COURSE OUTCOME - REGULATION 2020

SEMESTER - I

U20HS101 – Communicative English	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Speak clearly, effortlessly, confidently, and appropriately.
CO2	Write coherently with acceptable accuracy, organizing ideas logically.
CO3	Listen and comprehend different discourses and genres of texts.
CO4	Read and comprehend different discourses and genres of texts.
CO5	Read and infer, analyze, predict, interpret, and draw conclusions from any printed text.

U20MA101 - Engineering Mathematics	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Express large amounts of data and functions in an organized and concise form, apart from diagonalizing matrices.
CO2	Solve maxima and minima problems using differentiation.
CO3	Apply functions of several variables to solve problems in engineering and technology.
CO4	Evaluate integrals by using the Fundamental Theorem of Calculus.
CO5	Apply integration to compute multiple integrals, area, volume, and integrals in polar coordinates, in addition to changing the order of integration and change of variables.

U20PH101 - Engineering Physics - I	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Assess the elastic behavior of materials and the bending behavior of beams.
CO2	Acquire knowledge of NDT and the applications of ultrasonics.
CO3	Know the development of modern physics and its applications.
CO4	Recognize the uses of lasers and fiber optics.
CO5	Distinguish the different crystal systems, structural determination, and synthesis of crystals.

U20CY101 - Engineering Chemistry	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Describe the general structure of polymers. Identify and explain differences between addition and stepwise polymerization.
CO2	Explain how selected isomers could be used for the measurement of surface area of materials or in the rationalization of catalysis.
CO3	Derive and discuss the First and Second Laws of Thermodynamics.
CO4	Make it possible to apply this knowledge in different areas other than photochemistry and spectroscopy.
CO5	Illustrate the phase transition of one-component and two-component systems, and the types of alloys and their applications in industries.

U20GE101 - C – Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Develop simple applications in C using basic constructs.
CO2	Design and implement applications using arrays and strings.
CO3	Develop and implement applications in C using functions and pointers.
CO4	Develop applications in C using structures.
CO5	Design applications using sequential and random access file processing.

U20GE102- Engineering Graphics	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals and standards of engineering graphics.
CO2	Perform freehand sketches of basic geometrical constructions and multiple views of objects.
CO3	Construct orthographic projections of lines, planes, and surfaces.
CO4	Draw projections of solids and develop surfaces.
CO5	Visualize and project isometric and perspective sections of simple solids.

U20BS101- Physics and Chemistry Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Apply the basic theory for the corresponding experiment.
CO2	Know the procedure to use physics equipment.
CO3	Perform experiments accurately, record observations systematically, and interpret the results to draw valid conclusions.
CO4	The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality–related parameters.
CO5	Utilize the fundamental laboratory techniques for analyses such as titrations, separation, purification, and spectroscopy.

U20GE103- C – Programming Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Develop C programs for simple applications making use of basic constructs, arrays, and strings.
CO2	Develop C programs involving functions, recursion, pointers, and structures.
CO3	Design applications using sequential and random access file processing.
CO4	Apply decision-making, looping, and user-defined functions to solve computational problems.
CO5	Analyze and implement algorithms for data processing, string manipulation, and problem-solving using C programming.

SEMESTER - II

U20HS201 - Functional English	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Use academic and technical vocabulary in relevant contexts. Construct meaningful and grammatically correct sentences.
CO2	Effectively listen and acquire language and content, read fast, and understand texts.
CO3	Use oral presentation skills in all professional contexts.
CO4	Demonstrate the understanding of the nature and importance of technical communication. Draft various types of technical and business documents like reports, proposals, and business letters.
CO5	Compose documents like job applications, book reviews, etc.

U20MA201- Advanced Calculus and Ordinary Differential Equations	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Evaluate the effective mathematical tools to obtain the solutions of first- and second-order differential equations that model physical processes.
CO2	Express gradient, divergence, and curl of a vector point function and related identities. Evaluate line, surface, and volume integrals using Gauss, Stokes, and Green's theorems and verify them.
CO3	Apply the tools of differentiation and integration of functions of a complex variable used in various techniques for solving engineering problems.
CO4	Express analytic functions, conformal mapping, and complex integration.
CO5	Solve Laplace transform and inverse transform of simple functions, understand their properties, apply related theorems, and use them to solve differential equations with constant coefficients.

U20PH201 - Engineering Physics - II	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Select the metals required for specific applications in the area of engineering and technology.
CO2	Distinguish between different types of semiconductors and determine the Hall co-efficient.
CO3	Understand the dielectric and ferroelectric properties of materials.
CO4	Identify different magnetic materials and superconducting materials.
CO5	Understand the ideas used in new technologies.

U20GE201 - Python Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Develop algorithmic solutions to simple computational problems.
CO2	Decompose a Python program into functions.
CO3	Implement database and GUI applications.
CO4	Represent compound data using Python lists, tuples, and dictionaries.
CO5	Read and write data from/to files in Python programs.

U20CS201 - Data Structures and algorithm	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Derive the time and space complexities and justify the correctness of a given algorithm.
CO2	Compare the performances of various searching and sorting techniques.
CO3	Create the ADTs and demonstrate the applications of stacks and queues.
CO4	Demonstrate the advantages of dynamic memory allocation via linked lists.
CO5	Illustrate different types of trees and graph structures and implement search and traversal algorithms.

U20EC201 - Semiconductor Devices	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Confidence in handling and usage of electronic devices
CO2	Know broadly the concepts and functionalities of the electronic devices
CO3	Understand the use
CO4	Operate basic electronic devices such as PN junction diodes
CO5	Understand the concepts of power control devices

U20GE203 - Engineering Practices Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Fabricate carpentry components and pipe connections, including plumbing works.
CO2	Use welding equipments to join the structures.
CO3	Carry out basic machining operations.
CO4	Make models using sheet metal works.
CO5	Illustrate centrifugal pump, air conditioner, and operations of smithy, foundry, and fittings.

U20GE204 - Python Programming Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Compile and execute simple Python programs.
CO2	Implement mathematical calculations in programs.
CO3	Develop Python programs step-wise by defining functions and calling them.
CO4	Use Python lists, tuples, and dictionaries for representing compound data.
CO5	Execute simulations of Pygame programs.

U20CS202 - Data Structures Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Write functions to implement linear and non
CO2	Suggest appropriate linear or non
CO3	Appropriately use the linear or non
CO4	Apply appropriate hash functions that result in a collision
CO5	Analyze and optimize data structures and algorithms for efficiency in terms of time and space complexity.

SEMESTER – III

U20MA302 - Mathematical Foundations of Computer Science	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Demonstrate skills in solving mathematical problems.
CO2	Comprehend mathematical principles and logic.
CO3	Develop the understanding of the mathematical and logical basis of modern technology.
CO4	Solve problems using basic graph theory.
CO5	Design discrete problems to be solved by computers.

U20IT302 - Object Oriented Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Gain the basic knowledge of object
CO2	Develop the ability to create applications using object
CO3	Implement features of object
CO4	Understand and apply core OOP concepts in C++.
CO5	Understand and apply core OOP concepts in C++.

U20IT303 - Design and Analysis of Algorithm	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design algorithms for various computing problems.
CO2	Analyze the time and space complexity of algorithms.
CO3	Critically evaluate different algorithm design techniques for a given problem.
CO4	Modify existing algorithms to improve efficiency.
CO5	Apply various algorithm design techniques to solve computational problems efficiently.

U20IT304 - Database Management System	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Classify modern and futuristic database applications based on size and complexity.
CO2	Map ER models to relational models for effective database design.
CO3	Write and optimize queries using normalization criteria.
CO4	Compare and contrast various indexing strategies in different database systems.
CO5	Evaluate how advanced databases differ from traditional databases.

U20IT305 - Computer Organization andArchitecture	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design arithmetic and logic units.
CO2	Design and analyze pipelined control units.
CO3	Evaluate the performance of memory systems.
CO4	Understand parallel processing architectures.
CO5	Analyze and design computer architecture components, including ALUs, control units, memory systems, and parallel processing architectures.

U20EC306 - Digital Systems	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Simplify Boolean functions using K-Map.
CO2	Design and analyze combinational and sequential circuits.
CO3	Implement designs using programmable logic devices.
CO4	Write HDL code for combinational and sequential circuits.
CO5	Design, implement, and optimize digital systems using combinational and sequential circuits, memory devices, and programmable logic technologies.

U20IT306 - Object oriented Programming With C++ Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Gain the basic knowledge of object
CO2	Develop applications using object
CO3	Implement features of object
CO4	Understand and apply object-oriented programming concepts through practical implementation of classes, functions, inheritance, and polymorphism.
CO5	Develop proficiency in using file handling, templates, and advanced OOP features to design and implement real

U20IT307 - Data Base Management System Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design and implement a database schema for a given problem domain.
CO2	Populate and query a database.
CO3	Create and maintain tables using PL/SQL.
CO4	Prepare reports.
CO5	Develop skills to optimize queries and ensure data integrity in database applications.

SEMESTER – IV

U20IT401 - Artificial Intelligence and Expert System.	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Use appropriate search algorithms for any AI problem.
CO2	Represent a problem using first-order and predicate logic.
CO3	Provide the apt agent strategy to solve a given problem.
CO4	Design software agents to solve a problem.
CO5	Design applications for NLP that use Artificial Intelligence.

U20IT402 - Operating System	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Analyze various scheduling algorithms.
CO2	Understand deadlock, prevention, and avoidance algorithms.
CO3	Compare and contrast various memory management schemes.
CO4	Understand the functionality of file systems.
CO5	Perform administrative tasks on Linux servers.

U20IT403 - Computer Networks	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the basic layers and their functions in computer networks.
CO2	Evaluate the performance of a network.
CO3	Understand the basics of how data flows from one node to another.
CO4	Analyze and design routing algorithms.
CO5	Design protocols for various functions in the network.

U20IT404 - Web Technology	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design simple webpages using markup languages like HTML and XHTML.
CO2	Create dynamic webpages using DHTML and JavaScript that are easy to navigate and use.
CO3	Program server-side webpages that process requests from client-side webpages.
CO4	Represent web data using XML and develop webpages using JSP.
CO5	Understand various web services and how these web services interact.

U20EC406 - Microprocessors and Micro Controllers	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand and execute programs based on the 8086 microprocessor.
CO2	Design and implement 8051 microcontroller-based systems.
CO3	Design and interface I/O circuits.
CO4	Understand and execute programs based on the ARM microprocessor.
CO5	Explain concepts relevant to ARM application development.

U20HS203 - Environmental Science and Engineering	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Public awareness of environment at infant stage.
CO2	Ignorance and incomplete knowledge has led to misconceptions.
CO3	Development and improvement in standard of living has led to serious environmental disasters.
CO4	Understand the interrelationships between natural resources, ecosystems, biodiversity, and human activities for sustainable environmental management.
CO5	Apply environmental laws, policies, and conservation practices to mitigate pollution, manage disasters, and promote sustainable development.

U20IT405 - Operating System Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Compare the performance of various CPU scheduling algorithms.
CO2	Implement deadlock avoidance and detection algorithms.
CO3	Implement semaphores.
CO4	Create processes and implement IPC.
CO5	Analyze the performance of various page replacement algorithms.

U20IT406 - Computer Networks Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Implement various protocols using TCP and UDP.
CO2	Compare the performance of different transport layer protocols.
CO3	Use simulation tools to analyze the performance of various network protocols.
CO4	Analyze various routing algorithms.
CO5	Implement error correction codes.

SEMESTER – V

U20MA501 - Random Process and Statistics	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamental concepts of probability and have knowledge of standard distributions that describe real-life phenomena.
CO2	Understand the basic concepts of one- and two-dimensional random variables and apply them in engineering applications.
CO3	Apply the concept of random processes in engineering disciplines.
CO4	Understand and apply the concepts of correlation and spectral densities.
CO5	The students will have an exposure various distribution functions and help in acquiring skills in handling situations involving more than one variable, able to analyze the response of random inputs to linear time-invariant systems.

U20IT501 - Java Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Apply basic features of Java to write programs.
CO2	Apply inheritance, packages, interfaces, and exceptions to write efficient programs.
CO3	Use the collection framework to write efficient programs for real-time applications.
CO4	Develop GUI-based, data-driven applications using JDBC.
CO5	Design and implement Java applications integrating threads, data handling, and user interfaces.

U20IT502 - Software Engineering	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Compare and analyze the various lifecycle models of the software process.
CO2	Design an appropriate analysis model that suits the requirements.
CO3	Design software architecture models for various applications.
CO4	Implement strategies for software testing.
CO5	Estimate the cost of the project using appropriate methods

U20IT503 - Theory of Computation	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Construct automata and regular expressions for any pattern.
CO2	Write context-free grammar for any construct.
CO3	Design Turing machines for any language.
CO4	Propose computational solutions using Turing machines.
CO5	Analyze and solve undecidability problems.

U20IT504 - Software Engineering Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand and apply software engineering methodologies for project development.
CO2	Use open-source CASE tools to design and model software systems effectively.
CO3	Develop and implement software solutions based on analyzed requirements and design models.
CO4	Perform software testing, including validation, coverage analysis, and debugging, to ensure quality and reliability.
CO5	Analyze, design, and develop domain-specific software applications in areas such as academic, railway, medicine, finance, and human resource management.

U20IT505 - Java Programming Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Implement object-oriented features using Java.
CO2	Apply the concepts of polymorphism and inheritance.
CO3	Implement exception handling.
CO4	Develop network and window-based applications using AWT and Swing.
CO5	Design and build robust Java applications integrating OOP concepts, GUI, and networking.

SEMESTER – VI

U20IT601 - Fundamental of Data Science	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand data science fundamentals and statistical concepts.
CO2	Perform data preprocessing for analysis.
CO3	Apply machine learning algorithms and feature selection.
CO4	Implement and evaluate clustering techniques.
CO5	Visualize data using effective tools and methods.

U20IT602 - Machine Learning	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Implement a neural network for an application of your choice using an available tool.
CO2	Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
CO3	Use a tool to implement typical clustering algorithms for different types of applications.
CO4	Design and implement an HMM for a sequence-model type application.
CO5	Identify applications suitable for different types of machine learning with appropriate justification.

U20IT603 - Internet of Things	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals, architecture, and enabling technologies of the Internet of Things (IoT).
CO2	Identify and apply the elements of IoT, including sensors, actuators, communication modules, and IoT system management.
CO3	Implement and analyze IoT communication protocols and standards for various applications.
CO4	Develop IoT solutions using cloud platforms, data analytics, and visualization tools.
CO5	Evaluate security challenges and design real-time IoT applications in domains such as smart homes, cities, environment, and agriculture.

U20IT604 - Cloud Computing	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.
CO2	Understand the key enabling technologies that support cloud development.
CO3	Analyze and use the architecture of compute and storage clouds, including service and delivery models.
CO4	Explain core issues of cloud computing, such as resource management and security.
CO5	Install and work with current cloud technologies.

U20IT605 - Cloud Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Configure various virtualization tools such as VirtualBox and VMware Workstation.
CO2	Design and deploy a web application in a PaaS environment.
CO3	Simulate a cloud environment to implement new schedulers.
CO4	Install and use a generic cloud environment as a private cloud.
CO5	Manipulate large datasets in a parallel environment.

U20IT606 - Machine Learning Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Gain proficiency in using Python and R for data analysis and machine learning.
CO2	Implement classifiers and predictive models for real-world datasets, such as sales and house prices.
CO3	Apply decision tree and backpropagation algorithms for prediction and classification tasks.
CO4	Use clustering techniques for anomaly detection, fraud detection, and medical data analysis.
CO5	Apply reinforcement learning to develop intelligent systems and control applications, such as games and traffic signal control.

U20HS601 - Inter Personal Skills – I	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Develop effective listening skills to understand and process personal and academic information.
CO2	Improve speaking ability, pronunciation, and articulation for clear and coherent communication.
CO3	Enhance fluency and accuracy in informal and formal conversations using appropriate lexical chunks.
CO4	Participate actively in group discussions, provide feedback, and summarize academic content.
CO5	Apply conversational and presentation skills in various real-world contexts, including lectures, interviews, and multimedia sources.

SEMESTER – VII

U20IT701 - Big Data Analytics	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Work with big data tools and apply data analysis techniques.
CO2	Analyze data using clustering and classification algorithms.
CO3	Apply various mining algorithms and recommendation systems for large datasets.
CO4	Perform analytics on data streams in real time.
CO5	Understand and manage NoSQL databases for big data applications.

U20IT702 - Deep Learning	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of deep learning.
CO2	Implement various deep learning models for different tasks.
CO3	Apply dimensionality reduction techniques to high-dimensional data.
CO4	Analyze optimization and generalization in deep learning models.
CO5	Explore and apply deep learning to real-world applications.

U20IT703 - Cryptography and Network Security	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of network security, security architecture, threats, and vulnerabilities.
CO2	Apply cryptographic operations using symmetric key algorithms.
CO3	Apply cryptographic operations using public key cryptography.
CO4	Implement various authentication schemes for different applications.
CO5	Understand security practices and system security standards.

U20IT704 - Network Security Laboratory	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Develop code for classical encryption techniques to solve problems.
CO2	Build cryptosystems using symmetric and public key encryption algorithms.
CO3	Implement authentication algorithms in software.
CO4	Develop a digital signature scheme using the Digital Signature Standard.
CO5	Demonstrate network security systems using open-source tools.

PROFESSIONAL ELECTIVE - I

U20IT511 - Principles of Management	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of management
CO2	Apply planning concepts
CO3	Organize resources and human capital
CO4	Direct and motivate individuals and groups
CO5	Implement controlling processes using budgetary and non-budgetary techniques

U20IT512 - Distributed Systems	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Elucidate the foundations and issues of distributed systems.
CO2	Understand synchronization issues and global state in distributed systems.
CO3	Understand mutual exclusion and deadlock detection algorithms in distributed systems.
CO4	Describe agreement protocols and fault tolerance mechanisms in distributed systems.
CO5	Describe the features of peer-to-peer and distributed shared memory systems.

U20IT513 - C# .Net Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand and apply C# fundamentals
CO2	Use advanced C# features like delegates
CO3	Manipulate data with .NET libraries
CO4	Develop window-based and web applications
CO5	Understand with .NET Framework and Compact Framework

U20IT514 - Block Chain Techniques	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand blockchain fundamentals and cryptography
CO2	Explain Bitcoin, cryptocurrency, and mining processes
CO3	Analyze consensus mechanisms like PoW and PoS
CO4	Comprehend distributed consensus protocols (RAFT, BFT)
CO5	Apply Hyperledger Fabric and Ethereum for real-world applications

U20IT515 - Embedded Systems	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Describe the architecture and programming of ARM processor
CO2	Explain the concepts of embedded systems
CO3	Understand peripherals and sensor interfacing
CO4	Apply system design techniques to develop firmware
CO5	Illustrate coding for building embedded systems

PROFESSIONAL ELECTIVE – II

U20IT621 - Linux Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Use Linux commands for system administration and network management
CO2	Write shell programs using Linux commands
CO3	Design applications to manipulate the Linux kernel-level file system
CO4	Develop IPC APIs for process synchronization
CO5	Implement network programming for efficient resource usage across machines

U20IT622 - Data Warehousing and Data Mining	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of data warehousing, OLAP operations, and multidimensional data modeling
CO2	Explain data warehouse architecture, ETL processes, and business intelligence applications
CO3	Apply data mining concepts, preprocessing techniques, and knowledge discovery methods
CO4	Implement classification and clustering algorithms for analyzing structured data
CO5	Explore advanced data mining applications on complex data types, including text, graph, spatial, and temporal data

U20HS601– Professional Ethics	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the importance of human values, ethics, integrity, and professional behavior in personal and professional life
CO2	Apply engineering ethics to analyze moral dilemmas and make ethical decisions in professional contexts
CO3	Demonstrate responsibility and accountability as engineers while following codes of ethics and legal requirements
CO4	Evaluate safety, risk, and professional rights, including intellectual property rights and conflict resolution
CO5	Analyze global and societal issues, including environmental ethics, corporate social responsibility, and professional leadership

U20IT624 - Soft Computing	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of soft computing, including artificial intelligence, neural networks, fuzzy systems, and genetic algorithms
CO2	Apply fuzzy logic concepts for reasoning, decision-making, and approximate problem-solving
CO3	Apply fuzzy logic concepts for reasoning, decision-making, and approximate problem-solving
CO4	Understand and implement genetic algorithms for optimization problems, including encoding, selection, and mutation techniques
CO5	Integrate hybrid systems combining neural networks, fuzzy logic, and genetic algorithms for

	complex problem-solving

U20IT625 - Cyber Security	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamental mathematical concepts related to security
CO2	Implement cryptographic techniques for real-time applications
CO3	Comprehend authentication processes, data integrity, and their implementation
CO4	Gain knowledge of cybercrimes and various cyber offenses
CO5	Recognize cyber threats, attacks, vulnerabilities, and corresponding defensive mechanisms

PROFESSIONAL ELECTIVE – III

U20IT731 - Software Project Management	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the basic concepts of products, processes, and projects, including product and project life cycles
CO2	Analyze and apply process models such as ISO 9001, CMM, and People CMM in project management
CO3	Implement umbrella activities in projects including metrics, configuration management, software quality assurance, and risk analysis
CO4	Plan, execute, track, and close projects effectively using project management principles
CO5	Address engineering and people-related issues across different project phases, including requirements, design, development, testing, maintenance, and deployment

U20IT732 - Wireless Adhoc and Sensor Networks	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design their own wireless network
CO2	Evaluate existing networks and enhance quality of service
CO3	Select appropriate protocols for various applications
CO4	Examine security measures at different levels
CO5	Analyze energy consumption and management

U20IT733 - Natural Language Processing	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the origins, challenges, and language modeling techniques in NLP, including tokenization and spelling correction
CO2	Apply word-level analysis techniques such as POS tagging using rule-based, stochastic, and HMM/Maximum Entropy models
CO3	Perform syntactic analysis using context-free grammars, dependency grammar, parsing techniques, and probabilistic models
CO4	Analyze semantics and pragmatics including first-order logic, semantic roles, word sense disambiguation, and similarity measures
CO5	Use discourse analysis and lexical resources for anaphora resolution, coreference resolution, and NLP resource utilization

U20IT734 - Multicore Architecture and Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Identify the limitations of ILP and understand the need for multicore architectures
CO2	Discuss multiprocessing issues and propose suitable solutions
CO3	Analyze the salient features of different multicore architectures and their approaches to exploiting parallelism
CO4	Evaluate different types of interconnection networks and their performance trade-offs
CO5	Design and optimize a memory hierarchy for efficient system performance

U20IT735 - Data Visualization	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the core principles of visual analysis and effectively interpret data using visualization techniques
CO2	Perform time-series, ranking, and deviation analysis to identify trends and anomalies in datasets
CO3	Analyze distributions, correlations, and multivariate relationships for deeper insights
CO4	Design information dashboards with clear visual hierarchy, usability, and analytical effectiveness
CO5	Apply advanced visualization elements like bullet graphs, etc to build comprehensive dashboards

PROFESSIONAL ELECTIVE – IV

U20IT841 - Advanced JAVA Programming	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the basics of Applets, AWT components, and event handling for interactive Java applications
CO2	Develop GUI applications using Swing components and Java Beans with proper property management
CO3	Implement distributed applications using RMI and handle networking concepts like sockets and URLs
CO4	Establish database connectivity using JDBC, execute queries, and manage result sets efficiently
CO5	Design and develop server-side applications using Servlets, handle HTTP requests/responses, and manage sessions and cookies

U20IT842 - Service Oriented Architecture	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of Service-Oriented Architecture (SOA) and its benefits for business and technology.
CO2	Integrate SOA with web services using SOAP, service contracts, and enterprise service bus patterns.
CO3	Design and implement multi-channel access and web service compositions using BPEL and RESTful services.
CO4	Design and implement multi-channel access and web service compositions using BPEL and RESTful services.
CO5	Apply security, reliable messaging, and transaction management techniques in web service implementations.

U20IT843 - Network Programming and Management	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of TCP/IP socket programming and implement basic TCP client-server applications.
CO2	Develop robust network applications handling multiple clients, signals, and I/O multiplexing techniques.
CO3	Configure and use socket options, implement UDP-based communication, and integrate DNS and IPv6 support.
CO4	Design and implement advanced socket applications including threaded servers, raw sockets, and network utilities like ping and traceroute
CO5	Understand network management concepts using SNMP, including MIBs, RMON, and SNMP protocol versions for practical network monitoring.

U20IT844 - Open Source Systems	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the philosophy, history, and advantages of Free and Open Source Software (FOSS) and Linux, including installation and build systems.
CO2	Work with open-source non-relational databases like MongoDB and CouchDB, performing CRUD operations and deploying applications.
CO3	Develop web applications using open-source programming languages such as PHP, implementing OOP, database connectivity, and security features.
CO4	Write Python programs using core concepts, data structures, object-oriented programming, and exception handling.
CO5	Configure and use open-source tools and technologies, including web servers (Apache, Google Web Server) and Model-Driven Architecture (MDA) for software development.

U20IT845 - Fundamentals of NanoScience	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of nanoscience and nanotechnology, including classifications, nanoscale length effects, and properties of nanomaterials.
CO2	Explain general methods of nanomaterial synthesis using top-down and bottom-up approaches.
CO3	Describe various nanomaterials such as carbon nanostructures, nanometal oxides, quantum dots, and their structure–property relationships and applications.
CO4	Apply characterization techniques like X-ray diffraction, SEM, TEM, AFM, STM, and nanoindentation for analyzing nanomaterials.
CO5	Recognize applications of nanotechnology in information technology, biotechnology, medicine, MEMS/NEMS, sensors, energy, and other emerging fields.

PROFESSIONAL ELECTIVE –V

U20IT851 - Human Computer Interaction	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design effective dialog for HCI.
CO2	Design effective HCI for individuals and persons with disabilities.
CO3	Assess the importance of user feedback
CO4	Explain HCI implications for designing multimedia, e-commerce, and e-learning websites.
CO5	Develop meaningful user interfaces.

U20IT852 - Software Testing	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Design test cases suitable for software development for different domains.
CO2	Identify suitable tests to be carried out.
CO3	Prepare test planning based on the documents
CO4	Document test plans and test cases designed.
CO5	Use automatic testing tools.

U20IT853 - TCP/IP Technology	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand different IP addressing schemes, subnetting, supernetting, and routing methods.
CO2	Analyze the roles of ARP, RARP, ICMP, IGMP, and UDP in network communication.
CO3	Understand TCP services, flow control, congestion control, and unicast/multicast routing protocols.
CO4	Develop and implement client-server applications using TCP and UDP sockets.
CO5	Understand application layer protocols like BOOTP, DHCP, DNS, and remote login services.

U20IT854 - Information Retrieval	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals, history, and components of Information Retrieval (IR) and its relation to web search and AI.
CO2	Apply Boolean, vector-space, probabilistic, and language-model-based retrieval techniques, including TF-IDF weighting and relevance feedback.
CO3	Analyze web search architectures, crawling techniques, index structures, and web spam/SEO considerations.
CO4	Implement link analysis algorithms (PageRank, HITS), document ranking, and personalized/recommendation-based search.
CO5	Apply text mining techniques for document classification, clustering, and information filtering using algorithms like Naive Bayes, k-means, and EM.

U20IT855 - Speech Processing	
Course Code	**Course Outcomes**
	Upon completion of the course, the students will be able to:
CO1	Understand the fundamentals of speech and language processing, including ambiguity, language models, automata, and N-grams.
CO2	Apply speech modeling techniques such as part-of-speech tagging, Hidden Markov Models, and maximum entropy models for linguistic analysis.
CO3	Analyze speech pronunciation, phonetics, and acoustic signal processing for articulatory and gestural phonology.
CO4	Implement speech synthesis techniques, including diphone and unit-selection waveform synthesis, with evaluation methods.
CO5	Develop automatic speech recognition systems using feature extraction (MFCC), HMMs, decoding strategies, and context-dependent acoustic models.