DELHI TECHNOLOGICAL UNIVERSITY

Department of Software Engineering
M.TECH DATA SCIENCE

Course Outcomes (COs)

SEMESTER I

DSC501 Mathematical Foundations of Computer Science

S. No.	Course Outcomes (CO)
CO1	Understand fundamental probability theory concepts, including sample spaces, probability axioms, and joint and conditional probabilities, for computational applications.
CO2	Apply statistical inference techniques such as random sampling, distribution functions, and parameter estimation using methods of moments and maximum likelihood.
CO3	Analyze multivariate statistical models, including classification, regression, and principal component analysis, while addressing overfitting challenges.
CO4	Utilize graph theory concepts such as isomorphism, planar graphs, permutations, and combinations for solving computational problems.
CO5	Implement mathematical principles in computer science applications, including software engineering, data mining, and machine learning, while exploring recent trends.

DSC503 Data Management and Ethics

S. No.	Course Outcomes (CO)
CO1	Explain database system architecture, data models, schema, and database languages to design and interact with relational databases.
CO2	Analyze functional dependencies and apply normalization techniques (1NF to 5NF) to optimize database design and ensure data integrity.
CO3	Implement transaction management techniques, ensuring recoverability, serializability, and concurrency control to maintain database consistency.
CO4	Evaluate ethical concerns in data management, including data ownership, privacy, and corporate responsibilities, while implementing security measures.
CO5	Understand the role of a Database Administrator, existing ethical guidelines, and best practices for responsible data handling in professional environments.

DSC505 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.

DSC507 Advanced Data Structures

S. No.	Course Outcomes (CO)
CO1	Understand elementary and advanced data structures, including their applications in combinatorial problems
CO2	Apply divide and conquer techniques and operations on disjoint sets to solve computational problems efficiently.
CO3	Analyze and implement graph algorithms, greedy methods, and dynamic programming techniques.
CO4	Understand NP-complete problems and explore approximation algorithms for tackling intractable problems.
CO5	Implement algorithms for matching, flow networks, and circular problems in various applications.

DSC5401 Advanced Database Management System

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 Advanced Operating System

S. No.	Course Outcomes (CO)
CO1	Learn about Operating system concepts: history, evolution and philosophy of operating systems.
CO2	Learn about Concurrent processes, process coordination and CPU scheduling.
CO3	Learning about process synchronization and deadlocks
CO4	Understand memory management, virtual memory
CO5	Learn about secondary storage and file management, device management,
CO6	Understand the security and protection, networking, and distributed and real-time systems.

DSC5405 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.
C06	Understand clustering and various types of clustering.
CO7	Apply clustering algorithms like k-means, DBSCAN etc.

DSC5407 Data Visualization and Predictive Analytics

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of information and scientific visualization, including visual perception, data distortion techniques, visual reference models, and methods for handling information overload.
CO2	Explore techniques for creating visual representations of various data structures such as groups, trees, graphs, clusters, networks, volumetric data, and geographic information using advanced visualization systems and GIS tools.
CO3	Analyze recent trends and perception techniques in data visualization, as well as the data structures and frameworks supporting effective visual representation.
CO4	Gain proficiency in predictive modeling, focusing on classification, regression analysis, data preparation, attribute reduction/extraction, and the analysis of metric and correlation data.
CO5	Apply statistical tests, hypothesis testing, cross-validation, and performance evaluation techniques (e.g., ROC analysis) for model validation and the assessment of categorical and continuous dependent variables.

DSC5409 Intelligent Systems and Interfaces

S. No.	Course Outcomes (CO)
CO1	Understand computational phonology, phonological rules, and probabilistic models of pronunciation and spelling.
CO2	Apply syntactic analysis techniques such as POS tagging, CFG parsing, and probabilistic parsing.
CO3	Explore discourse, dialogue agents, natural language generation, and machine translation methods.
CO4	Implement machine learning and data mining techniques, including clustering, decision trees, and text mining.
CO5	Develop intelligent interfaces for standalone systems, databases, robots, and web-based applications.

DSC5411 Introduction to Statistical Methods

S. No.	Course Outcomes (CO)
CO1	Understand fundamental probability concepts, including random variables, mathematical expectation, and probability distributions (discrete and continuous).
CO2	Apply statistical techniques such as joint probability distributions, sampling distributions, estimation, and hypothesis testing in real-world scenarios.
CO3	Analyze relationships between variables using correlation, regression analysis, and analysis of variance (ANOVA) for one-way and two-way classifications.
CO4	Utilize statistical tools such as WEKA, SPSS, R, Python, and MATLAB for data analysis and decision-making.
CO5	Implement statistical methodologies in various domains, including data science, machine learning, and engineering applications.

DSC5413 Fundamentals of Information Retrieval

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of information retrieval and search engine architecture.
CO2	Analyze different retrieval models and their applications in search engines.
CO3	Evaluate retrieval performance using classical and advanced evaluation metrics such as Mean Average Precision and interleaving.
CO4	Apply relevance feedback techniques to improve search results.
CO5	Explore link analysis methods and their role in search applications.

DSC511 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

DSC502 Data Preparation and Analysis

S. No.	Course Outcomes (CO)
CO1	Understand data collection strategies and mining techniques from software repositories.
CO2	Analyze different types of software repositories, including version control and bug tracking systems.
CO3	Differentiate between types of variables and identify independent and dependent variables in datasets.
CO4	Apply descriptive statistics techniques such as mean, mode, standard deviation, and histogram analysis.
CO5	Perform inferential statistical analyses, including regression, T-tests, ANOVA, correlation, and Chi-square tests.

DSC504 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

DSC5402 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.

DSC5404 Empirical Software Engineering

S. No.	Course Outcomes (CO)
CO1	Understand the fundamental concepts and importance of empirical software engineering.
CO2	Explore different types of empirical studies and the empirical study process, including ethical considerations.
CO3	Conduct systematic literature reviews and analyze software metrics for empirical research.
CO4	Design and execute empirical experiments, including data collection from software repositories.
CO5	Apply data analysis techniques, statistical testing, and model development for empirical studies.

DSC5406 Artificial Neural Networks

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of neural networks, their architecture, and their relation to artificial intelligence.
CO2	Analyze different learning processes, including error correction, Hebbian learning, and competitive learning.
CO3	Explore the statistical nature of learning and concepts such as memory, adaptation, and credit assignment.
CO4	Implement single-layer perceptron models, including adaptive filtering, least mean square algorithms, and perceptron convergence.
CO5	Develop multilayer perceptron networks using the backpropagation algorithm and apply heuristics for optimization.

DSC5408 Business Analytics

S. No.	Course Outcomes (CO)
CO1	Understand decision-making, business analytics, big data, and data visualization techniques.
CO2	Develop and apply spreadsheet models, linear programming, and optimization using tools like Excel Solver.
CO3	Explore advanced optimization models, including nonlinear and binary variables, for business applications.
CO4	Use Monte Carlo simulation and risk analysis for decision-making and problem-solving.
CO5	Apply resource management, prescriptive modeling, and performance metrics in business analytics.

DSC 5410 Distributed Systems

S. No.	Course Outcomes (CO)
CO1	Understand the fundamental concepts of distributed systems, including models, transparency, and scalability.
CO2	Analyze inter-process communication, middleware, and synchronization mechanisms.
CO3	Explore resource allocation, process scheduling, and load balancing techniques..
CO4	Implement mutual exclusion and election algorithms in distributed environments.
CO5	Understand distributed file systems and apply cryptographic security techniques.

DSC5412 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.

DSC5414 Semantic Web Mining

S. No.	Course Outcomes (CO)
CO1	Understand semantic web languages and techniques for information extraction from text.
CO2	Explore ontology-directed information extraction and reasoning methods in the semantic web.
CO3	Apply classification and clustering techniques for web data analysis.
CO4	Analyze community detection, recommendation systems, and personalization techniques.
CO5	Implement web ranking algorithms, pattern mining, and spam/botnet detection methods.
CO6	Utilize representation learning techniques and sentiment analysis for web mining applications.

DSC5416 Natural Language Processing

S. No.	Course Outcomes (CO)
CO1	Understand the fundamental phases of natural language processing and its applications.
CO2	Analyze word morphology, finite state machine-based approaches, and automatic morphology learning.
CO3	Apply parsing techniques and algorithms for robust language processing, including noisy text.
CO4	Explore lexical knowledge networks, WordNet theory, and multilingual dictionaries.
CO5	Implement semantic role labeling and word sense disambiguation techniques.
CO6	Examine NLP applications in Web 2.0, multilinguality, and real-world language processing tasks.

DSC5418 Optimization Techniques

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of optimization techniques and linear programming.
CO2	Apply graphical and simplex methods for solving optimization problems.
CO3	Analyze post-optimality conditions using duality theory and sensitivity analysis.
CO4	Explore dynamic programming and integer programming techniques.
CO5	Implement nonlinear programming methods and queuing theory for real-world applications.

DSC5420 Web Analytics and Development

S. No.	Course Outcomes (CO)
CO1	Understand the principles and methods of social network analysis.
CO2	Apply graph theory concepts and network metrics to analyze social and web-based data.
CO3	Utilize web analytics tools for data collection, user behavior analysis, and optimization.
CO4	Examine connection dynamics in networks, including link analysis and network robustness.
CO5	Explore applications of social network analysis in understanding diffusion, affiliation, and innovation.

DSC5422 Computer Vision

S. No.	Course Outcomes (CO)
CO1	Understand the fundamentals of image formation in digital cameras and biological systems.
CO2	Apply mathematical and practical techniques for basic image processing.
CO3	Explore space/frequency representations and classical computer vision methods.
CO4	Implement 3D measurement techniques using images.
CO5	Analyze deep learning-based approaches for image classification and recognition.

DSC5424 Intellectual Property Rights

S. No.	Course Outcomes (CO)
CO1	Gain a comprehensive understanding of intellectual property rights, including their historical development and various types
CO2	Understand the legal framework governing IPR, including the Indian Patent Act of 1970 and 2002
CO3	Acquire a deep understanding of trademarks and the Indian copyright act 1957
CO4	Acquire a deep understanding of Industrial design and the Industrial act, 2000.
CO5	Gain information about various treaties and case laws relevant to IPR.

DSC5426 GPU Computing

S. No.	Course Outcomes (CO)
CO1	Explain basic concepts of Graphics Processing Units (GPUs), parallel programming models like CUDA and OpenCL.
CO2	Utilize various memory types (global, shared, constant) and synchronization mechanisms to optimize memory allocation.
CO3	Demonstrate the use of device and host functions for efficient GPU programming.
CO4	Identify and resolve parallel programming challenges such as error handling, synchronization issues, and algorithmic efficiency in GPU computing.
CO5	Develop optimized GPU-based solutions for real-world applications.

DSC5428 Recommender Systems

S. No.	Course Outcomes (CO)
CO1	Understand the fundamental techniques and approaches for building recommender systems.
CO2	Explore various types of recommendation methods such as content-based and collaborative filtering.
CO3	Analyze the advantages, drawbacks, and applications of hybrid recommendation approaches.
CO4	Evaluate recommender systems using metrics like accuracy, diversity, and scalability.
CO5	Gain insights into real-world applications and ethical considerations of recommender systems.

DSC506 Python for Data Science

S. No.	Course Outcomes (CO)
CO1	Explain Python's history, features, syntax, keywords, identifiers, variables, data types, and basic input/output operations.
CO2	Utilize Python data structures (lists, tuples, sets, and dictionaries) and apply decision-making statements and loops to control program execution.
CO3	Design and implement functions, use function arguments, decorators, and apply modular programming using built-in and custom modules and packages.
CO4	Manipulate strings using built-in functions, string formatting, regular expressions, and utilize advanced collection modules like dequeue, named tuples, ordered dictionaries, and counters.
CO5	Implement exception handling, logging, and demonstrate object-oriented programming (OOP) concepts in Python.

SEMESTER III

DSC601 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.

DSC6401 Data Security & Privacy

S. No.	Course Outcomes (CO)
CO1	Explain the principles of data security, privacy, and cryptographic techniques in the context of modern computing systems.
CO2	Implement symmetric and asymmetric encryption algorithms, hashing functions, and digital signatures to protect data confidentiality and integrity.
CO3	Analyze security threats, vulnerabilities, and attacks on data systems and propose appropriate risk mitigation strategies.
CO4	Develop security architectures, access control mechanisms, and data protection strategies for cloud, IoT, and enterprise environments.
CO5	Evaluate data privacy laws, regulations (e.g., GDPR, HIPAA), and ethical considerations in handling sensitive data

DSC6403 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.

DSC6405 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.

DSC6407 Cloud Computing

S. No.	Course Outcomes (CO)
CO1	Demonstrate an understanding of computing paradigms, recent trends, and the evolution of cloud computing, including its properties, characteristics, and limitations.
CO2	Analyze and compare cloud computing with other paradigms like cluster and grid computing, emphasizing the role of open standards and network architecture in cloud computing.
CO3	Understand and explain the core concepts of cloud service models, including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
CO4	Evaluate different cloud deployment models such as public, private, hybrid, and community clouds, and explore resource and application management techniques in cloud environments.
CO5	Identify and address security challenges in cloud computing, focusing on data privacy, compliance, risk management, and mitigation strategies for secure cloud service operations.

DSC6409 Security Analysis

S. No.	Course Outcomes (CO)
CO1	Understand the role of data mining and machine learning in security analytics.
CO2	Apply investigative data warehousing techniques for criminal analysis.
CO3	Analyze financial and identity crimes using link analysis and anomaly detection.
CO4	Implement intrusion detection systems based on anomaly and misuse patterns.
CO5	Evaluate forensic considerations and early warning systems in cybersecurity.
CO6	Explore advanced intrusion detection techniques using data mining methods.

DSC6411 Introduction to Health Care Data Analytics

S. No.	Course Outcomes (CO)
CO1	Understand the key drivers of health care transformation and the role of quality initiatives in shaping the national health care landscape.
CO2	Apply quality improvement frameworks that utilize data analytics to enhance health care quality and performance.
CO3	Utilize health care data analytics techniques to improve decision-making and operational efficiency in health care organizations.
CO4	Manage health care data as an organizational asset by understanding the data-information-knowledge-wisdom (DIKW) hierarchy and principles of data governance.

CO5	Evaluate challenges faced by health care organizations in using data for quality and performance improvement and propose effective solutions.
CO6	Implement data analytics tools and techniques to analyze health care data and solve real-world problems in quality improvement and performance management.

DSC6413 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.
CO5	Apply evolutionary computing algorithms to real-world optimization problems like the traveling salesman problem.