Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: ES-301		
Course Name: Energy Environment Ecology and Society		
Unit No	**Course Content**	**Course Outcome**
1	Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries).	**ES301.1** Students will be able to define the importance of various energy sources, their impact on the environment, and the possible alternatives.
2	Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**ES301.2** Students will be able to elaborate on the concept of ecosystems, their components, interactions between them, and the flow of energy.
3	Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-sports of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**ES301.3** Students will be able to explain the concept of biodiversity, its values, and the need for conservation.

4	Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.	**ES301.4** Students will be able to summarize various types of pollution, its causes, and effects and also the role of a common person in their prevention.
5	From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.	**ES301.5** Students will be able to identify various legal acts which will save the environment, management of natural resources, and discover the need of environmental ethics.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 302		
Course Name: Discrete Structure		
Unit No	**Course Content**	**Course Outcome**
1	Set Theory: Definition of sets,countable and uncountable sets, Venn Diagrams, proofs of some general identities on sets , Relation:Definition, types of relation, composition of relations, Pictorial representation of relation, Equivalence relation, Proof by contradiction. Partial ordering relation,Job-Scheduling problem Function: Definition, type of functions , one to one, into and onto function, inverse function, composition of functions, recursively defined functions, pigeonhole principle , Theorem proving Techniques: Mathematical induction.	**CO302.1:** Students will be able to explain the concept of sets, relations, functions and mathematical induction.

2	Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields definition and standard results.	**CO302.2:** Students will be able to evaluate discrete mathematical structures.
3	Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers. Introduction to finite state machine Finite state machines as Models of physical system equivalence machines, Finite state machines as language recognizers.	**CO302.3:** Students will be able to apply propositional logic and finite state automata to solve problems.
4	Graph Theory: Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs.	**CO302.4:** Students will be able to formulate and solve graph problems.
5	Posets, Hasse Diagram and Lattices: Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices. Combinatorics: Introduction, Permutation and combination, Binomial Theorem, Multimonial Coefficients Recurrence Relation and Generating Function: Introduction to Recurrence Relation and Recursive algorithms, linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Generating functions, Solution by method of generating functions.	**CO302.5:** Students will be able to formulate and solve recurrence relations.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 303		
Course Name: Data Structure		
Unit No	**Course Content**	**Course Outcome**
1	Review of C programming language.Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Abstract Data Types,Implementation aspects: Memory representation. Data structures operations and its cost estimation. Introduction to linear data structures- Arrays, Linked List:Representation of linked list in memory, different implementation of linked list.Circular linked list, doubly linked list, etc. Application of linked list: polynomial manipulation using linked list, etc.	**CO303.1:**Students will be able to explain the concepts of data structure along with its applications.
2	Stacks: Stacks as ADT, Different implementation of stack, multiple stacks.Application of Stack: Conversion of infix to postfix notation using stack,evaluation of postfix expression, Recursion. Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dqueue and Priority Queue,Queue simulation, Application of queues.	**CO303.2:** Students will be able to develop and analyze the algorithm for stack and queue.
3	Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree -Operations, Traversal, Search. AVL Tree, Heap, Applications and comparison of various types of tree; Introduction to forest, multi-way Tree, B tree, B+ tree, B* tree and red-black tree.	**CO303.3:**Students will be able to elaborate on the concepts of trees.
4	Graphs: Introduction, Classification of graph: Directed and Undirected graphs,etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST)- Kruskal,Prim's algorithms. Dijkstra's shortest path algorithm; Comparison between different graph algorithms. Application of graphs.	**CO303.4:**Students will be able to classify the concepts of graphs along with their real-world applications.

5	Sorting: Introduction, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort and Radix sort; comparison of various sorting techniques. Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods. Hashing & Indexing. Case Study: Application of various data structures in operating system, DBMS etc.	**CO303.5:**Students will be able to explain and develop sorting and searching algorithms.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science and Engineering)

Course Code: CS 304		
Course Name: Digital Systems		
Unit No.	**Course Content**	**Course Outcome**
1	Review of number systems and number base conversions. Binary codes, Boolean algebra, Boolean functions, Logic gates. Simplification of Boolean functions, Karnaugh map methods, SOP-POS simplification, NAND-NOR implementation.	**CO304.1-**Students will be able to state the basic laws of boolean algebra and apply them to solve the logical problems
2	Combinational Logic: Half adder, Half subtractor, Full adder, Full subtractor, look- ahead carry generator,BCD adder, Series and parallel addition, Multiplexer – demultiplexer, encoder- decoder, arithmetic circuits, ALU.	**CO304.2-**Students will be able to design and implement the arithmetic operations using combinational logic circuits.
3	Sequential logic: flip flops, D,T, S-R, J-K Master- Slave, racing condition, Edge & Level triggered circuits, Shift registers, Asynchronous and synchronous counters, their types and state diagrams. Semiconductor memories, Introduction to digital ICs2716, 2732 etc. & their address decoding. Modern trends in semiconductor memories such as DRAM, FLASH RAM etc. Designing with ROM and PLA.	**CO304.3-**Students will be able to explain the functions of various digital integrated circuits.
4	Introduction to A/D & D/A convertors & their types, sample and hold circuits, Voltage to Frequency & Frequency to Voltage conversion. Multivibrators : Bistable, Monostable, Astable, Schmitt trigger, IC 555 & Its applications. TTL, PMOS, CMOS and NMOS logic. Interfacing between TTL to MOS.	**CO304.4-**Students will be able to analyze complex digital electronics circuits.

5	Introduction to Digital Communication: Nyquist sampling theorem, time division multiplexing, PCM, quantization error, introduction to BPSK & BFSK modulation schemes. Shannon's theorem for channel capacity.	**CO304.5-**Students will be able to explain different digitalization techniques, the transmission of analog signals, and digital modulation schemes.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 305		
Course Name: Object Oriented Programming and Methodology		
Unit No	**Course Content**	**Course Outcome**
1	Introduction to Object Oriented Thinking & Object Oriented Programming: Comparison with Procedural Programming, features of Object oriented paradigm-Merits and demerits of OO methodology; Object model; Elements of OOPS, IO processing.	**CO305.1:** Students will able to explain the fundamental principle of object-oriented Paradigm.
2	Encapsulation and Data Abstraction- Concept of Objects: State, Behavior & Identity of an object; Classes: identifying classes and candidates for Classes Attributes and Services, Access modifiers, Static members of a Class, Instances,Message passing, and Construction and destruction of Objects.	**CO305.2:** Students will able to analyze the polymorphic behavior of objects and class.
3	Relationships - Inheritance: purpose and its types, 'is a' relationship; Association,Aggregation. Concept of interfaces and Abstract classes.	**CO305.3:** Students will able to identify and analyze the relationships between the objects.
4	Polymorphism: Introduction, Method Overriding & Overloading, static and run time Polymorphism.	**CO305.4:** Students will able to define the principle of polymorphism.
5	Strings, Exceptional handling, Introduction of Multi-threading and Data collections. Case study like: ATM, Library management system.	**CO305.5:** Students will able to define the concept of interface and packages.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 306	
Course Name: Computer Workshop	
Unit No	**Course Outcome**
1	**CS306.1:** Students will be able to explain the types of hardware and software components.
2	**CS306.2:** Students will be able to elaborate on the operating system installation process.
3	**CS306.3:** Students will be able to describe and analyze the various software-based troubleshooting mechanism.
4	**CS306.4:** Students will be able to explain the various networking concepts.
5	**CS306.5:** Students will be able to classify and describe various operating system utility software.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: BT 107	
Course Name: Internship	
Unit No	**Course Outcome**
1	**BT107.1:** Students will be able to explain the essentials of internships.
2	**BT107.2:** Students will be able to assess interests and abilities in their field of study.
3	**BT107.3:** Students will be able to develop communication, interpersonal, and other critical skills in the job interview process.
4	**BT107.4:** Students will be able to develop work habits and attitudes necessary for job success.
5	**BT107.5:** Students will be able to build a record of work experience.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: BT-401		
Course Name: Mathematics-III		
Module	**Course Content**	**Course Outcome**
1	**Module 1: Numerical Methods – 1:** Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.	**CO401.1:** Students will be able to create knowledge of forward & backward difference tables & apply its formula under the given set of values.
2	**Module 2: Numerical Methods – 2:** Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.	**CO401.2:** Students will be able to evaluate the integral & differentiation by finite difference method & also able to solve the system of a linear algebraic equation.
3	**Module 3: Numerical Methods – 3:** Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender- Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.	**CO401.3**: Students will able to define the concepts of ODE & also apply the finite difference method to solve special partial differential equations.
4	**Module 4: Transform Calculus:** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.	**CO401.4**: Students will be able to evaluate the Laplace transform of function, the concept of convolution, and solution of differential equation with the help of Laplace Transform and Fourier transform.

5	**Module 5: Concept of Probability:** Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.	**CO401.5** Students will be able to analyze the concept of probability and probability distribution.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 402		
Course Name:Analysis Design of Algorithm		
Unit No	**Course Content**	**Course Outcome**
1	Algorithms, Designing algorithms, analyzing algorithms, asymptotic notations, heap and heap sort. Introduction to divide and conquer technique, analysis, design and comparison of various algorithms based on this technique, example binary search, merge sort, quick sort, strassen's matrix multiplication.	**CO402.1:** Students will able to analyze the various algorithm designing approaches.
2	Study of Greedy strategy, examples of greedy method like optimal merge patterns, Huffman coding, minimum spanning trees, knapsack problem, job sequencing with deadlines, single source shortest path algorithm.	**CO402.2:** Students will able to analyze and solve the problems using the Greedy Strategy.
3	Concept of dynamic programming, problems based on this approach such as 0/1 knapsack, multistage graph, reliability design, Floyd-Warshall algorithm.	**CO402.3:** Students will able to analyze and solve the problem using the Dynamic Programming Approach.
4	Backtracking concept and its examples like 8 queen's problem, Hamiltonian cycle, Graph coloring problem etc. Introduction to branch & bound method, examples of branch and bound method like traveling salesman problem etc. Meaning of lower bound theory and its use in solving algebraic problem, introduction to parallel algorithms.	**CO402.4:** Students will able to acquire knowledge of Backtracking and Branch-Bound methods.
5	Binary search trees, height balanced trees, 2-3 trees, B-trees, basic search and traversal techniques for trees and graphs (In order, preorder, postorder, DFS, BFS), NP-completeness.	**CO402.5:** Students will be able to demonstrate the various types of Non-linear Data structure and NP-Completeness problem.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 403		
Course Name: Software Engineering		
Unit No	**Course Content**	**Course Outcome**
1	**The Software Product and Software Process** Software Product and Process Characteristics, Software Process Models: Linear Sequential Model, Prototyping Model, RAD Model, Evolutionary Process Models like Incremental Model, Spiral Model, Component Assembly Model, RUP and Agile processes. Software Process customization and improvement, CMM, Product and Process Metrics.	**CO403.1:**Students will be able to identify the aptness of various software development processes and models.
2	**Requirement Elicitation, Analysis, and Specification** Functional and Non-functional requirements, Requirement Sources and Elicitation Techniques, Analysis Modeling for Function-oriented and Object-oriented software development, Use case Modeling, System and Software Requirement Specifications, Requirement Validation, Traceability.	**CO403.2:**Students will be able to formulate real-life problems using Software Requirement Specification.
3	**Software Design** The Software Design Process, Design Concepts and Principles, Software Modeling and UML, Architectural Design, Architectural Views and Styles, User Interface Design, Function-oriented Design, SA/SD Component Based Design, Design Metrics .	**CO403.3:**Students will be able to design the architecture of real life problems using UML Modeling Techniques.
4	**Software Analysis and Testing** Software Static and Dynamic analysis, Code inspections, Software Testing, Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, Test Oracles, Test Techniques, Black-Box Testing, White-Box Unit Testing and Unit, Testing Frameworks, Integration Testing, System Testing and other Specialized, Testing, Test Plan, Test Metrics, Testing Tools. , Introduction to Object-oriented analysis, design and comparison with structured Software Engg.	**CO403.4:**Students will be able to demonstrate the quality of end product using different testing strategies, and also able to compare OOAD and structured software engineering.

5	**Software Maintenance & Software Project Measurement** Need and Types of Maintenance, Software Configuration Management (SCM), Software Change Management, Version Control, Change control and Reporting, Program Comprehension Techniques, Re-engineering, Reverse Engineering, Tool Support. Project Management Concepts, Feasibility Analysis, Project and Process Planning, Resources Allocations, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance (SQA). Project Plan, Project Metrics.	**CO403.5:**Students will be able to apply the software project management process during the software development.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 404		
Course Name: Computer Organization and Architecture		
Unit No	**Course Content**	**Course Outcome**
1	**Basic Structure of Computer:** Structure of Desktop Computers, CPU: General Register Organization-Memory Register, Instruction Register, Control Word, Stack Organization, Instruction Format, ALU, I/O System, Bus, CPU and Memory Program Counter, Bus Structure, Register Transfer Language-Bus and Memory Transfer, addressing modes. **Control Unit Organization:** Basic Concept of Instruction, Instruction Types, Micro Instruction Formats, Fetch and Execution cycle, Hardwired control unit, Microprogrammed Control unit microprogram sequencer Control Memory, Sequencing and Execution of Micro Instruction.	**CO404.1:** Students will be able to describe the components of Computer System architecture.
2	**Computer Arithmetic:** Addition and Subtraction, Tows Compliment Representation, Signed Addition and Subtraction, Multiplication and Division, Booths Algorithm, Division Operation, Floating Point Arithmetic Operation. design of Arithmetic unit.	**CO404.2:** Students will be able to evaluate the concepts of computer arithmetic operations using the 8086 emulator.
3	**I/O Organization:** I/O Interface –PCI Bus, SCSI Bus, USB, Data Transfer: Serial, Parallel, Synchronous, Asynchronous Modes of Data Transfer, Direct Memory Access(DMA), I/O Processor.	**CO404.3:** Students will be able to explain the different modes of data transfer in a computer system.

4	**Memory Organization:** Main memory-RAM, ROM, Secondary Memory –Magnetic Tape, Disk, Optical Storage, Cache Memory: Cache Structure and Design, Mapping Scheme, Replacement Algorithm, Improving Cache Performance, Virtual Memory, Memory Management Hardware.	**CO404.4:** Students will be able to distinguish the memories and define the memory management & organization techniques.
5	**Multiprocessors:** Characteristics of Multiprocessor, Structure of Multiprocessor-Interprocessor Arbitration, Inter-Processor Communication and Synchronization. Memory in Multiprocessor System, Concept of Pipelining, Vector Processing, Array Processing, RISC And CISC, Study of Multicore Processor –Intel, AMD.	**CO404.5:** Students will be able to describe the working and characteristics of multiprocessors in computer systems.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS-405		
Course Name: Operating Systems		
Unit No	**Course Content**	**Course Outcome**
1	UNIT 1. Introduction to Operating Systems: Function, Evolution, Different Types, Desirable Characteristics and features of an O/S, Operating Systems Services: Types of Services, Different ways of providing these Services – Utility Programs, System Calls.	**CO405.1:**Students will be able to explain the types of operating systems with their features.
2	UNIT 2. File Systems: File Concept, User's and System Programmer's view of File System, Disk Organization, Tape Organization, Different Modules of a File System, Disk Space Allocation Methods – Contiguous, Linked, Indexed. Directory Structures, File Protection, System Calls for File Management, Disk Scheduling Algorithms.	**CO405.2:**Students will be able to define the types of file systems along with the file organization.
3	UNIT 3. CPU Scheduling : Process Concept, Scheduling Concepts, Types of Schedulers, Process State Diagram, Scheduling Algorithms, Algorithms Evaluation, System calls for Process Management; Multiple Processor Scheduling; Concept of Threads. Memory Management: Different Memory Management Techniques – Partitioning, Swapping,Segmentation, Paging, Paged Segmentation, Comparison of these techniques, Techniques for supporting the execution of large programs: Overlay, Dynamic Linking and Loading, VirtualMemory – Concept, Implementation by Demand Paging etc.	**CO405.3:**Students will be able to elaborate on the concept of schedulings along with performance parameters.

4	UNIT 4. Input / Output : Principles and Programming, Input/Output Problems, Asynchronous Operations, Speed gap Format conversion, I/O Interfaces, Programme Controlled I/O, Interrupt Driven I/O, Concurrent I/O. Concurrent Processes : Real and Virtual Concurrency, Mutual Exclusion, Synchronization, Inter- Process Communication, Critical Section Problem, Solution to Critical Section Problem : Semaphores – Binary and Counting Semaphores, WAIT & SIGNAL Operations and their implementation. Deadlocks: Deadlock Problems, Characterization, Prevention, Avoidance, Recovery.	**CO405.4:**Students will be able to analyze the concepts of deadlock and semaphores in process communication.
5	UNIT 5. Introduction to Network, Distributed and Multiprocessor Operating Systems. Case Studies: Unix/Linux, WINDOWS and other Contemporary Operating Systems.	**CO405.5:**Students can validate the performance of the different operating systems.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 406

Course Name: Programming Practices

Unit No	Course Outcome
1	**CS406.1:** Students will be able to understand and implement the concepts of variables, operators, and control statements.
2	**CS406.2:** Students will be able to analyze the problem and implement the concepts of iterative and break statements.
3	**CS406.3:** Students will be able to describe the concepts of data structure such as list, array, and dictionary.
4	**CS406.4:** Students will be able to implement the program by using function calling methods along with string.
5	**CS406.5:** Students will be able to use the concepts of Inheritance and Classes.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS-501		
Course Name: Theory of Computation		
Unit No	**Course Content**	**Course Outcome**
1	Introduction of Automata Theory: Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.	**CO501.1:** Students will able to define formal language and automata theory.
2	Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, conversion of NDFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Meaning of union, intersection, concatenation and closure, 2 way DFA.	**CO501.2:** Students will be able to explain the fundamentals of NDFA and regular language.
3	Grammars: Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, killing null and unit productions. Chomsky normal form and Greibach normal form.	**CO501.3:** Students will able to classify the grammar and describe the concepts of context free grammar.
4	Push down Automata: Example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petrinet model.	**CO501.4:** Students will able to describe the relationship between context free language and push down automata.
5	Turing Machine: Techniques for construction, Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages, Halting problem of Turing machine & the post correspondence problem.	**CO501.5:** Students will able to explain the concept of undecidability and able to design turing machines for formal languages.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code:CS 502		
Course Name: Database Management System		
Unit No	**Course Content**	**Course Outcome**
1	DBMS Concepts and architecture Introduction, Database approach v/s Traditional file accessing approach, Advantages, of database systems, Data models, Schemas and instances, Data independence, Data Base Language and interfaces, Overall Database Structure, Functions of DBA and designer, ER data model: Entitles and attributes, Entity types, Defining the E-R diagram, Concept of Generalization, Aggregation and Specialization. transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model, Comparison between the three types of models.	**CO502.1-** Students will be able to describe the functional component of the DBMS.
2	Relational Data models: Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages: SQL-DDL, DML, integrity con straints, Complex queries, various joins, indexing, triggers, assertions , Relational algebra and relational calculus, Relational algebra operations like select, Project ,Join, Division, outer union. Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations.	**CO502.2**- Students will be able to analyze queries using relational calculus, relational algebra, and SQL.
3	Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies. Query Optimization: Introduction, steps of optimization, various algorithms to implement select, project and join operations of relational algebra, optimization methods: heuristic based, cost estimation based.	**CO503.3**- Students will be able to explain the use of database schema and the need for normalization.

4	Transaction Processing Concepts: -Transaction System, Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling. Concurrency Control Techniques: Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction. Introduction to Distributed databases, data mining, data warehousing, Object Technology and DBMS, Comparative study of OODBMS Vs DBMS . Temporal, Deductive, Multimedia, Web & Mobile database.	**CO504.4-** Students will be able to define the transaction process, concurrency control, and recovery techniques.
5	Study of Relational Database Management Systems through Oracle/PL SQLQL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi threaded server. Distributed database, database links, and snapshot. Data dictionary, dynamic performance view. Security, role management, privilege management, profiles, invoker defined security model. SQL queries, Data extraction from single, multiple tables equi-join, non equi-join, self -join, outer join. Usage of like, any, all, exists, in Special operators. Hierarchical quires, inline queries, flashback queries. Introduction of ANSI SQL, anonymous block, nested anonymous block, branching and looping constructs in ANSI SQL. Cursor management: nested and parameterized cursors, Oracle exception handling mechanism. Stored procedures, in, out, in out type parameters, usage of parameters in procedures. User defined functions their limitations. Triggers, mutating errors, instead of triggers.	**CO505.5- S**tudents will be able to construct different types of the physical implementation of DBMS.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS-503		
Course Name: Cyber Security		
Unit No	**Course Content**	**Course Outcome**
1	Introduction of Cyber Crime, Challenges of Cyber Crime, Classifications of Cyber Crimes: E-Mail Spoofing, Spamming, Internet Time Theft, Salami Attack/Salami Technique.	**CO503.1:** Students will be able to explain the basic functions and challenges of cybercrimes.
2	Web jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, Cyber Terrorism, Virtual Crime, Perception of Cyber Criminals: Hackers, Insurgents and Extremist Group etc. Web Servers were Hacking, Session Hijacking.	**CO503.2:** Students will be able to analyze various network-specific crimes and also able to analyze the vulnerability of cyberattacks.
3	Cyber Crime and Criminal Justice: Concept of Cyber Crime and The IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackle Cyber Crime and Trends.	**CO503.3:** Students will be able to define cyber acts and their consequences.
4	The Indian Evidence Act of 1872 v. Information Technology Act, 2000: Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of EEvidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages.	**CO503.4:** Students will be able to describe the principles of IT Laws and Indian E-evidence.
5	Tools and Methods in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks , Buffer and Overflow, Attack on Wireless Networks, Phishing : Method of Phishing, Phishing Techniques.	**CO503.5:** Students will be able to identify the security challenges in cybercrime along with the protective measures.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 504		
Course Name: Internet and Web Technology		
Unit No	**Course Content**	**Course Outcome**
1	**World Wide Web and Website Designing** Introduction: Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0 Web Design: Concepts of effective web design, Webdesign issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.	**CO504.1:**Student will be able to define the concepts of the world wide web along with effective website designing techniques.
2	**HTML Programming** HTML :Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5.	**CO504.2:**Student will be able to explain the concepts of HTML Programming.
3	**CSS and JavaScript** Style sheets : Need for CSS, introduction to CSS, basic syntax andstructure, using CSS, background images, colors and properties,manipulating texts, usingfonts, borders and boxes, margins, padding lists,positioning using CSS, CSS2, Overview and features of CSS3. JavaScript : Client side scriptingwith JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations,DHTML : Combining HTML, CSS andJavascript, Events and buttons.	**CO504.3:**Student will be able to identify the concept of CSS along with its features and also analyze the concepts of JavaScript in web development.

4	**XML and PHP Programming** XML : Introduction to XML, uses of XML, simple XML, XML keycomponents, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.	**CO504.4:**Student will be able to analyze the concept of XML along with its applications and also demonstrate the basic concepts of PHP Programming.
5	**Advance PHP with MySQL** PHP and MySQL:Basic commandswith PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names,creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and databasebugs.	**CO504.5:**Student will be able to analyze the implementation of advanced PHP programming along with MySQL database concepts.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 505	
Course Name: Linux	
Unit No	**Course Outcome**
1	**CS505.1:** Students will be able to explain the basic commands of Linux.
2	**CS505.2:** Students will be able to elaborate on the concepts of the system calls.
3	**CS505.3:** Students will be able to compare between ANSI C AND C++ AND POSIX standards.
4	**CS505.4:** Students will be able to describe the relationship between UNIX Kernel support for files.
5	**CS505.5:** Students will be able to explain the kernel support for process creation, termination, and memory allocation.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 506	
Course Name: Python	
Unit No	**Course Outcome**
1	**CS506.1:** Students will be able to explain the steps of Python installation.
2	**CS506.2:** Students will be able to elaborate on the concepts of Python data structures.
3	**CS506.3:** Students will be able to describe the concepts of looping in Python.
4	**CS506.4:** Students will be able to classify the various visualization packages in Python.
5	**CS506.5:** Students will be able to explain the concept of file handling in Python.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 508	
Course Name: Minor Project-1	
Unit No	**Course Outcome**
1	**CS508.1:** Students will be able to contribute as an individual or in a team in the development of technical projects.
2	**CS508.2:** Students will be able to gather the requirements related to software projects along with the software model identification.
3	**CS508.3:** Students will able to identify, analyze and design the architecture design of the software using various UML diagrams.
4	**CS508.4:** Students will able to use various validation and verification methods for evaluating software projects along with implementation and testing.
5	**CS508.5:** Students will able to acquire practical knowledge within the chosen area of technology for project development.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 601		
Course Name: Machine Learning		
Unit No	**Course Content**	**Course Outcome**
1	Introduction to machine learning, scope and limitations, regression, probability, statistics and linear algebra for machine learning, convex optimization, data visualization, hypothesis function and testing, data distributions, data preprocessing, data augmentation, normalizing data sets, machine learning models, supervised and unsupervised learning.	**CO601.1:**Student will be able to explain the fundamental concept of machine learning and apply knowledge of computing & mathematics to machine learning problems, models, and algorithms.
2	Linearity vs non linearity, activation functions like sigmoid, ReLU, etc., weights and bias, loss function, gradient descent, multilayer network, backpropagation,weight initialization, training, testing, unstable gradient problem, auto encoders, batch normalization, dropout, L1 and L2 regularization, momentum, tuning hyper parameters.	**CO601.2:**Student will be able to analyze a problem and identify the computing requirements appropriate for its solution based on BPN.
3	Convolutional neural network,flattening, subsampling, padding, stride, convolution layer, pooling layer, loss layer, dance layer 1x1 convolution, inception network, input channels, transfer learning, one shot learning, dimension reductions, implementation of CNN like tensor flow, keras etc.	**CO601.3:**Student will be able to design the CNN algorithms to solve related real-life problems.
4	Recurrent neural network, Long short-term memory, gated recurrent unit, translation, beam search and width, Bleu score, attention model, Reinforcement Learning, RL-framework, MDP, Bellman equations, Value Iteration and Policy Iteration, Actor-critic model, Q-learning, SARSA.	**CO601.4:**Student will be able to apply Recurrent neural network principles to the modeling and design of computer-based systems.
5	Support Vector Machines, Bayesian learning, application of machine learning in computer vision, speech processing, natural language processing etc, Case Study: ImageNet Competition.	**CO601.5:**Student will be able to elaborate on the concepts of machine learning in various domains.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 602		
Course Name: Computer Networking		
Unit No	**Course Content**	**Course Outcome**
1	**Computer Network:** Definitions, goals, components, Architecture, Classifications & Types. Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service primitives, Design issues & its functionality. ISO-OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Principals of physical layer: Media, Bandwidth, Data rate and Modulations.	**CO602.1:** Students will be able to describe basic fundamentals of networking.
2	**Data Link Layer:** Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary &Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Protocol verification: Finite State Machine Models & Petri net models. ARP/RARP/GARP.	**CO602.2:** Students will be able to explain the services and protocols used in the data link layer along with the verification process and process tools.
3	**MAC Sublayer:** MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted-ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bit Map, BRAP, Binary Count Down, MLMA Limited Contention Protocols: Adaptive Tree Walk, Performance Measuring Metrics. IEEE Standards 802 series & their variant.	**CO602.3:** Students will be able to explain the various protocols and IEEE 802.x standards along with collision avoidance and detection method.
4	**Network Layer:** Need, Services Provided , Design issues, Routing algorithms: Least Cost Routingalgorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing. IP Addresses, Header format, Packet forwarding, Fragmentation and reassembly, ICMP, Comparative study of IPv4 & IPv6.	**CO602.4:** Students will be able to analyze various routing protocol algorithms of the network layer.

5	**Transport Layer:** Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management.Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).	**CO602.5:** Students will be able to explain the header format of various protocols used in the transport and application layer.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 603		
Course Name: Compiler Design		
Unit No	**Course Content**	**Course Outcome**
1	**Introduction to compiling & Lexical Analysis** Introduction of Compiler, Major data Structure in compiler, types of Compiler, Front-end and Back-end of compiler, Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, Lexical analysis: Input buffering, Specification & Recognition of Tokens,Design of a Lexical Analyzer Generator, LEX.	**CO603.1:**Students will be able to describe the basic concept and application of compiler design.
2	**Syntax Analysis &Syntax Directed Translation** Syntax analysis: CFGs, Top down parsing, Brute force approach, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence parsing, LR parsers (SLR,LALR, LR),Parser generation. Syntax directed definitions: Construction of Syntax trees,Bottom up evaluation of S-attributed definition, L-attribute definition, Top down translation, Bottom Up evaluation of inherited attributes Recursive Evaluation, Analysis of Syntax directed definition.	**CO603.2:**Students will be able to construct a parse tree and syntax tree using various LR parsers.

3	**Type Checking & Run Time Environment** Type checking: type system, specification of simple type checker, equivalence of expression, types, type conversion, overloading of functions and operations, polymorphic functions. Run time Environment: storage organization, Storage allocation strategies, parameter passing, dynamic storage allocation ,Symbol table, Error Detection & Recovery, Ad-Hoc and Systematic Methods.	**CO603.3:**Students will be able to apply type checking for semantic analysis and analyze the run-time environment.
4	**Code Generation** Intermediate code generation: Intermediate code generation: Declarations, Assignment statements, Boolean expressions, Case statements, Back patching, Procedure calls Code Generation: Issues in the design of code generator, Basic block and flow graphs, Register allocation and assignment, DAG representation of basic blocks, peephole optimization, generating code from DAG.	**CO603.4:**Students will be able to elaborate on different code generation methodologies.
5	**Code Optimization** Introduction to Code optimization: Introduction to Code optimization: sources of optimization of basic blocks, loops in flow graphs, dead code elimination, loop optimization, Introduction to global data flow analysis, Code Improving transformations ,Data flow analysis of structure flow graph Symbolic debugging of optimized code.	**CO605.5:**Students will be able to apply various code optimization techniques on intermediate code.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 604		
Course Name: Project Management		
Unit No	**Course Content**	**Course Outcome**
1	**1. Conventional Software Management** Evolution of software economics, Improving software economics: reducing product size, software processes, team effectiveness, automation through software environments, Principles of modern software management.	**CO604.1:**Student will be able to identify the aptness of various software development processes and models. **CO604.2:**Student will be able to formulate the real-life problems using Software Requirement Specification.
2	**2. Software Management Process Framework** Life cycle phases-inception, elaboration, construction and training phase, Artifacts of the process-the artifact sets, management artifacts, engineering artifacts, pragmatics artifacts, Model based software architectures, Workflows of the process, Checkpoints of the process.	**CO604.3:**Student will be able to design the architecture of the real-life problems using UML Modeling Techniques. **CO604.4:**Students will be able to demonstrate the quality of end product using different testing strategies, and also able to compare OOAD and structured software engineering.
3	**3. Software Management Disciplines** Iterative process planning, Project organisations and responsibilities, Process automation, Project control And process instrumentation-core metrics, management indicators, life cycle expections, Process discriminants.	**CO604.5:**Student will be able to apply the software project management process during the software development.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 605	
Course Name: Data Analytics	
Unit No	**Course Outcome**
1	**CS605.1:** Students will be able to understand the basics of data analytics using concepts of statistics and probability.
2	**CS605.2:** Students will be able to understand the needs of data processing techniques.
3	**CS605.3:** Students will be able to implement the data analytics techniques using R, MATLAB, and Python.
4	**CS605.4:** Students will be able to implement various data preprocessing operations.
5	**CS605.5:** Students will be able to apply the data analytics techniques in the real-life applications.

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Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 606	
Course Name: Data Analytics	
Unit No	**Course Outcome**
1	**CS606.1:** Students will be able to understand the basics of software as a product.
2	**CS606.2:** Students will be able to understand the current requirements of industries.
3	**CS606.3:** Students will be able to describe the various software development standards.

4	**CS606.4:** Students will be able to implement the software as a product using different design patterns.
5	**CS606.5:** Students will be able to apply the software development techniques in the real-life applications.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 608	
Course Name: Minor Project-2	
Unit No	**Course Outcome**
1	**CS608.1:** Students will be able to contribute as an individual or in a team in the development of technical projects.
2	**CS608.2:** Students will be able to implement the project as per the collected requirements.
3	**CS608.3:** Students will able to analyze and design the database and entity relationships.
4	**CS608.4:** Students will able to use various validation and verification methods for evaluating software projects.
5	**CS608.5:** Students will able to acquire the necessary knowledge for the purpose of project report writing.

Chameli Devi Group of Institutions

Program: B.Tech. (Computer Science & Engineering)

Course Code: CS 701		
Course Name: Software Architect		
Unit No	**Course Content**	**Course Outcome**
1	Overview of Software development methodology and software quality model, different models of software development and their issues. Introduction to software architecture, evolution of software architecture, software components and connectors, common software architecture frameworks, Architecture business cycle – architectural patterns – reference model.	**CO701.1:** Students will be able to describe the fundamentals of software architecture, qualities, and terminologies.
2	Software architecture models: structural models, framework models, dynamic models, process models. Architectures styles: dataflow architecture, pipes and filters architecture, call-and return architecture, data-centered architecture, layered architecture, agent based architecture, Micro-services architecture, Reactive Architecture, Representational state transfer architecture etc.	**CO701.2:** Students will be able to explain the software architecture models along with micro-services.
3	Software architecture implementation technologies: Software Architecture Description Languages (ADLs), Struts, Hibernate, Node JS, Angular JS, J2EE – JSP, Servlets, EJBs; middleware: JDBC, JNDI, JMS, RMI and CORBA etc. Role of UML in software architecture.	**CO701.3:** Students will be able to use implementation techniques of software architecture for effective software development.
4	Software Architecture analysis and design: requirements for architecture and the life-cycle view of architecture design and analysis methods, architecture-based economic analysis: Cost Benefit Analysis Method (CBAM), Architecture Tradeoff Analysis Method (ATAM). Active Reviews for Intermediate Design (ARID), Attribute Driven Design method (ADD), architecture reuse, Domain –specific Software architecture.	**CO701.4:** Students will be able to understand the fundamental principles and guidelines for software architecture design, architectural styles, patterns, and frameworks.
5	Software Architecture documentation: principles of sound documentation, refinement, context diagrams, variability, software interfaces. Documenting the behavior of software elements and software systems, documentation package using a seven-part template.	**CO701.5:** Students will be able to apply core values and principles of software architectures for enterprise application development.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS-702		
Course Name: Wireless & Mobile Computing		
Unit No	**Course Content**	**Course Outcome**
1	Review of traditional networks: Review of LAN, MAN, WAN, Intranet, Internet, and interconnectivity devices: bridges, Routers etc. Review of TCP/IP Protocol Architecture: ARP/RARP, IP addressing, IP Datagram format and its Delivery, Routing table format, ICMP Messages, Subnetting, Supernetting and CIDR, DNS. NAT: Private addressing and NAT, SNAT, DNAT, NAT and firewalls, VLANS: Concepts, Comparison with Real LANS, Type of VLAN, Tagging, IPV6: address structure, address space and header.	**CO702.1**: Students will be able to describe the traditional networks along with traditional protocols.
2	Study of traditional routing and transport: Routing Protocols: BGP- Concept of hidden network and autonomous system, An Exterior gateway protocol, Different messages of BGP. Interior Gateway protocol: RIP, OSPF. Multiplexing and ports, TCP: Segment format, Sockets, Synchronization, Three Way Hand Shaking, Variable window size and Flow control, Timeout and Retransmission algorithms, Connection Control, Silly window Syndrome. Example of TCP: Taho, Reno, Sack etc. UDP: Message Encapsulation, Format and Pseudo header.	**CO702.2**: Students will be able to Evaluate the transport layer issues in wireless networks due to errors and mobility of nodes and understand existing solutions for the same.
3	Wireless LAN: Transmission Medium For WLANs, MAC problems, Hidden and Exposed terminals, Near and Far terminals, Infrastructure and Ad hoc Networks, IEEE 802.11- System arch, Protocol arch, Physical layer, Concept of spread spectrum, MAC and its management, Power management, Security. Mobile IP: unsuitability of Traditional IP; Goals, Terminology, Agent advertisement and discovery, Registration, Tunneling techniques. Ad hoc network routing: Ad hoc Network routing v/s Traditional IP routing, types of routing protocols, Examples: OADV, DSDV, DSR, ZRP etc.	**CO702.3**: Students will be able to understand the different issues in MAC and routing issues in multi-hop wireless and ad-hoc networks and existing solutions for the same.

4	Mobile transport layer: unsuitability of Traditional TCP; I-TCP, S-TCP, M-TCP. Wireless Cellular networks: Cellular system, Cellular networks v/s WLAN, GSM – Services, system architecture, Localization and calling, handover and Roaming.	**CO702.4**: Students will be able to explain the architecture of GSM.
5	Mobile Device Operating Systems: Special Constraints & Requirements, Commercial Mobile Operating Systems. Software Development Kit: iOS, Android etc.MCommerce : Structure , Pros &Cons, Mobile Payment System ,Security Issues	**CO702.5**: Students will be able to discuss the services, emerging issues, and future trends in M-Commerce.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS-703		
Course Name: Data Mining and Warehousing		
Unit No	**Course Content**	**Course Outcome**
1	Data Warehousing: Introduction, Delivery Process, Data warehouse Architecture, Data Preprocessing: Data cleaning, Data Integration and transformation, Data reduction. Data warehouse Design: Datawarehouse schema, Partitioning strategy Data warehouse Implementation, Data Marts, Meta Data, Example of a Multidimensional Data model. Introduction to Pattern Warehousing.	**CO703.1**: Students will be able to understand the need of designing Enterprise data warehouses andwill be enabled to approach business problems analytically by identifying opportunities to derive business.
2	OLAP Systems: Basic concepts, OLAP queries, Types of OLAP servers, OLAP operations etc. Data Warehouse Hardware and Operational Design: Security, Backup And Recovery.	**CO703.2**: Students will be able to compare and contrast, various methods for storing & retrieving data from different data sources/repository.
3	Introduction to Data & Data Mining :Data Types, Quality of data, Data Preprocessing, Similarity measures, Summary statistics, Data distributions, Basic data mining tasks, Data Mining V/s knowledge discovery in databases. Issues in Data mining. Introduction to Fuzzy sets and fuzzy logic.	**CO703.3**: Students will be able to explain the data preprocessing operations along with the concepts of Fuzzy Logic.
4	Supervised Learning: Classification: Statistical-based algorithms, Distance-based algorithms, Decision tree-based algorithms, Neural network-based algorithms, Rule-based algorithms, Probabilistic Classifiers.	**CO703.4**: Students will be able to apply supervised learning methods to given data sets such as classification and its various types.

5	Clustering & Association Rule mining : Hierarchical algorithms, Partitional algorithms, Clustering large databases – BIRCH, DBSCAN, CURE algorithms.Association rules : Parallel and distributed algorithms such as Apriori and FP growth algorithms.	**CO703.5**: Students will be able to apply Unsupervised learning methods to given data sets such as clustering and its various types along with association rule.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 705	
Course Name: Data Mining and Warehousing Lab	
Unit No	**Course Outcome**
1	**CO705.1:** Students will be able to identify the key processes of data marts and conceptual modeling of the data warehouse.
2	**CO705.2:** Students will be able to identify the basic characteristics of the OLAP system and able to implement its different types of servers.
3	**CO705.3:** Students will be able to apply data mining preprocessing techniques and knowledge discovery processes.
4	**CO705.4:** Students will be able to apply association rule mining to improve the performance of data mining algorithms.
5	**CO705.5:** Students will be able to analyze different types of classification and clustering methods for data analysis.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 706	
Course Name: Major Project-1	
Unit No	**Course Outcome**
1	**CS706.1:** Students will able to interpret the SRS and deduce practical conclusions from it.
2	**CS706.2:** Students will able to identify correct methods and software tools to find out the solution of real-world problems.

3	**CS706.3:** Students will able to analyze how to apply the prior knowledge of Data Structure, Design of Algorithm, Database, and Programming Language in finding out the solutions.
4	**CS706.4:** Students will able to design the algorithm to solve real-world problems using Software Engineering & Project management.
5	**CS706.5:** Students will able to evaluate the sustainability of the model in the real-world.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 801		
Course Name: Internet of Things		
Unit No.	**Course Content**	**Course Outcome**
1	IoT definition, Characteristics, IoT conceptual and architectural framework, Components of IoT ecosystems, Physical and logical design of IoT, IoT enablers, Modern day IoT applications, M2M communications, IoT vs M2M, IoT vs WoT, IoT reference architecture, IoT Network configurations, IoT LAN, IoT WAN, IoT Node, IoT Gateway, IoT Proxy, Review of Basic Microcontrollers and interfacing.	**CO801.1:** Students will be able to understand Internet of Things and its hardware and software components.
2	Define Sensor, Basic components and challenges of a sensor node, Sensor features, Sensor resolution; Sensor classes: Analog, Digital, Scalar, Vector Sensors; Sensor Types, bias, drift, Hysteresis error, quantization error; Actuator; Actuator types: Hydraulic, Pneumatic, electrical, thermal/magnetic, mechanical actuators, soft actuators.	**CO801.2:** Students will be able to interface I/O devices, sensors & communication modules.
3	Basics of IoT Networking, IoT Components, Functional components of IoT, IoT service oriented architecture, IoT challenges, 6LowPAN, IEEE 802.15.4, ZigBee and its types, RFID Features, RFID working principle and applications, NFC (Near Field communication), Bluetooth, Wireless Sensor Networks and its Applications.	**CO801.3:** Students will be able to analyze data from various sources in real-time and take necessary actions in an intelligent fashion.
4	MQTT, MQTT methods and components, MQTT communication, topics and applications, SMQTT, CoAP, CoAP message types, CoAP Request-Response model, XMPP, AMQP features and components, AMQP frame types.	**CO801.4:** Students will be able to explain the working of remotely monitor data and control devices.
5	IoT Platforms, Arduino, Raspberry Pi Board, Other IoT Platforms; Data Analytics for IoT, Cloud for IoT, Cloud storage models & communication APIs, Attacks in IoT system, vulnerability analysis in IoT, IoT case studies: Smart Home, Smart framing etc.	**CO801.5:** Students will be able to develop real life IoT based projects.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 802		
Course Name: Cloud Computing		
Unit No	**Course Content**	**Course Outcome**
1	Introduction to Service Oriented Architecture, Web Services, Basic Web Services Architecture, Introduction to SOAP, WSDL and UDDI; REST ful services: Definition, Characteristics, Components, Types; Software as a Service, Plat form as a Service, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Study of a Hypervisor.	**CO802.1:** Students will be able to identify the various models, environments, and types of services used in cloud computing.
2	Utility Computing, Elastic Computing, Ajax: asynchronous 'rich' interfaces, Mashups: User interface, Services Virtualization Technology: Virtualization applications in enterprises, Pitfalls of virtualization Multitenant software: Multi-entity support, Multischema approach, Multi-tenancy using cloud data stores.	**CO802.2:** Students will be able to describe the concepts of virtualization.
3	Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Features and comparisons among GFS, HDFS etc, Big Table, H Base and Dynamo. Map-Reduce and extensions: Parallel computing, The Map Reduce model: Parallel efficiencyofMapReduce,Relationaloperations,Enterprisebatchprocessing, Example/Application of MapReduce.	**CO802.3:** Students will be able to apply the Map-Reduce techniques.
4	Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud: Cloud computing security architecture, General Issues, Trusted Cloud computing, Security challenges: Virtualization security management-virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.	**CO802.4:** Students will be able to describe the cloud security fundamentals.
5	Issues in cloud computing; implementing real time application; QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. Agrid of clouds, Sky computing, load balancing, Resource optimization, Resource dynamic reconfiguration, Monitoring in Cloud, Installing cloud platforms and performance evaluation, Features and functions of cloud computing platforms.	**CO802.5:** Students will be able to describe the services of different cloud platforms along with issues.

Chameli Devi Group of Institutions

Program: BE (Computer Science & Engineering)

Course Code: CS 803		
Course Name: Managing Innovation and Entrepreneurship		
Unit No	**Course Content**	**Course Outcome**
1	Innovation, the basic definition and classification: The relationship of innovation and entrepreneurship, creation of competitive advantage based on innovation. Innovative models, Product, process, organizational and marketing innovation and their role in business development.	**CO803.1:** Students will be able to understand the innovation models and key terms.
2	Sources of innovation (push, pull, analogies), transfer of technology. Creative methods and approaches used in innovation management. Approaches to management of the innovation process (agile management, Six Thinking Hats, NUF test).	**CO803.2:** Students will be able to identify the source of innovation along with the innovation process.
3	Project approach to innovation management, method Stage Gate, its essence, adaptation of access to selected business models. In-house business development of the innovation process in the company. Open Innovation as a modern concept, the limits of this method and its benefits for business development.	**CO803.3:** Students will be able to apply various business models.
4	Innovations aimed at humans, role of co-creation in the innovation process. The strategy of innovation process, types and selection of appropriate strategies.	**CO803.4:** Students will be able to explain the various strategies of the innovation process.
5	Measurement and evaluation of the benefits of innovation for business (financial and nonfinancial metrics, their combination and choice). Barriers to innovation in business, innovation failure and its causes, post-audits of innovative projects. Organization and facilitation of an innovation workshop.	**CO803.5:** Students will be able to analyze the benefits of innovation for business.

Chameli Devi Group of Institutions

Program: B.Tech (Computer Science & Engineering)

Course Code: CS 805	
Course Name: Major Project -II	
Unit No	**Course Outcome**
1	**CO805.1:** Students will able to apply fundamental principles and algorithms of Computer Science to a wide range of applications.
2	**CO805.2:** Students will able to analyze and compare optimal solutions to computing problems.
3	**CO805.3:** Students will able to design and implement effective solutions to computing problems by using various algorithms.
4	**CO805.4:** Students will able to interpret the test cases of project outcome for synthesis and evaluation of the solution.
5	**CO805.5:** Students will able to recognize the usability of project outcomes in society to fulfill ethical responsibility.