

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
COURSE OUTCOMES (REGULATION 2021)

SEMESTER III

Course Code / Course Name: MA3354 / Discrete Mathematics

CO No.	Course Outcomes (COs)
C201.1	Learn the key concepts to validate program logic and ensure the correctness and efficiency of computational processes.
C201.2	Develop the ability to analyze and evaluate structures across multiple levels to enhance comprehension and application of complex systems by identifying their underlying frameworks.
C201.3	Understand and apply the concept of functions that transform a finite set into another finite set to analyze and evaluate input-output relationships in computer science.
C201.4	Relate fundamental counting principles to solve combinatorial and quantitative problems effectively.
C201.5	Comprehend with the concepts and properties of algebraic structures and their applications in mathematical and computational contexts.

Course Code / Course Name: CS3351 / Digital Principles and Computer Organization

CO No.	Course Outcomes (COs)
C202.1	Learn the principles of digital logic to create efficient and functional circuit designs, diverse combinational digital circuits using logic gates.
C202.2	Develop the skills to design sequential circuits and understand their working principles, analyze and implement design procedures for reliable circuit.
C202.3	Understand the core principles of computer systems, architecture and the processes involved in the execution of instructions.
C202.4	Study various control design approaches and evaluate their effectiveness. Identify potential hazards to ensure safe and efficient system operation
C202.5	Identify the features of different memory systems and explore I/O communication methods and their role in system performance.

Course Code / Course Name: AD3391 / Database Design and Management

CO No.	Course Outcomes (COs)
C203.1	Understand the database development life cycle and apply conceptual modeling techniques to analyze, design, and evaluate database systems
C203.2	Apply SQL and programming in SQL to create, manipulate and query the database, and to write and optimizing queries for data management.
C203.3	Learn to design normalized and efficient database schemas, ensuring data integrity and minimizing redundancy.
C203.4	Analyze transaction management concepts such as ACID properties to maintain consistency and reliability in database operations.
C203.5	Apply data models and querying techniques in Object-relational and No-SQL databases to manage data efficiently across various database types.

Course Code / Course Name: AD3351 / Design and Analysis of Algorithms

CO No.	Course Outcomes (COs)
C204.1	Evaluate the computational complexity of recursive and non-recursive algorithms, apply mathematical reasoning to solve and compare their efficiency under different scenarios.
C204.2	Examine the computational trade-offs of brute force, divide and conquer, decrease and conquer, and transform and conquer techniques.
C204.3	Illustrate dynamic programming and greedy principles and evaluate the conditions under which each technique is optimal.
C204.4	Apply iterative methods to develop solutions for optimization problems, analyze the convergence of these techniques with applicability to various scenarios.
C204.5	Analyze the theoretical limits of computational algorithms for solving constrained problems to design and implement effective solutions.

Course Code / Course Name: AD3301 / Data Exploration and Visualization

CO No.	Course Outcomes (COs)
C205.1	Understand the foundational concepts of exploratory data analysis, comprehend its purpose and role in identifying patterns and insights within datasets.
C205.2	Demonstrate data visualization techniques to create visual representations of data using Matplotlib and relate the effectiveness of various visualization styles.
C205.3	Compare statistical methods to explore univariate and evaluate patterns and anomalies within single-variable datasets.
C205.4	Use statistical and graphical methods to examine relationships between two variables, analyze correlations to assess patterns and trends in bivariate data.
C205.5	Identify advanced exploration and visualization techniques to investigate multivariate datasets and time series data for uncover complex relationships.

Course Code / Course Name: AL3391 / Artificial Intelligence

CO No.	Course Outcomes (COs)
C206.1	Understand and describe the foundational principles of intelligent agent frameworks, by exploring their components and architecture in real-world scenarios.
C206.2	Use various problem-solving methodologies to solve complex tasks with expected outcomes in diverse contexts.

C206.3	Utilize game-playing strategies and constraint satisfaction problem (CSP) techniques to develop intelligent solutions to specific scenarios.
C206.4	Apply principles of formal logic to construct arguments, evaluate logical consistency, using deductive and inductive reasoning methods.
C206.5	Develop probabilistic models to analyze uncertain scenarios, evaluate the likelihood of events, and make well-informed decisions based on the outcomes.

Course Code / Course Name: AD3381 / Database Design and Management Laboratory

CO No.	Course Outcomes (COs)
C207.1	Demonstrate the stages of the database development life cycle and assess the significance of each phase in building an effective database system.
C207.2	Illustrate the principles of conceptual-to-relational mapping and normalization to design efficient relational database schemas for data organization.
C207.3	Utilize SQL to create, manipulate, and retrieve data from databases, study query performance in meeting data requirements.
C207.4	Apply database design and programming techniques to develop real-time applications and assess their functionality in solving practical problems.
C207.5	Design object-relational databases using advanced concepts by applying appropriate queries to retrieve, manipulate and manage complex data types.

Course Code / Course Name: AD3311 / Artificial Intelligence Laboratory

CO No.	Course Outcomes (COs)
C208.1	Implement AI algorithms, such as search algorithms, machine learning models, and optimization methods, to address complex real-world problems.
C208.2	Design and develop intelligent agents using frameworks with insights into system improvements.
C208.3	Understand the principles of supervised and unsupervised learning, apply machine learning techniques to real datasets.
C208.4	Construct systems for knowledge representation using logic-based techniques, reasoning algorithms to infer new knowledge from existing data.
C208.5	Analyze the ethical considerations surrounding the use of AI with critical thinking to assess the societal impacts for mitigating potential biases and risks in AI applications.

Course Code / Course Name: GE3361 / Professional Development

CO No.	Course Outcomes (COs)
C209.1	Use MS Word to create quality documents by formatting and organizing technical content effectively to meet academic and professional requirements.
C209.2	Use MS Excel to perform data operations and analytics for effective data management and visualization competently.
C209.3	Use MS PowerPoint to create high-quality academic presentations by integrating charts, graphs, and multimedia elements with clarity and engagement.
C209.4	Use Outlook to efficiently manage emails, calendars, and cloud storage to streamline personal and professional productivity.
C209.5	Use OneDrive for effective communication and collaboration in team settings for effective communication and collaboration.

SEMESTER IV

Course Code / Course Name: MA3391 / Probability and Statistics

CO No.	Course Outcomes (COs)
C210.1	Understand the fundamental knowledge of the concepts of probability to analyze uncertainty in real-world problems.
C210.2	Relate the concepts of one and two-dimensional random variables to model relationships in datasets.
C210.3	Demonstrate testing of hypothesis for small and large samples to solve real-life challenges.
C210.4	Apply the basic concepts of classifications of design of experiments to improve processes in agriculture.
C210.5	Interpret the concept of sampling, apply appropriate sampling methods, and analyze the resulting data to draw meaningful insights from a population.

Course Code / Course Name: AL3452 / Operating Systems

CO No.	Course Outcomes (COs)
C211.1	Analyze various scheduling algorithms and process synchronization to optimize CPU utilization.
C211.2	Explain deadlock, prevention, and avoidance algorithms to understand system reliability.
C211.3	Compare and contrast various memory management schemes to evaluate their efficiency.
C211.4	Demonstrate the functionality of file systems, I/O systems, and virtualization to understand storage and processing mechanisms.
C211.5	Compare iOS and Android operating systems to identify their unique features.

Course Code / Course Name: AL3451 / Machine Learning

CO No.	Course Outcomes (COs)
C212.1	Explain the basic concepts of machine learning to understand its foundational principles.
C212.2	Construct supervised learning models to predict outcomes based on labelled data.
C212.3	Construct unsupervised learning algorithms to uncover hidden patterns in data.
C212.4	Evaluate and compare different models to determine their accuracy and efficiency.
C212.5	Apply supervised and unsupervised learning algorithms to solve classification, regression, and clustering tasks.

Course Code / Course Name: AD3491 / Fundamentals of Data Science and Analytics

CO No.	Course Outcomes (COs)
C213.1	Explain the data analytics pipeline to understand the sequential stages of data processing to optimize workflows for better insights.
C213.2	Describe and visualize data to uncover patterns and trends effectively to make complex information more comprehensible.
C213.3	Perform statistical inferences from data to draw meaningful conclusions to support decision-making under uncertainty.

C213.4	Analyze the variance in the data to identify sources of variability in the data to assess its impact on outcomes.
C213.5	Build models for predictive analytics to forecast future trends and behaviors for predictive analytics to make data-driven predictions.

Course Code / Course Name: CS3591 / Computer Networks

CO No.	Course Outcomes (COs)
C214.1	Explain the basic layers and its functions in computer networks to understand their role in data transmission.
C214.2	Understand the basics of data flows from one node to another in a network.
C214.3	Analyze routing algorithms to determine the best path for data transmission and improve network efficiency and minimize delays.
C214.4	Describe protocols for various functions in the network to ensure smooth communication and data transfer.
C214.5	Analyze the working of various application layer protocols to understand their role in enabling network services.

Course Code / Course Name: GE3451 / Environmental Sciences and Sustainability

CO No.	Course Outcomes (COs)
C215.1	Identify and understand the functions of environment, ecosystems and biodiversity and their conservation.
C215.2	Classify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
C215.3	Understand the renewable and non-renewable resources towards sustainable measures to preserve them for future generations.
C215.4	Recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development
C215.5	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization

Course Code / Course Name: AD3411 / Data Science and Analytics Laboratory

CO No.	Course Outcomes (COs)
C216.1	Develop Python programs to handle data using Numpy and Pandas for efficient data manipulation and to process and analyze large datasets.
C216.2	Perform descriptive analytics to summarize and interpret data characteristics and gain insights into data distribution and trends.
C216.3	Perform data exploration using Matplotlib to visualize and understand data patterns to create informative visual representations of data.
C216.4	Perform inferential data analytics to make conclusions and predictions based on sample data to estimate population parameters and assess relationships.
C216.5	Build models of predictive analytics to forecast future trends and to generate data-driven solutions for decision-making.

Course Code / Course Name: AD3461 / Machine Learning Laboratory

CO No.	Course Outcomes (COs)
C217.1	Apply suitable algorithms for selecting the appropriate features for analysis to improve model performance.

C217.2	Implement supervised machine learning algorithms on standard datasets and evaluate the performance to solve classification and regression problems.
C217.3	Demonstrate unsupervised machine learning algorithms on standard datasets and evaluate the performance to discover hidden patterns in data.
C217.4	Build graph-based learning models for standard datasets to capture relationships and dependencies in data.
C217.5	Assess and compare the performance of different ML algorithms and select the suitable one based on the application to optimize model selection.

SEMESTER V

Course Code / Course Name: AD3501 / Deep Learning

CO No.	Course Outcomes (COs)
C301.1	Understand and explain the foundational concepts of deep neural networks, applying the principles to evaluate their architecture and functions.
C301.2	Utilize convolutional neural networks (CNNs) for image processing tasks, applying CNN architectures to analyze and classify visual data effectively.
C301.3	Demonstrate recurrent neural networks (RNNs) and their variants for text analysis by applying these models to understand sequential patterns and contextual information.
C301.4	Assess model evaluation techniques for different machine learning applications to ensure the effectiveness of models in various domains.
C301.5	Implement autoencoders and generative models for specific applications to study and generate data for unsupervised learning tasks.

Course Code / Course Name: CW3551 / Data and Information Security

CO No.	Course Outcomes (COs)
C302.1	Understand the foundational concepts of data and information security, applying these concepts to evaluate the protection mechanisms in information systems.
C302.2	Relate the legal, ethical, and professional issues in information security, applying ethical decision-making frameworks to address challenges and ensure compliance in real-world scenarios.
C302.3	Apply various authentication schemes to simulate different applications, analyzing their effectiveness in securing systems and verifying user identity.
C302.4	Identify security practices and system security standards to evaluate their role in securing systems and prevent breaches in various environments.
C302.5	Develop web security protocols, evaluating their effectiveness in securing e-commerce applications and ensuring safe transactions over the internet.

Course Code / Course Name: CS3551 / Distributed Computing

CO No.	Course Outcomes (COs)
C303.1	Understand the basic principles of distributed systems and involve multiple independent entities work together to achieve a common goal.
C303.2	Demonstrate techniques to manage concurrency and maintain a consistent view of data across multiple nodes by addressing synchronization challenges.
C303.3	Examine resource sharing methods like load balancing and distributed file systems to optimize the use of resources in distributed environments.

C303.4	Explore consensus algorithms like Paxos and Raft to achieve agreement across distributed nodes to ensure reliability and fault tolerance.
C303.5	Illustrate the core concepts of cloud computing and cloud service models to understand on-demand access to computing resources.

Course Code / Course Name: CCS334 / Big Data Analytics

CO No.	Course Outcomes (COs)
C304.1	Understand the concept of big data and its characteristics to explore real-world use cases across business domains for data-driven decision-making.
C304.2	Recall the principles of NoSQL databases for managing unstructured and semi-structured big data for handling large datasets.
C304.3	Install and configure Hadoop, along with its Hadoop Distributed File System (HDFS), to store and process large datasets for distributed data processing.
C304.4	Use Hadoop's MapReduce framework to process and analyze large datasets in parallel for efficient computation.
C304.5	Leverage Hadoop ecosystem tools like HBase, Cassandra, Pig, and Hive for efficient big data storage, querying, and analytics to process massive datasets.

Course Code / Course Name: CCS335/ Cloud Computing (Professional Elective I)

CO No.	Course Outcomes (COs)
C305.1	Relate key design challenges in cloud computing, such as scalability, resource management, and performance optimization to build efficient cloud architecture.
C305.2	Understand the concept of virtualization and its different types to enhance resource utilization and flexibility in cloud environments..
C305.3	Experiment with hardware resource virtualization and containerization using Docker to simplify application deployment and improve system efficiency.
C305.4	Learn to develop, deploy, and manage cloud-based services to run applications and scale resources as needed.
C305.5	Identify the security challenges in the cloud and explore methods to mitigate risks and secure cloud infrastructures.

Course Code / Course Name: CCS336/ Cloud Services Management (Professional Elective II)

CO No.	Course Outcomes (COs)
C306.1	Utilize various cloud service models and deployment strategies with their implications for businesses in terms of scalability, security, and management.
C306.2	Develop skills to monitor, optimize, and manage cloud resources and services to ensure efficient service delivery and performance.
C306.3	Understand cloud security frameworks and compliance requirements to secure cloud environments and ensure regulatory compliance.
C306.4	Learn to design and deploy cloud solutions for various business needs to create scalable and cost-effective systems for enterprise applications.
C306.5	Assess the performance of cloud services by identifying areas for improvement to optimize cloud service efficiency, cost-effectiveness, and user experience.

Course Code / Course Name: AD3511 / Deep Learning Laboratory

CO No.	Course Outcomes (COs)
C307.1	Implement deep neural networks to solve basic problems like classification and regression to build and train models to handle structured data tasks.
C307.2	Use Convolutional Neural Networks (CNNs) for image recognition, classification, and processing tasks to detect patterns and features in visual data.
C307.3	Implement Recurrent Neural Networks (RNNs) and their variants (LSTMs, GRUs) to process sequential data for sentiment analysis and language translation.
C307.4	Utilize generative models like GANs to create synthetic data for augmentation to improve model generalization and performance.
C307.5	Create practical solutions for real-world problems by selecting and applying the appropriate deep neural network architectures to specific applications.

Course Code / Course Name: AD3512 / Summer internship

CO No.	Course Outcomes (COs)
C308.1	Participate in real-world projects and tasks that provide practical to develop professional skills and knowledge applicable to career goals.
C308.2	Utilize academic concepts and techniques to address real-life challenges to enhance problem-solving abilities by working on industry-relevant projects.
C308.3	Sole as teams with professionals and peers to complete tasks and projects through effective communication, collaboration, and conflict resolution.
C308.4	Make use of the tools, software, and technologies commonly used in industry by gaining proficiency in platforms that will enhance future career prospects.
C308.5	Motivation from the industry mentors who provide feedback and advice on career development that can support career progression.

SEMESTER VI**Course Code / Course Name:** CS3691 / Embedded Systems and IoT

CO No.	Course Outcomes (COs)
C309.1	Interpret the internal structure and components of embedded processors to handle tasks and interface with other system elements in embedded systems.
C309.2	Develop embedded systems applications by writing C programs tailored to hardware constraints for optimizing code in embedded environments.
C309.3	Create basic embedded applications by integrating hardware and software components to develop functional solutions for specific tasks.
C309.4	Examine different communication models used in IoT systems to understand their strengths, limitations, and suitability for various IoT applications.
C309.5	Utilize platforms like Arduino and Raspberry Pi to design and prototype IoT applications that connect sensors, actuators, and networks to transmit data.

Course Code / Course Name: OCE351/ Environmental and Social Impact Assessment (Open Elective – I*)

CO No.	Course Outcomes (COs)
C310.1	Illustrate scoping and screening processes to identify potential environmental and social impacts of projects before carrying out detailed assessments.
C310.2	Learn various methodologies for predicting and assessing environmental impacts, in evaluating potential project effects.
C310.3	Select environmental impact assessments (EIAs) and environmental management plans (EMPs) that comply with regulations and minimize negative environmental effects.
C310.4	Analyze EIA reports to ensure thorough evaluation of potential environmental consequences for adequacy and accuracy of findings and recommendations.
C310.5	Identify the legal and regulatory frameworks governing environmental and social assessments for project planning and implementation.

Course Code / Course Name: CCS345/ Ethics and AI (Professional Elective III)

CO No.	Course Outcomes (COs)
C311.1	Understand and learn the principles of morality and ethics in AI, applying ethical frameworks to assess AI behavior and decision-making processes.
C311.2	Relate the ethical issues and challenges in real-time AI applications, applying this understanding to evaluate potential risks and impacts on society.
C311.3	Find the ethical harms that can arise in AI systems, apply ethical initiatives to mitigate risks and promote responsible AI development.
C311.4	Make use of AI standards and regulations to ensure safe design practices for autonomous and semi-autonomous systems in real-world applications.
C311.5	Demonstrate the concepts of Roboethics and the morality of robotic systems to evaluate the professional responsibilities involved in designing and deploying robots.
C311.6	Survey the societal issues in AI, applying national and international strategies to address challenges and promote the responsible use of AI technologies worldwide.

Course Code / Course Name: CCS354 / Network Security (Professional Elective V)

CO No.	Course Outcomes (COs)
C313.1	Examine various encryption techniques, including symmetric, asymmetric, and hash-based methods to find their strengths in securing data.
C313.2	Classify management techniques for secure data exchange and explore different authentication methods to ensure data integrity and access control.
C313.3	Analyze the security measures implemented at the network and transport layers, to evaluate their effectiveness in protecting data during transmission.
C313.4	Identify security standards at the application layer, including protocols like HTTPS, SSL/TLS, and OAuth to protect data and ensure secure communication.
C313.5	Apply security measures for real-time applications, focusing on securing communication and preventing unauthorized access in dynamic environments.

Course Code / Course Name: CCS359/ Quantum Computing (Professional Elective VI)

CO No.	Course Outcomes (COs)
C314.1	Relate the fundamental principles of quantum computing to understand quantum algorithms and computations.
C314.2	Explore the principles of quantum mechanics, such as wave-particle duality and uncertainty that form the foundation of quantum computing t.
C314.3	Differentiate various quantum computation models, such as quantum circuits and quantum Turing machines with their applications.
C314.4	Build quantum circuits using quantum computation environments like Qiskit and Cirq frameworks for practical quantum computing.
C314.5	Identify quantum operations, including the effects of noise on quantum systems and methods for error correction to confirm reliable quantum computations.

Course Code / Course Name: CCS360/ Recommender Systems (Professional Elective IV)

CO No.	Course Outcomes (COs)
C312.1	Understand the basic concepts of recommender systems, applying these concepts to study user preferences and recommend relevant items effectively.
C312.2	Apply machine-learning and data-mining algorithms to recommender system datasets to identify patterns and optimize recommendation accuracy.
C312.3	Demonstrate collaborative filtering methods in recommender systems to evaluate the performance and assess the quality and relevance of recommendations.
C312.4	Develop a simple recommender system, applying basic algorithms to provide personalized recommendations based on user data.
C312.5	Experiment advanced topics in recommender systems by applying knowledge of sophisticated techniques to enhance the performance and scalability.