SCHEME & SYLLABUS

Integrated BCA-MCA (Data Science & AI)

As per NEP-2020

Department of Computer Science and Information Technology

University of Ladakh

Batch: 2023-2028

COORDINATOR

SCHEME & SYLLABUS

(5 YEARS BCA-MCA INTEGRTAED PROGRAMME)

Session: 2023-28

ABOUT THE BCA-MCA Integrated Program

In recent years, computer application has emerged as a significant field of science and technology, carving out a niche for itself alongside computer science and engineering. Computer application involves both theory and additional application, and it necessitates both abstract and tangible thinking. The field of computer science has many specialized areas. A few of these are software systems, computer architecture, graphics, artificial intelligence, mathematical and statistical analysis, data science, computational science, and software engineering.

SALIENT FEATURES OF THE DEPARTMENT

- The Institute utilizing its strengths of highly qualified well-trained professors, cutting-edge infrastructure, and innovative teaching methodologies; research-oriented curriculum designed to enable students to learn all the skills needed to collect and analyze the data.
- Elective courses designed to connect the academic and corporate worlds.
- Practical experience in the majority of computer application courses to impart skills in the pertinent field.

The institute is equipped with a variety of specialized research labs and software labs to keep students up to date with the latest technology available in the job market.

BCA-MCA Integrated Scheme

The Program outcomes in BCA-MCA Integrated Programme are aimed at allowing flexibility and innovation in design and development of course content, in method of imparting training, in teaching learning process and in assessment procedures of the learning outcomes. The emphasis in BCA-MCA Integrated Programme, is to help students learn how to solve problems, accomplishing IT tasks, and expressing creativity, both individually and collaboratively. The proposed framework will help Students learn programming techniques and the syntax of one or more programming languages. The students will able to become post graduate in 5 Years.

ELIGIBILITY CRITERIA

1. The candidate must have passed 12th from any recognized state or central board.
2. Should have scored at least 50% marks in 12th for SC/ST/ALC/RBA candidates and at least 55% marks in 12th for general category candidates.
3. He/she must have studied Mathematics/Statistics, Information Technology, or Information Science, as one of the subjects in 12th.
4. In case the student has studied neither of the subjects mentioned above, then the candidate is eligible to enroll in the integrated course but has to take bridge courses in semester 1 and semester 2.

Note: The bridge courses in semester 1 and semester 2 will consist of essential mathematics and statistics topics necessary for understanding the basic concepts of computer science.

DURATION

5 Years

The present Curriculum Framework for BCA-MCA Integrated degree is intended to facilitate the students to achieve the following:

- To develop an understanding and knowledge of the basic theory of Computer Science and Information Technology with good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation
- To develop the ability to use this knowledge to analyze new situations in the application domain.
- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above- mentioned purpose.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems
- To learn skills and tools like mathematics, statistics and electronics to find the solution, interpret the results and make predictions for the future developments
- To formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate

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The objectives of the Programme are:

- The primary objective of this program is to provide a foundation of computing principles and business practices for effectively using/managing information systems and enterprise software.
- It helps students analyze the requirements for system development and exposes students to business software and information systems.
- This course provides students with options to specialize in legacy application software, system software or mobile applications.
- To produce outstanding IT professionals who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves.
- To provide opportunity for the study of modern methods of information processing and its applications.
- To develop among students, the programming techniques and the problem- solving skills through programming.
- To prepare students who wish to go on to further studies in computer science and related subjects.
- To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

Program Outcomes:

PO1: Domain knowledge: Acquiring expertise with the basic principles of computer science and being able to apply basic design principles to the creation of solutions for challenges with growing complexity.

PO2: Problem Solving: Strong mathematical skills and improved thinking are required in order to identify, formulate, and solve problems in computer science. Additionally, students must exhibit an in-depth knowledge of data structures and algorithms.

PO3: Design and Solution Development: Ability to design and development of algorithmic solutions to real world problems and acquiring basic knowledge on statistics and optimization challenges. Acquiring exceptional skills in applying a variety of design methodologies to address complicated issues.

PO4: Programming a Computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.

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PO5: Application Systems Knowledge: Possessing a sound knowledge on computer application software and ability to design and develop applications for given problems.

PO6: Modern Tool Usage: Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.

PO7: Communication: Must have a reasonably good communication knowledge both in oral and writing.

PO8: Project Management: Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions. The ability to work independently on a substantial software project and as an effective team member

PO9: Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

PO10: Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

Curriculum Structure: BCA-MCA Integrated programme will have a curriculum with Syllabi consisting of following type of courses: -

A. **Core Courses:** A course, which should be studied compulsorily by a candidate as a necessary requirement is termed as a core course.

- **Major:** Compulsory Course
- **Minor:** Use their minor course to focus or specialized certain area
- **Skill/ Vocational:** Skill Enhancement
- **Interdisciplinary Course:** Introduce for other course

B. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

- **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

- **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

C. **Major Specific Elective courses (MSE):** Elective courses offered under the major: Management/Economics/History/Sociology/Political-science/Philosophy/Public-administration shall be referred to as major specific electives.

D. **Open Elective Courses (OE):** Open electives courses offered under the related stream/disciplines (Languages/Performing and visual arts) and those under the unrelated streams/disciplines (Physical and chemical sciences/Mathematical, Management and computational sciences) to seek exposure beyond main discipline of choice shall be referred to as open elective courses.

Semester-1

Theory Subjects

S. No.	Course Type	Course Code	Course Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	Major	CSI101	Programming using C- Language	4:0:0	4:0:0	4	4
2.	Major	CSI102	Modern Digital Electronics	4:0:0	4:0:0	4	4
3.	Major	CSI103	Discrete Mathematics-I	3:1:0	3:1:0	4	4
4.	AECC	CSIS101	Communication Skills	2:0:0	2:0:0	2	2
5.	Minor	CSIM102	Basic Linear Algebra for Data Sciences	4:0:0	4:0:0	4	2

Practical Subjects

S.No	Course Type	Course Code	Course Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	Major	CSIL101	Programming using C- Language (Lab)	0:0:8	0:0:4	8	4

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Semester-2

Theory Subjects

S No.	Course Type	Course Code	Course Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	Major	CSI202	Basics concept of OOPS using C++	4:0:0	4:0:0	4	4
2.	Major	CSI203	Operating System	3:1:0	3:1:0	4	4
3.	Major	CSI204	Discrete Mathematics-II	4:0:0	4:0:0	4	4
4.	AECC	CSIS201	Environmental Science	2:0:0	2:0:0	2	2
5.	Multi-Disciplinary	CSIM201	Applications of Statistics in data Science	2:0:0	2:0:0	4	2

Practical Subjects

S No.	Course Type	Course Code	Course Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	Major	CSIL112	Basics concept of OOPS using C++ Lab	0:0:8	0:0:8	8	4

Note: Students who wish to exit after 1st year i.e. after completing 1st and 2nd Semester must gain 10 credits in Internship/Apprenticeship from the Department or any other Govt./Private agency.

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Detailed Syllabus for

First Semester

Course Code	**CSI101**
Course Title	**Programming using C- Language**
Type of Course	Major
L T P	4:0:0
Credits	4

Objective:

The course aims to teach students the fundamentals of computer programming, including instructions, program execution, and the role of compilers, interpreters, and IDEs. It will provide a solid foundation in C programming, covering its history, syntax, data types, variables, expressions, conditionals, loops, iteration constructs, arrays, strings, functions, pointers, macros, and user-defined data types to solve programming problems effectively.

UNIT I:

Fundamentals of Computer Programming: Instructions, Program, Execution Environment, steps in Execution of a program, Compiler, interpreter, Loading, linking, IDE, Algorithm.

UNIT II:

Introduction to C programming: History, Introduction of C programming language, Structure of C program, C character set, Data types, Variables, Constants, Storage Class in C Language Keywords and Identifiers, Expression statements in C language, Operators (Arithmetic, Logical, Relational, Assignment etc.), Errors, Syntax error, runtime error and semantics error.

Conditional Statements: IF statement, IF-ELSE statements, nested IF-ELSE and ELSE IF ladder. Program Loops and Iteration, WHILE loop, DO loop and FOR loop, Nested Loops, Use of break, continue and GOTO statements, Switch statement, use of break and default with switch.

UNIT III:

Arrays: Definition of array, declaration, Linear Arrays, Multidimensional Arrays, traversing arrays, Storing arrays in memory (Row Major Order & Column Major Order), String, string handling in C, Dynamic Memory Allocation.

Functions: Built-In and User Defined functions, Function Declaration, Definition and Function Calling, Parameter Passing (Call by Value and Call by Reference), Recursion, Pointers, Macros.

UNIT IV:

User Defined data types and File Handling: Definition user defined data types, Structure, Union, Enumeration, Difference between Structure and Union.

File Handling: Opening and Closing data files, Read and Write Functions, different modes of files.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand computer programming fundamentals and the role of compilers, interpreters, and IDEs.
2. Proficiency in the C programming language, including syntax, data types, variables, and expressions.
3. Solve programming problems using conditionals, loops, and iteration constructs effectively.

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4. Work with arrays, strings, functions, pointers, and user-defined data types in C.
5. Apply file handling operations and develop problem-solving skills in C programming**.**

Textbooks:

1. Balagurusamy. (2018). Programming in ANSI C. McGraw Hill Education.
2. Yashavant Kanetkar. (2017). Let Us C. BPB Publications.
3. Byron Gottfried. (2018). Programming with C. Tata McGraw Hill Education.

Reference Readings:

1. Brian W. Kernighan and Dennis M. Ritchie. (2017). The C Programming Language. Prentice Hall of India.
2. R. C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain. (2018). Data Structures Through C in Depth. Laxmi Publications.

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Course Code	**CSI102**
Course Title	**Modern Digital Electronics**
Type of Course	Major
L T P	4:0:0
Credits	4

Objective:

This course aims to provide students with a comprehensive understanding of digital systems, including number systems, data representation, logic gates, Boolean algebra and circuit design. The objective is to equip students with the necessary skills to analyze, design, and implement digital systems effectively.

UNIT – I: Introduction & Data Representation:

Number systems, inter - conversion rules, Rules of addition/subtraction for r's, (r - 1)'s complements, BCD, excess – 3, Gray code, ASCII code representation. Integer & floating-point representation using IEEE FORMAT, Rules of Floating-Point Arithmetic, parity, Error detection and correction methods using Hamming technique.

UNIT – II: Logic Gates & Boolean Algebra:

Logic gates, And, OR, NOT, NAND, XOR, NOR, XNOR Gates & their design. Boolean Algebra: Binary arithmetic, Boolean Expressions, Laws of Boolean Algebra, De – Morgan laws, simplification of Boolean Expressions using SOP, POS, Min terms, Max terms, K – map techniques.

UNIT III: Circuits Design:

Combinational circuit Design: Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder, Multiplexer, De-multiplexer, Decoder, Encoder, Priority Encoder.

UNIT IV: Sequential Circuit Design:

Synchronous and Asynchronous sequential circuits, Latches and Flip flops (SR, JK, T, D), Master/Slave FF, Registers and its types (Serial in serial out, Parallel in parallel out etc.), Shift registers and its types, Design of Counters- Ripple Counters, Ring Counters

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand number systems, including conversion rules and complement representations. Apply them to BCD and Gray code. Learn integer and floating-point representation using IEEE format. Apply rules of floating-point arithmetic and error detection and correction using Hamming technique.
2. Design and implement logic gates (AND, OR, NOT, NAND, XOR, NOR, XNOR) and simplify Boolean expressions using laws of Boolean algebra and De Morgan's laws. Use SOP, POS, and K-map techniques for circuit design.
3. Design combinational circuits: Half and Full Adders/Subtractors, Binary Parallel Adders, Multiplexers, De-multiplexers, Decoders, Encoders, and Priority Encoders.
4. Design sequential circuits: Latches, Flip-flops (SR, JK, T, D), Master/Slave FF, Registers

(Serial in/parallel out, etc.), Shift registers, and Counters (Ripple Counters, Ring Counters).

Textbooks:

1. M. Morris Mano and Michael D. Ciletti. (2021). Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog. Pearson India Education Services.
2. Floyd, Thomas L. (2021). Digital Fundamentals. Pearson India.

Reference Readings:

1. R.P. Jain. (2020). Modern Digital Electronics. McGraw-Hill Education.
2. P. Raja. (2019). Digital Systems: Principles and Design. Oxford University Press India.
3. Subrata Ghoshal. (2018). Digital Electronics: Principles, Devices, and Applications. McGraw-Hill Education.
4. A.P. Godse and D.A. Godse. (2017). Digital Electronics. Technical Publications.

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Course Code	**CSI105**
Course Title	**Discrete Mathematics I**
Type of Course	Major
L T P	3:1:0
Credits	4

Objective:

The course objectives include understanding propositional and predicate logic, sets, functions, counting principles, and graph theory. Students will learn logical operators, truth tables, argument validity, and graph terminology. They will develop problem-solving skills for permutations, combinations, and recurrence relations. The course aims to apply these concepts to real-world scenarios.

UNIT I: Foundation of Logic:

Propositional Logic: Introduction, Applications of Propositional Logic, Logical operators: Conjunction, Disjunction, Negation, Condition, Bi-condition, Truth Tables, Argument, Validity of Arguments, Rules of inference, Logical Equivalence, Inverse, Converse and Contrapositive, Tautologies and contradictions.

Predicate Logic: Introduction, Applications of Predicate Logic, Propositional Functions and predicates, Quantifiers (Universal, Existential, Unique), Nesting of Quantifiers.

UNIT II:

Basic Structures:

Sets: Definition, Representation, Types, operations, Cardinality, Cartesian product of Sets.

Functions: Definition, representation, Domain and so-domain, One-One, onto, One-One-Onto functions, Types of functions (Ceil, Floor, Polynomial, Linear, Constant, Modulus, Identity, Inverse etc.).

UNIT III:

Basics of Counting Principles:

Basic Counting principle: product rule, sum rule subtract rule, divide rule, Principle of inclusion-exclusion, Pigeonhole principle, Permutation, Combination, Binomial theorem and its applications.

UNIT IV:

Introduction of Graphs: Graphs, Applications of Graphs, Properties of a graph, Basic graph terminology: Adjacency, Incidence, Degree, Graph types: Complete graphs, Bipartite graphs, Directed Graphs, connected graphs, Null graph, regular graph, cyclic graph, etc.,

Course Outcomes:

By the end of this course, students will be able to:

1. Understand and apply the foundational concepts of propositional and predicate logic, including logical operators, truth tables, argument validity, rules of inference, and quantifiers.
2. Analyze and solve problems related to basic structures such as sets and functions, including operations on sets, cardinality, and various types of functions.

3. Apply counting principles such as the product rule, sum rule, subtraction rule, and inclusion-exclusion principle to solve problems related to permutations, combinations, and binomial theorem.
4. Gain knowledge of graph theory and its applications, including understanding graph properties, basic terminology, graph types, and operations on graphs.
5. Demonstrate proficiency in representing graphs using adjacency matrices and adjacency lists and perform basic graph operations like union, intersection, and complement.

Textbooks:

1. Discrete Mathematics and its Applications by Kenneth H. Rosen. (2017). McGraw-Hill Education.
2. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo. (2004). Prentice Hall of India.

Reference Readings:

1. A Course in Mathematical Logic for Mathematicians by Yu. I. Manin. (2010). Hindustan Book Agency.
2. Counting: The Art of Enumerative Combinatorics by George E. Martin. (2001). Hindustan Book Agency.
3. Introduction to Graph Theory by Robin J. Wilson. (2012). Pearson Education India.

Course Code	**CSIS101**
Course Title	**Communication Skills**
Type of course	AECC (Ability Enhancement Course)
L T P	2:0:0
Credits	2

Objective:

To develop students' communication skills, including verbal and nonverbal communication, listening, reading, writing, and speaking, enabling them to effectively convey ideas, engage with audiences, and comprehend various forms of communication.

UNIT-I

Basics of Communication Skills: Communication, Process of Communication, Types of Communication-Verbal and Nonverbal communication, Channels of Communication- Upward, Downward, Horizontal, Barriers to Communication, Role of Communication in society.

UNIT-II

Listening Skills: Listening Process, Hearing and Listening, Types of Listening, Effective Listening, Barriers of Effective Listening, Note Taking.

Reading Skills: Purpose of reading, Process of reading, reading skills Models and strategies, scanning, skimming, SQ3R, Approaches of Reading, Comprehension passages for practice.

Writing Skills: Purpose of writing, Effective writing, Types of writing, Business Correspondence, Precise writing, Memo writing, minutes of meeting.

Speaking Skills: Speech process, Skills of effective speaking, Role of audience, Feedback Skill, Oral Presentation.

Course Outcome:

By the end of this course, students will be able to:

1. Develop a strong understanding of the principles and processes of effective communication, including verbal and nonverbal aspects, and demonstrate proficiency in utilizing different communication channels.
2. Enhance listening, reading, writing, and speaking skills, enabling effective comprehension, expression, and presentation of ideas in both personal and professional contexts.
3. Acquire the ability to overcome communication barriers, adapt communication style to different audiences, and utilize feedback effectively for continuous improvement in communication skills.

Textbooks:

1. Rajendra Pal, J.S. Korlahalli. Essentials of Business Communication. Sultan Chand & Sons.
2. Meenakshi Raman, Prakash Singh. (2021). Technical Communication: Principles and Practice. Oxford University Press.

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Course Code	**CSIM102**
Course Title	**Basic Linear Algebra for Data Sciences**
Type of course	Minor
L T P	2:0:0
Credits	2

Objective:

This course covers matrices, matrix operations, systems of linear equations, vectors, vector spaces, subspaces, and linear transformations. Students will learn to perform matrix operations, solve linear equations using matrices, analyze vectors and vector spaces, and represent linear transformations using matrices**.**

Unit 1: Matrices, Matrix Operations and Systems of Linear Equations:

Introduction to matrices: Definition, matrix representation, matrix operations (addition, subtraction, scalar multiplication). Matrix multiplication: Row-column rule, properties of matrix multiplication. Transpose and inverse of matrices: Definition, properties, calculating inverse.

Gaussian elimination: Row echelon form, reduced row echelon form, solving systems of linear equations.

Matrix equations: Representing systems of equations using matrices, solving matrix equations

Unit 2: Vectors, Vector Spaces and Sunspaces:

Introduction to vectors: Scalars and vectors, vector representation, vector operations.

Vector spaces: Definition, properties, linear combinations, linear independence, basis, dimension.

Vector space properties: Subspace definition, span, linear independence in vector spaces.

Basis of a vector space, dimension of a vector space. Linear transformations: Definition, properties, matrix representation of linear transformations.

Course Outcome:

By the end of this course, students will be able to:

1. Understand and apply fundamental concepts of matrices, solve systems of linear equations using Gaussian elimination and represent them as matrix equations.
2. Gain knowledge of vectors, vector spaces, and subspaces. Perform vector operations, determine linear combinations, assess linear independence, and identify basis and dimension.
3. Develop problem-solving skills by applying learned concepts to solve practical problems related to matrices, linear equations, vectors, and vector spaces. Analyze and interpret mathematical models, communicate solutions effectively.

Textbooks:

1. Shanti Narayan, P.K. Mittal. (2018). Matrices. S. Chand & Company Ltd.
2. H.S. Hall, S.R. Knight. (2019). Higher Algebra. S. Chand & Company Ltd.
3. S.K. Mapa. (2021). Linear Algebra. Wiley India Pvt. Ltd.

Reference Readings:

1. S.K. Jain, A.R. Vasishtha. (2022). Matrix Algebra. Vishal Publishing Co.
2. R.D. Sharma. (2020). Linear Equations in One Variable. Dhanpat Rai Publications.

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Detailed Syllabus for Second Semester

Course Code	**CSI202**
Course Title	**Object Oriented Programming in C++**
Type of Course	Major
L T P	4:0:0
Credits	4

Objective:

The course objective is to understand object-oriented programming, C++ basics, and key concepts like encapsulation, inheritance, and polymorphism. Students will gain practical experience in implementing these concepts using C++, including arrays, strings, and virtual functions. The goal is to develop proficiency in object-oriented programming and its application in software development**.**

UNIT-I:

Introduction: What is object-oriented programming? Why do we need object-oriented? Programming characteristics of object-oriented languages. C and C++.

C++ Programming basics: Output using cout. Directives. Input with cin. Type bool. The setw manipulator. Type conversions

UNIT-II :

Functions: Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.

Arrays and string arrays fundamentals. Arrays as class Member Data : Arrays of object, string, The standard C++ String class.

UNIT-III :

Object and Classes: Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes objects and memory static class data. Const and classes.

UNIT – IV :

Inheritance: Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation: Classes within classes, inheritance and program development.

Virtual Function: Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

Course Outcome:

By the end of this course, students will be able to:

1. Gain a thorough understanding of object-oriented programming and its principles, as well as the characteristics of object-oriented languages like C++.
2. Acquire proficiency in C++ programming basics, including input/output operations, type conversions, arrays, and string arrays.
3. Develop practical skills in implementing object-oriented concepts such as encapsulation,

inheritance, polymorphism, and virtual functions using C++, and apply them to real-world software development scenarios.

Textbooks:

1. Robert Lafore. (2002). Object-Oriented Programming in C++. Sams Publishing.
2. Balagurusamy. (2019). Object-Oriented Programming with C++. McGraw-Hill Education.
3. Bjarne Stroustrup. (2013). The C++ Programming Language. Pearson Education India.

Reference Readings:

1. Stanley B. Lippman, Josee Lajoie, and Barbara E. Moo. (2014). C++ Primer. Pearson Education India.
2. Herb Schildt. (2015). C++: The Complete Reference. McGraw-Hill Education.

Course Code	**CSI203**
Course Title	**Operating System Concepts**
Type of Course	Major
L T P	3:1:0
Credits	4

Objective:

The objective of the course is to provide a comprehensive understanding of operating systems, covering their basic functions, resource management, types, process management, memory management, file and I/O management, as well as protection and security policies. Students will gain the ability to evaluate and analyze operating system mechanisms and solve issues related to process management, memory management, and file and I/O management.

UNIT-I

Introduction: Evolution of operating systems, operating systems concepts, types of operating systems, Functions of Operating System, services of operating systems, different views of the operating system (user, Kernel), operating system structure.

UNIT – II

Processes: Concept, operating system's view of processes, Process Control Block, Interprocess communication, The Critical Section Problem, mutual exclusion, Interprocess synchronization, semaphores, Monitors, Message passing, process scheduling and performance criteria, scheduling algorithms.

Deadlock: Characterization, Dead lock prevention, avoidance and detection, Recovery from dead lock.

UNIT – III

Memory Management: Basic memory management, swapping, relocation & protection, virtual memory, paging, demand paging, page replacement algorithms, Design issues for paging systems, segmentation.

File Management: Concept, access methods, Files, directories, disk organization, disk space management, disk scheduling algorithms, Protection Mechanisms,

I/O Management: I/O devices, I/O buffering, device controllers.

UNIT – IV

Distributed OS: Introduction, benefits, algorithms for distributed processing.

Mobile OS: IOS and Android, SDK framework, Media Layer, Service Layer, Core OS layer, File System.

Course Outcome:

By the end of this course, students will be able to:

1. Understand the evolution and concepts of operating systems, including different types and functions of operating systems, and the structure of operating systems.
2. Gain knowledge of process management, including process control, interprocess communication, synchronization, and scheduling algorithms. Learn about deadlock prevention, avoidance, detection, and recovery.

3. Acquire an understanding of memory management, including swapping, virtual memory, paging, and segmentation. Explore file management, disk organization, protection mechanisms, and I/O management. Additionally, grasp the concepts of distributed operating systems and mobile operating systems, including their benefits and components.

Textbooks:

1. Silberschatz, A., Galvin, P. B., & Gagne, G. (2020). Operating System Concepts. Wiley India Pvt Ltd.
2. Stallings, W. (2018). Operating Systems: Internals and Design Principles. Pearson Education India.

Reference Readings:

1. Tanenbaum, A. S., & Bos, H. (2014). Modern Operating Systems. Pearson India Education Services.
2. Deitel, H. M., Deitel, P. J., & Choffnes, D. R. (2011). Operating Systems. Pearson India Education Services.
3. Abraham, S. (2017). Operating Systems: A Concept-Based Approach. Oxford University Press India.

Course Code	**CSI204**
Course Title	**Discrete Mathematics-II**
Type of Course	Major
L T P	4:0:0
Credits	4

Objective:

The objective of this course is to make the students develop a strong understanding of set theory, relations, recurrence relations, fuzzy systems, graph theory, trees, and graph coloring, and to make them able to analyze and solve complex problems in engineering and scientific applications. They course aims to make the learners proficient in topics such as set operations, composite relations, fuzzy logic principles, spanning trees, and graph coloring algorithms, equipping them with the skills needed for real-world problem-solving.

UNIT I:

Set Theory: Introduction, Combination of sets, Multisets, ordered pairs, Set Identities. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.

UNIT II:

Introduction to fuzzy systems, Fuzzy sets and membership functions, equality of fuzzy sets, normal fuzzy sets, containment, support of a fuzzy set. Alpha-level sets. Basic operation of Fuzzy sets.

UNIT III:

Graphs: Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; connectedness; Walks, Paths and Circuits; Connectedness Algorithm, shortest path Algorithms, Eulerian graph;

UNIT IV:

Trees: Properties of trees; Center of a tree; Spanning Trees – spanning tree algorithms; Spanning trees of a weighted graph, cutsets and cut-Vertices; Fundamental cutsets; connectivity and separativity.

Graph Coloring: Colorings: Vertex coloring, Chromatic number; Chromatic polynomial, The four colour problem, edge coloring, Coloring algorithms.

Course Outcome:

By the end of this course, students will be able to:

1. Understand the fundamental concepts of set theory, including combination of sets, multisets, ordered pairs, set identities, and their applications in various scenarios.
2. Develop a comprehensive understanding of relations, their properties, operations, and composite relations. Gain knowledge about recurrence relations, their solutions, decision trees, and the divide and conquer technique.
3. Acquire knowledge about fuzzy systems, fuzzy sets, and their membership functions.
4. Acquire knowledge about Graphs, Handshaking Lemma, Subgraphs, spanning tress, connectivity and graph coloring.

Textbooks:

1. Kenneth H. Rosen. (2019). Discrete Mathematics and Its Applications. Tata McGraw-Hill Education.
2. H.M. Deitel, P.J. Deitel, and D.R. Choffnes. (2017). Operating Systems: Principles and Practice. Pearson Education India.

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Reference Readings:

1. S. N. Sivanandam, S. Sumathi, and S. N. Deepa. (2007). Introduction to Fuzzy Logic using MATLAB. Springer India.
2. Narasimhan Sundararajan. (2019). Fuzzy Sets and Systems: Theory and Applications. PHI Learning Private Limited.
3. Narsingh Deo. (2004). Graph Theory: With Applications to Engineering and Computer Science. Prentice Hall India.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. (2009). Introduction to Algorithms. PHI Learning Private Limited.

Course Code	**CSIS201**
Course Title	**Environmental Studies**
Type of course	AECC (Ability Enhancement Compulsory Course)
L T P	2:0:0
Credits	2

Objective:

The course aims to introduce environmental studies, covering its multidisciplinary nature, ecosystems, and ecological interactions. It will address environmental pollution, global issues, biodiversity conservation, and climate change impacts on communities. Additionally, it will explore sustainability, endangered species preservation, and pollution tragedies.

Unit 1: Introduction to environmental studies:

Multidisciplinary nature of environmental studies; Scope and importance; the need for environmental education. Concept of sustainability and sustainable development.

Ecosystems: What is an ecosystem? Structure: food chains, food webs and function of ecosystem: Energy flow in an ecosystem, nutrient cycle and ecological succession. Ecological Interactions.

Environmental Pollution and Global Environmental Issues: Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution.

Unit 2: Biodiversity and Conservation:

Levels of biological diversity: genetic, species and ecosystem diversity; India as a mega-biodiversity nation; Endangered and endemic species of India, Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Pollution Tragedies: Love canal, Bhopal Gas, Endosulfan, Minamata and Flint water.

Course Outcome:

By the end of this course, students will be able to:

1. Understand the multidisciplinary nature of environmental studies and recognize the scope and importance of environmental education. Gain knowledge about sustainability and sustainable development concepts.
2. Comprehend the structure and function of ecosystems, including food chains, food webs, energy flow, nutrient cycles, and ecological succession. Understand ecological interactions within ecosystems.
3. Identify different types of environmental pollution, their causes, effects, and control measures. Develop awareness of global environmental issues such as climate change, global warming, ozone layer depletion, acid rain, and their impacts on human communities and agriculture.

Textbooks:

1. Erach Bharucha. (2012). Textbook of Environmental Studies for Undergraduate Courses. University Press (India) Pvt Ltd.

Reference Readings:

1. Madhav Gadgil and Ramachandra Guha. (1995). This Fissured Land: An Ecological History of India. Oxford University Press.
2. Sunita Narain. (2008). Green Politics: Global Environmental Negotiations. Centre for

Science and Environment.

3. Vandana Shiva. (2002). Water Wars: Pollution, Profits, and Privatization. Penguin India.
4. S. Ramachandran. (2010). Environmental Studies. Oxford University Press.
5. Priya Davidar, Jean-Philippe Puyravaud, and Jean-Marc Hero. (2018). Biodiversity Conservation: From Genes to Landscapes. Cambridge University Press India Pvt Ltd.

Course Code	**CSIM201**
Course Title	**Applications of Statistics in Data Science**
Type of course	Minor
L T P	2:0:0
Credits	**2**

Objective:

The course objective is to provide a comprehensive understanding of basic statistics and sampling theory, enabling students to analyze data, make informed decisions, and apply statistical methods effectively.

UNIT-I. **Basic Statistics:**

Basic Statistics: Measures of central tendencies:- Mean, Median, Mode; Measures of dispersion: Range variance and standard deviation; Frequency distribution and cumulative frequency distributions; Linear correlation coefficient; Linear regression; Non-linear regression; Multiple correlation and multiple-regression.

UNIT-II. **Sampling Theory:**

Concept of Population, Sample. Importance of Sampling and its advantages, Sampling distributions, mean and standard deviation of the sampling distribution of means. Sampling distribution as a probability distribution, Sampling distribution of percentages, mean and standard deviation of Sampling distribution of percentages.

Estimating mean and percentages: Estimator, Estimate, Estimation, interval estimation of population mean, interval, level of confidence, estimating population mean.

Course Outcome:

By the end of this course, students will be able to:

1. Gain a comprehensive understanding of basic statistics, including measures of central tendencies and dispersion, frequency distributions, linear correlation and regression, and multiple regression.
2. Apply statistical concepts to analyze and interpret data effectively.
3. Develop proficiency in sampling theory, including the concept of population and sample, advantages of sampling, sampling distributions, and estimation of population mean and percentages.
4. Apply sampling techniques to make reliable inferences about a population.

Textbooks:

1. Gupta, S. C., & Kapoor, V. K. (2021). Fundamentals of Mathematical Statistics. S. Chand Publishing.
2. Kapoor, V. K. (2022). Statistical Analysis with Excel and SPSS. S. Chand Publishing.

Reference Readings:

1. Aggarwal, R. K., & Gupta, R. D. (2019). Introduction to Statistical Methods. S. Chand Publishing.
2. Shukla, R. K., & Pandey, V. K. (2018). Statistical Methods and Applications. Pearson India.
3. Sen, P. K., & Srivastava, M. (2021). Statistics: Principles and Methods. Academic Publishers India.

COORDINATOR