking skills

II Semester

Programme/Class: Bachelor of Computer Application	**Year: I**	**Semester: II**
Subject: Major 1		
Course Code: C 201	**Course Title: Java Programming**	
Course Outcomes: After successful completion of this course, students will be able to: **CO1:** Understand the fundamentals of Java programming, including syntax, data types, operators, control structures, and execution process. **CO2:** Apply object-oriented programming concepts such as classes, objects, inheritance, polymorphism, abstraction, and encapsulation in Java. **CO3:** Demonstrate the use of packages, multithreading, and exception handling to develop efficient and robust Java applications. **CO4:** Implement input/output operations, string handling, and applet-based programs using Java APIs. **CO5:** Develop GUI-based applications and database connectivity using AWT, JDBC, and understand advanced concepts like Swing, Servlets, and JSP.		
Credit: 4	**Core compulsory**	
Max Marks: 75	**Min Passing Marks:**	
Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)		

Unit	**Topic**	**No. of Lectures**
1	**Introduction:** Java Tokens, Java Statements, Command Line Arguments, Programming Style, Constants, Variables, Data Types, Constants, Variables, Declaration of Variables, Scope of Variables, Symbolic Constants, Type Casting, Java Program Structure, Operators, Expressions, Statements, Decision Statements, Control Structure or statement, JDK, JRE, and JVM (Java Virtual Machine), Class-path, Execution process of Java program.	7
2	**Defining a Class:** Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods and Inheritance: Extending a Class, interface, super, Overriding & Overloading Methods, final Variables and Methods, Classes, Finalize Methods, Abstract Methods and Classes, Visibility Control. Arrays, One, Dimensional Arrays, Creating an Array, Two Dimensional Arrays, Wrapper Classes.	8
3	**Packages:** Introduction, Java API Packages, Using system Packages, Naming Conventions, Creating Packages, Accessing a Packages, Adding a Class to a Package, Hiding Classes. **Multithreaded Programming:** Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread	7

	Exceptions, Thread Priority, and Synchronization. **Managing Errors and Exceptions:** Introduction, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging.	
4	**Functions:** String handling and its functions, Maths Functions. **Input/output-basics:** Input/output-basics streams and Byte and character streams, Character Reading from Keyboard by Input Stream Reader, Reading a Line/String from Keyboard by Buffered Reader, Standard I/O Streams Using Data Streams to read/write. **Applet:** Introduction of Applet, How Applets Differ from Application, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet	5
5	**Introduction to AWT programming:** Graphics, Dialog Boxes, AWT Components/Controls, Layouts, Event Handling. JDBC architecture Establishing connectivity and working with connection interface, Working with statements, Creating and executing SQL statements, Working with Result Set, Socket Programming, Introduction to Swing, Servlet and JSP.	5

Suggested Books:

1. E. Balagurusamy, Programming with Java, A Primer Second Edition, Tata McGraw Hill, New Delhi.
2. P. Naughton and H. Schildt, JAVA: The Complete Reference, TMH, New Delhi 2005.
3. D. Jana, Java and Object Oriented Programming Paradigm, PHI, New Delhi, 2005

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computers and operating systems
- Fundamental understanding of programming concepts (preferably in C or any high-level language)
- Familiarity with problem-solving techniques and logical thinking

Programme/Class: Bachelor of Computer Application	Year: I	Semester: II
Subject: Major 2		
Course Code: C 202	**Course Title: Data Structure Using 'C'**	

Course Outcomes:

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

CO1:

Understand fundamental concepts of data structures, their classification, operations, memory representation, and applications of arrays.

CO2:

Implement and apply stack and queue data structures, including recursion, expression conversion, and evaluation techniques.

CO3:

Design and implement linked list data structures (singly, doubly, circular) and perform various operations on them.

CO4:

Analyze and implement tree data structures, including binary trees, tree traversals, and binary search trees (BST).

CO5:

Apply sorting and searching algorithms to solve computational problems efficiently and analyze their performance.

Credit: 4	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	Classification of Data Structure, Operations on Data Structure, Address Calculation, Application of arrays, Limitation of Array, Array as Parameters, Sparse Matrices	7
2	**Continuous Implementation (Stack):** Array Representation, Operations on Stacks: Push & Pop, Applications of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack Recursion: Recursive Definition and Processes, Principles of Recursion, Tower of Hanoi Problem, Recursion Vs. Iteration Continuous. Implementation (Queue): Array representation and implementation of Queues, Operations on Queue: Create, Add, Delete, Full and Empty Queue, Circular Queue, Dequeue and Priority Queue	8
3	**Non-Continuous Implementation:** Link Lists: Linear List concept, LinkedList Terminology, Representation of Linked List in Memory, Types of Linked List, Single Linked List, Doubly Linked List, Single Circular Linked list, Circular Doubly Linked List, Operations on Link List: Create List Insert node (empty list, beginning, middle, end), Delete node(first, general case), Traversing node, Searching node, Print list, Count Nodes, Sort Lists	7

4	**Trees:** Introduction to Tree & its Terminology, Binary trees, Types of Binary trees, Representation of Binary Tree, Traversals (Inorder, Preorder, Postorder), Tree Expression, Binary Search Tree, Insertion and Deletion in BST.	5
5	**Sorting & Searching Techniques:** Sorting & Searching Techniques: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Sequential Search, Binary Search. Graph: Introduction and types of graph, graph representation, shortest path problem	5

Suggested Readings:

1. S. Lipschutz,"Data structures",Mc,Graw,Hill International Editions,1986.
2. A. Michael Berman,"Data Structures via C++",Oxford University Press,2002.
3. M. Weiss,"Data Structures and Algorithm Analysis in C++",Pearson Education

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of programming (preferably in **C/C++ or any high-level language**)
- Understanding of fundamental programming constructs: variables, data types, operators, loops, and functions
- Familiarity with arrays and basic problem-solving techniques
- Basic understanding of algorithms and flowcharts
- Logical thinking and analytical ability
- Basic mathematical concepts (such as recursion and simple computations)

Programme/Class: Bachelor of Computer Application	Year: I	Semester: II
Subject: Minor		
Course Code: C 203	**Course Title: Mathematics -I**	

Course Outcomes:

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

CO1:

Understand and apply trigonometric functions, identities, and their applications in problem-solving.

CO2:

Evaluate limits and analyze continuity of functions using standard theorems and properties.

CO3:

Apply differentiation techniques to solve problems involving rates of change, maxima-minima, and curve tracing.

CO4:

Solve integration problems using various methods and understand the applications of definite and indefinite integrals.

CO5:

Apply vector algebra concepts to compute scalar and vector products and interpret geometrical and physical meanings.

Credit: 4	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Basic concept of Trigonometry:** Basic trigonometric functions, Evaluating trigonometric functions for common angles, trigonometrical identities (Sum, difference and double angle formulas) and their applications	7
2	**Limits & Continuity:** Limit at a Point, Properties of Limit, Computation of Limits of Various Types of Functions, Continuity at a Point, Continuity Over an Interval, Intermediate Value Theorem, Type of Discontinuities	8
3	**Differentiation:** Derivative, Derivatives of Sum, Differences, Product & Quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Rolle's Theorem, Mean Value Theorem, Expansion of Functions (Maclaurin's& Taylor's), Indeterminate Forms, L-Hospitals Rule, Maxima& Minima, Curve Tracing, Successive Differentiation & Leibnitz Theorem (definition only).	7
4	**Integration:** Integral as Limit of Sum, Fundamental Theorem of Calculus (without proof), Indefinite Integrals, Methods of Integration Substitution, By Parts, Partial Fractions, Reduction Formulae for Trigonometric Functions, Gamma and Beta Functions (definition only).	5

5	**Vector Algebra:** Definition of a vector in 2 and 3 Dimensions, Double and Triple Scalar and Vector Product and physical interpretation of area and volume.	5

Suggested Readings:

1. B.S. Grewal, "Elementary Engineering Mathematics", 34th Ed., 1998.
2. Shanti Narayan, "Integral Calculus", S. Chand & Company, 1999
3. H.K. Das, "Advanced Engineering Mathematics", S. Chand & Company, 9th Revised Edition, 2001.

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of algebra (equations, inequalities, polynomials)
- Understanding of elementary trigonometry (angles, ratios, identities)
- Familiarity with functions and graphs
- Basic concept of limits (introductory level)
- Fundamental mathematical skills and logical reasoning

Programme/Class: Bachelor of Computer Application	Year: I	Semester: II
Subject: SEC		
Course Code: C 205	**Course Title: Cyber Security**	

Course Outcomes:

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

CO1: Understand the concept of cyber crime, its types, and legal frameworks in India such as the IT Act 2000 and relevant IPC provisions.

CO2: Identify social media threats, cyberbullying, and online scams, and apply safe practices for responsible use of digital platforms.

CO3: Implement basic security measures to protect digital devices and networks, including safe browsing and Wi-Fi security practices.

CO4: Recognize various online financial frauds and apply preventive measures while using digital payment systems.

CO5: Understand fundamental cyber security concepts (CIA triad) and identify common cyber threats like malware, phishing, and DoS/DDoS attacks.

Credit: 4	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Cyber Crime and Cyber Hygiene:** Understanding cybercrime: What it is & how it affects individuals. Categories of cybercrime: Financial fraud, identity theft, cyberstalking, etc. Laws governing cyber crime in India (IT Act 2000, IPC sections)	7
2	**Social Media Threats & Cyberbullying:** Fake profiles & impersonation scams. WhatsApp & Telegram frauds (Deepfake videos, sextortion). Cyberbullying, online harassment & legal protections in India. Safe use of Instagram, Facebook, LinkedIn, and Twitter Password Security	8
3	**Securing Digital Devices and Networks:** Protecting Computers, Smartphones, and Tablets. Network Security Basics: Wi-Fi Security, Firewalls, etc. Secure Web Browsing Practices	7
4	**Online Financial Frauds & Digital Payments Security:** UPI & credit/debit card frauds (skimming, SIM swapping). Fake investment & job scams. Digital wallet & cryptocurrency frauds. Legal rights of victims in India (How to report cyber frauds)	5
5	**Introduction to Cyber Security:** Basic Security Concepts: Confidentiality, Integrity, Availability. Types of cyber threats: Malware, Phishing, DoS/DDoS	5

Suggested Readings:

1. Charles P. Pfleeger & Shari Lawrence Pfleeger, *Security in Computing*, Pearson Education.

2. William Stallings & Lawrie Brown, *Computer Security: Principles and Practice*, Pearson Education.
3. Joseph Migga Kizza, *Guide to Computer Network Security*, Springer.

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computers, internet, and digital devices
- Familiarity with social media platforms and online applications
- Basic understanding of digital transactions (UPI, cards, wallets)
- Awareness of common internet usage practices
- Logical thinking and general awareness about online safety

Programme/Class: Bachelor of Computer Application	Year: I	Semester: II
Subject: Practical		
Course Code: C 206	**Course Title: Lab**	

Course Outcomes:

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

CO1: Write, compile, and execute basic Java programs using proper syntax and structure.

CO2: Implement object-oriented programming concepts such as classes, objects, inheritance, and polymorphism.

CO3: Develop programs using arrays, strings, and exception handling techniques.

CO4: Create programs using file handling and basic input/output streams.

CO5: Design simple GUI-based applications and demonstrate database connectivity using Java.

Credit: 4	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (0-0-2)

Unit	Topic	No. of Lectures
1	**Q1.** Write a Java program to perform arithmetic operations using operators. **Q2.** Write a Java program to check whether a number is even or odd using if-else. **Q3.** Write a Java program to demonstrate class and object with a method to display student details. **Q4.** Write a Java program to demonstrate inheritance using a base class and derived class. **Q5.** Write a Java program using exception handling to handle division by zero. **Q6.** Write a Java program to demonstrate array operations (sum of elements).	7
2	**Q1.** Write a Java program to demonstrate class and object. **Q2.** Write a Java program using constructor. **Q3.** Write a Java program to demonstrate inheritance. **Q4.** Write a Java program to demonstrate method overloading. **Q5.** Write a Java program for 1D array operations. **Q6.** Write a Java program using interface or abstract class.	8
3	**Q1.** Create a package and demonstrate its use in another class. **Q2.** Write a Java program to create a thread using Thread class. **Q3.** Write a Java program to demonstrate synchronization. **Q4.** Write a Java program using Runnable interface. **Q5.** Write a Java program to handle exception using try-catch-finally. **Q6.** Write a Java program for user-defined exception.	7

4	**Q1.** Write a Java program demonstrating string functions. **Q2.** Write a Java program using Math functions. **Q3.** Write a Java program to read input using Buffered Reader. **Q4.** Write a Java program using Data Input Stream and Data Output Stream **Q5.** Write a Java Applet to display a message. **Q6.** Explain Applet life cycle with a program.	5
5	**Q1.** Write a Java program using AWT to create a window with a button. **Q2.** Write a Java program to handle button click event. **Q3.** Write a Java program to connect to database using JDBC and display records. **Q4.** Write a Java program for socket communication between client and server. **Q5.** Write a Swing program to create a simple GUI. **Q6.** Write a basic Servlet or JSP program.	5

Suggested Books:

1. E. Balagurusamy, Programming with Java, A Primer Second Edition, Tata McGraw Hill, New Delhi.
2. P.Naughton and H. Schildt, JAVA: The Complete Reference, TMH, New Delhi 2005.
3. D.Jana, Java and Object Oriented Programming Paradigm, PHI, New Delhi, 2005

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computers and operating systems
- Fundamental understanding of programming concepts (preferably in C or any high-level language)
- Familiarity with problem-solving techniques and logical thinking
- Basic understanding of data types, variables, and control structures (if-else, loops)
- Awareness of file handling and basic input/output concepts
- Basic knowledge of using command line/terminal

III Semester

Programme/Class: Bachelor of Computer Application	**Year: II**	**Semester: III**
Subject: Major 1		
Course Code: C-301	**Course Title: Python Programming**	

Course Outcomes:

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

CO1: Understand Python fundamentals including features, data types, variables, operators, and execution environment (interpreter vs compiler).

CO2: Develop Python programs using input/output operations, conditional statements, and looping constructs with control statements.

CO3: Apply Python data structures such as strings, lists, tuples, and dictionaries for data manipulation and problem-solving.

CO4: Design modular programs using functions with different types of arguments, return values, and scope management.

CO5: Perform file operations including reading, writing, updating, and managing files using Python.

Credit: 6	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (3-0-0)

Unit	**Topic**	**No. of Lectures**
1	**Basic of Python:** Features, Application, Python interpreter, Interpreters vs Compilers, Data Types, Identifiers and keywords, Literals, Strings, Assigning Values to Variables, Multiple Assignment Basic Operators in Python: Arithmetic, Comparison, Assignment, Bitwise, Logical, Membership Operators (in, not in), Identity Operators (is, is not), Operators Precedence.	7
2	**Creating Python Programs:** Input and Output Statements, Conditional Statement- if...else, Difference between break, continue and pass, Control statements (Looping- while Loop, for Loop, Loop Control, nested loops).	8

3	**Python Data types:** Strings, Accessing Values in Strings, String Special Operators, String Formatting Operator, Triple Quotes, Indexing and Slicing, Built-in String functions. **Python Lists -**Accessing Values in Lists, Updating Lists, Basic List Operations, Indexing, Slicing, and Matrixes, Built-in List Functions & Methods. **Python Tuples -** Accessing Values in Tuples, Updating Tuples, Delete Tuple Elements, Basic Tuples Operations, Indexing, Slicing, Built-in Tuple Functions. **Python Dictionary -** Accessing Values in Dictionary, Updating Dictionary Python Programming, Delete Dictionary Elements, Built-in Dictionary Functions & Methods.	7
4	**Functions:** Defining a Function, Syntax, calling a Function, call by value and call by reference, pass by reference vs value, Function Arguments, required arguments, Keyword arguments, Default arguments, Variable-length arguments, The return Statement, Scope of Variable.	7
5	**File Handling:** Manipulation, Opening Text File, Working with a File on Python, The open function, File modes, The file object attributes, close() method, write() method, read() method, Files: Input, Files: Output, Reading files, Renaming & deleting files, Writing into a file, remove() method.	5

Suggested Readings:

1. Reema Thareja, Python Programming: Using Problem Solving Approach, 2nd Edition, Oxford University Press, 2019.
2. Paul Barry, Head First Python, 2nd Edition, O'Reilly Media, 2016.
3. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, 2013.

Course Prerequisites: Basic knowledge of computers and logical problem-solving skills is required. Familiarity with basic programming concepts such as variables, data types, and control structures will help students understand Python programming effectively.

Programme/Class: Bachelor of Computer Application	Year: II	Semester: III
Subject: Major 2		
Course Code: C-302	**Course Title: Digital Electronics**	

Course Outcomes:

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

CO1: Apply number system conversions, binary arithmetic, Boolean algebra, logic gates, and K-map techniques for simplification of logic expressions.

CO2: Design and analyze combinational circuits such as adders, subtractors, multiplexers, demultiplexers, encoders, and comparators.

CO3: Analyze and design sequential circuits using flip-flops, state diagrams, and state tables.

CO4: Understand and implement registers including shift registers, synchronous and asynchronous register.

CO5: Understand and analyze different types of counters including asynchronous and synchronous counters, BCD and binary counters, and design counters such as ring and Johnson counters for digital applications.

Credit: 6	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-2-0)

Unit	Topic	No. of Lectures
1	**Number System & Boolean Algebra: Number System:** Binary, Octal, Decimal, Hexadecimal, Conversion of Number System, Binary Arithmetic & Complement (1's and 2's), Binary Codes: Weighted & Non-Weighted, Gray Code, Excess-3 Code, Cyclic codes, Hamming Code, Boolean Function, Boolean Postulates, De-Morgan's Theorem **Boolean Expressions:** Sum of Product, Product of Sum, Minimization of Boolean Expressions using K- Map, Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR, Implementations of Logic Functions using Gates, NAND, NOR Implementations.	7
2	**Combinational Circuits:** Adders &Subtractors: Half Adder, Full Adder, Binary Adder, Half Subtractor, Full Subtractor, Magnitude Comparator: Two Bit Magnitude Comparator, Three Bit Magnitude Comparator, Multiplexer & De-Multiplexer: 4*1 Multiplexer, 8*1Multiplexer, Decoder & Encoder.	8
3	**Sequential Circuit:** Introduction to Flip Flops: SR, JK, T, D, Master Slave Flip Flops, Characteristic Table & Equation, Edge Triggering &	7

	Level Triggering, Excitation Table, State Diagram, State Table, State Reduction, Design of Sequential Circuits.	
4	**Registers:** Introduction of Registers, Classification of Registers, Register with Parallel Load, Shift Registers, Bidirectional Shift Register with Parallel Load.	7
5	**Counters:** Introduction of Counter, Asynchronous/Ripple Counters, Synchronous Counters, BCD Counter, 4-bit Binary Counter with Parallel Load, Design of Synchronous Counters, Ring Counter, Johnson Counter.	5

Suggested Readings:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2013.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, McGraw Hill Education, 2010.
3. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education, 2015.

Course Prerequisites: Basic knowledge of mathematics and fundamental concepts of electricity is required. Familiarity with binary number systems and basic logic will help students understand digital electronic concepts effectively.

Programme/Class: Bachelor of Computer Application	Year: II	Semester: III
Subject: Minor		
Course Code: C-303	**Course Title: Numerical Methods**	

Course Outcomes:

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

CO1: Organize and present data using classification, tabulation, frequency distributions, and graphical methods.

CO2: Compute and interpret mean, median, and mode for grouped and ungrouped data.

CO3: Analyze data variability using range, quartile deviation, mean deviation, standard deviation, and coefficient of variation.

CO4: Evaluate the skewness of data using Karl Pearson's and Bowley's coefficients.

CO5: Analyze relationships between variables using correlation techniques including Karl Pearson and Spearman's rank correlation.

Credit: 5	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Classification of data**: Tabulation of data, Preparation of frequency distribution, Presentation of data through histogram, frequency polygon, frequency curve	7
2	**Measures of Central Tendency:** Computation of Arithmetic mean, median and mode for ungrouped data and grouped data, Verification of median through ogives.	8
3	**Measures of dispersion:** Computation of Range, Quartile deviation, mean deviation and Standard deviation, coefficient of variation. (Numerical Applications Only)	7
4	**Concept of Skewness:** Karl Pearson's and Bowley's Coefficients of Skewness (Numerical Applications Only)	7
5	**Correlation:** Meaning of Correlation, types of correlation, correlation coefficient, Karl Pearson, spearman's rank correlation coefficient. (Numerical Applications Only)	5

Suggested Readings:

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons, 2012.
2. S. P. Gupta, Statistical Methods, 44th Edition, Sultan Chand & Sons, 2019.
3. J. K. Sharma, Business Statistics, 4th Edition, Pearson Education, 2010.

Course Prerequisites: Basic knowledge of mathematics, including arithmetic and algebra, is required. Familiarity with simple calculations and logical reasoning will help students understand statistical concepts effectively.

Programme/Class: Bachelor of Computer Application	Year: II	Semester: III
Subject: AEC		
Course Code: C-304	Course Title: Principles of Management	

Course Outcomes:

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

CO1: Explain the meaning, nature, importance, functions, and evolution of management, including its role as an art, science, profession, and social system.

CO2: Apply planning, forecasting, and decision-making concepts, including types, techniques, and rational decision-making processes.

CO3: Analyze organizing and staffing functions, including types of organizations, delegation, decentralization, and their significance.

CO4: Demonstrate understanding of directing, communication, motivation theories, and leadership styles for effective management.

CO5: Evaluate controlling, coordination, strategic management concepts, and recent trends such as TQM, stress management, and international management.

Credit: 2	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Nature of Management:** Meaning, Definition, it's nature purpose, importance & Functions, Management as Art, Science & Profession- Management as social System Concepts of management, Administration, Organization, Evolution of Management.	7
2	**Functions of Management:** Planning - Meaning - Need & Importance, type's levels, advantages & limitations. Forecasting - Need & Techniques Decision making – Types, Process of rational decision making & techniques of decision-making Organizing.	8
3	**Elements of organizing & processes:** Types of organizations, Delegation of authority - Need, difficulties in delegation - Decentralization Staffing - Meaning & Importance Direction, Nature, Principles Communication, Types & Importance Motivation,	7

	Importance, theories, Leadership - Meaning - styles, qualities & functions of leaders	
4	**Functions of Management:** Controlling - Need, Nature, importance, Process & Techniques Coordination - Need – Importance, Strategic Management Definition, Classes of Decisions, Levels of Decision, Strategy, Role of different Strategist, Relevance of Strategic Management and its Benefits Strategic Management in India.	7
5	**Recent Trends in Management:** Social Responsibility of Management – environment friendly management, Management of Change Management of Crisis Total Quality Management Stress Management International Management	5

Suggested Readings:

1. Principles of Management, Harold Koontz and Cyril O'Donnell, McGraw Hill Education, 12th Edition, 2019.
2. Principles of Management: Text and Cases, Tripathi P.C. and Reddy P.N., Tata McGraw Hill Education, 6th Edition, 2017.
3. Principles and Practice of Management, L. M. Prasad, Sultan Chand & Sons, 8th Edition, 2019.

Course Prerequisites: Basic understanding of business environment and organizational structure. Familiarity with fundamental concepts of economics and communication skills will help students grasp management principles effectively. No prior specialized knowledge is required, making the course suitable for beginners.

Programme/Class: Bachelor of Computer Application	Year: II	Semester: III
Subject: SEC		
Course Code: C-305	**Course Title: AI of Everyone**	

Course Outcomes:

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

CO1: Explain the meaning, scope, evolution, and applications of AI, and differentiate between AI, Machine Learning, and Deep Learning.

CO2: Understand fundamental Machine Learning concepts, including types of learning, basic techniques, and the role of data and datasets.

CO3: Apply AI tools such as ChatGPT, Google Gemini, and Canva for tasks like content creation, presentations, resume building, and basic data analysis using effective prompts.

CO4: Analyse AI applications in specific domains and understand core concepts such as expert systems, NLP, and basic problem-solving techniques (DFS, BFS).

CO5: Evaluate ethical issues, responsible use, and future trends of AI, including career opportunities and government initiatives in India.

Credit: 2	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Introduction to Artificial Intelligence** (i) Meaning, definition, and scope of AI (ii) History and evolution of AI (iii) AI vs Machine Learning vs Deep Learning (iv) Applications of AI in: Education, Business & Commerce, Healthcare, Social Sciences (v) AI in daily life (chatbots, recommendation systems)	7
2	**Basics of Machine Learning** (i) Concept of Machine Learning (ii) Types: Supervised Learning, Unsupervised Learning (ii) Simple examples (classification, clustering) (iv) Data and its importance in AI (v) Introduction to dataset	8

3	**AI Tools and Applications** Introduction to popular AI tools: ChatGPT, Google Gemini, Canva AI AI for: Content writing, Presentations, Resume building, Data analysis (basic) Prompt writing basics (how to interact with AI)	7
4	**AI in Different Disciplines. Any one as per their stream** Component of Expert System: Knowledge Base, Inference Engine, User Interface, Feature of Expert System, Expert system life cycle, Natural language Processing, Problem solving: State space search; depth first search, breadth-first search.	7
5	**Ethics and Future of AI** Ethical issues in AI: Bias and fairness, Privacy concerns, Job displacement Responsible use of AI, Future trends and career opportunities in AI, Government initiatives in India (AI policy overview)	5
Suggested Readings: 1. AI for Everyone, Andrew Ng, DeepLearning.AI, 2019 (Course-based material). 2. Artificial Intelligence: A Guide for Thinking Humans, Melanie Mitchell, Farrar, Straus and Giroux, 1st Edition, 2019. 3. You Look Like a Thing and I Love You, Janelle Shane, Little, Brown and Company, 1st Edition, 2019.		
Course Prerequisites: Basic understanding of computers and everyday digital technologies. No prior knowledge of programming or mathematics is required, as the course is designed for beginners and non-technical learners interested in understanding AI concepts and applications.		

Programme/Class: Bachelor of Computer Application	Year: II	Semester: III
Subject: Practical		
Course Code: C-306	**Course Title: Lab**	

Course Outcomes:

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

CO1: Implement programs to demonstrate data types, identifiers, and literals in Python.

CO2: After the completion of this course, students will be able to write programs to check whether a number is even or odd using if–else statements, determine the largest among three numbers using nested if conditions, and identify whether a number is positive, negative, or zero.

CO3: Apply Python data structures such as strings, lists, tuples, and dictionaries for data manipulation and problem-solving.

CO4: Design modular programs using functions with different types of arguments, return values, and scope management.

CO5: Perform file operations including reading, writing, updating, and managing files using Python.

Credit: 2	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (0-0-2)

Unit	Topic	No. of Lectures
1	1. Write a program to declare variables of different data types and display their types. 2. Write a program to demonstrate valid and invalid identifiers and keywords. 3. Write a program to illustrate different types of literals (numeric, string, Boolean). 4. Write a program to compare two numbers using comparison operators. 5. Write a program to evaluate expressions using logical operators (and, or, not). 6. Write a program to evaluate expressions demonstrating **operator precedence**.	7
2	1. Write a program to check whether a number is **even or odd** using `if…else`. 2. Write a program to find the **largest of three numbers** using nested `if`. 3. Write a program to check whether a number is **positive, negative, or zero**. 4. Write a program to print numbers from 1 to 10 using a while loop.	8

	5. Write a program to calculate the sum of first N natural numbers using while loop. 6. Write a program to find the factorial of a number using while loop.	
3	1. Write a program to use string formatting operators (%, format(), f-string). 2. Write a program using triple quotes to display multi-line text. 3. Write a program to apply built-in string functions (upper(), lower(), len(), replace()). 4. Write a program to count vowels and consonants in a string. 5. Write a program to demonstrate nested lists (matrix representation). 6. Write a program to use built-in list functions and methods (sort(), reverse(), len(), max(), min()).	7
4	**1. Write a program to demonstrate call by value.** **2. Write a program to demonstrate call by reference using mutable objects (like lists).** 3. Write a program to calculate factorial of a number using a function. 4. Write a program to check whether a number is prime using a function. 5. Write a program to find the largest of three numbers using a function. 6. Write a program to swap two numbers using a function.	7
5	1. Write a program to create a file and write data into it using write (). 2. Write a program to append data to an existing file. 3. Write a program to write multiple lines into a file. 4. Write a program to copy content from one file to another. 5. Write a program to count number of lines, words, and characters in a file. 6. Write a program to search for a specific word in a file.	5
Suggested Readings: 1. Python Crash Course, Eric Matthes, No Starch Press, 3rd Edition, 2023. 2. Learning Python, Mark Lutz, O'Reilly Media, 5th Edition, 2013. 3. Automate the Boring Stuff with Python, Al Sweigart, No Starch Press, 2nd Edition, 2019.		
Course Prerequisites: Basic knowledge of computers and logical problem-solving skills is required. Familiarity with basic programming concepts such as variables, data types, and control structures will help students understand Python programming effectively.		

IV Semester

Programme/Class: Bachelor of Computer Application	**Year: II**	**Semester: IV**
Subject: Major 1		
Course Code: C 401	**Course Title: Web Technology with HTML-CSS-XML-PHP & MySQL**	

Course Outcomes:

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

CO1: Understand the fundamentals of Internet, World Wide Web, client-server architecture, web browsers, and various web protocols.

CO2: Apply Dynamic HTML concepts including DOM, CSS positioning, and event handling to create interactive and responsive web pages.

CO3: Design and develop structured web pages using HTML, CSS, and XML with proper layout, formatting, hyperlinks, and multimedia integration.

CO4: Develop server-side applications using PHP, including form handling, functions, arrays, file handling, and control structures.

CO5: Implement session and cookie management and perform database connectivity using MySQL with SQL operations and basic error handling.

Credit: 4	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-2-0)

Unit	**Topic**	**No. of Lectures**
1	**Basics of Internet:** World Wide Web, Web page, Home page, Web site, Static, Dynamic and Active web page, Overview of Protocols, Client server computing concepts. Web Client and Web Sever, Web Browser e.g., Netscape navigator, VB Script and Java Script, Image maps, CGI, API web database connectivity, DBC, ODBC	7
2	**Dynamic HTML:** Document Object Model, Features of DHTML, CSSP (Cascading Style Sheet Positioning) and JSSS (JavaScript assisted Style Sheet), The ID Attribute, DHTML Events	8
3	**Introduction to HTML:** Basics, Element, Attribute, Headings, Paragraphs, Styles, Formatting, Quotations,Comments,CSS,Links,Images,Tables,Lists,Blocks,Classes,ID, frames, File Paths, Head, Layout, Entities, Symbols, Charset, Color and Background of Web Pages, Hypertext, Hyperlink and Hypermedia, Links, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Footnote and E-Mailing, Creating Table, Frame, Form and Style Sheet.	7

	CSS: Introduction, Syntax, Colors, Backgrounds, Borders, Margins, Padding, Height/ Width, Box Model, Outline, Text, Fonts, Icons, Links, Lists, Tables, Display, Max, Width, Position, Overflow, Float, Inline, Block, Align, Combinators, Opacity, Navigation Bar, Dropdowns, Image Gallery, Image Sprites, Attr Selectors, Forms, Counters, Website Layout, Units, Specificity. **XML:** Introduction, Tree, Syntax, Elements, Attributes, Namespaces, Display, HTTP request, Parser, DOM, XPath, XSLT, XQuerry, XLink, Validator, DTD, Schema, Server	
4	**PHP**: Introduction, Basic Syntax, variable and constant, PHP Data type, Operator and Expression. Decisions and loop Making Decisions, Function: Define a function, Call by value and Call by reference, Recursive function, String, String Library function. **Array**: Accessing array, Looping with associative array using each () and foreach(), Some useful Library function. Handling Html Form with PHP Capturing Form, Generating File uploaded form, redirecting a form after submission. **Working with file and Directories**: Opening and closing a file, Coping, renaming and deleting a file, working with directories.	5
5	**Session and Cookie:** Introduction to Session Control, What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Database Connectivity. **MySQL**: Introduction to RDBMS, Connection with MySQL Database, Performing basic database operation (DML) (Insert, Delete, Update, Select), Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.) Exception Handling Understanding Exception and error, Try, catch, throw. Error tracking and debugging.	5

Suggested Readings:

1. Shelley Powers, “Dynamic Web Publishing” 2
2. Html & CSS: The Complete Reference 5th Edition (English, Paperback, Thomas A. Powell)
3. XML: The Complete Reference Book by Heather Williamson

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computers and internet usage
- Familiarity with operating systems and file handling
- Understanding of fundamental programming concepts (preferably C or any high-level language)
- Basic knowledge of HTML or exposure to web browsing (helpful but not mandatory)
- Logical thinking and problem-solving skills

Programme/Class: Bachelor of Computer Application	Year: II	Semester: IV
Subject: Major 1		
Course Code: C 402	**Course Title: Operating System**	

Course Outcomes:

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

CO1: Understand the basic concepts, types, and functions of operating systems, including process management and CPU scheduling techniques.

CO2: Analyze process synchronization mechanisms and deadlock situations, and apply appropriate methods for prevention, avoidance, detection, and recovery.

CO3: Understand memory management techniques such as paging, segmentation, virtual memory, and page replacement algorithms for efficient utilization of memory.

CO4: Explain file system structures, file organization, access methods, and directory implementation for effective data storage and retrieval.

CO5: Evaluate disk management techniques including disk scheduling algorithms, swap-space management, and system reliability.

Credit: 4	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-2-0)

Unit	Topic	No. of Lectures
1	**Introduction:** What is an operating system, Simple Batch Systems, Multi, programmed Batch systems, Time, Sharing Systems, Personal, Computer Systems, Parallel systems, Distributed systems, Real, Time Systems. **Process Management:** Process Concept, Process Scheduling, Cooperating Processes, Threads, Inter process Communication, CPU Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.	7
2	**Process Synchronization and Deadlocks**: The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors, **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	8
3	**Memory Management:** Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with Paging, Virtual Memory, Demand Paging and its performance, Page Replacement Algorithms, Allocation of Frames, Thrashing, Page Size and other considerations, Demand Segmentation.	7
4	**File Management**: File Systems, Secondary Storage Structure, File concept, Access methods, Directory implementation, Efficiency and performance, Recovery.	5

5	**Disk Management:** Disk Structure, Disk scheduling, Disk scheduling algorithm: FCFS, SSTF, SCAN, Recovery, Swap-Space Management, Disk Reliability.	5

Suggested Readings:

1. Silbersachatz and Galvin, "Operating System Concepts", Person, 5th Ed. 2001
2. Madnick E., Donovan J., "Operating Systems:, Tata McGraw Hill, 2001

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computer systems and hardware components
- Understanding of fundamental programming concepts (preferably in C or any high-level language)
- Familiarity with data structures (arrays, stacks, queues)
- Basic understanding of computer organization and architecture
- Logical thinking and problem-solving skills

Programme/Class: Bachelor of Computer Application	Year: II	Semester: IV
Subject: Minor		
Course Code: C 403	**Course Title: Optimization Techniques**	

Course Outcomes:

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

CO1: Understand the fundamentals of Operations Research, its characteristics, and its role in decision-making and industrial applications.

CO2: Formulate and solve Linear Programming Problems (LPP) using graphical and algebraic methods such as simplex, two-phase, and Big-M methods.

CO3: Analyze and solve transportation and assignment problems using various optimization techniques like Vogel's Approximation Method and Hungarian Method.

CO4: Apply sequencing models to optimize processing of jobs through machines in different operational scenarios.

CO5: Evaluate decision-making situations using game theory concepts including minimax, maximin, dominance, and graphical solutions.

Credit: 4	Core compulsory
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	Basics of operation research (OR): Characteristics of OR, Necessity of OR in industry, OR and decision making, role of computers in OR. Linear Programming: Formulations and graphical solution of (2 variables) canonical and standard terms of linear programming problem.	7
2	Algebraic solution: Simplex methods, Charnes method of penalties, two phase simplex method.	8
3	Transportation Model: Definition, formulation and solution of transportation models, The row, minima, column, minima, matrix, minima and Vogel's approximation methods. Assignment model: Definition of assignment model, comparison with transportation model, formulation and solution of assignment model.	7
4	Sequencing Problem: Processing of n jobs through 2 machines, processing n jobs through 3 machines, processing 2 jobs through m machines.	5
5	Game Theory: Characteristics of games, maxima, minimax criteria of optimality, dominance property, algebraic and graphical method of solution of solving 2 x 2 games.	5

Suggested Readings:

1. Silbersachatz and Galvin, "Operating System Concepts", Person, 5th Ed. 2001
2. Madnick E., Donovan J., "Operating Systems:, Tata McGraw Hill, 2001

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computer systems and hardware components

- Understanding of fundamental programming concepts (preferably in C or any high-level language)
- Familiarity with data structures (arrays, stacks, queues)
- Basic understanding of computer organization and architecture
- Logical thinking and problem-solving skills

Programme/Class: Bachelor of Computer Application	Year: II	Semester: IV
Subject: AEC		
Course Code: C-404	Course Title: Data Science	

Course Outcomes:

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

CO1: Understand the fundamental concepts of Data Science, including data collection, data preprocessing, and data exploration techniques.

CO2: Apply statistical methods and probability concepts to analyze and interpret data effectively.

CO3: Apply exploratory data analysis techniques using descriptive statistics (mean, median, mode, variance), visualize data through charts and graphs, analyze relationships using correlation and covariance.

CO4: Implement basic Utilize programming tools (such as Python/R) and libraries for data manipulation, visualization, and analysis.machine learning algorithms for classification, regression, and clustering tasks.

CO5: Utilize programming tools (such as Python/R) and libraries for data manipulation, visualization, and analysis.

Credit: 4	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Introduction to Data Science:** Definition and scope of Data Science, Data Science lifecycle, Applications of Data Science, Tools and technologies (Python, R, Excel)	7
2	**Data Collection and Pre-processing:** Types of data (structured, unstructured), Data collection methods, Data cleaning and handling missing values, Data transformation and normalization	8
3	**Exploratory Data Analysis (EDA):** Descriptive statistics (mean, median, mode, variance), Data visualization (charts, graphs), Correlation and covariance, Introduction to libraries (NumPy, Pandas, Matplotlib)	7

4	**Machine Learning Basics:** Introduction to Machine Learning, Types: Supervised and Unsupervised learning, Algorithms: Linear Regression, Logistic Regression, K-Means Clustering, Model evaluation (accuracy, confusion matrix)	5
5	**Data Analysis using Python:** Python basics for Data Science, Working with NumPy and Pandas, Data visualization using Matplotlib/Seaborn	5

Suggested Readings:

1. Joel Grus, Data Science from Scratch, 2nd Edition, O'Reilly Media, 2019.
2. Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly Media, 2017.
3. Jake VanderPlas, Python Data Science Handbook, 1st Edition, O'Reilly Media, 2016.

Course Prerequisites: Before studying this course, students should have basic knowledge of digital electronics (number systems, logic gates), computer fundamentals, and programming concepts (such as C) is required.

Programme/Class: Bachelor of Computer Application	Year: II	Semester: IV
Subject: Project		
Course Code: C-405	**Course Title: Mini Project**	

Course Outcomes:

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

CO1: Identify a real-world problem and analyze requirements to propose an appropriate solution using computing techniques.

CO2: Design and develop a small-scale software/hardware project by applying programming, database, or web technologies.

CO3: Apply problem-solving, logical thinking, and technical skills to implement and test the developed system.

CO4: Work effectively in a team, demonstrating collaboration, planning, and project management skills.

CO5: Prepare technical documentation and present the project work effectively using appropriate communication tools.

Credit: 3	**Core compulsory**
Max Marks: 100	**Min Passing Marks:40**

Total No. of Lectures- Tutorials – Practical (In hours per week): (0-0-3)

	Topic	
	HTML-CSS-PHP Based • Online Student Management System • Library Management System • Online Voting System • E-Commerce Website (Basic) • Online Examination System • College Event Management System • Job Portal System • Blog Website with Admin Panel • Online Feedback System • Hospital Management System **Java-Based Projects** • Student Record Management System • Banking Management System • Library Management System (Java GUI) • Quiz Application • Hotel Management System • Inventory Management System • ATM Simulation System • Employee Payroll System	

Suggested links:

MDN Web Docs, Best for **detailed concepts of HTML, CSS, JavaScript, APIs**

W3Schools, Beginner-friendly tutorials with **"Try It Yourself" editor**

freeCodeCamp

Programme/Class: Bachelor of Computer Application	Year: II	Semester: IV
Subject: Major 1		
Course Code: C 406	**Course Title: Web Technology with HTML-CSS-XML-PHP & MySQL**	

Course Outcomes:

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

CO1: Understand the fundamentals of Internet, World Wide Web, client-server architecture, web browsers, and various web protocols.

CO2: Apply Dynamic HTML concepts including DOM, CSS positioning, and event handling to create interactive and responsive web pages.

CO3: Design and develop structured web pages using HTML, CSS, and XML with proper layout, formatting, hyperlinks, and multimedia integration.

CO4: Develop server-side applications using PHP, including form handling, functions, arrays, file handling, and control structures.

CO5: Implement session and cookie management and perform database connectivity using MySQL with SQL operations and basic error handling.

Credit: 4	Core compulsory
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-2-0)

Unit	Topic	No. of Lectures
1	1. Create a simple **web page** showing your personal details (Name, Course, College). 2. Design a **home page** with links to at least 3 other pages (About, Contact, Services). 3. Demonstrate **client-server communication** using a diagram and explanation. 4. Write a short program/report showing the working of **HTTP protocol**. 5. Write a JavaScript program to display "Hello World" in a browser. 6. Create a form and validate input fields using JavaScript.	7
2	1. Write a JavaScript program to access and display content of an HTML element using DOM. 2. Create a program to change text and style dynamically using getElementById(). 3. Develop a web page to add and remove elements dynamically using DOM methods. 4. Write a JavaScript program to change CSS properties dynamically (color, font size, background). 5. Create a button that changes multiple styles of a webpage dynamically. 6. Develop a theme switcher (light/dark mode) using JavaScript.	8

3	1. Design a page using **different text styles** (bold, italic, underline, quotations). 2. Create a page using **HTML entities and symbols**. 3. Design a table with rows, columns, and merged cells. 4. Create a webpage layout using div, classes, and id. 5. Create a navigation bar with dropdown menu. 6. Design an image gallery using CSS.	7
4	1. Write a PHP program to display **"Hello World"**. 2. Create a program using **variables, constants, and data types**. 3. Write a PHP program to perform **arithmetic operations** using operators 4. Write a PHP program to check whether a number is **even or odd**. 5. Write a program to perform **string operations** (length, reverse, compare). 6. Demonstrate **built-in string functions** (strlen, strrev, strpos, etc.).	5
5	1. Write a PHP program to **start a session and store user data** (name, login status). 2. Create a session-based **login/logout system**. 3. Write a program to **destroy a session** and clear session variables. 4. Create a PHP program to **set and retrieve cookies**. 5. Demonstrate how to **delete cookies** in PHP. 6. Create a program using **cookies with sessions** (e.g., remember user preference). 7. Write a PHP program using try-catch block. 8. Demonstrate throwing custom exceptions. 9. Create a program to handle division by zero exception.	5

Suggested Readings:

1. Shelley Powers, "Dynamic Web Publishing" 2
2. Html & CSS: The Complete Reference 5th Edition (English, Paperback, Thomas A. Powell)
3. XML: The Complete Reference Book by Heather Williamson
4. Learning PHP, MySQL, books by "O riley Press".
5. Beginning PHP and My SQLby" W. Jason Gilmore"

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computers and internet usage
- Familiarity with operating systems and file handling
- Understanding of fundamental programming concepts (preferably C or any high-level language)
- Basic knowledge of HTML or exposure to web browsing (helpful but not mandatory)
- Logical thinking and problem-solving skills

V Semester

Programme/Class: Bachelor of Computer Application	**Year: III**	**Semester: V**
Subject: Major 1		
Course Code: C- 501	**Course Title: Visual Basic. NET**	

Course Outcomes:

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

CO1: Understand the fundamentals of the .NET Framework, including CLR, FCL, and the Visual Studio IDE environment.

CO2: Develop programs using Visual Basic .NET with appropriate data types, operators, control structures, and arrays.

CO3: Design interactive applications using menus, toolbars, dialog boxes, and functions (built-in and user-defined).

CO4: Create GUI-based applications using various VB.NET controls and handle events, properties, and methods effectively.

CO5: Apply advanced concepts such as object-oriented programming, file handling, exception handling, and database connectivity using ADO.NET.

Credit: 5	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	**Topic**	**No. of Lectures**
1	Visual Basic .NET and the .NET Framework: Introduction to .net framework, Features, Common Language Runtime (CLR), Framework Class Library (FCL). Visual Studio.Net – IDE, Languages Supported, Components, Visual Programming, VB.net, Features, IDE, Menu System, Toolbars, Solution Explorer, Object Browser, Toolbox, Class View Window, Properties Window, Server Explorer, Task List, Output Window, Command Window.	7
2	Programming in Visual basic .net: Data Types, Keywords, Declaring Variables and Constants, Operators, Understanding Scope and accessibility of variables, Conditional Statements, If- then, If- then- else, Nested If, Select Case, Looping Statement, Do loop, For Loop, For Each, Next Loop, While Loop, Arrays, Static and Dynamic.	8
3	Functions, Built-In Dialog Boxes, Menus and Toolbar: Menus and toolbars, Menu Strip, Tool Strip, Status Strip, Built-In Dialog Boxes –Open File Dialogs, Save File Dialogs, Font Dialogs, Color Dialogs, Print Dialogs, Input Box, Msg box, Interfacing with End user, Creating MDI Parent and Child, Functions and Procedures, Built-In Functions, Mathematical and String Functions, User Defined Functions and Procedures.	7
4	Elements of Visual Basic .Net: Properties, Events and Methods of Form, Label, Text Box, List Box, Combo Box, Radio Button, Button, Check Box, Progress Bar, Date Time Picker, Calendar, Picture Box, HScroll bar, VScroll Bar, Group Box, ToolTip, Timer.	5
5	Advanced Concepts in VB.Net: Object Oriented Programming, Creating Classes, Objects, Fields, Properties, Methods, Events, Constructors and	5

	destructors, Exception Handling, Models, Statements, File Handling, Using File Stream Class, File Mode, File Share, Opening or Creating Files with File Stream Class, Reading and Writing Text using Stream Reader and Stream Writer Classes, Data Access with ADO.Net – What are Databases? Data Access with Server Explorer, Data Adapter and Data Sets, ADO.NET Objects and Basic SQL. Creating Windows/Web Applications with the help of databases.	

Suggested Readings:

1. Jesse liberty :"Learning Visual Basic.net"
2. Steven Holzner: " VB.NETBlackBook "
3. Chuck Easttom: " Learn VB.NET"

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of computers and operating systems
- Familiarity with fundamental programming concepts (such as variables, data types, and control structures)
- Basic understanding of any programming language (C or similar is preferred but not mandatory)
- Awareness of basic graphical user interface (GUI) usage

Programme/Class: Bachelor of Computer Application	Year: III	Semester: V
Subject: Major 2		
Course Code: C- 502	**Course Title: Computer Organization and Architecture**	

Course Outcomes:

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

CO1: Understand the basic structure and functional units of a computer system, including input/output units, memory, and CPU with addressing mode.

CO2: Explain the architecture and functioning of the central processing unit (CPU), including instruction execution, addressing modes, and control unit design.

CO3: Evaluate different memory organization techniques, cache memory, and virtual memory concepts to optimize system performance

CO4: Understand input/output organization, interrupt handling mechanisms, and data transfer techniques in computer systems.

CO5: Understand Instruction Set Architecture (ISA), RISC and CISC Architecture, vector processing.

Credit: 5	Core compulsory
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Basic structure of Computers Operational concepts:** Von Neumann Architecture, Booths Algorithm, IEEE Standards, Floating Point Arithmetic, the accumulator, Shifts, Carry and Overflow, CPU with Single BUS, Addressing Modes, Instruction Formats.	7
2	**Processor Organization:** Programmers Model of 8086, Register Organization, 8086 Registers, Instruction Cycles, Addressing Modes. Micro operations, The Instruction cycle, Control of the CPU, Single, Two, Three bus structure, Execution of a complete instruction, Branching, Sequencing of Control Signals, Hardwired Control Unit, Micro-Programmed Control.	8

3	**Memory Organization:** Concept of Memory: Memory hierarchy (Registers, Cache, Main Memory, Secondary Memory), Cache Memory: Concept and need of cache memory, Cache organization and levels (L1, L2, L3), Mapping functions, Replacement algorithms, Virtual memory.	7
4	**I/O Organization:** Input / Output Module: Interrupt Driven I/O, Basic concepts of an Interrupt, Response of CPU to an Interrupt, Design Issues, Priorities, Interrupt handling, Types of Interrupts**.** Data Transfer Techniques, Data Memory Access, I/O Interface, Synchronous and Asynchronous Data Transfer.	5
5	**Microprogramming:** Basic Principles, Features of microprogramming, Instruction Set Architecture (ISA), RISC and CISC, Characteristics of CISC, Characteristics of RISC, RISC versus CISC, Vector Processing Requirements and Characteristics of vector processing.	5

Suggested Readings:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance," 10th Edition, Pearson Education, 2016.
2. Morris Mano, "Computer System Architecture," 3rd Edition, Pearson Education, 1993.
3. Andrew S. Tanenbaum, "S**tructured Computer Organization,"** 6th Edition, Pearson / Prentice Hall, 2013.

Course Prerequisites: Before studying this course, students should have basic knowledge of digital electronics (number systems, logic gates), computer fundamentals, and programming concepts (such as C) is required.

Programme/Class: Bachelor of Computer Application	Year: III	Semester: V
Subject: Major 3		
Course Code: C-503	**Course Title: Computer Network and Security**	

Course Outcomes:

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

CO1:

Understand the fundamentals of the .NET Framework, including CLR, FCL, and the Visual Studio IDE environment.

CO2:

Develop programs using Visual Basic .NET with appropriate data types, operators, control structures, and arrays.

CO3:

Design interactive applications using menus, toolbars, dialog boxes, and functions (built-in and user-defined).

CO4:

Create GUI-based applications using various VB.NET controls and handle events, properties, and methods effectively.

CO5:

Apply advanced concepts such as object-oriented programming, file handling, exception handling, and database connectivity using ADO.NET.

Credit: 5	Core compulsory
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Basics of Computer Networks:** Definition of Computer Network, Components of a Computer Network Types of Network: LAN, MAN, WAN , Organization of the Internet, ISP, Network Structure , OSI Reference Model, TCP/IP Protocol Suite Network Devices and Components, Data Transmission Modes: Serial & Parallel, Simplex, Half Duplex, Full Duplex, Multiplexing: FDM, WDM, TDM ,Transmission Media: Guided & Unguided ,Twisted Pair, Coaxial Cable, Optical Fiber , Comparison: Fiber Optics vs Copper Wire,Wireless Transmission	7
2	**Data Link Layer & Medium Access:** Data Link Layer**:** Services to Upper Layer, Framing, Error Control, Flow Control, Sliding Window Protocols. Medium Access Sub Layer, Channel Allocation**,** LAN Protocols: ALOHA	8
3	**Network & Transport Layer:**Network Layer **:** Routing Algorithms (Centralized, Distributed), Congestion Control (Token & Non-Token Based) **,** Internetworking, IP Packet **,** IP Addressing, IPv4 & IPv6. Transport Layer: Introduction & Design **,**Connection Management, UDP	7
4	**Higher Layers & Cryptography Basics:**Session Layer: Design & Remote Procedure Call, Presentation Layer: Design **.**Application Layer: File	5

	Transfer, Email, Virtual Terminals Cryptography :Symmetric Encryption ,Public Key Cryptography (RSA) ,Diffie-Hellman, Elliptic Curve	
5	**Network Security:** Encryption Techniques & DES, Block Cipher & Modes of Operation, Authentication & Hashing ,MAC, Digital Signatures & Protocols .Security Applications: Kerberos, IP Security, Web Security . System Security :Password Management, Viruses & Countermeasures, Firewall Design	5

Suggested Readings:

1. W. Stallings, "Data and Computer Communication", Pearson Education.
2. A. S. Tanenbaum, "Computer Network", 4th, Edition, Pearson Education.
3. Forouzan, "Data Communication and Networking", 2nd Edition, Tata McGraw Hill.
4. William Stallings, "Cryptography and Network Security, Principles and Practices ", Prentice Hall of India, Third Edition,2003.
5. AtulKahate-"Cryptography and Network Security & quot;,Tata McGraw,Hill,2003.

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic understanding of **computer fundamentals** (hardware & software)
- Knowledge of **operating systems concepts**
- Familiarity with **basic programming concepts** (any language)
- Basic understanding of **data communication and internet usage**
- Elementary knowledge of **mathematics** (number systems, logic)

Programme/Class: Bachelor of Computer Application	Year: III	Semester: V
Subject: Major 4		
Course Code: C 504	**Course Title: Cloud Computing**	

Course Outcomes:

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

CO1: Understand the fundamental concepts of cloud computing, including its evolution, characteristics, and service models.

CO2: Explain and apply virtualization technologies and cloud-enabling technologies in computing environments.

CO3: Analyze cloud architecture, deployment models (Public, Private, Hybrid) and service models (IaaS, PaaS, SaaS).

CO4: Evaluate resource management techniques and security challenges in cloud computing environments.

CO5: Apply knowledge of modern cloud technologies such as Hadoop, MapReduce, and cloud platforms for real-world applications.

Credit: 5	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	lntroduction: lntroduction: lntroduction to cloud computing, Definition of Cloud , Evolution of cloud computing, Underlying Prlnciples of Parallel and Distributed computing,Cloud Cha racteristics, Elasticity in Cloud, On-demand Provisioning.	7
2	Cloud enabling technologies: Service Oriented Architecture , Basics of Virtualization, Types of virtualization, lmplementation Levels of virtualization, virtualization structures ,Tools and Mechanisms, virtualization of CPU, Memory - l/O Devices , virtualization support and Disaster Recovery	8
3	**Cloud architecture, Services and Storage:** Layered Cloud Architecture Design , cloud Architecture ,Public, Private and Hybrid Clouds: laaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage: Storage as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers - S3	7
4	**Resource management and security in cloud:** lnter Cloud Resource Management Resource provisioning and Resource Provisioning Methods ,security overview, Cloud security challenges, Software-as-a Service Security, Security Governance	5
5	**Cloud technologies and advancements:** Hadoop, MapReduce, Virtual Box, Google App Engine Programming Environment for Google App Engine	5

Suggested Readings:

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

Course Prerequisites:

Before enrolling in this course, students should have:

- Basic knowledge of **computer fundamentals**
- Understanding of **operating systems concepts**
- Familiarity with **computer networks and internet basics**
- Basic knowledge of **programming (any language)**
- Introductory understanding of **data structures and databases**

Programme/Class: Bachelor of Computer Application	Year: III	Semester: V
Subject: Internship/project		
Course Code: C 505	Course Title: Internship	

Course Outcomes:

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

CO1: Develop desktop-based applications using VB.NET.

CO2: Design user-friendly interfaces using Windows Forms.

CO3: Implement database connectivity (ADO.NET) in applications.

CO4: Apply event-driven programming concepts.

CO5: Develop and present a complete project with proper documentation.

Credit: 4	Core compulsory
Max Marks: 100	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (0-0-4)

	Topic	
	Suggested Areas for Internship: • Windows Forms Application Development • Database-driven Applications (using SQL Server / MS Access) • GUI Design and Event Handling • File Handling and Reports Generation • Small Business Applications (Billing System, Inventory System, Student Management System)	
	Sample Project Ideas: • Student Management System • Library Management System • Billing / Invoice System • Hospital Management System (basic) • Employee Payroll System	

Deliverables:

- **Internship Completion Certificate**
- **Project Source Code**
- **Project Report (40–60 pages)**
- **Presentation (PPT)**

Course Prerequisites:

- **Basic knowledge of programming concepts**
- **Understanding of Visual Basic / VB.NET basics**
- **Familiarity with databases (basic SQL)**

VI Semester

Programme/Class: Bachelor of Computer Application	**Year: III**	**Semester: VI**
Subject: Major 1		
Course Code: C-601	**Course Title: Design and Analysis of Algorithms**	

Course Outcomes:

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

CO1: Understand algorithm fundamentals, complexity analysis techniques, asymptotic notations, and methods such as Master theorem, substitution, and iteration.
CO2: Apply sorting and searching algorithms such as binary search, merge sort, quick sort, and heap sort to solve computational problems.
CO3: Design efficient algorithms using greedy and dynamic programming approaches for optimization problems.
CO4: Solve computational problems using backtracking techniques and analyze graph algorithms including BFS and DFS.
CO5: Analyse graph algorithms such as minimum spanning trees and shortest paths, and understand complexity classes like P, NP, NP-complete, and NP-hard problems.

Credit: 5	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	**Topic**	**No. of Lectures**
1	**Basic Concepts of Algorithms:** Definition of algorithm, Characteristic of algorithm, Complexity Analysis techniques, Asymptotic Notations (Growth of Functions), Master theorem, Substitution Method, Iteration Method	7
2	**Divide and Conquer Approach:** Maximum &Minimum, Merge Sort, Quick Sort, Heap Sort with time Complexity.	8
3	**Greedy method:** General method, Knapsack Problem, Huffman Codes. **Dynamic Programming:** Matrix Chain Multiplications, Longest Common Subsequence **Backtracking:** General method, N Queens Problem, Sum of subsets.	7
4	**Analysis of Graph Algorithms:** Elementary Graph Algorithms, Multistage Graphs, Basic Traversals and search techniques, techniques of graphs: BFS, DFS. **Minimum Spanning Trees:** Kruskal's& Prim's Algorithm, Single Source Shortest Path, Dijkstra's& Bellman Ford, All Pairs Shortest Path: Warshal Algorithm.	7

5	**Introduction to Complexity Theory:** The class P and NP, Polynomial reduction, NP- Complete Problems, NP-Hard Problems	5

Suggested Readings:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 3rd Edition, MIT Press, 2009.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2008.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson Education, 2012.

Course Prerequisites: Basic knowledge of programming concepts and data structures is required. Familiarity with problem-solving techniques, mathematics (especially discrete mathematics), and logical reasoning will help students understand algorithm design and analysis effectively.

Programme/Class: Bachelor of Computer Application	Year: III	Semester: VI
Subject: Major 2		
Course Code: C-602	**Course Title: Software Engineering**	

Course Outcomes:

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

CO1: Understand software characteristics, software engineering principles, challenges, and requirement specification techniques.

CO2: Analyse different SDLC models such as Waterfall, Spiral, Agile, and Prototype for software development.

CO3: Apply design concepts like abstraction, modularity, cohesion, coupling, and user interface design in software development.

CO4: Evaluate software quality using testing techniques, test case design, and quality assurance models.

CO5: Analyse software cost estimation methods and factors affecting software development and maintenance costs.

Credit: 5	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Software:** Type of Software, Characteristic of Software, Attributes of Good Software, Definition of Software Engineering. Software Engineering Costs, Key Challenges that Software Engineering Facing, System Engineering and Software Engineering. Requirements Definition - Software Requirements Specification - Specification Techniques - Languages and Processors for Requirements.	7
2	**System Development Life Cycle:** The Waterfall Model, Verification & Validation Model, Spiral Model, Iterative Incremental Model, Big Bang Model, Rapid Application Model, Agile Model, Extreme Programming, Prototype Model: Evolutionary Development of Software.	8
3	**Design Concept:** Abstraction, Architecture, Patterns, Modularity: Cohesion, coupling, Information Hiding, Functional Independence Model, User Interface Design: Information Presentation, Interface Evaluation, Design Notation	7
4	**Software Testing and Quality Assurance:** Verification and Validation, Techniques of Testing: Black-Box and White Box Testing, Inspections. Level of Testing: Unit Testing, Integration Testing, Interface testing, System Testing, Alpha and Beta Testing, Regression Testing. Design of test Cases, Quality Management activities, Product and process quality, capability Maturity Model (CMM)	7
5	**Software Cost Estimation:** Introduction - Software Cost Factors - Software Cost Estimation Techniques - Stating Level estimation - Estimating Software Maintenance Costs Software.	5

Suggested Readings: 1. Roger S. Pressman and Bruce R. Maxim, Software Engineering: A Practitioner's Approach, 9th Edition, McGraw Hill Education, 2023. 2. Ian Sommerville, Software Engineering, 10th Edition, Pearson Education, 2016. 3. K. K. Aggarwal and Yogesh Singh, Software Engineering, 3rd Edition, New Age International Publishers, 2008.		
Course Prerequisites: Basic knowledge of programming concepts and computer fundamentals is required. Familiarity with data structures, problem-solving techniques, and system development concepts will help students understand software engineering principles effectively.		

Programme/Class: Bachelor of Computer Application	Year: III	Semester: VI
Subject: Major 3		
Course Code: C-603	**Course Title: Computer Graphics**	

Course Outcomes:

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

CO1: Understand fundamental concepts of computer graphics, display technologies, and input/output devices.

CO2: Apply scan conversion techniques for drawing primitives and implement line clipping algorithms.

CO3: Perform 2D and basic 3D transformations using matrix representations and coordinate systems.

CO4: Analyze curves, surfaces, and solid modeling techniques for graphical object representation.

CO5: Understand animation principles and techniques including keyframing, morphing, and motion control.

Credit: 5	**Core compulsory**
Max Marks: 75	**Min Passing Marks:**

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**Introduction:** Concept of Computer Graphics**,** Interactive Graphics, Advantages of Interactive Graphics, Uses of Computer Graphics, Hardcopy Technologies, Display Technologies, Raster Scan Display System, Video Controller, Random, Scan Display processor, Image Scanners.	7
2	**Conceptual Framework for Interactive Graphics:** Overview, Scan Converting Lines, Scan Converting Circles, Scan Converting Ellipses. Line Clipping: Clipping Southland, Cohen Algorithm, Cyrus Beck Algorithm, Midpoint Subdivision Algorithm	8
3	**Geometrical Transformation:** Introduction, types of transformation, **2D Transformation:** (translation, rotation, scaling, reflection and shearing), Homogeneous Coordinates and Matrix Representation of 2D Transformations, Successive and composition of 2D Transformations, the Window to Viewport Transformations, Introduction to 3D Transformations Matrix.	7
4	**Curves & Surfaces:** Polygon Surfaces and polygon meshes, Quadratic and super quadrics surfaces, Spline curve and representation. **Solid Modeling:** Characteristics, Representation, primitive Instancing, Sweep Representations, Boundary Representations, Constructive Solid Geometry, Spatial Partitioning Representations: Cell	7

	Decomposition, Enumeration of Space Occupation, Octree representation	
5	**Computer Animation:** introduction, Application of animation, Morphing, Keyframe system, Motion specifications in Animation, Types of animation, Sequencing of Animation Design and Fundamental principles of animation**.**	5

Suggested Readings:

1. James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics: Principles and Practice, 2nd Edition, Addison-Wesley, 1995.
2. Donald Hearn and M. Pauline Baker, Computer Graphics with OpenGL, 4th Edition, Pearson Education, 2011.
3. Steven Harrington, Computer Graphics: A Programming Approach, 2nd Edition, McGraw Hill Education, 1987.

Course Prerequisites: Basic knowledge of computer fundamentals and programming is required. Familiarity with mathematics (especially geometry and matrices) will help students understand graphical transformations and algorithms effectively.

Programme/Class: Bachelor of Computer Application	Year: III	Semester: VI
Subject: Major 4		
Course Code: C-604	Course Title: Artificial Intelligence and Machine Learning	

Course Outcomes:

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

CO1: Understand fundamental concepts of Artificial Intelligence, problem representation, characteristics, and application areas.
CO2: Analyze the structure, components, and applications of expert systems along with their advantages and limitations.
CO3: Apply various search algorithms including uninformed and informed (heuristic) methods to solve AI problems.
CO4: Understand basic concepts of natural language processing, text and speech recognition, and their applications.
CO5: Apply basic machine learning techniques including supervised, unsupervised, and reinforcement learning algorithms.

Credit: 5	Core compulsory
Max Marks: 75	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (4-1-0)

Unit	Topic	No. of Lectures
1	**AI Concepts:** Various definitions of AI, Knowledge Pyramid, Characteristics of AI Problems, Problem Representation in AI, AI Evolution, Application Areas of AI.	7
2	**Expert System:** Components of Expert System: Knowledge Base, Inference Engine, User Interface, Features of Expert System, Expert System Life Cycle, Advantages/Limitations of Expert System, Application Areas of Expert System.	8
3	**AI and Search Process:** Brute Force Search, Depth First/Breadth First Search, Heuristic Search: Hill Climbing, Constraint Satisfaction, Mean End Analysis, Best First Search, A* Algorithm, AO* Algorithm, Beam Search.	7
4	**Natural Language Processing:** Introduction, Need, Goal, Fundamental Problems in Natural Language, Text and Speech Recognition: Introduction, Advantages and Approaches.	7
5	**Machine Learning:** Introduction, Supervised, Unsupervised, Reinforcement Learning, Decision Tree, KNN, Support Vector Machine (SVM), Bayes Theorem, Clustering: K-Means, K- Mediods	5
Suggested Readings:		

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, 2020.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, 2nd Edition, O'Reilly Media, 2019.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, 1st Edition, Springer, 2006.
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, 1st Edition, MIT Press, 2012.

Course Prerequisites: Basic knowledge of programming (preferably Python) and data structures is required. Familiarity with mathematics, especially linear algebra, probability, and statistics, along with logical reasoning, will help students understand AI and ML concepts effectively.

Programme/Class: Bachelor of Computer Application	Year: III	Semester: VI
Subject: Major Project		
Course Code: C-605	**Course Title: Major Project**	

Course Outcomes:

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

CO1: Identify and analyze real-world problems and define appropriate project objectives and scope.
CO2: Apply knowledge of computing concepts, tools, and techniques to design and develop a software/system solution.
CO3: Demonstrate the ability to work independently and in teams, managing time and resources effectively.
CO4: Implement, test, and evaluate the developed system to ensure functionality, reliability, and performance.
CO5: Prepare technical documentation and present the project effectively using oral and written communication skills.

Credit: 5	Core compulsory
Max Marks: 100	Min Passing Marks:

Total No. of Lectures- Tutorials – Practical (In hours per week): (0-0-4)

Unit	Topic	No. of Lectures
1	**Web Development Projects** 1. Online Student Management System 2. E-Commerce Website (with payment integration) 3. Online Job Portal 4. Event Management System 5. Blogging Platform with Admin Panel 6. Online Examination System 7. Library Management System (Web-based) 8. Complaint Management System	7
2	**Python / AI / Data Science Projects** 1. Movie Recommendation System 2. Student Performance Prediction System 3. Fake News Detection using Machine Learning 4. Chatbot for College/Customer Support 5. House Price Prediction System 6. Email Spam Detection System	8

	7. Sentiment Analysis of Social Media 8. Resume Screening System using AI	
3	**Database-Oriented Projects** 1. Hospital Management System 2. Inventory Management System 3. Banking Management System 4. Payroll Management System 5. Hotel Reservation System 6. Vehicle Management System	7
4	**Networking / Security Projects** 1. Network Traffic Analyzer 2. Password Strength Checker 3. File Encryption & Decryption Tool 4. Secure File Sharing System 5. Intrusion Detection System (Basic)	7
5	**Machine Learning Project** 1. Student Performance Prediction 2. House Price Prediction 3. Fake News Detection System 4. Sentiment Analysis System 5. Handwritten Digit Recognition	5

Suggested Readings:

1. Roger S. Pressman and Bruce R. Maxim, Software Engineering: A Practitioner's Approach, 9th Edition, McGraw Hill Education, 2023.
2. Ian Sommerville, Software Engineering, 10th Edition, Pearson Education, 2016.
3. Herbert Schildt, The Complete Reference (Programming Series), Latest Edition, McGraw Hill Education.
4. Efraim Turban, Linda Volonino, Information Technology for Management, 11th Edition, Wiley India, 2019.
5. Eric Matthes, Python Crash Course, 2nd Edition, No Starch Press, 2019.

Course Prerequisites: Basic knowledge of programming languages, database management systems, and software development concepts is required. Familiarity with problem-solving techniques, system design, and tools/technologies relevant to the chosen project domain will help students complete the project effectively.