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ಪಿಇಎಸ್ ಇನ್‌ಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ ಅಡ್ವಾನ್ಸ್‌ಡ್ ಮ್ಯಾನೇಜ್‌ಮೆಂಟ್ ಸ್ಟಡೀಸ್
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MATHEMATICS –I FOR COMPUTER APPLICATIONS

Subject Code: BCA-13

Syllabus

UNIT	Content	Hours Allotted
I	Definition of a set, sub-set with examples, Venn diagrams, types of sets-equal sets, null set, disjoint sets, finite set, infinite set, power set, cardinality of set. Operations on sets-union and intersection of two sets, complement of a set, difference of two sets, symmetric difference of sets. Algebraic properties of set operations, addition principle for two finite sets and for three disjoint sets. Computer representation of sets and subsets, strings, and regular expressions. Definition of a relation with examples, types of relations-empty, universal, trivial, equivalence, reflexive, symmetric, transitive relation (definition and examples only, no problems). Definition of a function with examples, types of function, one-to-one(injective), Binary operation commutative, associative, identity, invertible (definition and examples only, no problems).Functions for computer science-characteristic function, floor function, ceiling function.	**10 Hours**
II	Definition of proposition or statement, proposition variables, negation of statements, truth table, conjunction, disjunction, implications quantifiers- predicate, universal quantifier, universal quantification, existential quantification. Conditional statement/implication, contrapositive and converse, equivalence or biconditional, tautology, contradiction, logical equivalence, properties of proposition operation commutative, associative, distributive, idempotent negation. Simple problems on tautology and equivalence. Rules for validating statements	**10 Hours**
III	Principle of mathematical induction, simple problems on principle of mathematical induction. Fundamental principle of counting (statement with examples only), permutations definition and simple problems. combinations- definition and simple problems. pigeonhole principle-statement and proof, extended pigeonhole principle- statement and proof.	**10 Hours**
IV	Definition of matrix and order of matrix, types of matrices-column matrix, row matrix, square matrix, diagonal matrix, scalar matrix, identity matrix, zero matrix (definition and examples only, no problems), equality of matrices (definition and examples), simple problems on equality of matrices. operations on matrices-addition, subtraction, product of two matrices, scalar multiplication of a matrix, inverse of a matrix, simple problems on these operations.	**10 Hours**
V	Definition of determinant (definition and examples), determinant of matrix of order one, order two and order three (simple problems), properties of determinant (examples only, no verification),applications of determinants and matrices for solving the system of linear equations of two variables and three variables(simple problems),applications of determinant and matrices for checking the system of linear equations for consistency and inconsistency(simple problems).	**8 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Solve problems on Sets, Relations and functions.
CO-2	Verify the correctness of an argument using propositional and predicate logic and truth tables.
CO-3	Construct the proofs by using proof by mathematical induction, principles of counting and application of permutation and combination
CO-4	Demonstrate the ability to solve problems using operations of matrices.
CO-5	Relate applications of determinant and matrices

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COMPUTER FUNDMENTALS

Subject Code: BCA 14

Syllabus

UNIT	Content	Hours Allotted
I	**Introduction to Computer Systems** Definition of a Computer, History of Computers, Generations of Computers, Block diagram of a computer with functional units (explanation), Parts of a computer system with peripherals (explanation of peripherals), and essential computer hardware, Information processing Cycle.	**08 Hours**
II	**Input and output device** Input devices-key board mouse, track ball, light pen, joystick (explanation with diagram and working), output devices, monitors types of monitors printing and types of printers and working with advantages and disadvantages. Representation of data, text code-EBCDIC, ASCII, EXTENDED, ASCII, UNICODE. Memory: Tracks and sectors, cache memory Primary memory: RAM and its types,ROM and its types Secondary memory : hard disk, CD-ROM,DVD	**05 Hours**
III	**Software** Definition of software, types of software's application and system software with example, assembler, compiler, interpreter, linker, loader (Definitions only). Classification of languages high level and low-level language (assembly and machine level) advantage and disadvantages. Operating System Basics: Definition, functions of an operating system, types of operating system, graphical user interface - basic components of GUI.MS DOS COMMANDS with syntax and example: copycon, type, copy, rename, del, make directory, remove directory, dir and its types, copy files from one drive to other drive, tree, hiding files)	**08 Hours**
IV	**Problem Solving Techniques** Problem Definition, Problem Analysis, Design of Problems and Design Tools. ALGORITHMS: Algorithm-definition, Characteristics, Notations, Advantages and Disadvantages. FLOWCHART: Definition, Symbols, Advantages and Disadvantages. Debugging, Testing, Documentation and Maintenance. Writing an algorithm and flowchart: Area of circle, arithmetical operations, simple interest and compound interest, quadratic equation, largest of three numbers, sum of N natural numbers, factorial of number, Fibonacci series, prime number, reverse a given number.	**10 Hours**
V	**Computer Networks -basic concepts** Definition, uses of network, types of network, network topology, network transmission media (twisted pair, co axial, optical fiber), definitions of network interface card (NIC), Hub, Bridge, Switch, Router, Bandwidth), internet and its applications, understanding world wide web(how the web works, web browsers)	**05 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Demonstrate the components of Computer systems.
CO-2	Acquire basic understanding of Computer Organization architecture & storage devices.
CO-3	Memorize software applications and system software. Write simple Dos programs.
CO-4	Develop simple algorithms and flowcharts on problem statements.
CO-5	Interpret various types of networks and visualize network using topologies.

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C Programming
Subject Code: BCA 15
Syllabus

UNIT	Content	Hours Allotted
I	**Introduction** History of c-programming, Features, basic program structure, character set, tokens, keywords, and identifiers. Constants, variables, data types, variable declaration, symbolic constant definition.	**08 Hours**
II	**Operators** Arithmetic, relational, logical, assignment, increment and decrement, conditional, bitwise, and special operators, Arithmetic expressions, precedence of operators and associatively. Type conversions, mathematical functions. Managing I/O operations – reading and writing a character, formatted and unformatted I/O. Review of algorithm and flow chart	**10 Hours**
III	**Decision making, branching, and looping.** If and if-else statement, nested if, else if ladder, switch statement, ? operator, go to statement, while, do-while and for, nested for, infinity for loop, examples, break and continue statements.	**10 Hours**
IV	**Arrays and Functions** One- and two-dimensional arrays, array initialization. Strings - declaration and initialization of string variable, reading and writing strings, string handling functions. Functions – Need, syntax of function declaration, all types of functions, nesting of functions, categories, parameter passing mechanism, function with arrays, Recursion.	**10 Hours**
V	**Structures And Pointers** Pointers- concept, pointer operator and operation Pointer arithmetic, dynamic memory allocation, command line arguments. Structure Definition, declaration, accessing structure members, structure within structure, example programs, structure with array, union and difference between structure and union with example programs, typedef, enum	**10 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Understand the basic concepts of C-Language.
CO-2	Explain different types of operators and manage I/O Operations.
CO-3	Understand the basic concepts of Decision making, branching and looping. Practical exposure to use a programming language.
CO-4	Develop practical knowledge on arrays and different types of string functions.
CO-5	Understand the basic concepts of pointers and structures. Practical exposure through Implementation.

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DIGITAL FUNDAMENTALS
Subject Code: BCA 16
Syllabus

UNIT	Content	Hours Allotted
I	**Number system and codes** Binary number system, decimal number system, octal number system, hexadecimal number system. Bases inter conversions. Representation of negative numbers 1's and 2's complements. Codes: BCD, GRAY, EXCESS-3.	**04 Hours**
II	**Boolean algebra and logic systems** Laws of Boolean algebra, Boolean laws. Evaluation of Boolean expression, De Morgan's theorems and proof, simplification on Boolean expressions using Boolean laws Basic gates (AND, OR NOT): truth table, Definition, Boolean expression and symbols, universal gates (NAND, NOR): truth table, definition, Boolean expression and symbols, design of basic gates using NAND and NOR gates. Logical gates using NAND and NOR, Design of given Boolean expression using basic gates or NAND gate or NOR gate. XOR and XNOR gate (Definition, Boolean expression and symbols, truth table).	**10 Hours**
III	**Simplification of Boolean functions** SOP and POS form, min term and max term, expression of Boolean equation in Min and Max term (conversion of SOP and POS forms to standard form) K-map method: Rules, simplification of Boolean equation using K-map (up to 4 variables), without and with don't-care condition, Implementation using basic gates or NAND gates or NOR gate, Quine - Mc Cluskey Tabulation method, determination and selection of prime implicates	**12 Hours**
IV	**Combination logic** Design procedure, design of half adder and full adder, half subtract or and full sub tractor. Code converters: - BCD to Excess 3 code, gray code, magnitude comparator, encoders (BCD to decimal), decoder (decimal to BCD), multiplexer (4:1 and 8:1), de-multiplexer(1:4 and 1:8).	**08 Hours**
V	**Sequential logic** Introduction, Flip-flops – SR, JK, D, T, JK-MS (Detailed Study) Registers – Introduction, shift register- types and applications. Counters – synchronous and asynchronous counters (Up, down, up down and Mod counters, ring counter, Johnson counter) with timing diagram.	**14 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Understand number representation and conversion between different representation of numbers.
CO-2	Recognize different Boolean expressions and design basic gates.
CO-3	Illustrate digital logic and apply it to solve real life problems using K-Map.
CO-4	Analyze, design and implement combinational logic circuits.
CO-5	Analyze, design and implement sequential logic circuits.

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MATHEMATICS –II FOR COMPUTER APPLICATIONS

Subject Code: BCA 23

Syllabus

UNIT	Content	Hours Allotted
I	**Graph theory** Definition of graph, graph as models, matrices and isomorphism, graph terminologies- definitions, properties and examples, Decomposition and special graphs. Paths, cycles and trails -connection in graphs, bipartite graphs, Eulerian circuits. Vertex, degree, bijections paths, cycles and trails-connection in graphs,	**08 Hours**
II	**Introduction to Graph theory** Definition of graph, graph as models, matrices and isomorphism, graph terminologies definitions, properties and examples, Decomposition and special graphs. Paths, cycles and trails -connection in graphs, bipartite graphs, Eulerian circuits. Vertex degree and counting, counting extremal problems and graphic sequences and bijections paths, cycles and trails connection in graphs	**10 Hours**
III	**Directed Graphs** Definition of directed graph, properties and examples, vertex degrees, Trees and distance-basic properties, properties of trees, distance in trees and graphs, disjoint spanning trees, spanning trees and enumeration of trees, Hamilton paths and circuits, Decomposition of graphs, special graphs. Optimization and trees-minimum spanning tree, shortest paths, trees in computer science.	**10 Hours**
IV	**Introduction to operations research** Nature and definition of OR, meaning, models characteristics, advantages. General methods for solving O.R..models - analytical, numeric and Monte Carlo. Advantages and scope.	**10 Hours**
V	**Linear programming problem, transportation, assignment** Linear Programming Problems: Formulation (both minimization and maximization type) solution of LPP using graphical method. General LPP. Basic solutions and degenerate solutions. Standard form and canonical form. Characteristic features of LPP. Transportation problem (NWC, LC, VAM), Assignment problem, Travelling salesman Problem	**10 Hours**

Statements of Course Outcomes (COs) :

By the end of the course, the student will be able to

CO-1	Define basic concepts of graphs, weighted graphs and decomposition of graphs.
CO-2	Relate graphs, paths, cycles and trials and understand the connection
CO-3	Understand the basic concepts of Directed graphs, Trees. Optimization of trees and application areas in Computer Science.
CO-4	Analyze methods for solving O R Models.
CO-5	Conclude basic solutions for Linear Programming Problems.

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COMPUTER ORGANISATION AND ARCHITECTURE

Subject Code: BCA 24

Syllabus

UNIT	Content	Hours Allotted
I	**Basic Structure of Computers** Basic operational concepts, Bus Structures, performance, Multiprocessors and Multicomputer, Historical perspective.	**10 Hours**
II	**Machine instructions and programs** Numbers, Arithmetic Operation and Characters, Memory Location and Addresses, Memory Operations, Instruction and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input/output Operation, Stacks and Queues, Subroutines, Additional Instructions.	**10 Hours**
III	**Input/ output organization** Accessing I/O Devices, Interrupts, Direct Memory Access, Buses, Interface Circuits, Standard I/O interfaces	**10 Hours**
IV	**The memory system** Basic Concepts, Semiconductor RAM memories, Cache memories, Virtual Memories.	**10 Hours**
V	**Basic processing unit** Some fundamental concepts, execution of complete instruction, multiple-bus organization, introduction on hardwired control and Micro programmed control, distinguish between hardware control and micro control	**10 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Memorize bus structure and summarize multiprocessor and multicomputer.
CO-2	Extract memory location and addresses by using various addressing modes.
CO-3	Identify and compare different methods for computer I/O
CO-4	Illustrate RAM memories, cache memories and virtual memories.
CO-5	Identify the elements of modern instructions sets and their impact on processor design.

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STATISTICS AND PROBABILITY

Subject Code: BCA 25

Syllabus

UNIT	Content	Hours Allotted
I	**Introduction to statistics** Definition of statistics, scope of statistics, characteristics of statistics, functions, and limitations of statistics. Basic concepts (definitions only)-units/ individuals, populations/universe, sample, variable, attribute, discrete variable, continuous variable, qualitative data and quantitative data. Stages of Statistical method – collection, organization/classification, presentation, analysis, and interpretation of data (in brief). Classification of data-definition, objectives, types of classification. Definitions of frequency, class frequency, frequency distribution, discrete frequency distribution, continuous frequency distribution, class-inclusive class and exclusive class, class limits, correction factor, open-end frequency distribution, mid-point or class mark, width/size of class number of classes, cumulative frequency, frequency density. Rules/Guidelines for classification. Tabulation-definition, objectives, types of tables-one way/simple, two way and manifold tables(dominions only).	**10 Hours**
II	**Analysis of Univariate data** Definitions-central tendency, average, arithmetic mean, mode, median, geometric mean and harmonic mean. Simple problems on arithmetic mean, geometric mean and harmonic mean. Measures of Dispersion- range, range coefficient, mean deviation, mean deviation coefficient and standard deviation, standard deviation coefficient (definitions only). simple problems on mean deviation, mean deviation coefficient and standard deviation, standard deviation coefficient.	**10 Hours**
III	**Analysis of Bivariate data** Correlation-definition, types of correlation (i)based on number of variables-simple, multiple and partial correlation, (ii) based on direction of change –positive and negative correlation, (iii) based on change in proportion-linear and non- linear correlation(explanation in brief).Measurement of correlation-scatter diagram method to represent data(brief explanation with merits and demerits),Karl Pearson's coefficient of correlation formula and simple problems on this formula, Spearman's Rank correlation coefficient formula and simple problems on this formula. Regression- definition, difference between correlation and regression, regression line, regression equation, properties of regression line, uses of regression analysis. Simple problems on regression equations.	**10 Hours**
IV	**Probability theory** Definition of probability, experiment, events, sample space. Types of events-simple, composite, equally likely, mutually exclusive, exhaustive, independent and dependent events (definition and examples). Classical definition of Probability with example, axiomatic definition of probability with example. Union and intersection of two events with example. Definition of conditional probability, statement and proof of addition theorem of probability for two non-mutually exclusive events (theorem of total probability) and problems on this theorem, statement and proof of multiplication theorem of probability for two independent events (theorem of compound probability)and problems on this theorem. Bayer's theorem (statement only).	**10 Hours**
V	**Probability distributions** Random variable-definition, types of random variables-discrete and continuous (definitions and examples only), definition of probability distribution, definition of mathematical expectation E(X) and variance V(X) of random variable 'X', types of probability distributions-Bernoulli distribution, Binomial distribution, Poisson distribution and Normal distribution(simple problems on these).	**08 Hours**

Statements of Course Outcomes (COs) :

By the end of the course, the student will be able to

CO-1	Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
CO-2	Analyze statistical data using measures of central tendency, dispersion and location
CO-3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
CO-4	Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.
CO-5	Define the concept of a random variable and express the features of discrete and continuous random variables.

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DATA STRUCTURES USING C
Subject Code: BCA 26
Syllabus

UNIT	Content	Hours Allotted
I	**Introduction** Review of structures and pointers(briefly), definition of data structure, types (primitive, nonprimitive-linear and nonlinear). Linear data structure-Stack: Definition and example, operations, representation of stack in C, evaluation of postfix expression, conversion from infix to postfix using stack table. Recursion: Recursive definition, and process, Recursion in C, writing Recursive programs efficiency of recursion- examples	**10 Hours**
II	**Queue** Definition and example, operations, representation of queue in C and its types- Ordinary queue, circular queue, priority queues, double ended queue.	**10 Hours**
III	**Linked list** Definition and example, stack and queue operations using linked list, insert and delete node in between a list, circular linked list and doubly linked list (concepts only).	**10 Hours**
IV	**Trees** Tree terminologies, Binary tree, binary tree representation, types of binary tree - linked representation, tree traversals, and binary search tree and their applications, algorithm on searching element in a binary search tree, arithmetic expression in tree representation	**10 Hours**
V	**Searching and Sorting** Basic search technique, sequential search, and its efficiency searching ordered table- index sequential search, Binary search, interpolation search, binary tree searching, Hashing (open address and close address). Sorting: General background, quick sort, insertion sort – simple insertion, shell sort, radix sort, selection sort, binary tree sort, heap sort, merge sort.	**8 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Describe stacks and evaluate expressions and understand process of recursion
CO-2	Use different types of queues and explain its operations
CO-3	Impart basic concepts of stack and queue operations using linked list
CO-4	Memorize types of binary tree and traverse them
CO-5	Understand concepts about searching and sorting techniques

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OBJECT ORIENTED PROGRAMMING WITH C++

Subject Code: BCA 33

Syllabus

Unit	Content	Hours Allotted
I	**Introduction to C++ and OOPS** Object Oriented Programming paradigm, Limitations of structures in C, Basic concepts of Object Oriented Programming- Classes, Objects, Data Abstraction and Encapsulation, Polymorphism, Inheritance, Dynamic binding, Message passing, Benefits of OOP, Object Oriented languages, applications of OOP.C++ features, Comparison with C, Structure of a C++ program, input and output statements Keywords, Data types, symbolic constants, type compatibility, declaration of variables, reference variables, operators in C++, control structures.	08 Hours
II	**Classes Objects, Member Functions** Limitations of structures in C, specifying a class, creating objects, memory allocation for objects static data members, arrays within a class, local classes. Defining member functions, call by reference, return by reference, inline functions, default arguments, making an outside function inline, nesting of member functions, private member functions, function overloading, static member functions, const member functions, pointer to members, friend and virtual functions.	10 Hours
III	Constructors and Destructors Introduction, constructors, parameterized constructors, multiple constructors in a class, constructors with default arguments, dynamic initialization of objects, copy constructor, dynamic constructors, constructing two dimensional arrays, const objects, destructors.	10 Hours
IV	**Operator overloading** Introduction, definition, overloading unary operators, overloading binary operators, overloading operators using friends, string manipulations using operators, rules for operator overloading, type conversions.	08 Hours
V	**Inheritance and Templates** Inheritance definition, defining derived classes, types-single inheritance, making a private member inheritable, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes. Template definition, class templates, class templates with multiple parameters, function templates, function templates with parameters.	10 Hours

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Understand the fundamental Object-oriented programming concepts and methodologies which are essential to build a good C++ program.
CO-2	Develop programs using OOPS techniques and demonstrate virtual functions and dynamic binding with polymorphism.
CO-3	Categorize various types of Constructors and implement them.
CO-4	Illustrate overloading of unary and binary operators and use of friend functions.
CO-5	Exposure to overloading and learn how inheritance promote code reusability in C++.

SYSTEM SOFTWARE

Subject Code: BCA 34

Syllabus

Unit	Content	Hours Allotted
I	**Machine Architecture** Introduction, System software and machine architecture, Simplified Instructional Computers (SIC) and its architecture, Instruction Formats of IBM-360.	**08 Hours**
II	**Assembler** Introduction, General design procedure, design of Assembler, statement of problem, data Structure, Format of Date bases, Algorithm for pass 1 and pass 2, look for modularity. Explanation along with flowcharts for both pass 1 and pass 2 (detail flowchart). Table Processing :Searching& Sorting - Linear and binary search , comparison, examples. Interchange sort, shell sort, bucket sort, radix exchange sort, address calculation sort, Random entry searching	**10 Hours**
III	**Macro Language and macro processor** Introduction, Macro instructions, Features of macro facility-macro instruction arguments, Conditional macro Expansion, Macro calls within macro, Macro instruction defining macro. Macro processor implementation: statement of problem, specification of databases and specification of database format, Algorithm and flowchart for processing macro definitions and macro expansion.	**10 Hours**
IV	**Loader** Introduction, Loader schemes-compile and go loader scheme, general loader, Absolute loader, Sub routine linkage, Relocating loader, Direct linking loader, overlays, Dynamic loading.	**10 Hours**
V	**Compiler** Introduction, Statement of problem, Phases of compiler, Detailed study of - Lexical phase, syntax phase, interpretation phase optimization phase, storage assignment phase, code generation phase, Assembly phase, passes of compiler. Data Structures: statement of problem, storage classes and its use.	**10 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Analyze the design of modern processors, memories, and I/Os.
CO-2	Summarize pass 1 and pass 2 algorithm and various searching and sorting techniques.
CO-3	Understand the design and implementation of macro processors.
CO-4	Analyze the design and implementation of one pass, two pass or multi pass assembler loader and linker.
CO-5	Analyze the major phases of compilation and to understand the knowledge of Lex tool.

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DATABASE MANAGEMENT SYSTEM

Subject Code: BCA35

Syllabus

Unit	Content	Hours Allotted
I	**Introduction** Definitions of Data, database, database system, DBMS, examples, database system applications. Meaning of data and information, database management system vs. file management system, views of data, data independence, data models, database languages, database users and administrators, database system structure, application architecture, advantages of using DBMS, classification of DBMS, meaning of schema and instance.	**10 Hours**
II	**E-R Model** Basic-concepts, Definition of Data Models, Using high-level, conceptual data models for database design, constraints, keys, an example database application, E-R diagram, types of entities, entity sets, attributes, types of attributes, weak entity sets, cardinality ratios (mapping cardinality), Definition of Ordinality, specialization, generalization. Differences between specialization and generalization.	**10 Hours**
III	**Relational Model** Structure of relational Databases, Relational algebra - select, project. union, set difference, rename, division operations, Modification of the database, queries using relational algebra. Extended relational algebra operations. SQL- Background, basic structure, set operation, aggregate functions, NULL values, nested sub queries, Views, complex queries, Modification of the database, joined relations, Data Definition Language, domain constraints, referential integrity in SQL. Assertions, authorization, privileges in SQL, Encryption techniques.	**12 Hours**
IV	**Relational Database Design** Pitfalls in relational data base design, Normalization for relational databases. Normal forms based on primary keys, General definitions of first, second and third normal forms, Functional Dependency (concept and example) decomposition, Boyce-Codd Normal Form - definition and example, fourth Normal form - Multi valued Dependencies - definition and example.	**10 Hours**
V	**Storage and File Structure** Overview of physical storage media, RAID, Organization of records in files, Data dictionary, Ordered indices, B+ tree, introduction to transactions.	**06 Hours**

Statements of Course Outcomes (COs):

By the end of the course, the student will be able to

CO-1	Evaluate the role of database management systems in information technology applications within organizations.
CO-2	Develop an Entity-Relationship model based on user requirements.
CO-3	Understand the basics of relational data model. Transform Entity-Relationship diagrams to Relational Schema.
CO-4	Interpret relational database designs and understand different types of normal forms
CO-5	Illustrate organization of records in files

JAVA PROGRAMMING
Subject Code: BCA 43
Syllabus

Unit	Content	Hours Allotted
I	**Introduction to Java and Java Program Structure** History of Java, Java features, Difference between C/C++ and Java, Java program structure, Java tokens, Statements, JVM, Java environment- JDK, JSL. Data types, Constants and Variables, Operators &Expressions, Type History of Java, Java features, Difference between C/C++ and Java, Java program structure, Java tokens, Statements, JVM, Introduction to packages in Java, Applets, Operators & Expressions, Data types, Constants and Variables, Type conversions, Mathematical functions; Control Statements: Decision making and Branching with while, do-while, for and labeled loops; Arrays, Vectors & Strings: Initialization, Declaration of 1D, 2D arrays, String arrays, String methods, Vectors, Wrapper classes	**10** Hours
II	**Overview** Class, Objects, Constructor, Method overloading, Static members; Inheritance: Single, Multilevel, Hierarchical, Visibility modes, Method overriding, Final variable, Abstract methods and classes; Interface: Defining, Extending and Implementing assigning interface variables	**10** Hours
III	**Packages and multithreading** Java API Packages, using system packages, naming convention, accessing and using a package, adding a class to packages, hiding classes. Multithreaded programming: Creating a thread, extending the thread class, stopping and blocking a thread, life cycle of a thread, using thread methods, thread exceptions, thread priority, synchronization, implementing the runnable interface.	**10 Hours**
IV	**Exceptions and Debugging** Meaning of errors and exceptions, Dealing with errors, Classifications of exceptions, syntax of handling exceptions, advertising the exceptions, throwing and rethrowing exceptions, creating Exception classes, multiple catch statements, finally clause, tips for using exceptions, Debugging techniques – tricks for debugging, Assertions, Java Debugger (JDB).	**10 Hours**
V	**Applets and Graphics** Applet's basics, applets and application, Life cycle, Life cycle of Applet programming-passing parameter to applets, paint and repaint methods, Graphics class, Line, Rectangle, Circle, Ellipse, Arcs and Polygon. Using control loops in applets, drawing bar charts.	**08 Hours**

Statements of Course Outcomes (COs) :

By the end of the course, the student will be able to

CO-1	Acquire basic knowledge of the structure and model of the Java programming language
CO-2	Understand Inheritance and its applications.
CO-3	Explore the principles of packages and multithreading.
CO-4	Identify exceptions and develop programs using debugging techniques.
CO-5	Develop interactive programs using applets and Graphics.

COMPUTER GRAPHICS
Subject Code: BCA 44
Syllabus

Unit	Content	Hours Allotted
I	**Introduction to Multimedia** Definition, CD-ROM and the multimedia highway, Uses of Multimedia, Introduction to making multimedia – The stages of Project, the hardware & software requirements to make good multimedia, Multimedia skills. Multimedia building blocks- SOUND: MIDI, Digital audio, audio file formats. Images: still images, color, and file formats. ANIMATION: principles of animation, making animation. VIDEO: using video, how video works, and video standards.	**10 Hours**
II	**Introduction to Graphics applications** CAD, presentation graphics, computer art, entertainment, education and training, visualization, image processing. Display devices – raster scan displays – color CRT, DVST, LCD, 3D viewing devices. Raster scan systems, Random scan systems. List of I/O devices.	**10 Hours**
III	**Output primitives** Points and lines, line drawing algorithm, DDA algorithm, Bresenham's line algorithm, examples, parallel line algorithm, loading the frame buffer, circle generating algorithm, midpoint circle algorithm, ellipse generating algorithm. Pixel addressing and object geometry. Color and gray scale levels, color tables, character attributes.	**10 Hours**
IV	**2D Transformation** Basic Transformations- translation, Scaling, rotation, matrix representation and homogeneous coordinates, composite transformations- translation, scaling, general pivot point and fixed-point rotation, scaling directions, other transformations – reflection, shear, transformation between coordinates, inverse transformations.	**10 Hours**
V	**Windowing and Clipping** Introduction, the viewing transformation, viewing transformation implementation, clipping, the Cohen-Sutherland outcode algorithm, Liang-Barsky line clipping algorithm, the SutherlandHodgeman algorithm, the clipping of polygons and adding clipping to the system, text clipping, exterior clipping, curve clipping.	**8 Hours**

Statements of Course Outcomes (COs) :

By the end of the course, the student will be able to

CO-1	Cite uses of multimedia, understand digital audio and video file formats.
CO-2	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
CO-3	Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
CO-4	Use of geometric transformations on graphics objects and their application in composite form.
CO-5	Extract scene with different clipping methods and its transformation to graphics display device.

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Data Warehousing and Data Mining
Subject Code: BCA 45
Syllabus

Unit	Content	Hours Allotted
I	Data Warehousing and OLAP Data Warehouse basic concepts, Data Warehouse Modeling, Data Cube and OLAP, Data warehouse Schemes.	10 Hours
II	Data Mining Introduction, Data Mining, Motivating Challenges, Data Mining Tasks, Technologies, Data Mining Applications, Data Preprocessing.	10 Hours
III	Association Analysis Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets	10 Hours
IV	Classification Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.	10 Hours
V	Methods, Improving accuracy of Classification Methods, Improving accuracy of clarification methods, Evaluation criteria for classification methods, Multiclass Problem.	08 Hours

Statements of Course Outcomes (COs) :

By the end of the course, the student will be able to

CO-1	Identify the key processes of data mining, data warehousing and knowledge discovery process.
CO-2	Understand the basic principles and algorithms used in practical data mining and their strengths and weaknesses.
CO-3	Understanding Association Rules and analyzing Frequent Item set Generation
CO-4	Evaluating the Classification problem and Decision Tree
CO-5	Describe different methodologies used in data mining and data ware housing.

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ADVANCED PROGRAMMING IN JAVA

Subject Code: BCA 51

Syllabus

UNIT	CONTENT	HOURS ALLOTTED
I	**Review of Java Concepts and AWT, Graphics Programming** Review of Java Concepts .AWT and AWT Classes, Window fundamentals – Component,Container, Panel, Window, Frame, Canvas. Working with frame window. GraphicsProgramming: Graphics class, methods, drawing objects, line graphs, polygon classes, workingwith colours and fonts. Advanced graphics operations using Java2D. Designing simple UserInterfaces (UIs) using AWT, Layout Manages.	10Hours
II	**Swing, Event Handling and Event Handling** Event Handling: Basics of Event Handling, the delegation event model, AWT event hierarchyand event classes, Event Listener Interfaces, Adapter Classes, Event queue. Swing: Meaning,need difference between AWT and swing. The Model-View-Controller (MVC) design patterns,Creating simple UIs using swing, and handling basic events.	10Hours
III	**Java Beans, Java Archives (JAR)** Meaning and need of Java Beans, Advantages, Bean writing process, Bean properties. JavaArchives (JARs): Meaning, need, the JAR utility, Creating JAR files.	10Hours
IV	**File Management and JDBC** File, creating a file, writing to a file, opening a file, reading from a file, file management,checking existence of a file, deleting a file. JDBC: Meaning, need, concept and structure ofJDBC, relation with ODBC, JDBC driver types and their meaning, the JDBC process – loadingthe driver, connecting to the DBMS, creating and executing SQL statement, Connection object,Statement object, Prepared Statement object, Callable Statement, Result Set, JDBC Exceptions	10Hours
V	**Fundamental concepts of Collections, Generics and Network programming** Collections: Meaning, need, Collection interfaces, Concrete Collections – Array List, Hash set,Map. Generics**:** Meaning, need, benefits, generics usage, basics of generic types, type parameternaming conventions, type wildcards, using type wildcards, generic methods, bound types,writing simple generic container, implementing the container, implementing the constructors,implementing generic methods. Network programming**:** Meaning of Client, Server, Socket,port. Creating a client socket, creating a server socket, writing simple server and client.	08 Hours

Statements of Course Outcomes (COs)

By the end of the course, the student will be able to

CO-1	Illustrate a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit
CO-2	Summarize event handling on AWT and learn how to design stand-alone desktop-oriented Graphical User Interface based Java applications using Swing/Java Foundation Components
CO-3	Understand basic file operations, file management, and learn to access database through Java programs, using Java Data Base Connectivity
CO-4	Compare the types ofinterfaces in Collections Framework and learn how to use Java beans.
CO-5	Understand the objective of generic programming and implement generic classes and methods.

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DATACOMMUNICATION

Subject Code: BCA 52

Syllabus

UNIT	CONTENT	Hours Allotted
I	**Introduction to Data Communication** Communication model & Data Communication networking -types. Data Transmission- Transmission terminology, Analog & Digital data transmission, Transmission impairments – attenuation, delay distortion & noise.	**08Hours**
II	**Data Transmission media** Guided Transmission- types- Twisted pair, coaxial cable & optical fiber – physical description,application & characteristics. Unguided Transmission- wireless transmission: types- Terrestrialtype, Satellite, Broadcast radio – physical description, application & characteristics.	**10 Hours**
III	**Data encoding** Basics, types and description of different signals, Digital data & digital signals: NRZ, multilevel binary, Bi phase techniques. Digital data & Analog signals: Encoding techniques- ASK, FSK, PSK Analog data & Digital signals: PCM & delta modulation Analog data & Analog signals: Modulation- AM & FM Spread spectrum: Frequency hopping, direct sequence Asynchronous & synchronous transmission: Line configurations- full duplex & half duplex.	**10Hours**
IV	**Data link control & medium access sub** Flow control: Stop and wait & sliding window flow control. Error detection: Parity check, CRC Error control: Stop and wait ARQ, Go Back-N ARQ High-level data link control: basics, Characteristics, frame structure, operation Medium access sub layer- the channel allocation problem. Multiple access Protocol-ALOHA, carriers sense multiple access protocol, collision free protocol.	**10Hours**
V	**Multiplexing and Switching** Frequency division multiplexing- characteristics, analogcarrier systems, Time division multiplexing- characteristics, link control. Digital carrier system, ISDN user network interface.Circuit switching networks- switching concept, space division & time division switching- Pocketswitching networks-principles, switching technique, and packet size. Comparison of Circuitswitching & Pocket switching	**10 Hours**

Statements of Course Outcomes (COs)

By the end of the course, the student will be able to

CO-1	Explain the basics of internet, data communication and networking. Classify Guided and Unguided transmissions.
CO-2	Classify wired and wireless computer networks
CO-3	Articulate types of signals and illustrate synchronous and asynchronous transmission, network formation.
CO-4	Illustrate various flow control. Relate error control schemes and judge multiple access protocols
CO-5	Describe time division multiplexing and design user network interface. Evaluate and compare various network switching techniques

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Web programming with J2EE Concepts and PHP
Subject Code: BCA 53
Syllabus

UNIT	CONTENT	HOURS ALLOTTED
I	**Introduction** Internet, WWW, Web Browsers and Web Servers, URLs, HTTP, Evolution of the Web, Peak into theHistory of the Web, Internet Applications, Important Components of the Web, Web Search Engines,Application Servers.HTML and DHTML Concepts: Programming structure, different basic tags,Images, Hypertext Links. Lists, Tables, Forms, Frames. Cascading Style Sheets**:** Introduction, Levelsof style sheets, Style specification formats, Selector forms, Property value forms, Font properties, ListProperties, Color, Alignment of text, The box model, Background images, The and tags.	08Hours
II	**The JavaScript** Overview of JavaScript, Execution Environment, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Arrays, Functions, Pattern matching using regular expressions, Examples. Events and Event Handling,	10Hours
III	**Client – Server Systems** Meaning of client and server, Client-Server architecture, benefits, concept of ports and sockets. Protocol – Meaning, definition, examples, meaning of stateless and state (state full) protocols. HTTP protocol – meaning, http protocol request and response header formats, status codes. Client-Server communication scenario.	10 Hours
IV	**JEE Technology Concepts** Multi-tier architecture for application development – Meaning, need, advantages. Meaning of enterprise application and web application, various tiers in enterprise application – client tier, web tier, business tier, and enterprise information system tier. Introduction to JEE concepts – Need, advantages, characteristics of JEE technology, the concepts of containers, components, and services –meaning of web container, application client container, EJB container.	10Hours
V	**Basics of PHP and Java Server Pages Programming Concepts** Introduction to JSP - language structure, advantages, characteristics, comparison between Java and Java Server Pages. Various aspects of Java Server Pages programs, writing and executing JSP programs. Writing dynamic programs using JSP. Database programming through JSP. Basics of PHP : Introduction ,variables ,functions, sessions, date, mysql integrations with php, file uploading.	10 Hours

Statements of Course Outcomes (COs)
By the end of the course, the student will be able to

CO-1	Discover history and evolution of web and internet applications and design simple web pages.
CO-2	Understand operations in java script and handle events.
CO-3	Understand network security and define various protocols FTP, HTTP.
CO-4	Illustrate multi-tier architecture for developing a web application.
CO-5	Memorize structure and advantages of JSP and develop JSP programs.

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OPERATING SYSTEM

Subject Code: BCA 54

Syllabus

UNIT	CONTENT	HOURS ALLOTTED
I	**Introduction** Definition of Operating System, need. Early systems – Batch Systems, Multiprogramming, Time Sharing, Parallel and Distributed systems. Special Purpose Systems – Real Time, Embedded Systems, Multimedia Systems, Handheld Systems. Computing Environments – Traditional, Client Server, Peer-to-Peer and Web based. Open-Source Operating Systems.	10Hours
II	**Process Management** Process concept – meaning of process, sequential and concurrent processes, process state, processcontrol block, threads, Process scheduling – scheduling queues, schedulers, context switch.Operations on Processes – creation and termination. Inter process communication – Independent and co-operating processes. Communication in client-server systems – RPC and RMI. Process scheduling– Basic concepts Processor - CPU I/O burst cycle, CPU Scheduler, Preemptive scheduling, dispatcher. Scheduling criteria, Scheduling algorithm – First-Come-First-Served (FCFS), ShortestJob First (SJF), Priority Scheduling, Round Robin. Multi-level queue scheduling (Concepts only), multi-level feedback queue scheduling (Concepts only). Multiple processor scheduling, real time scheduling.	10Hours
III	**Deadlocks** Definition with example, System model, Dead lock characterization – Necessary Conditions, Resource Allocation Graph, Dead lock prevention, Avoidance and detection, Recovery from deadlock.	10Hours
IV	**Memory Management** Logical and Physical address space, Swapping, Contiguous allocation, Paging, Segmentation, Virtual memory - demand paging and its performance, Page replacement algorithms, Allocation of frames, Thrashing.	10Hours
V	**Disk and File Management** Secondary Storage Structure and Disk Management: Disk structure & scheduling methods, Disk management, disk reliability. File concepts, Access methods, Directory structure, Protection and consistency semantics, File system structure, Allocation methods, free space management.	08 Hours

Statements of Course Outcomes (COs)

By the end of the course, the student will be able to

CO-1	Identify basic components of operating system and relate different types of Operating System and their services.
CO-2	Compare process scheduling algorithms and interpretsynchronization techniques to achieve better performance of a computer system.
CO-3	Illustrate deadlocks on advanced applications and Understand principles of deadlock and its prevention.
CO-4	Explain the limits of fixed memory allocation schemes, fragmentation in dynamic memory allocation, approaches ofbasic dynamic allocation.
CO-5	Describe the basics of disk structures, working mechanism of hard disk and disk management. Learn file access allocation methods.

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SOFTWARE ENGINEERING
Subject Code: BCA 55
Syllabus

UNIT	CONTENT	HOURS ALLOTTED
I	**Introduction** Definition of software, software problems (industrial strength software, software is expensive, late and unreliable maintenance and rework), software engineering challengers (scale, quality and productivity, attributes), software engineering approach (phased development process, managing process, components.	10 Hours
II	**Software processes** Introduction to software process (processes and process modules, component of software process), characteristics of software process (predictability, support testability and maintainability, support change, early defect removal, process improvement and feedback), software process models (waterfall, prototype, iterative enhancement model, spiral, comparison of process models).	10Hours
III	**Software Planning** Introduction to planning, effort estimation (uncertainties, building efforts, bottom-up, COCOMO model), project scheduling and staffing (overall, detailed scheduling, team structure), risk management (concepts, assessment), project monitoring plan (measurements, project monitoring and tracking).	10Hours
IV	**Analysis and Design** Software requirements (needs and requirement process), problem analysis (informal approach, data flow modeling, object oriented modeling, prototyping), requirement specification (characteristics of SRS, components of SRS, specification language, structure of requirement document), validation. Design: Function oriented design: design principles, module level concept (coupling, cohesion), structure design methodology (DFD, first level factoring).	10Hours
V	**Coding and Testing** Coding: programming principles and guidelines (common coding errors, structured programming, information hiding, some programming practices, coding standards), refactoring (basic concepts with examples, common refactoring), verification (code inspections, static analysis, proving correctness, unit testing).Testing: testing fundamentals, black box and white box testing, comparison between black box and white box testing, testing process (levels of testing, test plan).	08 Hours

Statements of Course Outcomes (COs)

By the end of the course, the student will be able to

CO-1	Acquire basic knowledge and understanding of the software engineering challenges, analysis and design of complex systems
CO-2	Analyze and specify software requirements through a productive working relationship with various stakeholders of the project
CO-3	Specify software requirements through a productive working relationship with various stakeholders of the project
CO-4	Develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice
CO-5	Understand on quality control and how to ensure good quality software.

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COMPUTER NETWORKS

Subject Code:BCA61

Syllabus

UNIT	CONTENT	HOURS ALLOTTED
I	**Basics** Uses of computer networks, network hardware- broadcast networks, point – to -point networks, network software-protocol hierarchies, design issues, interface & services, connection oriented & connection less services, service primitives.	**10 Hours**
II	**Reference models** OSI reference model- description of each layer. TCP/IP reference model, comparison of the two models, Critique of the OSI model and protocols, Critique of the TCP/IP model and protocols, Example networks-ARPANET,ATM	**10 Hours**
II	**The Network layer** Design issues, routing algorithms- the optimality principle, shortest path routing, distance vector routing, **and** link state routing. Congestion control algorithms- general principle, Congestion prevention policies, traffic shaping. The network layer in the internet - the IP protocol, IP address, and subnet. Internet control protocol.	**10 Hours**
III	**The Transport layer** The transport service- services provided to the upper layer, quality service, and transport service primitives. Elements of transport protocol - addressing, establishing a connection, releasing a connection. A simple transport protocol- the example service primitives, the example transport entity. The Internet transport protocol (TCP & UDP)- the service model, the TCP segment header, the TCP connection management. UDP - header.	**10 Hours**
IV	**The Application layer** Network security - traditional cryptography, two fundamental cryptographic principles, secret key & public key algorithms.DNS - Name space, SNMP – model .Electronic mail, architecture and services, www.	**08 Hours**

Statements of Course Outcomes (COs)

By the end of the course, the student will be able to

CO-1	Conclude the usage of computer networks, network hardware and its types.
CO-2	Understand reference models, protocol & its types , Example networks-ARPANET,ATM.
CO-3	Analyze the routing algorithms and congestion control algorithms, policies to prevent congestions
CO-4	Understand the elements of transport services provided to upper layer & protocol and learn about Internet transport protocol (TCP & UDP)
CO-5	Explain network security in application layer and interpret cryptography principles.

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Department of Computer Science

DOTNET PROGRAMMING

Subject Code: BCA 62

Syllabus

UNIT	CONTENT	HoursAllotted
I	**Introduction to C# & .NET platform and Building C# Applications** Introduction to C# and .NET platform: .NET solution, Building blocks of the .NET platform(CLR, CTS, CLS), Role of .NET base class libraries, .NET Aware programming languages, role of common intermediate languages & type metadata and assembly manifests, A tour of the .NET namespaces. Building C# Applications: Role of the command line complier(csc.exe), Building a C# application using csc.exe, the command line debugger(cordbg.exe), using the visual studio .NET IDE & its debugging, C# "pre-processor" directives.	08Hours
II	**C# language fundamentals** Anatomy of a basic C# class, creating objects: constructor basics, Default assignments & variables scope, variables initialization syntax, basic inputs & output with the console class, understand static methods, arrays & string manipulations, Encapsulation Services, Class Properties , Read and Write only Properties, Static Properties, Inheritance Is As keyword Usage, Controlling Base Class Creation With Base, Sealed Classes, Delegation , Polymorphism, The Virtual and Override Keywords ,Abstract Classes, Abstract Methods.	10 Hours
III	**Exception & object life time and Interface and Collections** Exception & object life time :The Basics of Object Life Time, The Role Of Application Roots, Understanding Object Generations, The Role Of .NET Exception Handling ,Throwing a Generic Exception ,Catching Exceptions, Properties of Exception, Multiple Exception (Concepts Only),The Finally Block Interface & Collections : Definition, Implementing an Interface in C#, Interface members at object level, Interface as Parameters, Interface as Return Values, Arrays of Interface Types, Interface Hierarchies, Interface as polymorphic agents, Exploring the system. collections Namespaces.	10Hours
IV	**Introducing windows forms-** Overview of the system. windows. Forms Namespaces, An Anatomy of a Form, A Simple Form Program, Function with Control Class, The Functionality Of the Form Class, Component class, control class, Programming with windows forms controls : Working with Button types, Check Boxes, Radio Buttons, Group Boxes, List Boxes, Calender control, assigning tool tips for controls.	10Hours
V	**Data access with ADO.NET** The Two Faces Of ADO.NET, Understanding ADO.NET Data Providers, Understanding The Connected Layer of ADO.NET, Working with Connection Object, Inserting, Updating and Deleting Records	10 Hours

Statements of Course Outcomes (COs)

By the end of the course, the student will be able to

CO-1	Develop applications on Visual Studio .NET platform by understanding the syntax and semantics of C#.
CO-2	Demonstrate knowledge of object-oriented concepts and design user experience and functional requirements C#.NET application.
CO-3	Understand and implement events, and exception handling within .NET application environment.
CO-4	Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
CO-5	Develop database connectivity using ADO.NET in window-based application.

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Department of Computer Science

UNIX OPERATINGSYSTEM
Subject Code: BCA63
Syllabus

UNIT	CONTENT	Hours Allotted
I	**Introduction** The Unix operating system, A brief Session, The Unix Architecture, Features of UNIX, POSIX and Single UNIX specification, Locating commands, Internal and External commands, Command Structure, Flexibility of command Usage, Man Browsing the Manual Pages ON-line, Understanding the man documentation. General-Purpose Utilities: Cal command, date command, echo, printf, bc, script, passed, who, uname.	08Hours
II	**The File System** The file, The Parent –Child Relationship, The HOME Variable, pwd, cd, mkdir, rmdir, Absolute Pathname, Relative Pathname, ls, The Unix File system. Handling Ordinary Files: Cat, cp, rm, mv, more, Thelp subsystem: Printing a File, File, wc, od, cmp, comm, diff, dos2unix and unix2dos, compressing and archiving files, gzip, and gunzip, tar, zip and unzip. Basic File Attributes: Listing file attributes, listing directory attributes, File Ownership, File Permissions, changing file permissions,Directory Permissions, Changing File Ownership.	10 Hours
III	**The Vi Editor** Vi basics, Input Mode, Saving Text and Quitting, Navigation, Editing Text, Undoing Last Editing Instructions(UandU),Repeating the last command(.),Searching for a Pattern(/and ?), Substitution.	10Hours
IV	**The process** Process basics, process status, system process, Mechanism of process creations, Internal and external commands, process states and zombies, running jobs in background, nice, killing process with signals, job control, at and batch, cron, timing process. Simple Filters: The sample database, pr, head, tail,cut, paste, sort, uniq, tr, displaying a word- count list. Filters using regular expressions: grep, basic regular expressions, extended regular expressions.	10 Hours
V	**The Shell** -The shell's Interpretive Cycle, Shell Offering, Pattern Matching, Escaping and Quoting, Redirection, /dev/null and /dev/tty, Pipes, tee, Command Substitution, Shell variables. Essential shell programming: Shell scripts, read, using command line arguments, exit and exit status of command, the logicaloperators &&and ||- conditional execution, the if conditional, using test and to evaluate expressions, the case conditional, expr, $0: calling a script by different names, while, for, set and shift, the here document (<<), trap, debugging shell scripts with set –x, sample validation and data entryscripts.	08Hours

Statements of Course Outcomes (COs)
By the end of the course, the student will be able to

CO-1	Describe the architecture and features of UNIX Operating System and distinguish it from other Operating Systems.
CO-2	Demonstrate UNIX commands for file handling and process control.
CO-3	Formulate regular expressions and use them for pattern matching
CO-4	Understand of important aspects related to the process
CO-5	Interpret SHELL programming, its services, and utilities.

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