DELHI TECHNOLOGICAL UNIVERSITY

Department of Software Engineering
M.TECH SOFTWARE ENGINEERING

Course Outcomes (COs)

SEMESTER I

SWE501 Software Requirement Engineering

S. No.	Course Outcomes (CO)
CO1	Understand essential software requirements components and dimensions. Apply good practices in requirements engineering, emphasizing processes and risk management.
CO2	Understand current trends in requirements elicitation, analysis models, and methods for verifying requirements.
CO3	Apply principles and practices of Software Requirements Management (RM). Utilize requirements attributes and the Change Management Process.
CO4	Analyse the importance of Requirements Traceability Matrix and links in the requirements chain. Evaluate the benefits of RM tools like Rational Requisite Pro and Caliber RM.
CO5	Evaluate commercial requirements management techniques and tools. Compare and assess the advantages and challenges of implementing requirements management automation. Understand latest trends in requirements engineering, including aspect-oriented and agent-based approaches.

SWE503 Object-Oriented Software Engineering

S. No.	Course Outcomes (CO)
CO1	Understand the basics of software engineering, object-oriented paradigms, object-oriented methodologies used, and various basic terminologies.
CO2	Develop real-world software using conventional software development life cycle models, and object-oriented software development life cycle models.
CO3	Apply various techniques to gather requirements from the customers such as interviews, brainstorming session, FAST, and prototyping.
CO4	Design software requirement specification document, software design document, and test case matrix.
CO5	Design UML diagrams such as use case diagrams, class diagrams, sequence diagrams, state chart diagrams, and activity diagrams.
CO6	Analyze existing software by considering the issues of software risk management, and approaches to estimate the risk.

SWE505 Advanced Data Structures and Algorithms

S. No.	Course Outcomes (CO)
CO1	Possess an understanding of different tree, heap and graph-based advanced data structures covered in the course.
CO2	Formulate, design and analyze algorithms and complexity analysis of the main operations of advanced data structures covered in the course
CO3	Develop and analyze the efficiency and proof of correctness of the algorithms covered in the course.
CO4	Choose appropriate data structures and algorithms, understand the abstract data types/libraries, and use them to design algorithms for a specific problem
CO5	Comprehend and gain the ability to apply and implement learned algorithm design techniques and data structures to solve problems.

SWE507 Machine Learning

S. No.	Course Outcomes (CO)
CO1	Understand the basic concepts of machine learning, supervised, unsupervised, regression analysis, and machine learning algorithms.
CO2	Apply the learned concepts of machine learning to interpret various problems.
CO3	Analyze different mathematical machine learning models for various systems.
CO4	Evaluate the performance of the machine learning model using various performance measures.
CO5	Develop an efficient machine learning system to solve various real-time problems.

SWE5401 Advanced Database Management

S. No.	Course Outcomes (CO)
CO1	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.
CO2	Apply and demonstrate with understanding of relational query languages such as SQL, Relational Algebra and Relational Calculus.
CO3	Relate the concepts of inference rules, data constraints and normalization. Students would also have acquired skills to identify application of the same.
CO4	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.
CO5	Classify various concurrency control techniques and recovery procedures
C06	Familiar with case studies regarding commercial database, Oracle platforms, Postgres and MYSQL

SWE5403 Data Warehousing and Data Mining

S. No.	Course Outcomes (CO)
CO1	Understand Data Warehouse, Need of Data Warehouse, Architecture of Data Warehouse.
CO2	Understand KDD process, applications of Data Mining.
CO3	Understand Classification and various models of Classification like KNN, Rule Based Mining
CO4	Apply Association Rule Mining.
CO5	Analyse and Evaluate various Classification Models on different problems.
CO6	Understand clustering and various types of clustering.
CO7	Apply clustering algorithms like k-means, DBSCAN etc.

SWE5405 Probability and Statistics

S. No.	Course Outcomes (CO)
CO1	Understand and apply fundamental concepts of probability, Bayes' theorem, and various probability distributions.
CO2	Compute marginal and conditional distributions from joint distributions.
CO3	Compute measures of central tendency, dispersion, and apply regression and curve-fitting techniques for data analysis.
CO4	Apply methods for parameter estimation like maximum likelihood estimation.
CO5	Perform hypothesis testing using Chi-square and Neyman-Pearson tests to validate statistical data.

SWE5407 Advanced Operating System

S. No.	Course Outcomes (CO)
CO1	Understanding and implementing complex process scheduling algorithms, synchronization mechanisms, and inter-process communication techniques.
CO2	Exploring the principles and challenges of distributed operating systems, including resource sharing, fault tolerance, and distributed file systems.
CO3	Examining advanced security models, access control mechanisms, and strategies for protecting system resources against various threats.
CO4	Analyzing the role of operating systems in virtualization technologies and cloud environments, focusing on resource allocation, scalability, and isolation.
CO5	Developing skills to measure, analyze, and optimize the performance of operating systems using various tools and methodologies.

SWE5409 Software Design Patterns

S. No.	Course Outcomes (CO)
CO1	Explain fundamental concepts of software architecture, including definition, documentation, and reconstruction.
CO2	Apply quality attributes, architectural styles, and design patterns to create effective software architectures.
CO3	Analyze and evaluate software architectures using methods like SAAM, ATAM, and CBAM.
CO4	Develop systems using reusable architectural assets and off-the-shelf components.
CO5	Classify and implement design patterns to solve software design challenges efficiently.

SWE5411 Agile Methods

S. No.	Course Outcomes (CO)
CO1	Understand the principles of Agile methodology, including iterative and adaptive development, incremental delivery, and evolutionary requirement analysis.
CO2	Analyze the significance of Agile through its classification of methods, the Agile manifesto, and Agile project management practices, supported by research evidence.
CO3	Explore the Agile lifecycle, work products, roles, practices, values, and strategies for successful adoption in various organizational contexts.
CO4	Evaluate real-world Agile case studies to identify challenges, lessons learned, and effective solutions in Agile implementation.
CO5	Apply Agile testing techniques, including test-driven development (TDD), behavior-driven development (BDD), exploratory testing, and automation, to enhance software quality and delivery.

SWE5413 Fuzzy Logic and Neural Networks

S. No.	Course Outcomes (CO)
CO1	Understand fuzzy logic and neural network applications.
CO2	Apply fuzzy logic components in decision-making.
CO3	Describe neuron models and their operations.
CO4	Analyze activation functions and ANN architectures.
CO5	Apply single-layer and feed-forward neural networks.
CO6	Apply associative memories and Hopfield networks.

SWE511 Research Paper Writing

S. No.	Course Outcomes (CO)
CO1	Understand the basic concepts of research, its importance, and its process.
CO2	Understand and apply basic concepts of how to write systematic literature review (planning, conducting and review).
CO3	Understand the various sections which should be included in a research paper.
CO4	Understand the concepts of research ethics, plagiarism, and misconduct.
CO5	Apply concepts to write research paper in the respective majoring (specialized subject) areas.

SEMESTER II

SWE502 Software Testing

S. No.	Course Outcomes (CO)
CO1	Explain basics of software testing process, limitations, and the V-shaped life cycle model.
CO2	Apply various types of testing to ensure software functionality and reliability.
CO3	Demonstrate various functional testing techniques.
CO4	Implement structural and object-oriented testing methods.
CO5	Investigate automated testing tools and various testing activities.
CO6	Perform testing of web applications and generate automated test cases.

SWE504 Empirical Software Engineering

S. No.	Course Outcomes (CO)
CO1	Explain empirical study types and process for research in software engineering.
CO2	Apply software metrics and experimental design principles to measure software quality and conduct empirical studies.
CO3	Extract and analyze data from software repositories to derive insights using historical analysis techniques.
CO4	Develop predictive models, evaluate their performance and validate models using statistical testing.
CO5	Identify and mitigate validity threats, report findings ethically, and utilize empirical tools and text mining techniques to analyze and interpret software engineering data.

SWE5402 Software Project Management

S. No.	Course Outcomes (CO)
CO1	Understand basic project management concepts and software life cycle models.
CO2	Understand and apply various estimation models for cost, effort, schedule and productivity.
CO3	Analyse various project organizations & responsibilities and Project Tracking and Control Defect Tracking Concepts
CO4	Understand the importance of project closure analysis and apply it.
CO5	Analyse the evolution of software economics from conventional to modern practices.
CO6	Understand the upcoming trends in software project management and explore modern practices.

SWE5404 Distributed Systems

S. No.	Course Outcomes (CO)
CO1	Explain fundamental models of distributed systems, including transparency, scalability, and inter-process communication.
CO2	Evaluate middleware solutions and key design challenges in distributed systems, both current and emerging.
CO3	Apply synchronization techniques, serializability principles, and process coordination strategies in distributed environments.
CO4	Demonstrate efficient resource allocation, distributed shared memory management, process scheduling, and load balancing techniques.
CO5	Utilize security mechanisms such as cryptographic algorithms, digital signatures, and cryptography pragmatics to enhance system security.

SWE5406 Fundamentals of Information Retrieval

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of Boolean retrieval, term vocabularies, postings lists, and techniques for dictionary-based and tolerant retrieval, as well as index construction and compression.
CO2	Apply scoring methods, term weighting, vector space models, probabilistic models, and language models to compute and rank search results effectively in an information retrieval system.
CO3	Evaluate information retrieval systems using classical metrics like Mean Average Precision and modern techniques such as interleaving, along with relevance feedback and query expansion.
CO4	Develop skills in text classification using Naive Bayes, vector space methods, support vector machines, clustering methods, and matrix decompositions for advanced document analysis.
CO5	Explore web search fundamentals, including web crawling, link analysis, XML retrieval, recommendation systems, personalization techniques, and strategies for online advertising.

SWE5408 Artificial Intelligence

S. No.	Course Outcomes (CO)
CO1	Understand AI problems, task domains, and problem-solving methods.
CO2	Apply predicate logic for knowledge representation.
CO3	Demonstrate symbolic reasoning and structured knowledge in languages like Prolog.
CO4	Explain statistical reasoning, learning, and genetic algorithms.
CO5	Analyze neural networks and expert system research.

SWE5412 Multimedia Applications

S. No.	Course Outcomes (CO)
CO1	Explain fundamental concepts of multimedia systems, including architecture, components, and distributed processing models.
CO2	Demonstrate knowledge of multimedia elements such as text, sound, digital audio, video capture, and their integration in multimedia applications.
CO3	Implement various data compression algorithms to optimize multimedia storage and transmission.
CO4	Compare different speech, image, and video compression techniques, including JPEG, MPEG, and speech synthesis, for efficient multimedia representation and transmission.
CO5	Demonstrate various tools and technologies for solving real-world problems.

SWE5414 Deep Learning

S. No.	Course Outcomes (CO)
CO1	Understand Deep Learning and various applications of Deep Learning
CO2	Understand, apply and evaluate performance of CNN for image classification.
CO3	Understand and apply various Object Detection algorithms like Sliding Window Protocol, RCNN, Faster RCNN, YOLO etc.
CO4	Understand and Apply BERT algorithm
CO5	Understand and apply Text processing deep learning models like RNN, LSTM, GRU

SWE5416 Soft Computing

S. No.	Course Outcomes (CO)
CO1	Understand soft computing concepts and AI evolution towards computational intelligence.
CO2	Apply soft computing techniques and AI models in problem-solving.
CO3	Analyze ANN architecture, backpropagation, and their applications.
CO4	Explain fuzzy logic, fuzzy arithmetic, and neuro-fuzzy modeling techniques.
CO5	Apply genetic algorithms and swarm optimization in problem-solving.

SWE5418 Software Reliability

S. No.	Course Outcomes (CO)
CO1	To learn reliability mathematics to examine software reliability of a system
CO2	To understand system reliability concepts and terminologies.
CO3	To analyze and compare and evaluate Software Reliability Growth Models.
CO4	To design, select and apply appropriate ML algorithm to solve computer engineering problems.
CO5	To implement procedures for testcase generation, preparing test, executing test and developing operational profile for a system.

SWE5420 Natural Language Processing

S. No.	Course Outcomes (CO)
CO1	Extract information from text automatically using concepts and methods from natural language processing (NLP) including stemming, n-grams, POS tagging, and parsing.
CO2	Develop speech-based applications that use speech analysis (phonetics, speech recognition, and synthesis)
CO3	Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.
CO4	Apply machine learning algorithms to natural language processing. CO5: Evaluate the performance of NLP tools and systems.
CO5	Evaluate WSD techniques and NLP applications in web environments like blogs and social media.

SWE5422 Computer Vision

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of visual perception, image formation, and image representation, including the roles of pixels and color in digital and biological systems.
CO2	Apply image processing techniques such as filtering, edge detection, frequency domain analysis, and feature/keypoint extraction to analyze and process visual data.
CO3	Explore classical computer vision concepts, including camera calibration, depth estimation, motion analysis, stereopsis, structure from motion (SfM), and SLAM.
CO4	Develop proficiency in deep learning techniques for vision tasks such as image classification, object detection, segmentation, and transfer learning while addressing model training challenges.
CO5	Investigate advanced topics like generative models, augmented reality, computational photography, and ethical considerations, with an emphasis on emerging trends in computer vision.

SWE5424 Optimization Techniques

S. No.	Course Outcomes (CO)
CO1	Apply linear programming concepts and solve LPP using graphical methods and the Simplex algorithm.
CO2	Analyze post-optimality, duality theory, and sensitivity analysis in linear programming problems.
CO3	Apply dynamic programming principles and solve integer programming problems using branch and bound methods.
CO4	Explain nonlinear programming methods and apply queuing models in resource management and service systems.
CO5	Apply genetic algorithms for unconstrained and constrained optimization problems.

SWE5426 Information Theory and Coding

S. No.	Course Outcomes (CO)
CO1	Introduce the principles and applications of information theory.
CO2	Comprehend various communication channel and error control code properties.
CO3	Apply linear block codes for error detection and correction.
CO4	Apply cyclic codes and parity generator for performance analysis & cyclic codes for error detection and correction.
CO5	Apply information theory and coding concepts to solved real-world problems.

SWE5428 Big Data Analytics

S. No.	Course Outcomes (CO)
CO1	Understand the definition, characteristics, and challenges of Big Data, and explore Big Data technologies and applications.
CO2	Apply clustering techniques like K-means and evaluate methods for determining the number of clusters.
CO3	Analyze decision tree algorithms and Naïve Bayes classifiers for data classification.
CO4	Explain NoSQL databases and their role in Big Data management, including key-value, document, and graph stores.
CO5	Apply data analysis techniques to Big Data using R, with focus on platforms like Twitter and e-commerce.

SEMESTER III

SWE601 Software Quality & Metrics

S. No.	Course Outcomes (CO)
CO1	Understand basic concepts of software quality, the components of SQA, and SQA plan.
CO2	Analyze various software quality models and assess their impact on software quality.
CO3	Demonstrate internal and external product attributes using software metrics, including size, complexity, and modularity.
CO4	Assess software quality at different levels (product, process, and maintenance) using appropriate quality metrics and methodologies, including object-oriented metrics.
CO5	Demonstrate quality estimation tools and evaluate computer aided quality engineering technique for quality assurance.

SWE6401 Pattern Recognition

S. No.	Course Outcomes (CO)
CO1	Understand fundamental principles, and methodologies of pattern recognition, including real-world applications and models.
CO2	Implement bayesian classifier, discriminant functions, to address issues like missing and noisy features using Bayesian networks.
CO3	Utilize Maximum Likelihood and Bayesian parameter estimation methods, including PCA, Fisher Discriminant Analysis, and Expectation-Maximization for dimensionality reduction.
CO4	Develop models using hidden markov models, dynamic bayesian networks, perceptron, and other non-parametric density estimation techniques.
CO5	Apply clustering techniques like K-means, Mixture Modeling, Hidden Markov Models, and Kalman Filtering for pattern recognition tasks.

SWE6403 Mobile Computing

S. No.	Course Outcomes (CO)
CO1	Describe basics of mobile computing architecture, application development, and security considerations.
CO2	Analyze Cellular Technologies & Wireless Communication.
CO3	Implement wireless application protocols (WAP, MMS), WLAN, and intelligent networking concepts.
CO4	Design and develop mobile applications using platforms such as Palm OS, Symbian OS, Windows CE, and J2ME.
CO5	Assess security risks, encryption techniques, and security frameworks for mobile computing.

SWE6407 Cluster and Grid Computing

S. No.	Course Outcomes (CO)
CO1	Understand basics concepts of cluster and grid computing, web services, and web oriented architecture.
CO2	Explain OGSA, WSRF, and Globus Toolkit, and analyze their role in Grid computing, security, and database integration.
CO3	Compare parallel computing approaches and evaluate cluster architecture, middleware, and resource management.
CO4	Demonstrate cluster setup and administration, and apply fault tolerance for high availability.
CO5	Design job scheduling and load balancing strategies.

SWE6409 Swarm and Evolutionary Computing

S. No.	Course Outcomes (CO)
CO1	Understand the components and techniques of evolutionary computing, including global optimization and fitness functions.
CO2	Apply swarm intelligence methods like particle swarm optimization and genetic algorithms to optimization problems.
CO3	Analyze hybridization techniques and multi-objective optimization algorithms using evolutionary computing methods.
CO4	Evaluate algorithms like cuckoo search, artificial bee colony, and ant colony optimization for optimization tasks.

SWE6411 Internet of Things

S. No.	Course Outcomes (CO)
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models
CO2	Illustrate the smart objects and the technologies to connect them to network
CO3	Compare different Application protocols for IoT.
CO4	Infer the role of Data Analytics and Security in IoT.
CO5	Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

SWE6413 Software Maintainability

S. No.	Course Outcomes (CO)
CO1	Develop a comprehensive understanding of software maintenance concepts, including maintenance frameworks, economic implications, and challenges like nomenclature and image problems.
CO2	Analyze and evaluate traditional and modern maintenance models, decision-making processes, and program comprehension strategies to support maintainers effectively.
CO3	Gain proficiency in reverse engineering, reengineering, and reuse approaches, emphasizing domain analysis, component engineering, and their applications in software maintenance.
CO4	Apply software measurement techniques and configuration management practices to ensure maintainability, quality, and effective change control in software systems.
CO5	Explore, select, and utilize advanced maintenance tools and modern trends, including object-oriented paradigms and future research directions, to enhance software maintainability and address real-world problems.