DELHI TECHNOLOGICAL UNIVERSITY
DEPARTMENT OF SOFTWARE ENGINEERING
B.TECH 1st YEAR

Course Title: Basics of Software Engineering

Course Outcome (CO):

1. Describe the phases of software development life cycle for designing an efficient software.
2. Identification of user requirements using various requirements elicitation techniques.
3. Describe the procedure of designing software requirement specification for designing software as per user requirements.
4. Describe the basics of software design using various techniques.

Course Title: Fundamentals of Computers

Course Outcome (CO):

1. Describe the procedure of designing algorithm and drafting pseudocode for problem solving.
2. Describe the computer organization and architecture of central processing unit. CO3. Describe the computer codes, computer arithmetic and number conversion system.
3. Describes the procedure of installing functionalities and installation of different operating system, software.
4. Demonstrate steps to write a basic program for solving real world problems using high-level language.

Course Title: Computer Workshop 1

Course Outcome (CO):

1. Describe the procedure for installation of software on different systems and identify the various components of hardware systems.
2. Identify and demonstrate components of computer and operating system and their troubleshooting.
3. Describe the basics of Internet and web design.
4. Perform the process of software installation.

Course Title: Computer Workshop 2
Course Outcome (CO):

1. Demonstrate the modelling of data stored in a database.
2. Demonstrate the way information is flowing through the system.
3. Describe the procedure for designing data flow diagram and context diagram.
4. Describe the process of interaction among external entities with an internal software system.
5. Demonstrate the process of collecting requirements form the user for software development.

DELHI TECHNOLOGICAL UNIVERSITY

DEPARTMENT OF SOFTWARE ENGINEERING

B.TECH. 2nd YEAR (Course Outcome (CO)

Course Title: Digital Systems & Design

Course Outcome (CO):

1. Apply knowledge of minimization techniques to switching functions, and realization of FSM.
2. Apply synchronous sequential logic concept for designing Finite state machines.
3. Apply Asynchronous sequential logic concepts for designing circuits from given statements and apply ASM concepts for designing digital circuits.
4. Understand the concept of various ADC and DAC conversion and various techniques and designing circuits using programmable logic devices.
5. Understand the concept of HDL and demonstrate its knowledge by designing various digital systems.
6. Understand the concept of various logic families and their parameters.

Course Title: Data Structures

Course Outcome (CO):

1. Understand basic data structures such as arrays, linked list, stacks, and queues.
2. Analyze the concepts of algorithm evaluation, and find time and space complexities for searching and sorting algorithms.
3. Implement different types of trees, and apply them to problem solutions.
4. Discuss graph structure, and understand various operations on graphs and their applicability.
5. Apply algorithm for solving problems like sorting, searching, insertion, and deletion of data.

Course Title: Object-Oriented Programming

Course Outcome (CO):

1. To apply mathematics to arrange and manipulate the data in a computational way
2. To differentiate between structured and object-oriented programming.
3. To apply concepts of Constructor, destructor, friend functions and classes & dynamic objects.
4. To apply concepts of polymorphism, inheritance, and abstraction in designing programs
5. Design, implement, test, debug, and document programs in C++
6. Analyze how the stack is used to implement function calls, and parameter passing options.
7. Write programs that perform explicit memory management.
8. Design template functions and classes for generic programming

Course Title: Operating System

Course Outcome (CO):

1. Identify the basic concepts and functions of operating systems. Understand differentiation of various operating systems by their functionality.
2. Assess various process synchronization mechanisms and use different CPU scheduling methods in order to allocate resources effectively.
3. Understand various deadlock handling techniques to prevent and/or avoid deadlock.
4. Apply concepts of memory management including Virtual Memory and Page

Course Title:Software Engineering Methodologies

Course Outcome (CO):

1. Explain various software characteristics and analyse different software Development Models
2. Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards
3. Compare and contrast various methods for software design
4. Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing
5. Manage software development process independently as well as in teams and make use of Various software management tools for development, maintenance, and analysis.

Course Title:Computer System Architecture

Course Outcome (CO):

1. Describe the functionalities of various units of a computer.
2. Illustrate the logic design of Control Unit.
3. Understand the architecture and functionality of central processing unit.
4. Learn the different types of serial communication techniques.
5. Illustrate various memory components and memory mapping techniques.

Course Title: Object-Oriented Software Engineering

Course Outcome (CO):

1. Understand the basics of software engineering, object-oriented paradigms, object-oriented methodologies used, and various basic terminologies.
2. Develop real-world software using conventional software development life cycle models, and object-oriented software development life cycle models.
3. Apply various techniques to gather requirements from the customers such as interviews, brainstorming session, FAST, and prototyping.
4. Design software requirement specification document, software design document, and test case matrix.
5. Design UML diagrams such as use case diagrams, class diagrams, sequence diagrams, state chart diagrams, and activity diagrams.
6. Analyze existing software by considering the issues of software risk management, and approaches to estimate the risk.

Course Title: Machine Learning

Course Outcome (CO):

1. Understand the basic concepts of machine learning, supervised, unsupervised, regression analysis, and machine learning algorithms.
2. Apply the learned concepts of machine learning to interpret various problems.
3. Analyze the different mathematical machine learning models for various systems.
4. Evaluate the performance of the machine learning model using various performance measures.
5. Develop an efficient machine learning system to solve various real-time problems.

Course Title:Database Management Systems

Course Outcome (CO):

1. To understand the concepts of DBMS and would have acquired skills to analyse the real-world problem domains in the context of DBMS and demonstrate the same through ER diagram.
2. To apply and demonstrate with understanding of relational query languages such as SQL, Relational Algebra and Relational Calculus.
3. To relate the concepts of inference rules, data constraints and normalization. Students would also have acquired skills to identify application of the same.
4. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing. To appraise the basic issues of Transaction processing and Serializability.
5. To classify various concurrency control techniques and recovery procedures
6. Familiar with case studies regarding commercial database, Oracle platforms, Postgres and MYSQL.

Course Title:Algorithm Design and Analysis

Course Outcome (CO):

1. To learn the Algorithm and Design Concepts of linear and non-linear structures and complexity.
2. To understand the concept of searching and sorting
3. To learn concepts of searching and sorting.
4. To learn concepts of the Greedy method.
5. To understand concepts of Dynamic programming.
6. To understand the concepts of Branch and Bound.
7. To understand computational complexity.

Course Title:Fundamentals of Mathematics in Computer Science

Course Outcome (CO):

1. Understand the elementary concept of probability and set theory.
2. Apply concepts of probabilistic distribution functions and statistical inferences to solve
3. computing problems.
4. Understanding multivariate statistical models.
5. Illustrate number theory & group theory to solve real world computing problems.
6. Understanding mathematics involved in recent computer science and engineering applications.

DELHI TECHNOLOGICAL UNIVERSITY

DEPARTMENT OF SOFTWARE ENGINEERING

B.Tech. 3rd YEAR

Course Title : Software Testing

Course Outcomes(CO)

1. Explain basics of software testing process, limitations, and the V-shaped life cycle model.
2. Apply various types of testing to ensure software functionality and reliability
3. Demonstrate various functional testing techniques.
4. Implement structural and object-oriented testing methods.
5. Investigate automated testing tools and various testing activities.

Course Title: Software Quality and Metrics

Course Outcomes (CO)

1. Understand basic concepts of software quality, the components of SQA, and SQA plan.
2. Analyze various software quality models and assess their impact on software quality.
3. Demonstrate internal and external product attributes using software metrics, including size, complexity, and modularity.
4. Assess software quality at different levels (product, process, and maintenance) using appropriate quality metrics and methodologies, including object-oriented metrics.
5. Demonstrate quality estimation tools and evaluate computer aided quality engineering technique for quality assurance.

Course Title : Computer Networks

Course Outcomes (CO)

1. Understand and analyze the classification of network services, protocols, architectures and internet applications.
2. Learn basic concepts of MAC protocols and their protocols.
3. Design and analysis of the routing protocols.
4. Demonstrate the connection oriented and connection less protocols.
5. Investigate various design issues in Application layer.

Course Title: Software Requirement Engineering

Course Outcomes (CO)

1. Understand fundamentals of software requirements, best practices in requirements engineering, and risk management.
2. Analyze various activities used for requirements engineering.
3. Apply requirements management principles, including change management, requirements traceability, and maintaining links in the requirements chain.
4. Demonstrate requirements management tools such as Rational Requisite Pro and Caliber RM.
5. Explore and assess advanced requirement engineering techniques.

Course Title : Computer Graphics

Course Outcomes (CO)

1. Explain the fundamentals of computer graphics, applications, and graphic pipeline.
2. Apply and compare the algorithms for drawing 2D images also explain aliasing, anti-aliasing and half toning techniques.
3. Apply 2D and 3D transformations, including translation, scaling, rotation, reflection, shearing, affine transformation, and coordinate system conversions
4. Analyze and apply clipping algorithms and transformation on 2D images.
5. Explain basic ray tracing algorithm, shading, shadows, curves and surfaces and also solve the problems of curves.

Course Title : Information Theory and Coding

Course Outcomes (CO)

1. Introduce the principles and applications of information theory.
2. Comprehend various communication channel and error control code properties.
3. Apply linear block codes for error detection and correction.
4. Apply cyclic codes and parity generator for performance analysis & cyclic codes for error detection and correction.
5. Apply information theory and coding concepts to solved real-world problems.

Course Title : Digital Signal Processing

Course Outcomes (CO)

1. Understand and classify the signal continuous time and discrete time signals and systems, and describe the characteristics.
2. Define and describe the frequency domain representation of discrete time signals and systems, and different properties.
3. Demonstrate the concepts, representation, and properties of discrete Fourier transform, fast Fourier transform, and Z- transform.
4. Understand and evaluate the difference equations of digital systems.
5. Analyze the finite impulse response (FIR) systems and infinite impulse response (IIR) systems and evaluate the different methods in IIR filter design and FIR filter design.

Course Title: Advanced Data Structures

Course Outcomes (CO)

1. Understand advanced tree structures and their applications
2. Apply mergeable heaps (Binomial, Fibonacci, 2-3-4 Heaps) for efficient data management.
3. Understand graph theory concepts.
4. Implement graph theory algorithms for efficient utilization of resources.
5. Create efficient techniques for searching and indexing to solve real world problems.

Course Title: Discrete Structures

Course Outcomes (CO)

1. Understand and remember the symbols and properties of predicators, propositional logic, logic programming, and quantifiers.
2. Analyze and apply various theorem-proving techniques, principles of induction, and recurrence relation solutions.
3. Apply and understand set theory, combinatorial principles, and relational algebra.
4. Analyze and understand the concepts of lattices and boolean algebra and evaluate the operations.
5. Understand the concepts of graph theory and evaluate depth first search, breadth first search, in order, pre order, and post order traversal algorithms.

Course Title: Distributed Systems

Course Outcomes (CO)

1. Understand and remember the architectures, design principles, and communication mechanisms of distributed systems.
2. Understand the concepts of synchronization and evaluate the various synchronization algorithms.
3. Evaluate replication strategies and consistency models to design efficient data management solutions and apply consistency protocols.
4. Create and analyze fault tolerance mechanisms, including failure models, process resilience.
5. Analyze security mechanisms and naming strategies to ensure data integrity, authenticity, and confidentiality.

Course Title: Soft Computing

Course Outcomes (CO)

1. Understand the basic concepts of artificial neural networks and apply artificial neural network models and learning algorithms.
2. Analyze fuzzy logic principles and creation of fuzzy rules, and also evaluates membership function to solve problems.
3. Understand and evaluate various operations on fuzzy sets such as compliment, intersections, unions, and aggregation.
4. Apply and analyze evolutionary computing algorithms.
5. Analyze the architecture and evaluate the functioning of neuro-fuzzy systems.

Course Title: Artificial Intelligence

Course Outcomes (CO)

1. Understand the foundation and scope of Artificial Intelligence (AI).
2. Apply problem-solving methods, heuristic search techniques, and evolutionary algorithms to address AI-related challenges.
3. Explore and implement game playing algorithms, predicate logic and its applications to understand knowledge representation.
4. Implement reasoning techniques and neural network based systems.
5. Analyze AI applications such as expert systems, natural language processing, robotics, and computer vision using appropriate AI techniques.

Course Title: Theory of Computation

Course Outcomes (CO)

1. Understand basic concepts of formal languages, automata, and different types of finite automata.
2. Classify programming languages using Chomsky's hierarchy.
3. Demonstrate the concepts, representations, and limitations of regular languages.
4. Construct context free grammars and evaluate their characteristics.
5. Demonstrate deep understanding of pushdown automata and Turing machines to solve computational problems.

Course Title: Web Technology

Course Outcomes (CO)

1. Understand the concept of internet, history of internet and the terminology of internet, and also describes how the internet works
2. Understand and evaluate the use of various internet applications.
3. Describe the evolution, applications, and technologies of web 1.0, web 2.0, and web 3.0.
4. Understand client side and server-side technologies and create dynamic and interactive web applications.
5. Apply and evaluate web search and mining techniques, search optimization techniques, web mining, and text mining.

Course Title : Methods for Data Analysis

Course Outcomes (CO)

1. Understand the principles and importance of data analysis, including effective data collection strategies and mining software repositories.
2. Identify different types of variables, and classify data using appropriate measurement scales.
3. Apply descriptive statistics techniques to summarize data and inferential statistics methods to draw meaningful conclusions.
4. Implement data preparation techniques such as feature selection, and feature extraction in order to have quality data for model development.
5. Apply various data analysis techniques, including statistical and machine learning methods, to analyze data effectively and solve real-world problems.

Course Title: Predictive Analytics
Course Outcomes (CO)

1. Understand the concepts of classification, prediction, and regression models.
2. Analyzing the data and apply attribute reduction, attribute extraction, and statistical tests.
3. Create the predictive model and evaluate using hypothesis testing and performance evaluation measures.
4. Understand and apply linear regression and logistic regression technique.
5. Analyze and methods to resolve the problem of overfitting, class imbalance problems, and model hyperparameter tuning.

Course Title: Artificial Intelligence for Sports

Course Outcomes (CO)

1. Understand the basic applications of AI in sports industry.
2. Apply AI-driven techniques to track and enhance athlete rehabilitation and performance management.
3. Analyze different game strategies for demonstrating AI's role in optimizing performance.
4. Design and develop innovative solutions for fan engagement.
5. Evaluate the latest trends of AI for sports analytics.

Course Title: Empirical Software Engineering

Course Outcomes (CO)

1. Demonstrate deep understanding of fundamentals of empirical study.
2. Apply software metrics and experimental design principles to measure software quality and conduct empirical studies.
3. Extract and analyze data collected from software repositories to derive insights using historical analysis techniques.
4. Develop predictive models, evaluate their performance and validate models using statistical testing.
5. Identify and mitigate threats to validity, report findings ethically, and utilize empirical tools.

Course Title: Compiler Design

Course Outcomes (CO)

1. Demonstrate basic concepts of compiler and compilation of different phases.
2. Represent language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language
3. Design syntax directed translation schemes for a given context free grammar.
4. Evaluate symbol table structures, runtime memory management strategies, and error detection & recovery methods to enhance compiler efficiency.
5. Apply optimization techniques to intermediate code and generate machine code for high level language program.

Course Title: Software Reliability

Course Outcomes (CO)

1. Remember and understand the reliability mathematics.
2. Understand software and hardware reliability concepts and terminologies.
3. Apply non homogeneous poisson process models to access software reliability
4. Analyze, compare, and evaluate software reliability growth models.
5. Analyze and apply methods to prepare test case and executing those test cases.

Course Title: Multimedia Systems

Course Outcomes (CO)

1. Understand the basic concepts of multimedia, stages of multimedia projects, tools, and techniques.
2. Apply multimedia building blocks in order to create multimedia digital content.
3. Understand and apply data compression algorithms and evaluate compression ratio
4. Analyze, understand, and evaluate speech compression techniques, synthesis techniques, and image processing methods.
5. Apply multimedia database techniques, video compression standards, and streaming technologies

Course Title: Parallel Computer Architecture

Course Outcomes (CO)

1. Understand the fundamentals of parallel computing, architectural classifications, and performance evaluation techniques.
2. Apply multi-core programming techniques, optimization strategies, and parallel processing libraries.
3. Analyze and understand multi-threaded architectures, cache coherence mechanisms, and memory consistency models.
4. Understand and analyze compiler optimization and operating system issues for multiprocessing and approaches to resolve these issues.
5. Analyze and implement parallel computing techniques in real-world applications

Course Title: Introduction to Health Care Analytics

Course Outcomes (CO)

1. Understand the fundamentals of healthcare data analytics, healthcare policies, and standardized clinical data handling.
2. Apply machine learning techniques to preprocess, analyze, and model healthcare data for predictive analytics and evaluate the model performance.
3. Analyze and apply IoT, encryption techniques, and visual analytics to enhance healthcare management and decision support systems
4. Apply and evaluate deep learning techniques for healthcare analytics to analyze clinical data, biomedical images.
5. Apply descriptive, predictive, and prescriptive analytics techniques to analyze and improve healthcare decision-making.

Course Title: Natural Language Processing

Course Outcomes (CO)

1. Demonstrate understanding of fundamental concepts of natural language processing, including language structures, and finite-state automata.
2. Utilize various parsing techniques such as top-down, bottom-up, and feature-based parsing to analyse natural language structures.
3. Demonstrate grammars for natural language processing.
4. Implement probabilistic and statistical models, dependency parsing, and ambiguity resolution techniques in NLP applications.
5. Develop and demonstrate real-world NLP applications such as machine translation, speech recognition, and intelligent interfaces using advanced NLP techniques.

Course Title: Advanced Database Management Systems

Course Outcomes (CO)

1. Demonstrate deep understanding of advanced SQL features, object-based databases, and XML
2. Apply query processing and optimization techniques to improve database performance.
3. Analyze various recovery mechanisms to ensure data integrity and consistency in database systems.
4. Evaluate various database system architecture with parallel and distributed database.
5. Design and implement advanced database applications using real-time transaction systems, and distributed transaction processing techniques.

Course Title: Data Compression

Course Outcomes (CO)

1. Understand compression techniques, modelling approaches, and coding methods
2. Apply Huffman coding and its variants for efficient lossless compression in image, text, and audio processing
3. Apply arithmetic coding and dictionary-based compression techniques to optimize image and file compression.
4. Analyze image compression techniques, including GIF, predictive coding, and JPEG-LS.
5. Analyze lossy coding techniques, including scalar and vector quantization, to optimize data compression and signal representation.

Course Title: Real Time Systems

Course Outcomes (CO)

1. Understand real-time system fundamentals, including timing constraints, task models, and application domains.
2. Analyze real-time scheduling approaches and algorithms to optimize task execution in dynamic and time-constrained systems.
3. Analyze resource access control mechanisms, including priority-based protocols.
4. Analyze multiprocessor system environments, scheduling algorithms, and task schedulability to optimize performance.
5. Analyze real-time communication models, protocols, and scheduling techniques.

Course Title: Parallel Algorithms

Course Outcomes (CO)

1. Analyze and implement parallel algorithms for dense matrix computations to enhance computational efficiency.
2. Analyze decomposition and mapping techniques
3. Understand and apply parallel sorting algorithms for efficient data processing.
4. Understand and apply parallel searching and selection algorithms to optimize data retrieval and processing.
5. Apply graph algorithms such as graph coloring, minimum spanning tree, and shortest path algorithms.

Course Title: Probability and Statistics

Course Outcomes (CO)

1. Elucidate the basic principles of probability and statistics.
2. Compute marginal and conditional distributions from joint distributions.
3. Perform operations on random variables.
4. Explain probability distribution function, probability density function and solve problems.
5. Understand sampling, error and perform hypothesis testing.

Course Title: Artificial Intelligence for Sports Surfaces and Equipment

Course Outcomes (CO)

1. Understand the role of artificial intelligence in sports surfaces, wearable technologies, and preventive equipment.
2. Illustrate sports surfaces with an emphasis on future innovations and maintenance solutions.
3. Analyze use of internal sensors to assess an athlete's physiological and psychological response.
4. Demonstrate usage of wearable technology such as GPS tracking, video processing, and sensors to improve the design, analysis, and performance in various sports.
5. Develop data-driven applications to track player movement, and analyze the impact of surfaces.

Course Title: Sports Business Analytics

Course Outcomes (CO)

1. Understand the infrastructure and technologies required for processing large scale, real-time sports data.
2. Develop advanced skills for data engineering and creating insightful, dynamic visualizations.
3. Build advanced models to predict outcomes and recommend optimal decisions in sports scenarios.
4. Apply advanced analytics techniques to understand and influence fan behaviour effectively.
5. Use advanced financial models and analytics to optimize sports business revenue streams.
6. Leverage AI techniques to provide actionable insights and innovations in sports.

DELHI TECHNOLOGICAL UNIVERSITY

DEPARTMENT OF SOFTWARE ENGINEERING

B.Tech. 4th YEAR

Course Title : Software Maintenance

Course Outcomes (CO)

1. Understand software maintenance fundamentals, process models, and program comprehension strategies.
2. Analyze and understand reverse engineering techniques and software reuse strategies.
3. Understand configuration management principles, change control processes, and organizational strategies.
4. Analyze software maintenance strategies, tools, and quality assurance techniques.
5. Apply software administration techniques, including system monitoring, backups, updates, and performance tuning.

Course Title : Deep Learning

Course Outcomes (CO)

1. Demonstrate deep understanding of reinforcement learning fundamentals and apply action-value methods to optimize k-armed bandit problems.
2. Analyze Markov Decision Processes and evaluate policies, value functions, and optimality in sequential decision-making.
3. Implement dynamic programming techniques for policy evaluation, policy iteration, and value iteration.
4. Apply and analyze temporal-difference in reinforcement learning.
5. Evaluate N-step bootstrapping techniques for improving reinforcement learning algorithms.

Course Title: Grid and Cluster Computing

Course Outcomes (CO)

1. Understand the fundamental concepts of hardware, and software architectures used in cluster computing.
2. Apply different programming models and paradigms for efficient parallel computing.
3. Illustrate resource management and scheduling techniques, and parallel file systems to optimize computing performance in distributed environments.
4. Demonstrate grid computing models, security infrastructure, and deployment techniques for set up and execution of grid-based applications.
5. Examine standard tools and paradigms for performance measurement.

Course Title: Pattern Recognition

Course Outcomes (CO)

1. Understand fundamental principles, and methodologies of pattern recognition, including real-world applications and models.
2. Implement bayesian classifier, discriminant functions, to address issues like missing and noisy features using Bayesian networks.
3. Utilize Maximum Likelihood and Bayesian parameter estimation methods, including PCA, Fisher Discriminant Analysis, and Expectation-Maximization for dimensionality reduction.
4. Develop models using hidden markov models, dynamic bayesian networks, perceptron, and other non-parametric density estimation techniques.
5. Apply clustering techniques like K-means, Mixture Modeling, Hidden Markov Models, and Kalman Filtering for pattern recognition tasks.

Course Title: Agile Software Process

Course Outcomes (CO)

1. Understand iterative and evolutionary software development approaches to manage risks and ensure efficient incremental delivery.
2. Analyze and understand agile methodologies, iterative development principles, and software quality models.
3. Understand agile methodology, its lifecycle, roles, practices, and adoption strategies.
4. Analyze and apply agile methodologies, including Scrum, Extreme Programming, and Unified Process.
5. Apply and evaluate agile project management and testing principles.

Course Title: Cyber Forensics

Course Outcomes (CO)

1. Understand the fundamentals of cyber security, cyber-attacks, and digital forensics techniques.
2. Apply forensic techniques and data collection methods using built-in and freeware tools
3. Analyze live data collection and forensic investigation techniques in Unix/Linux environments.
4. Utilize forensic tools and techniques to recover deleted files, analyze network traffic, and assess vulnerabilities

Course Title: Robotics

Course Outcomes (CO)

1. Analyze and understand robot arm kinematics, dynamics, and trajectory planning
2. Apply control techniques such as computed torque, sequencing, and adaptive control.
3. Analyze robot sensing techniques, imaging geometry, and vision-based segmentation.
4. Analyze and apply robot programming languages, task planning, and intelligence techniques.

Course Title: Wireless and Mobile Computing

Course Outcomes (CO)

1. Describe fundamental concepts of mobile computing, and wireless telephony technologies.
2. Apply wireless networking protocols, and WAP technologies to develop efficient mobile communication applications.
3. Illustrate data management techniques, replication strategies, and mobile agent security mechanisms in wireless environments.
4. Analyze and implement different adhoc routing protocols, QoS considerations, and security algorithms for enhancing wireless network performance.
5. Design optimized mobile computing solutions for real-world applications.

Course Title: Intellectual Property Rights and Cyber Laws

Course Outcomes (CO)

1. Understand and remember the fundamental concepts, types, and significance and role of Intellectual Property Rights.
2. Understand the fundamentals of patent laws, procedures, and rights related to inventions.
3. Understand and remember the principles, registration process, and legal aspects of trademarks, including rights, infringement, and licensing.
4. Understand and remember copyright laws, ownership rights, infringement issues, and legal remedies.
5. Understand industrial design laws, international IPR frameworks, and dispute resolution mechanisms.

Course Title: Software Project Management

Course Outcomes (CO)

1. Understand project management concepts, process frameworks, and software life cycle models.
2. Apply cost and scheduling estimation models, including COCOMO II and Putnam.
3. Apply and analyze project management techniques, including risk management, tracking, and quality control.
4. Evaluate project closure processes and software management methodologies.
5. Evaluate advanced software project management practices and emerging trends.

Course Title: Data Warehouse and Data Mining

Course Outcomes (CO)

1. Describe fundamental concepts, architecture, and OLAP techniques.
2. Apply data mining concepts, and association rule mining techniques to extract useful patterns from large datasets.
3. Compare and contrast various classification, prediction, and clustering techniques to categorize and predict data patterns.
4. Implement advanced data mining techniques for mining complex data types, including spatial, multimedia, and time-series data.
5. Design solutions to solve real-world problems.

Course Title: Data Management and Ethics

Course Outcomes (CO)

1. Understand database system concepts, architectures, and data modelling techniques.
2. Apply relational data modelling concepts and normalization techniques.
3. Analyze transaction processing concepts and concurrency control techniques to ensure database consistency, recoverability, and security.
4. Evaluate ethical principles and responsibilities in data management.
5. Analyze and remember ethical challenges in data usage, privacy, and algorithmic decision-making through real-world case studies.

Course Title: GPU Computing

Course Outcomes (CO)

1. Demonstrate deep understanding of basic concepts of Graphics Processing Units (GPUs), parallel programming models like CUDA and OpenCL
2. Utilize various memory types (global, shared, constant) and synchronization mechanisms to optimize memory allocation.
3. Demonstrate the use of device and host functions for efficient GPU programming.
4. Identify and resolve parallel programming challenges such as error handling, synchronization issues, and algorithmic efficiency in GPU computing.
5. Develop optimized GPU-based solutions for real-world applications.

Course Title: Data Security and Privacy

Course Outcomes (CO)

1. Understand and remember the basic concepts related to data security and different types of symmetric key ciphers.
2. Understand and apply the concepts of encryption standards.
3. Understand hash functions and to learn the basic concepts of hiding data in text and images.
4. Understand the concepts of privacy, authentication, web and email security.

Course Title: Quantum Computing

Course Outcomes (CO)

1. Understand the fundamental concepts of qubits, quantum gates, entanglement, and quantum circuit design
2. Analyze and evaluate quantum algorithms, including Shor's Algorithm and Quantum Fourier Transform.
3. Analyze quantum simulation techniques and the impact of hardware noise on simulation results.
4. Understand the fundamentals of quantum computing, quantum circuits, and probabilistic differences from classical computing
5. Analyze quantum error correction techniques and their applications in cryptography, optimization, and machine learning.

Course Title: Advances in Software Engineering

Course Outcomes (CO)

1. Understand, remember, and apply formal methods and mathematical notation.
2. Apply Cleanroom software engineering principles to develop high-reliability software systems.
3. Analyze component-based software engineering processes, including component qualification, adaptation, and reuse.
4. Design and develop client-server and web-based applications.
5. Analyze software reengineering concepts, including reverse engineering, restructuring, and forward engineering.

Course Title: Information and Network Security

Course Outcomes (CO)

1. Understand security threats, cryptographic techniques, and encryption methods.
2. Analyze and understand modern block cipher principles, encryption techniques, and cryptanalysis methods.
3. Apply number theory concepts and cryptographic algorithms, including RSA, Diffie-Hellman, and elliptic curve cryptography.
4. Analyze message authentication techniques, hash functions, and digital signature protocols.
5. Analyze authentication mechanisms, IP security protocols, and web security technologies.

Course Title: Swarm and Evolutionary Computing

Course Outcomes (CO)

1. Understand and apply evolutionary computing and swarm intelligence techniques to solve optimization problems.
2. Analyze and apply genetic algorithms to solve optimization problems by utilizing concepts of selection, crossover, mutation, and fitness evaluation.
3. Analyze and develop hybrid multi-objective optimization algorithms.
4. Apply and understand nature-inspired evolutionary algorithms such as Cuckoo Search, Artificial Bee Colony, and Ant Colony Optimization.
5. Apply optimization techniques to real-world problems in machine learning, robotics, image processing, etc.

Course Title: Semantic Web and Web Mining

Course Outcomes (CO)

1. Understand the evolution of web documents and semantic search techniques to enhance information retrieval.
2. Apply XML languages in web-based development to structure, store, and transport data efficiently.
3. Create and apply ontologies, RDF, and OWL to effectively describe and annotate web resources.
4. Analyze, apply, and evaluate advanced semantic web technologies, their applications, and future directions.

Course Title: Cloud Computing

Course Outcomes (CO)

1. Explain fundamental concepts of cloud computing, its evolution, computing paradigms, and service providers.
2. Illustrate cloud computing architectures, service models (IaaS, PaaS, SaaS), and deployment models for various applications.
3. Apply virtualization techniques, resource provisioning, and storage management to optimize cloud infrastructure.
4. Formulate cloud service management techniques, scalability, SLAs, and economic considerations for efficient cloud solutions.
5. Design secure cloud environments by implementing data security, access control, and identity management mechanisms.

Course Title: Big Data Analytics

Course Outcomes (CO)

1. Understand basic concepts of Big Data, its challenges, and modern data analytic tools to analyze large datasets.
2. Apply data stream mining techniques such as filtering, sampling, and real-time analytics for applications like sentiment analysis and stock market predictions.
3. Implement MapReduce programs using Hadoop Distributed File System (HDFS) and analyze the execution of MapReduce jobs.
4. Configure and manage a Hadoop cluster by handling security, monitoring, maintenance, and cloud integration for efficient big data processing.
5. Demonstrate big data frameworks like Pig, Hive, HBase, and ZooKeeper to process, query, and visualize large-scale datasets effectively.