SYLLABUS

for

Bachelor of Science (Computer Science)

Programme

As Per

New Education Policy (NEP-2020)

Hemvati Nandan Bahuguna Garhwal University

SRINAGAR (GARHWAL)

Course Structure for Bachelor of Science (Computer Science) Programme as Per NEP 2020

Semester I

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C101	Fundamental of Computer	3	1	-	4
2		SET/BCS/C102	Programming in 'C'	3	1	-	4
3	Basic Science/Multidi sciplinary	SET/BCS/MD103	Internet Technologies	2	1	-	3
4	Skill Course	SET/BCS/SEC104	Mathematical Foundation/ Office Automation/ PC hardware	2	-	-	2
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP101	Fundamental of Computer Lab	-	-	2	2
6		SET/BCS/CP102	Programming in 'C' Lab	-	-	2	2
7	Basic Science/Multidi sciplinary Labs	SET/BCS/MDP103	HTML Lab	-	-	1	1
8	Value Addition Course/ Extracurricular* Courses/CC	SET/BCS/VAC-105	*Life Skills and Personality development	2	-	-	2
				12	3	5	20

***L= Lectures, T=Tutorials , P= Practicals**

***** Common syllabus for all UG Courses of the University.

Semester II

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C201	Data Structure & File Organization	3	1	-	4
2		SET/BCS/C202	Database Management System	3	1	-	4
3	Basic Science/Multidi sciplinary	SET/BCS/MD203	Computer Based Numerical Techniques	2	1	-	3
4	Skill Course	SET/BCS/SEC204	Management Information System / System Analysis Design /Business Intelligence	2	-	-	2
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP201	Data Structure & File Organization Lab	-	-	2	2
6		SET/BCS/CP202	Database Management System Lab	-	-	2	2
7	Basic Science/Multidi sciplinary Labs	SET/BCS/MDP203	Computer Based Numerical Techniques Lab	-	-	1	1
8	Value Addition Course/ Extracurricular* Courses/CC	SET/BCS/VAC-205	*Understanding and connecting with Environment	2	-	-	2
				12	3	5	20

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Exit option with Certificate in Computer Science (40 Credits)

Semester III

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C301	Object Oriented Programming using C++	3	1	-	4
2		SET/BCS/C302	Computer Architecture and Digital Electronics	3	1	-	4
3	Basic Science/Multidi sciplinary	SET/BCS/MD303	Web Technology	2	1	-	3
4	Skill Course	SET/BCS/SEC304	Modelling & Simulation/ Graph Theory/ Informatics Cyber laws	2	-	-	2
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP301	Object Oriented Programming using C++ Lab	-	-	2	2
6		SET/BCS/CP302	Computer Architecture and Digital Electronics Lab	-	-	2	2
7	Basic Science/Multidi sciplinary Labs	SET/BCS/MDP303	Web Technology lab	-	-	1	1
8	Value Addition Course/ Extracurricular* Courses/CC	SET/BCS/VAC-305	*Indian Knowledge System	2	-	-	2
				12	3	5	20

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Semester IV

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C401	Design and Analysis of Algorithm	3	1	-	4
2		SET/BCS/C402	Operating System	3	1	-	4
3	Basic Science/Multidi sciplinary	SET/BCS/MD403	Programming in Python	2	1	-	3
4	Skill Course	SET/BCS/SEC404	System Administrator/ Software Testing/ Software Engineering	2	-	-	2
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP401	Design and Analysis of Algorithm Lab	-	-	2	2
6		SET/BCS/CP402	Operating System Lab	-	-	2	2
7	Basic Science/Multidi sciplinary Labs	SET/BCS/MDP403	Programming in Python Lab	-	-	1	1
8	Value Addition Course/ Extracurricular* Courses/CC	SET/BCS/VAC-405	Additional Multidisciplinary Skill course (AMSC): **Any one of the following:** **1. Nursery training course** **2. Basic Yoga practices** **3. Physical education/sports management** **4. Folk and culture** **5. Indian traditional Music**	-	-	2	2
				10	3	7	20

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Exit option with Diploma in Computer Science (80 Credits)

Note: Student, on exit, after successfully completing two years (i.e., securing minimum required 90 credits, including minimum required 10 credits for Internship as per the UGC Guidelines:https://www.ugc.ac.in/pdfnews/1887287_Rsearch-Internship-Guidelines-120522.pdf), will be awarded "Undergraduate Diploma" of two years in Computer Science.

Semester V

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C501	Cryptography and Network Security	3	1	-	4
2		SET/BCS/C502	Computer Network	3	1	-	4
3	Vocational Course/ Field Visit/ Entrepreneurship skills	SET/BCS/VC503	E-Commerce	1	1	-	2
4	Discipline specific/ Open Elective/Project	SET/BCS/OE504	VB.Net/ PHP Programming/ Java Programming	3	1	-	4
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP501	Cryptography and Network Security Lab	-	-	2	2
6		SET/BCS/CP502	Computer Network Lab	-		2	2
7	Skill Course	SET/BCS/ OEP -505	DSE 1 Lab	-	-	2	2
				10	4	6	20

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Semester VI

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C601	Computer Graphics	3	1	-	4
2		SET/BCS/C602	Mobile Computing	3	1	-	4
3	Vocational Course/ Field Visit/ Entrepreneurship skills	SET/BCS/VC603	Multimedia Technology	1	1	-	2
4	Discipline specific/ Open Elective/Project	SET/BCS/OE604	Programming Paradigm/ Digital Image Processing/ Open-source data Programming	3	1	-	4
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP601	Computer Graphics Lab	-	-	2	2
6		SET/BCS/CP602	Mobile Computing Lab	-		2	2
7	Skill Course	SET/BCS/ OEP -605	Project	-	-	2	2
				10	4	6	20

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***** Common syllabus for all UG Courses of the University.

Exit option with Degree in Bachelor of Science (Computer Science) (120 Credits)

Note: Student, on exit, after successfully completing three years (i.e., securing minimum required 120 credits)and completion of SSD course work in any one semester within one to six semesters, will be awarded “Bachelor’s Degree” of three years in Computer Science.

Semester VII

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C701	Unix and Shell Programming	3	1	-	4
2		SET/BCS/C702	ADBMS	3	1	-	4
3	Vocational Course/ Field Visit/ Entrepreneurship skills	SET/BCS/VC703	Blockchain Technology	1	1	-	2
4	Discipline specific/ Open Elective/Project	SET/BCS/OE704	Android Programming / Natural Language Processing/ Deep Learning	3	1	-	4
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP701	Shell Programming Lab	-	-	2	2
6		SET/BCS/CP702	ADBMS Lab	-		2	2
7	Skill Course	SET/BCS/ OEP -705	DSE 2 Lab	-	-	2	2
				10	4	6	20

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Semester VIII

S. No.	Category	Course Code	Course Code and Title	L	T	P	Credits
1	Core Basic Engineering Subjects	SET/BCS/C801	Artificial Intelligence	3	1	-	4
2		SET/BCS/C802	Cloud Computing	3	1	-	4
3	Vocational Course/ Field Visit/ Entrepreneurship skills	SET/BCS/VC803	Fundamental of Data Science	1	1	-	2
4	Discipline specific/ Open Elective/Project	SET/BCS/ OE 805	Thesis/Dissertation	3	1		4
5	Core/Basic Engineering Subjects Labs	SET/BCS/CP801	Artificial Intelligence Lab	-	-	2	2
6		SET/BCS/CP802	Cloud Computing Lab	-		2	2
7	Skill Course	SET/BCS/OEP803	Thesis/Dissertation Seminar	-	-	2	2
				10	4	6	20

***L= Lectures, T=Tutorials , P= Practicals**

***** Common syllabus for all UG Courses of the University.

Exit option with Degree in Bachelor of Science (Computer Science) with Honors (160 Credits)

PROGRAMME OUTCOMES (POs)

PO1. Graduates will demonstrate the ability to analyze and solve complex problems using computational methods, algorithms, and data structures.

PO2. Students will acquire a strong proficiency in various programming languages and paradigms, enabling them to develop efficient software solutions.

PO3. Graduates will attain a solid understanding of the fundamental theoretical concepts in computer science, such as data structures, algorithms, automata theory, and computational complexity.

PO4. Students will apply mathematical concepts and analytical techniques effectively to model and solve real-world computational problems.

PO5. Graduates will grasp the architecture and organization of computer systems, encompassing hardware, operating systems, and networks.

PO6. Students will gain practical experience in the software development lifecycle, fostering effective teamwork and collaborative skills.

PO7. Graduates will gain a comprehensive understanding of database systems, data modeling, and database management principles.

PO8. Students will become proficient in web development technologies, including HTML, CSS, JavaScript, and various web frameworks.

PO9. Graduates will demonstrate ethical and professional conduct in their work, adhering to legal and social responsibilities related to computing resources.

PO10. Students will develop effective communication skills, enabling them to convey technical information through oral presentations and written reports.

PO11. Graduates will embrace a lifelong learning mindset, actively staying updated with the rapidly evolving field of computer science.

PO12. Students will recognize the interdisciplinary nature of computer science and its diverse applications across various domains.

SEMESTER - I

Course: Fundamental of Computer (SET/BCS/C101)

Course Objective: The objective of this course is to introduce students to the essential concepts and principles of computer science. The course aims to provide a comprehensive understanding of the foundational knowledge and skills necessary for students to explore more advanced topics in computer science and related fields. The course also seeks to cultivate problem-solving abilities and analytical thinking, fostering a strong foundation for future studies and careers in the computing industry.

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

1. Understand computer system characteristics, including hardware and software components.
2. Familiarize with number systems: decimal, binary, octal, and hexadecimal, along with logic gates and truth tables.
3. Identify various input devices like keyboards, scanners, and pointing devices, and output devices such as printers and projectors.
4. Describe the components of a Central Processing Unit (CPU) and memory (RAM and ROM).

Course Content/Syllabus:

Unit 1: Introduction to Computer Systems and Types

Computer system: characteristics and capabilities. Computer Hardware and Software: Block Diagram of a Computer, Different Data Processing: Data, Data Processing System, Storing Data, Processing Data. Types of Computers: Analogue, Digital, Hybrid, General and Special Purpose Computers. Generation of Computers. Computer Systems: Micros, Minis & Main-frames. Limitations of Micro Computer.

Unit 2: Number Systems and Logic Gates

Number systems: Decimal Number system, Binary number system, Octal & Hexadecimal number system, 1's & 2's complement Codes: ASCH, EBCDI Codes, Gray code & BCD.

Logic Gates: AND, OR, NOT GATES and their Truth tables, NOR, NAND & XOR gates

Unit 3: Input Devices and Computer Output

Introduction to Input Devices: Categorizing Input Hardware, Keyboard, Direct Entry — Card Readers, Scanning Devices — O.M.R., Character Readers, Thumb Scanner, MICR, Smart Cards, Voice Input Devices, Pointing Devices — Mouse, Light Pen, Touch Screen.

Computer Output: Output Fundamentals, Hardcopy Output Devices, Impact Printers, Non-Impact Printers, Plotters, Computer output Microfilm/Microfiche (COM) systems, Softcopy Output Devices, Cathode Ray Tube, Flat Screen Technologies, Projectors, Speakers.

Unit 4: Central Processing Unit (CPU)

Central Processing Unit: The Microprocessor, control unit, A.L.U., Registers, Buses, Main Memory, Main Memory (RAM) for microcomputers, Read Only Memory (ROM).

Unit 5: Storage Devices and Data Storage Methods

Storage Devices: Storage Fundamentals, Primary and Secondary Storage, Data Storage and Retrieval Methods — Sequential, Direct & Indexed Sequential, Tape Storage and Retrieval Methods Tape storage Devices, characteristics and limitations, Direct access Storage and Microcomputers – Hard Disks, Disk Cartridges, Direct Access Storage Devices for large Computer systems, Mass storage systems and Optical Disks, CD ROM.

Recommended Books:

1. "Computer Science: An Overview" by J. Glenn Brookshear
2. Computer Fundamentals, P. K. Sinha, BPB Publications, Sixth Edition.

Course: Programming in C (SET/BCS/C102)

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

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

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

Course Content/Syllabus:

Unit-1: Introduction to C Programming

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

Unit-2: Loops and Functions

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

Unit-3: Storage Classes and Preprocessor

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

Unit-4: User-defined Data Types

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

Unit-5: File Handling and Command-line Arguments

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

Recommended Books:

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

Course: Internet Technologies(SET/BCS/MD103)

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

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

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

Course Content/Syllabus:

Unit-1: Introduction to Internet Technologies

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

Unit-2: Client-Side Web Technologies

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

Unit-3: Server-Side Web Technologies

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

Unit-4: Web Security and Emerging Technologies

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

Recommended Books:

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

Course: Mathematical Foundation (SET/BCS/SEC104.1)

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

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

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

Course Content/Syllabus:

Unit-1 Mathematical Logic

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

Unit-2 Set Theory

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

Unit-3 Functions

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

Unit-4 Combinatorics

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

Unit-5 Number Theory

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

Recommended Books:

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

Course: Office Automation (SET/BCS/SEC104.2)

Course Objective: The "Office Automation" course aims to familiarize participants with tools and techniques for streamlining office tasks using digital technologies. By the course's end, students will be proficient in using office software applications for document creation, data analysis, and communication. The objective is to enhance productivity, collaboration, and efficiency in modern office environments through effective utilization of automation tools.

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

1. Effectively use office automation tools for document creation, presentation, and data analysis.
2. Apply advanced features of office software to optimize office tasks and workflows.
3. Demonstrate effective communication and collaboration skills using office automation tools.

Course Content/Syllabus:

Unit-1: Introduction to Office Automation

Overview of office automation and its benefits, Office Suite applications and their features.

Unit-2: Word Processing and Spreadsheets

Word processing: Formatting, Styles, Mail Merge, Spreadsheets: Formulas, Functions, Charts.

Unit-3: Presentation Tools and Email Management

Creating and delivering presentations, Email and Calendaring: Managing emails and appointments.

Unit-4: Database Management and Workflow Automation

Database management: Creating and querying databases, Document collaboration and version control, Workflow automation using macros and scripts.

Recommended Books:

1. "Microsoft Office 365 & Office 2019: Introductory" by Misty E. Vermaat.
2. "Office 2019 All-in-One for Dummies" by Peter Weverka.

Course: PC Hardware (SET/BCS/SEC104.3)

Course Objective: The "PC Hardware" course aims to provide participants with a comprehensive understanding of computer hardware components and their functionality. By the course's conclusion, students will be able to assemble, troubleshoot, and maintain personal computer systems. The objective is to equip students with practical skills for hardware configuration, upgrades, and diagnostics in various computing environments.

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

1. Understand the components and functionality of PC hardware.
2. Assemble, disassemble, and configure computer systems.
3. Identify and troubleshoot hardware-related issues.

Course Content/Syllabus:

Unit-1: Introduction to PC Hardware components

Overview of PC hardware architecture, Motherboard and BIOS setup, Central Processing Unit (CPU) and Memory.

Unit-2: Storage Devices and Input-Output Devices

Storage devices: Hard Drives, SSDs, and RAID, Input and Output devices: Keyboards, Mice, Monitors, Printers.

Unit-3: Expansion Cards and Power Supply

Expansion cards: Graphics cards, Sound cards, etc., Power supply and cooling systems.

Unit-4: PC Assembly, Troubleshooting, and Maintenance

PC assembly and hardware installation, Troubleshooting common hardware issues, Hardware maintenance and upgrades.

Recommended Books:

1. "CompTIA A+ Certification All-in-One Exam Guide" by Mike Meyers.
2. "Upgrading and Repairing PCs" by Scott Mueller.

Course: Life Skills and Personality Development (SET/BCS/VAC105)

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

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

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

Course Content/Syllabus:

UNIT I - Career and Professional Skills

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

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

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

UNIT II- Attitude and Motivation

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

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

UNIT III- Stress-management and Development of Capabilities

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

UNIT IV- Other Aspects of personality Development

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

UNIT V - Health and Hygiene

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

Recommended Books:

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

SEMESTER II

Course: Data Structure & File Organization (SET/BCS/C201)

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

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

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

Course Content:

Unit-1: Introduction to Data Structures

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

Unit-2: Trees and Graphs

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

Unit-3: Hashing

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

Unit-4: Sorting and Searching Algorithms

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

Unit 5: File Organization and Indexing

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

Recommended Books:

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

Course: Database Management System(SET/BCS/C202)

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

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

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

Course Content:

Unit-1: Introduction to Database Management System

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

Unit-2: Entity-Relationship Diagrams and Normalization

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

Unit-3: Query Languages and Transactions

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

Unit-4: Indexing and Concurrency Control

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

Recommended Books:

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

Course: Computer Based Numerical Techniques (SET/BCS/MD203)

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

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

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

Course Content:

Unit-1: Introduction to Numerical Technique

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

Unit-2: Solving Equations

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

Unit-3: Interpolation and Approximation

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

Unit-4: Numerical Integration and Differentiation

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

Unit-5: Linear Algebraic Equations and Eigenvalue Problems

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

Recommended Books:

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

Course: Management Information System (SET/BCS/SEC204.1)

Course Objective: The objective of this course is to provide students with an understanding of management information systems and their role in organizations. The course aims to develop students' skills in designing and managing information systems to support business operations and decision-making.

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

1. Understand the fundamental concepts of management information systems.
2. Analyze business requirements and design effective information systems.
3. Evaluate and select appropriate technologies for information system implementation.
4. Apply information systems principles to support business operations and decision-making.
5. Understand the ethical and security considerations in managing information systems.

Course Content:

Unit-1: Introduction to Management Information System

Definition and scope of Management Information System (MIS), Components and characteristics of MIS, Role of MIS in decision-making, Types of Information Systems: TPS, DSS, EIS, ERP, etc.

Unit-2: Information Technology and Business Processes

Business processes and their analysis, Business process reengineering and automation, Information Technology infrastructure for MIS.

Unit-3: Database and Data Management

Database concepts and design, Data modeling and normalization, Data storage, retrieval, and security.

Unit-4: Decision Support Systems and Business Intelligence

Introduction to Decision Support Systems (DSS), Data Warehousing and Data Mining, Business Intelligence tools and analytics.

Unit-5: Enterprise Systems and IT Governance

Enterprise Resource Planning (ERP) systems, IT governance and control mechanisms, Challenges and ethical issues in MIS.

Recommended Books:

1. "Management Information Systems: Managing the Digital Firm" by Kenneth C. Laudon and Jane P. Laudon.
2. "Information Systems Today: Managing in the Digital World" by Joseph Valacich, Christoph Schneider, and Robert M. Pearlson.

Course: System Analysis Design (SET/BCS/SEC204.2)

Course Objective: The objective of this course is to familiarize students with the principles and techniques of system analysis and design. The course aims to develop students' skills in analyzing business requirements, designing system architectures, and managing the software development life cycle.

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

1. Understand the fundamentals of system analysis and design.
2. Analyze business requirements and develop system specifications.
3. Design system architectures and data models.
4. Apply software development methodologies for system implementation.
5. Understand the importance of system testing and quality assurance.

Course Content:

Unit-1: Introduction to System Analysis and Design

Overview of System Development Life Cycle (SDLC), Role of System Analyst, Requirement gathering techniques: interviews, questionnaires, etc., Feasibility analysis and project planning.

Unit-2: System Design and Modeling

Data flow diagrams (DFDs) and Entity-Relationship diagrams (ERDs), Structured and Object-Oriented Analysis, User interface design and prototyping.

Unit-3: System Implementation and Testing

System implementation strategies, Testing and debugging techniques, User acceptance testing (UAT).

Unit-4: System Deployment and Maintenance

System deployment and user training, System maintenance and support, System documentation and knowledge transfer.

Recommended Books:

1. "Systems Analysis and Design" by Alan Dennis, Barbara Haley Wixom, and Roberta M. Roth.
2. "Object-Oriented Systems Analysis and Design Using UML" by Simon Bennett, Steve McRobb, and Ray Farmer.

Course: Business Intelligence (SET/BCS/SEC204.3)

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

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

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

Course Content:

Unit-1: Introduction to Business Intelligence (BI)

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

Unit-2: Data Analysis and Reporting

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

Unit-3: Data Mining and Predictive Analytics

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

Unit-4: Business Performance Management

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

Recommended Books:

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

Course: Understanding and Connecting with Environment (SET/BCS/VAC205)

Course Objective: The "Understanding and Connecting with Environment" course aims to provide participants with a comprehensive understanding of the natural world and the intricate relationships between humans and their environment. The course seeks to raise environmental awareness, foster a sense of responsibility towards the planet, and empower individuals to make informed decisions for sustainable living.

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

1. Develop a deep understanding of environmental concepts, ecosystems, and biodiversity.
2. Implement sustainable practices for responsible resource management and waste reduction.
3. Analyse the interconnectedness of species and ecosystems within the natural world.
4. Evaluate and address environmental issues such as climate change and habitat destruction.
5. Cultivate a sense of environmental responsibility and engage in ethical decision-making for sustainable living.

Course Content:

Unit I: Understanding of Environment

Definition, scope and importance of Environment, Multidisciplinary nature of Environmental Sciences, Understanding of Ecology and Ecosystems, Ecological Succession and Ecosystem Services, Energy flow in an Ecosystem; Food Chain, Food Web and Ecological Pyramids, Human interaction with its Environment

Unit II: Natural Resources and Biodiversity Conservation

Basic concept, types and values of Natural Resources, Resource Consumption, Restoration and Conservation Practices and Sustainable Development, Concept, values and distribution of Biodiversity and its linkages with culture, health and people, Threats to Biodiversity and Biodiversity conservation

Unit III: Global Environmental issues

Environmental Pollution and Waste Management, Climate Change, Green House Effect and Global Warming, Radiations, Nuclear and Technological Hazards, Population Growth, Disaster, Pandemic and Human Health Risks

Unit IV: Environment and Society

Origin and Evolution of Human; Social, Cultural and Religious Structure and values of Environment, Traditional Wisdom, Indigenous/traditional Communities and Livelihood Security Industrial Society, Modernization and Adaptations to Natural and Anthropogenic variations, Environmental Movements, Environmental Ethics and Legislations, Connecting human society with conservation and management of water, energy, biodiversity, culture and heritage and waste management

Recommended Books:

1. Erach Bharucha, Environmental Studies. 2004.UGC and BVIEER Pune
2. Singh, J.S., Singh, S.P. and Gupta, S.R.2014. Ecology, Environmental Science and recourse Conservation. Anamaya Publishers

SEMESTER-III

Course: Object Oriented Programming using C++ (SET/BCS/C301)

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

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

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

Course Content:

Unit-1: Introduction to Object-Oriented Programming (OOP)

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

Unit-2: C++ Programming Basics

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

Unit-3: Classes and Objects

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

Unit-4: Inheritance and Polymorphism

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

Unit-5: Exception Handling and File I/O

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

Recommended Books:

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

Course: Computer Architecture and Digital Electronics(SET/BCS/C302)

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

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

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

Course Content:

Unit-1 Introduction to Digital Electronics

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

Unit-2 Combinational Logic Design

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

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

Unit-3 Sequential Logic Design

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

Unit-4 Computer Organization and Architecture

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

Unit-5 Advanced Topics

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

Recommended Books:

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

Course: Web Technology (SET/BCS/MD303)

Course Objective: The objective of this course is to provide students with an understanding of web technologies and their applications in building dynamic and interactive websites. The course aims to develop students' skills in web development using HTML, CSS, JavaScript, and server-side scripting languages.

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

1. Understand the fundamentals of web technologies, including HTML, CSS, and JavaScript.
2. Design and develop static and dynamic web pages.
3. Apply client-side scripting techniques to enhance website interactivity.
4. Design and develop database-driven web applications using server-side scripting.
5. Understand web security and optimization techniques for efficient web development.

Course Content:

Unit-1: Introduction to Web Technology

Basics of the World Wide Web (WWW), Web browsers, web servers, and HTTP protocol, Web development process and tools.

Unit-2: HTML and CSS

HyperText Markup Language (HTML) fundamentals, HTML tags and elements for content and structure, Cascading Style Sheets (CSS) for web page styling.

Unit-3: JavaScript and Client-Side Scripting

Introduction to JavaScript programming, DOM manipulation and event handling, Client-side form validation and interactivity.

Unit-4: Server-Side Scripting and Web Frameworks

Server-side scripting languages (e.g., PHP, Python), Introduction to web frameworks (e.g., Express, Django), Database connectivity and web application development.

Unit-5: Web Security and Emerging Web Technologies

Web security threats and best practices, Secure Socket Layer (SSL) and HTTPS, Emerging web technologies.

Recommended Books:

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

Course: Modelling and Simulation (SET/BCS/SEC304.1)

Course Objective: The objective of this course is to provide students with an understanding of modelling and simulation techniques and their applications in various domains. The course aims to develop students' skills in designing and implementing simulations to analyze and solve complex problems.

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

1. Understand the concepts and principles of modelling and simulation.
2. Design and develop simulation models using appropriate simulation software or programming languages.
3. Apply statistical analysis techniques to evaluate simulation results.
4. Analyze and interpret simulation output to make informed decisions.
5. Apply modelling and simulation techniques to solve real-world problems in different domains.

Course Content:

Unit-1: Introduction to Modelling and Simulation

Overview of modeling and simulation concepts, Types of simulation models, Continuous and discrete event simulation.

Unit-2: Model Development and Validation

System dynamics modeling, Agent-based modeling, Validation and verification of simulation models.

Unit-3: Simulation Software and Tools

Popular simulation software: AnyLogic, Arena, etc., Simulation experiment design and analysis, Sensitivity analysis and optimization.

Unit-4: Case Studies in Simulation

Application of simulation in various domains, Simulation of manufacturing systems, Simulation of queuing systems.

Unit-5: Monte Carlo Simulation

Basics of Monte Carlo simulation, Generating random numbers, Monte Carlo simulation for risk analysis.

Recommended Books:

1. "Simulation Modeling and Analysis" by Averill M. Law and David Kelton.
2. "Discrete-Event System Simulation" by Jerry Banks, John S. Carson II, Barry L. Nelson, and David M. Nicol.

Course: Graph Theory (SET/BCS/SEC304.2)

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

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

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

Course Content:

Unit-1: Introduction to Graph Theory

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

Unit-2: Graph Traversal and Shortest Paths

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

Unit-3: Spanning Trees and Connectivity

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

Unit-4: Network Flows and Matching

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

Unit-5: Graph Algorithms

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

Recommended Books:

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

Course: Informatics Cyber laws (SET/BCS/SEC304.3)

Course Objective: The objective of this course is to provide students with an understanding of cyber laws and their implications in the field of informatics. The course aims to develop students' knowledge of legal frameworks, ethical considerations, and security measures related to information technology.

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

1. Understand the legal frameworks and regulations governing cyberspace.
2. Identify and analyse legal issues related to information technology.
3. Evaluate the ethical implications of information technology practices.
4. Apply security measures to protect information systems and data.
5. Develop an understanding of the legal rights and responsibilities of individuals and organizations in cyberspace.

Course Content:

Unit-1: Introduction to Informatics Cyber laws

Overview of Cyber laws and their significance, Types of Cybercrimes and legal implications, Jurisdiction and challenges in Cyber law enforcement.

Unit-2: Cyber Security and Data Privacy

Cyber security threats and countermeasures, Data protection laws and regulations, Cybersecurity policies and practices.

Unit-3: Legal Framework for E-commerce and Intellectual Property

Laws related to e-commerce and electronic transactions, Intellectual Property laws and their application in the digital environment.

Unit-4: Privacy and Data Protection Laws

Privacy laws and regulations, Data breach notification and handling, GDPR and other global data protection laws.

Unit-5: Cyber Crime Investigation and Digital Forensics

Digital evidence and forensic techniques, Cybercrime investigation process, Role of digital forensics in legal proceedings.

Recommended Books:

1. "Cyber Law: Legal and Practical Considerations for Computer, E-commerce, and Intellectual Property" by Brett J. Trout.
2. "Cyberlaw: Management and Entrepreneurship" by Patricia L. Bellia, Paul Schiff Berman, and David G. Post.

Course: Indian Knowledge System-I (SET/BCS/VAC305)

Course Objective: This course aims to provide participants with a comprehensive understanding of India's rich and diverse knowledge traditions, encompassing philosophy, literature, sciences, arts, and sustainable practices. Through the exploration of traditional wisdom and its contemporary relevance, this course seeks to foster appreciation, preservation, and responsible utilization of the Indian Knowledge System.

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

1. Define and explain the concept and scope of Indian Knowledge System (IKS).
2. Evaluate the contributions of renowned Indian scholars to philosophy, literature, mathematics, astronomy, medicine, yoga, and other disciplines.
3. Analyze ancient Indian literature, including Vedas, Upavedas, Puranas, and Upanishads, for insights into cultural and philosophical heritage.
4. Investigate the socio-cultural linkages between traditional, tribal, and ethnic communities and their knowledge systems.
5. Examine myths, rituals, spiritual practices, and belief systems as integral components of Indian culture.

Course Content:

Unit I: Introduction to Indian Knowledge System (IKS),

Definition, Concept and Scope of IKS, Definition, Concept and Scope of IKS, IKS based approaches on Knowledge Paradigms, IKS in ancient India and in modern India

Unit II: IKS and Indian Scholars, Indian Literature

Philosophy and Literature (Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini), Mathematics and Astronomy (Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta), Medicine and Yoga (Charak, Susruta, Maharishi Patanjali and Dhanwantri), Sahitya (Vedas, Upvedas, Upavedas (Ayurveda, Dhanurveda, Gandharvaveda), Puran and Upnishad) and shad darshan (Vedanta, Nyaya.Vaisheshik, Sankhya, Mimamsa, Yoga, Adhyatma and Meditation), Shastra (Nyaya, vyakarana, Krishi, Shilp, Vastu, Natya and Sangeet)

Unit III: Indian Traditional/tribal/ethnic communities, their livelihood and local wisdom

Geophysical aspects, Resources and Vulnerability, Resource availability, utilization pattern and limitations, Socio-Cultural linkages with Traditional Knowledge System, Tangible and intangible cultural heritage.

Unit IV: Unique Traditional Practices and Applied Traditional Knowledge

Myths, Rituals, Spirituals, Taboos and Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives, Agriculture, animal husbandry, Forest, Sacred Groves, Water Mills, Sacred Water Bodies, Land, water and Soil Conservation and management Practices, Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving, -Fiber Extraction and Costumes, Vaidya (traditional health care system), Tantra-Mantra, Amchi Medicine System, Knowledge of dyeing, chemistry of dyes, pigments and chemicals

Unit V: Protection, preservation, conservation and Management of Indian Knowledge System

Documentation and Preservation of IKS, Approaches for conservation and Management of nature and bio-resources, Approaches and strategies to protection and conservation of IKS

Recommended Books:

1. "Introduction To Indian Knowledge System: Concepts and Applications" by B. Mahadevan, Nagendra Pavana, Vinayak Rajat Bhat
2. "Traditional Knowledge System in India" by Amit Jha

SEMESTER IV

Course: Design and Analysis of Algorithm (SET/BCS/C401)

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

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

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

Course Content:

Unit-1: Introduction to Algorithms

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

Unit-2: Sorting and Searching Algorithms

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

Unit-3: Divide and Conquer Algorithms

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

Unit-4: Dynamic Programming and Greedy Algorithms

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

Unit-5: Graph Algorithms and NP-Completeness

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

Recommended Books:

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

Course: Operating System (SET/BCS/C402)

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

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

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

Course Content:

Unit 1: Introduction to Operating Systems

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

Unit 2: Process Management & Deadlock

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

Unit 3: Memory Management

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

Unit 4: File Systems

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

Unit 5: Device Management

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

Recommended Books:

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

Course: Programming in Python (SET/BCS/MD403)

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

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

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

Unit-1 Introduction to Programming

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

Unit-2 Creating Python Programs

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

Unit-3 Built-in data structures

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

Unit-4 Object Oriented Programming

Introduction to classes, objects and methods; Standard libraries

Unit 5 File and exception handling

File handling through libraries; Errors and exception handling.

Recommended Books:

1. "Mastering Python for Data Science" by Samikshan Bairagya.
2. "Effective Python: 90 Specific Ways to Write Better Python" by Brett Slatkin.

Course: System Administrator (SET/BCS/SEC404.1)

Course Objective: The objective of this course is to provide students with the knowledge and skills required to perform system administration tasks in various operating system environments. The course aims to develop students' understanding of system configuration, maintenance, security, and troubleshooting.

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

1. Understand the roles and responsibilities of a system administrator.
2. Configure and manage operating system environments.
3. Implement security measures to protect system resources.
4. Perform system maintenance and troubleshooting tasks.
5. Apply best practices for system administration in different operating systems.

Course Content:

Unit-1: Introduction to System Administration

Role and responsibilities of a system administrator, Operating systems and their management, User and group management.

Unit-2: System Configuration and Maintenance

Installation and configuration of software and services, System updates and patch management, Disk management and file system maintenance.

Unit-3: Network Administration

Network configuration and troubleshooting, Firewall and network security, Remote access and VPN setup.

Unit-4: System Backup and Recovery

Data backup strategies and tools, Disaster recovery planning and implementation, System monitoring and performance tuning.

Unit-5: Cloud Computing and Virtualization

Introduction to cloud computing, Virtualization technologies (e.g., VMware, Hyper-V), Cloud services and their administration.

Recommended Books:

1. "UNIX and Linux System Administration Handbook" by Evi Nemeth, Garth Snyder, Trent R. Hein, and Ben Whaley.
2. "Windows Server Administration Fundamentals" by Microsoft Official Academic Course.

Course: Software Testing(SET/BCS/SEC404.2)

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

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

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

Course Content:

Unit-1: Introduction to Software Testing

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

Unit-2: Test Planning and Test Case Design

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

Unit-3: Test Execution and Defect Management

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

Unit-4: Performance and Security Testing

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

Unit-5: Test Automation Tools and Emerging Trends

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

Recommended Books:

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

Course: Software Engineering (SET/BCS/SEC404.3)

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

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

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

Course Content:

Unit-1: Introduction to Software Engineering

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

Unit-2: Software Design and Architecture

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

Unit-3: Software Development Methodologies

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

Unit-4: Software Maintenance and Configuration Management

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

Unit-5: Software Metrics and Emerging Practices

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

Recommended Books:

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

SEMESTER V

Course: Cryptography & Network Security (SET/BCS/C501)

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

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

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

Course Content:

Unit-1: Introduction to Network Security

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

Unit-2: Cryptography and Encryption

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

Unit-3: Network Security Protocols

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

Unit-4: Network Access Control and Firewalls

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

Unit-5: Network Security Management and Emerging Technologies

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

Recommended Books:

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

Course: Computer Network (SET/BCS/C502)

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

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

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

Course Content:

Unit-1: Introduction to Data Communication & Networks

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

Unit-2: Network Architecture and OSI Model

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

Unit-3: Data Link Layer and Network Devices

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

Unit-4: Network Security and Wireless Networks

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

Unit-5: Network Management and Emerging Technologies

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

Recommended Books:

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

Course: E-Commerce (SET/BCS/VC503)

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

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

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

Course Content:

Unit-1: Introduction to E-Commerce

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

Unit-2: E-Commerce Infrastructure and Payment Systems

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

Unit-3: E-Commerce Website Development

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

Unit-4: E-Commerce Security and Legal Issues

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

Unit-5: E-Commerce Marketing and Emerging Trends

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

Recommended Books:

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

Course: VB.Net (SET/BCS/OE504.1)

Course Objective: The objective of this course is to introduce students to the Visual Basic .NET programming language and its applications in software development. The course aims to develop students' skills in designing and implementing Windows-based applications using VB.Net.

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

1. Understand the syntax and features of the VB.Net programming language.
2. Design and develop Windows-based applications using VB.Net.
3. Apply object-oriented programming principles in VB.Net.
4. Implement user interfaces and handle events in VB.Net applications.
5. Debug and test VB.Net programs effectively.

Course Content:

Unit-1: Introduction to VB.Net

Basics of VB.Net programming, Data types and variables, Control structures.

Unit-2: Object-Oriented Programming in VB.Net

Classes and objects, Inheritance, Polymorphism, Encapsulation.

Unit-3: Windows Forms and Event Handling

Creating Windows Forms applications, User interface design, Event handling.

Unit-4: File Handling and Database Connectivity

File input and output operations, Database connectivity using ADO.Net.

Unit-5: Advanced VB.Net Concepts

Multithreading, Exception handling, Deployment and distribution of VB.Net applications.

Recommended Books:

1. "Visual Basic .NET Programming" by Harold Davis.
2. "VB.NET Programming for the Absolute Beginner" by Jonathan S. Harbour.

Course: PHP Programming (SET/BCS/OE504.2)

Course Objective: The objective of this course is to introduce students to PHP programming language and its applications in web development. The course aims to develop students' skills in designing and implementing dynamic web applications using PHP.

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

1. Understand the syntax and features of the PHP programming language.
2. Design and develop dynamic web applications using PHP.
3. Interact with databases using PHP and MySQL.
4. Implement server-side scripting for web forms and user input validation.
5. Apply security measures in PHP web applications.

Course Content:

Unit-1: Introduction to PHP

Basics of PHP programming, Data types and variables, Control structures.

Unit-2: PHP and HTML

Embedding PHP in HTML, PHP form handling, Cookies and sessions.

Unit-3: PHP and MySQL

Database connectivity using PHP, CRUD operations with MySQL.

Unit-4: File Handling and Security in PHP

File input and output operations, PHP security best practices.

Unit-5: Advanced PHP Concepts

PHP frameworks (e.g., Laravel, CodeIgniter), RESTful API development, Introduction to PHP-based Content Management Systems (CMS).

Recommended Books:

1. "PHP and MySQL Web Development" by Luke Welling and Laura Thomson.
2. "PHP for the Web: Visual QuickStart Guide" by Larry Ullman.

Course: Java Programming (SET/BCS/OE504.3)

Course Objective: The objective of this course is to introduce students to the Java programming language and its applications in software development. The course aims to develop students' skills in writing Java programs and understanding object-oriented principles.

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

1. Understand the fundamentals of the Java programming language.
2. Develop object-oriented programs using Java.
3. Apply Java concepts for solving real-world programming problems.
4. Understand and implement exception handling, file I/O, and multithreading in Java.
5. Develop graphical user interfaces (GUIs) using Java Swing or JavaFX.

Course Content:

Unit-1: Introduction to Java

Overview of Java programming language, Java development environment setup, Data types, variables, and operators.

Unit-2: Control Structures and Functions

Decision-making constructs: if-else, switch, Looping constructs: for, while, do-while, Methods and functions in Java.

Unit-3: Object-Oriented Programming in Java

Classes and objects in Java, Inheritance, Polymorphism, and Encapsulation, Abstract classes and interfaces.

Unit-4: Exception Handling and File I/O

Handling exceptions in Java, File input and output operations, Serialization and Deserialization.

Unit-5: Java GUI and Event Handling

Java Swing library for GUI, Event handling and listeners, Creating interactive GUI applications.

Recommended Books:

1. "Java: A Beginner's Guide" by Herbert Schildt.
2. "Head First Java" by Kathy Sierra and Bert Bates.

SEMESTER VI

Course: Computer Graphics(SET/BCS/C601)

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

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

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

Course Content:

Unit 1: Introduction to Computer Graphics

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

Unit 2: 2D Graphics and Transformations

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

Unit 3: 3D Graphics and Transformations

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

Unit 4: Rasterization and Shading

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

Unit 5: Interactive Graphics and Virtual Environments

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

Recommended Books:

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

Course: Mobile Computing (SET/BCS/C602)

Course Objective: The objective of the "Mobile Computing" course is to introduce students to the concepts, technologies, and challenges related to mobile computing systems. The course aims to provide students with a comprehensive understanding of mobile devices, wireless communication, mobile application development, and the design considerations for mobile computing environments.

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

1. Understand the fundamentals of mobile computing, including the architecture and components of mobile devices.
2. Comprehend wireless communication technologies and protocols used in mobile networks.
3. Design and develop mobile applications for various platforms.
4. Evaluate the challenges and security aspects related to mobile computing.
5. Analyze and design mobile computing systems to meet specific requirements.

Course Content:

Unit 1: Introduction to Mobile Computing

Evolution of mobile computing and its significance, Mobile computing architecture and components, Mobile operating systems and application ecosystems.

Unit 2: Wireless Communication and Mobile Networks

Wireless communication technologies (e.g., GSM, CDMA, Wi-Fi, Bluetooth), Mobile network architecture (cellular networks, ad hoc networks), Mobility management and handover in wireless networks.

Unit 3: Mobile Application Development

Mobile app development frameworks and tools, User interface design for mobile applications, Mobile app development for Android and iOS platforms.

Unit 4: Mobile Web and Cloud Services

Mobile web technologies (HTML5, CSS3, JavaScript), Cloud computing for mobile applications, Location-based services and mobile APIs.

Unit 5: Mobile Security and Emerging Trends

Security challenges in mobile computing, Mobile device management and security solutions, Emerging trends in mobile computing (e.g., IoT integration, wearables).

Recommended Books:

1. "Mobile Computing" by Asoke K. Talukder and Roopa R. Yavagal.
2. "Mobile Computing: Principles and Practice" by Ajay D. Kshemkalyani and Mukesh Singhal.

Course: Multimedia Technology (SET/BCS/VC603)

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

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

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

Course Content:

Unit 1: Introduction to Multimedia Technology

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

Unit 2: Multimedia Authoring Tools and Techniques

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

Unit 3: Image and Video Processing in Multimedia

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

Unit 4: Audio and Animation in Multimedia

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

Unit 5: Multimedia Integration and Application Development

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

Recommended Books:

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

Course: Programming Paradigm (SET/BCS/OE604.1)

Course Objective **Course Objective:** The objective of this course is to introduce students to different programming paradigms and their underlying concepts. The course aims to develop students' understanding of various programming paradigms and their applications in solving computational problems.

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

1. Understand the concepts and principles of different programming paradigms.
2. Compare and contrast the strengths and weaknesses of different programming paradigms.
3. Implement programs using different programming paradigms.
4. Analyse and evaluate the suitability of programming paradigms for different problem domains.
5. Apply principles from multiple programming paradigms to solve complex computational problems.

Course Content:

Unit 1: Introduction to Programming Paradigms

Overview of programming paradigms and their significance, Imperative programming paradigm and its features, Declarative programming paradigm and its features

Unit 2: Procedural Programming Paradigm

Procedural programming concepts and principles, Variables, data types, and control flow in procedural programming, Modularity and procedural program design

Unit 3: Object-Oriented Programming Paradigm

Object-oriented programming concepts and principles, Classes, objects, and inheritance in object-oriented programming, Encapsulation, polymorphism, and inheritance

Unit 4: Functional Programming Paradigm

Functional programming concepts and principles, Pure functions, immutability, and recursion, Higher-order functions and functional program design

Unit 5: Other Programming Paradigms

Logic programming paradigm (e.g., Prolog), Concurrent programming paradigm (e.g., multithreading), Event-driven programming paradigm (e.g., GUI programming)

Recommended Books:

1. "Concepts of Programming Languages" by Robert W. Sebesta.
2. "Programming Language Pragmatics" by Michael L. Scott.

Course: Digital Image Processing (SET/BCS/OE604.2)

Course Objective: The objective of this course is to provide students with a comprehensive understanding of digital image processing techniques and their applications. The course aims to develop students' skills in analysing, manipulating, and enhancing digital images.

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

1. Understand the fundamental concepts and techniques of digital image processing.
2. Apply image enhancement and restoration techniques to improve image quality.
3. Implement image segmentation and feature extraction algorithms.
4. Develop image recognition and pattern recognition algorithms.
5. Apply digital image processing techniques in real-world applications.

Course Content:

Unit 1: Introduction to Digital Image Processing

Overview of digital image processing and its applications, Image acquisition, sampling, and quantization, Image representation and colour models

Unit 2: Image Enhancement and Restoration

Point processing operations: contrast enhancement, histogram equalization, Spatial domain techniques: filtering, noise removal, image sharpening, Frequency domain techniques: Fourier analysis, filtering in the frequency domain

Unit 3: Image Segmentation and Feature Extraction

Thresholding and region-based segmentation, Edge detection and boundary extraction, Feature extraction techniques: shape, texture, and colour features

Unit 4: Image Recognition and Pattern Recognition

Image classification and object recognition algorithms, Machine learning techniques in image processing, Neural networks and deep learning for image analysis

Unit 5: Applications of Digital Image Processing

Medical imaging and image analysis, Remote sensing and satellite image processing, Computer vision and image understanding

Recommended Books:

1. "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods.
2. "Digital Image Processing: An Algorithmic Introduction using Java" by Wilhelm Burger and Mark J. Burge.

Course: Open-Source Data Programming (SET/BCS/OE604.3)

Course Objective: The objective of this course is to introduce students to open-source data programming and its applications in data analysis and manipulation. The course aims to develop students' skills in working with open-source tools and libraries for processing and analyzing large datasets.

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

1. Understand the principles and benefits of open-source data programming.
2. Use open-source tools and libraries for data manipulation and analysis.
3. Implement data processing tasks using open-source programming languages.
4. Apply open-source data programming techniques to real-world datasets.
5. Evaluate and select appropriate open-source tools for specific data processing tasks.

Course Content:

Unit 1: Introduction to Open-Source Data Programming

Overview of open-source data programming and its significance, Introduction to open-source tools and libraries for data processing, Setting up the development environment for open-source data programming

Unit 2: Data Manipulation with Open-Source Tools

Working with structured and unstructured data, Data cleaning and pre-processing techniques, Data transformation and aggregation using open-source tools

Unit 3: Data Analysis and Visualization with Open-Source Libraries

Exploratory data analysis using open-source libraries, Statistical analysis and data visualization techniques, Interactive data visualization with open-source tools

Unit 4: Machine Learning with Open-Source Frameworks

Introduction to machine learning algorithms and techniques, Implementing machine learning models using open-source frameworks, Model evaluation and performance metrics with open-source tools

Unit 5: Big Data Processing with Open-Source Technologies

Introduction to big data concepts and challenges, Distributed data processing using open-source technologies (e.g., Hadoop, Spark), Scaling and optimizing data processing tasks with open-source tools

Recommended Books:

1. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney.
2. "R for Data Science: Import, Tidy, Transform, Visualize, and Model Data" by Hadley Wickham and Garrett Grolemund.

SEMESTER VII

Course: Unix & Shell Programming (SET/BCS/C701)

Course Objective: The objective of this course is to provide students with the knowledge and skills required to develop shell scripts and automate system administration tasks. The course aims to develop students' proficiency in shell programming, command-line tools, and system scripting.

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

1. Understand the fundamentals of shell scripting and command-line interfaces.
2. Develop shell scripts to automate routine system administration tasks.
3. Utilize command-line tools and utilities for efficient system management.
4. Apply shell programming techniques to manipulate and process text files.
5. Solve complex problems using shell scripting and system automation.

Course Content:

Unit 1: Introduction to Shell Programming

Overview of shell scripting and its applications, Shell script execution and environment variables, Shell scripting basics: variables, control structures, and functions

Unit 2: File and Text Processing with Shell

File and directory manipulation using shell commands, Text processing and pattern matching with regular expressions, Shell pipelines and input/output redirection

Unit 3: System Administration and Automation

System monitoring and resource management, Process control and job scheduling, Error handling and logging in shell scripts

Unit 4: Shell Scripting for Networking and Security

Network configuration and management with shell scripts, User and group management, Shell scripting for system security and hardening

Unit 5: Advanced Shell Programming Techniques

Shell scripting for system backups and recovery, Scripting with advanced tools and utilities (e.g., awk, sed), Script debugging and optimization

Recommended Books:

1. "Learning the bash Shell: Unix Shell Programming" by Cameron Newham and Bill Rosenblatt.
2. "The Linux Command Line: A Complete Introduction" by William E. Shotts Jr.

Course: ADBMS (SET/BCS/C702)

Course Objective: The objective of this course is to provide students with an advanced understanding of database management systems (DBMS) and their advanced concepts. The course aims to develop students' skills in database design, query optimization, transaction management, and advanced data management techniques.

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

1. Understand advanced concepts and techniques in database management systems.
2. Design and optimize database schemas for complex data models.
3. Optimize queries and evaluate query performance in DBMS.
4. Apply concurrency control and transaction management techniques.
5. Explore advanced data management techniques such as data warehousing and data mining.

Course Content:

Unit 1: Advanced Database Design Concepts

Entity-Relationship (ER) modelling and advanced ER concepts, Normalization and denormalization techniques, Multidimensional data modelling and OLAP

Unit 2: Query Optimization and Performance Tuning

Query optimization techniques and cost estimation, Indexing strategies and query execution plans, Database performance monitoring and tuning

Unit 3: Concurrency Control and Transaction Management

Concurrency control mechanisms and locking techniques, Deadlock detection and resolution, Transaction management and recovery techniques

Unit 4: Advanced Data Management Techniques

Introduction to data warehousing and data mining, Online Analytical Processing (OLAP) and data cube concepts, Data integration and ETL (Extract, Transform, Load) processes

Unit 5: Emerging Trends in Database Systems

NoSQL databases and their characteristics, Big data management and distributed databases, Blockchain and decentralized databases

Recommended Books:

1. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke.
2. "Database System Concepts" by Abraham Silberschatzand Henry F. Korth.

Course: Blockchain Technology (SET/BCS/VC703)

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

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

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

Course Content:

Unit 1: Introduction to Blockchain Technology

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

Unit 2: Blockchain Development Platforms and Tools

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

Unit 3: Blockchain Security and Privacy

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

Unit 4: Smart Contracts and Decentralized Applications (DApps)

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

Unit 5: Blockchain Applications and Industry Use Cases

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

Recommended Books:

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

Course: Android Programming(SET/BCS/OE704.1)

Course Objective: The objective of this course is to provide students with the knowledge and skills required to develop Android applications. The course aims to develop students' proficiency in Android app development, user interface design, and integration of device features.

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

1. Understand the fundamentals of Android application development.
2. Design and implement user-friendly Android applications with intuitive user interfaces.
3. Integrate device features and services into Android applications.
4. Apply best practices for app deployment, testing, and maintenance.
5. Develop real-world Android applications and deploy them to app stores.

Course Content:

Unit 1: Introduction to Android Development

Overview of Android platform and its architecture, Setting up the Android development environment, Basics of Java programming for Android

Unit 2: User Interface Design for Android Apps

Android layout components: views, view groups, and XML layout files, UI design principles and best practices, Handling user input and events in Android

Unit 3: Android App Components

Activities, services, and broadcast receivers, Intents and intent filters for inter-component communication, Working with fragments for flexible UI designs

Unit 4: Data Storage and Networking

Storing data in local databases using SQLite, Consuming web services and APIs in Android, Asynchronous programming and background tasks

Unit 5: Advanced Android Development Topics

Working with multimedia and sensors, Location-based services and Google Maps integration, App deployment, testing, and performance optimization

Recommended Books:

1. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart.
2. "Head First Android Development" by Dawn Griffiths and David Griffiths.

Course: Natural Language Processing (SET/BCS/OE704.2)

Course Objective: The objective of this course is to provide students with a comprehensive understanding of natural language processing (NLP) techniques and applications. The course aims to develop students' skills in processing and analyzing human language data, building language models, and developing NLP applications.

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

1. Understand the fundamentals of natural language processing and its applications.
2. Process and analyze textual data using NLP techniques.
3. Build and evaluate language models for various NLP tasks.
4. Develop NLP applications such as sentiment analysis, text classification, and named entity recognition.
5. Stay updated with the latest advancements and research in natural language processing.

Course Content:

Unit 1: Introduction to Natural Language Processing

Overview of natural language processing and its significance, Basics of text pre-processing and tokenization, Language modelling and probability theory in NLP

Unit 2: Text Representation and Information Extraction

Feature extraction techniques for text data, Text normalization and stemming, Named entity recognition and entity linking

Unit 3: Sentiment Analysis and Text Classification

Sentiment analysis techniques for opinion mining, Text classification algorithms and evaluation metrics, Document clustering and topic modeling

Unit 4: Language Generation and Machine Translation

Language generation techniques: text summarization, paraphrasing, Machine translation and language modeling, Neural machine translation models

Unit 5: Advanced Topics in Natural Language Processing

Question answering and information retrieval, Dialogue systems and conversational agents, Neural network architectures for NLP tasks

Recommended Books:

1. "Speech and Language Processing" by Daniel Jurafsky and James H. Martin.
2. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper.

Course: Deep Learning (SET/BCS/OE704.3)

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

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

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

Course Content:

Unit 1: Introduction to Deep Learning

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

Unit 2: Deep Neural Network Architectures

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

Unit 3: Deep Learning Frameworks and Libraries

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

Unit 4: Advanced Deep Learning Techniques

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

Unit 5: Applications of Deep Learning

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

Recommended Books:

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

SEMESTER VIII

Course: Artificial Intelligence (SET/BCS/C801)

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

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

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

Course Content:

Unit 1: Introduction to Artificial Intelligence

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

Unit 2: Problem Solving and Search Algorithms

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

Unit 3: Knowledge Representation and Reasoning

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

Unit 4: Machine Learning and AI Models

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

Unit 5: AI Systems and Applications

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

Recommended Books:

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

Course: Cloud Computing (SET/BCS/C802)

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

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

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

Course Content:

Unit 1 Introduction to Cloud Computing

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

Unit 2 Types of Cloud Services and Providers

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

Unit 3 Collaborating Using Cloud Services

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

Unit 4 Virtualization for Cloud and Cloud Security

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

Unit 5 Future Trends in Mobile Communication

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

Recommended Books:

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

Course: Fundamental of Data Science (SET/BCS/VC803)

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

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

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

Course Content:

Unit 1: Introduction to Data Science

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

Unit 2: Data Manipulation and Preparation

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

Unit 3: Data Analysis and Statistical Methods

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

Unit 4: Machine Learning for Data Science

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

Unit 5: Data Visualization and Communication

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

Recommended Books:

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