

# **INFO INSTITUTE OF ENGINEERING,COIMBATORE**

## **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

### **PROGRAM OUTCOMES**

**1 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**2 Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3 Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**4 Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**5 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**6 The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**7 Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**8 Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**9 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10 Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**11 Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**12 Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **PROGRAMME EDUCATIONAL OBJECTIVES**

<b>PEO I</b>	Apply their technical competence in computer science to solve real world problems, with technical and people leadership.
<b>PEO II</b>	Conduct cutting edge research and develop solutions on problems of social relevance.
<b>PEO III</b>	Work in a business environment, exhibiting team skills, work ethics, adaptability and lifelong learning

## **PROGRAM SPECIFIC OUTCOMES**

- Exhibit design and programming skills to build and automate business solutions using cutting edge technologies.
- Strong theoretical foundation leading to excellence and excitement towards research, to provide elegant solutions to complex problems.
- Ability to work effectively with various engineering fields as a team to design, build and develop system applications.

## COURSE OUTCOMES

Regulation 2021 Anna University Chennai

SUBJECT	COs
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I Semester		
<b>HS3152 Professional English - I</b>	CO1	To use appropriate words in a professional context.
	CO2	To gain understanding of basic grammatic structures and use them in right context
	CO3	To read and infer the denotative and connotative meanings of technical texts
	CO4	To write definitions, descriptions, narrations and essays on various topics
<b>MA3151 Matrices and Calculus</b>	CO1	Use the matrix algebra methods for solving practical problems.
	CO2	Apply differential calculus tools in solving various application problems.
	CO3	Able to use differential calculus ideas on several variable functions.
	CO4	Apply different methods of integration in solving practical problems.
	CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.
<b>PH3151 Engineering Physics</b>	CO1	Understand the importance of mechanics.
	CO2	Express their knowledge in electromagnetic waves.
	CO3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers
	CO4	Understand the importance of quantum physics
	CO5	Comprehend and apply quantum mechanical principles towards the formation of energy bands.
<b>CY3151 Engineering Chemistry</b>	CO1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water
	CO2	To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

	CO3	To apply the knowledge of phase rule and composites for material selection requirements.
	CO4	To recommend suitable fuels for engineering processes and applications.
	CO5	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
<b>GE3151 Problem Solving and Python Programming</b>	CO1	Develop algorithmic solutions to simple computational problems
	CO2	Develop and execute simple Python programs.
	CO3	Write simple Python programs using conditionals and loops for solving problems.
	CO4	Decompose a Python program into functions
	CO5	Represent compound data using Python lists, tuples, dictionaries etc
	CO6	Read and write data from/to files in Python programs.
<b>GE3171 Problem Solving and Python Programming Laboratory</b>	CO1	Develop algorithmic solutions to simple computational problems
	CO2	Develop and execute simple Python programs.
	CO3	Implement programs in Python using conditionals and loops for solving problems.
	CO4	Deploy functions to decompose a Python program.
	CO5	Process compound data using Python data structures.
	CO6	Utilize Python packages in developing software applications.
<b>BS3171 Physics Laboratory</b>	CO1	Understand the functioning of various physics laboratory equipment.
	CO2	Use graphical models to analyze laboratory data
	CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality
	CO4	Access, process and analyze scientific information.
	CO5	Solve problems individually and collaboratively
<b>BS3171 Chemistry Laboratory</b>	CO1	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
	CO2	To determine the amount of metal ions through volumetric and spectroscopic techniques
	CO3	To analyse and determine the composition of alloys.

	CO4	To learn simple method of synthesis of nanoparticles
	CO5	To quantitatively analyse the impurities in solution by electroanalytical techniques
<b>GE3172 English Laboratory</b>	CO1	To listen to and comprehend general as well as complex academic information
	CO2	To listen to and understand different points of view in a discussion
	CO3	To speak fluently and accurately in formal and informal communicative contexts
	CO4	To describe products and processes and explain their uses and purposes clearly and accurately
	CO5	To express their opinions effectively in both formal and informal discussions

<b>II Semester</b>		
<b>HS3252 Professional English - II</b>	CO1	To compare and contrast products and ideas in technical texts
	CO2	To identify and report cause and effects in events, industrial processes through technical texts
	CO3	To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
	CO4	To present their ideas and opinions in a planned and logical manner
	CO5	To draft effective resumes in the context of job search.
<b>MA3251 Statistics and Numerical Methods</b>	CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.
	CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
	CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
	CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
	CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques

		with engineering applications.
<b>PH3256 Physics for Information Science</b>	CO1	Gain knowledge on classical and quantum electron theories, and energy band structures
	CO2	Acquire knowledge on basics of semiconductor physics and its applications in various devices
	CO3	Get knowledge on magnetic properties of materials and their applications in data storage.
	CO4	Have the necessary understanding on the functioning of optical materials for optoelectronics
	CO5	Understand the basics of quantum structures and their applications and basics of quantum computing
<b>BE3251 Basic Electrical and Electronics Engineering</b>	CO1	Compute the electric circuit parameters for simple problems
	CO2	Explain the working principle and applications of electrical machines
	CO3	Analyze the characteristics of analog electronic devices
	CO4	Explain the basic concepts of digital electronics
	CO5	Explain the operating principles of measuring instruments
<b>GE3251 Engineering Graphics</b>	CO1	Use BIS conventions and specifications for engineering drawing.
	CO2	Construct the conic curves, involutes and cycloid
	CO3	Solve practical problems involving projection of lines.
	CO4	Draw the orthographic, isometric and perspective projections of simple solids.
	CO5	Draw the development of simple solids.
<b>CS3251 Programming in C</b>	CO1	Demonstrate knowledge on C Programming constructs
	CO2	Develop simple applications in C using basic constructs
	CO3	Design and implement applications using arrays and strings
	CO4	Develop and implement modular applications in C using functions
	CO5	Develop applications in C using structures and pointers.
	CO6	Design applications using sequential and random access file processing.

<b>GE3271 Engineering Practices Laboratory</b>	CO1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
	CO2	Wire various electrical joints in common household electrical wire work. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
	CO3	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
	CO4	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
<b>CS3271 Programming in C Laboratory</b>	CO1	Demonstrate knowledge on C programming constructs.
	CO2	Develop programs in C using basic constructs.
	CO3	Develop programs in C using arrays.
	CO4	Develop applications in C using strings, pointers, functions.
	CO5	Develop applications in C using structures.
	CO6	Develop applications in C using file processing.
<b>GE3272 Communication Laboratory / Foreign Language</b>	CO1	Speak effectively in group discussions held in a formal/semi formal contexts.
	CO2	Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
	CO3	Write emails, letters and effective job applications.
	CO4	Write critical reports to convey data and information with clarity and precision
	CO5	Give appropriate instructions and recommendations for safe execution of tasks

<b>III Semester</b>		
<b>MA3354 Discrete Mathematics</b>	CO1	Have knowledge of the concepts needed to test the logic of a program.
	CO2	Have an understanding in identifying structures on many levels.
	CO3	Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
	CO4	Be aware of the counting principles
	CO5	Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.
<b>CS3351 Digital Principles and Computer Organization</b>	CO1	Design various combinational digital circuits using logic gates
	CO2	Design sequential circuits and analyze the design procedures
	CO3	State the fundamentals of computer systems and analyze the execution of an instruction
	CO4	Analyze different types of control design and identify hazards
	CO5	Identify the characteristics of various memory systems and I/O communication
<b>CS3352 Foundations of Data Science</b>	CO1	Define the data science process
	CO2	Understand different types of data description for data science process
	CO3	Gain knowledge on relationships between data
	CO4	Use the Python Libraries for Data Wrangling
	CO5	Apply visualization Libraries in Python to interpret and explore data
<b>CS3301 Data Structures</b>	CO1	Define linear and non-linear data structure
	CO2	Implement linear and non-linear data structure operations.
	CO3	Use appropriate linear/non-linear data structure operations for solving a given problem.
	CO4	Apply appropriate graph algorithms for graph applications.
	CO5	Analyze the various searching and sorting algorithms.

<b>CS3391 Object Oriented Programming</b>	CO1	Apply the concepts of classes and objects to solve simple problems
	CO3	Make use of exception handling mechanisms and multithreaded model to solve real world problems
	CO4	Build Java applications with I/O packages, string classes, Collections and generics concepts
	CO5	Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications
<b>CS3311 Data Structures Laboratory</b>	CO1	Implement Linear data structure algorithms.
	CO2	Implement applications using Stacks and Linked lists
	CO3	Implement Binary Search tree and AVL tree operations.
	CO4	Implement graph algorithms.
	CO5	Analyze the various searching and sorting algorithms.
<b>CS3381 Object Oriented Programming Laboratory</b>	CO1	Design and develop java programs using object oriented programming concepts
	CO2	Develop simple applications using object oriented concepts such as package, exceptions
	CO3	Implement multithreading, and generics concepts
	CO4	Create GUIs and event driven programming applications for real world problems
	CO5	Implement and deploy web applications using Java
<b>CS3361 Data Science Laboratory</b>	CO1	Make use of the python libraries for data science
	CO2	Make use of the basic Statistical and Probability measures for data science.
	CO3	Perform descriptive analytics on the benchmark data sets.
	CO4	Perform correlation and regression analytics on standard data sets
	CO5	Present and interpret data using visualization packages in Python.

<b>GE3361 Professional Development</b>	CO1	Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
	CO2	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
	CO3	Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

<b>IV Semester</b>		
<b>CS3452 Theory of Computation</b>	CO1	Construct automata theory using Finite Automata
	CO2	Write regular expressions for any pattern
	CO3	Design context free grammar and Pushdown Automata
	CO4	Design Turing machine for computational functions
	CO5	Differentiate between decidable and undecidable problems
<b>CS3491 Artificial Intelligence and Machine Learning</b>	CO1	Use appropriate search algorithms for problem solving
	CO2	Apply reasoning under uncertainty
	CO3	Build supervised learning models
	CO4	Build ensembling and unsupervised models
	CO5	Build deep learning neural network models
<b>CS3492 Database Management Systems</b>	CO1	Construct SQL Queries using relational algebra
	CO2	Design database using ER model and normalize the database
	CO3	Construct queries to handle transaction processing and maintain consistency of the database
	CO4	Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database
	CO5	Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.
<b>CS3401 Algorithms</b>	CO1	Analyze the efficiency of algorithms using various frameworks
	CO2	Apply graph algorithms to solve problems and analyze their efficiency.
	CO3	Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems

	CO4	Use the state space tree method for solving problems.
	CO5	Solve problems using approximation algorithms and randomized algorithms
<b>CS3451 Introduction to Operating Systems</b>	CO1	Analyze various scheduling algorithms and process synchronization.
	CO2	Explain deadlock prevention and avoidance algorithms.
	CO3	Compare and contrast various memory management schemes.
	CO4	Explain the functionality of file systems, I/O systems, and Virtualization
	CO5	Compare iOS and Android Operating Systems.
<b>GE3451 Environmental Sciences and Sustainability</b>	CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
	CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
	CO3	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
	CO4	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
	CO5	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.
<b>CS3461 Operating Systems Laboratory</b>	CO1	Define and implement UNIX Commands.
	CO2	Compare the performance of various CPU Scheduling Algorithms.
	CO3	Compare and contrast various Memory Allocation Methods.
	CO4	Define File Organization and File Allocation Strategies.
	CO5	Implement various Disk Scheduling Algorithms.
<b>CS3481 Database Management Systems Laboratory</b>	CO1	Create databases with different types of key constraints.
	CO2	Construct simple and complex SQL queries using DML and DCL commands.
	CO3	Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.

	CO4	Create an XML database and validate with meta-data (XML schema).
	CO5	Create and manipulate data using NOSQL database.

<b>V Semester</b>		
<b>CS3591 Computer Networks</b>	CO1	Explain the basic layers and its functions in computer networks.
	CO2	Understand the basics of how data flows from one node to another.
	CO3	Analyze routing algorithms.
	CO4	Describe protocols for various functions in the network.
	CO5	Analyze the working of various application layer protocols.
<b>CS3501 Compiler Design</b>	CO1	Understand the techniques in different phases of a compiler.
	CO2	Design a lexical analyser for a sample language and learn to use the LEX tool
	CO3	Apply different parsing algorithms to develop a parser and learn to use YACC tool
	CO4	Understand semantics rules (SDT), intermediate code generation and run-time environment.
	CO5	Implement code generation and apply code optimization techniques.
<b>CB3491 Cryptography and Cyber Security</b>	CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
	CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
	CO3	Apply the different cryptographic operations of public key cryptography
	CO4	Apply the various Authentication schemes to simulate different applications.
	CO5	Understand various cyber crimes and cyber security.
<b>CS3551 Distributed Computing</b>	CO1	Explain the foundations of distributed systems
	CO2	Solve synchronization and state consistency problems
	CO3	Use resource sharing techniques in distributed systems

	CO4	Apply working model of consensus and reliability of distributed systems
	CO5	Explain the fundamentals of cloud computing

<b>VI Semester</b>		
<b>CCS356 Object Oriented Software Engineering</b>	CO1	Compare various Software Development Lifecycle Models
	CO2	Evaluate project management approaches as well as cost and schedule estimation strategies.
	CO3	Perform formal analysis on specifications.
	CO4	Use UML diagrams for analysis and design.
	CO5	Architect and design using architectural styles and design patterns, and test the system
<b>CS3691 Embedded Systems and IoT</b>	CO1	Explain the architecture of embedded processors.
	CO2	Write embedded C programs.
	CO3	Design simple embedded applications
	CO4	Compare the communication models in IOT
	CO5	Design IoT applications using Arduino/Raspberry Pi /open platform.
<b>CS3711 Summer Internship</b>	CO1	Industry Practices, Processes, Techniques, technology, automation and other core aspects of software industry
	CO2	Analyze, Design solutions to complex business problems
	CO3	Build and deploy solutions for target platform
	CO4	Preparation of Technical reports and presentation.

<b>VIII Semester</b>		
<b>CS3811 Project Work/Internship</b>	CO1	Gain Domain knowledge and technical skill set required for solving industry /research problems
	CO2	Provide solution architecture, module level designs, algorithms
	CO3	Implement, test and deploy the solution for the target platform
	CO4	Prepare detailed technical report, demonstrate and present the work

## ELECTIVE COURSES

SUBJECT	COs
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ELECTIVE I		
<b>CCS346 Exploratory Data Analysis</b>	CO1	Understand the fundamentals of exploratory data analysis.
	CO2	Implement the data visualization using Matplotlib.
	CO3	Perform univariate data exploration and analysis.
	CO4	Apply bivariate data exploration and analysis.
	CO5	Use Data exploration and visualization techniques for multivariate and time series data.
<b>CCS360 Recommender Systems</b>	CO1	Understand the basic concepts of recommender systems.
	CO2	Implement machine-learning and data-mining algorithms in recommender systems data sets.
	CO3	Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
	CO4	Design and implement a simple recommender system.
	CO5	Learn about advanced topics of recommender systems.
	CO6	Learn about advanced topics of recommender systems applications
<b>CCS355 Neural Networks and Deep Learning</b>	CO1	Apply Convolution Neural Network for image processing.
	CO2	Understand the basics of associative memory and unsupervised learning networks.
	CO3	Apply CNN and its variants for suitable applications.
	CO4	Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
	CO5	Apply autoencoders and generative models for suitable applications
<b>CCS369 Text and Speech Analysis</b>	CO1	Explain existing and emerging deep learning architectures for text and speech processing
	CO2	Apply deep learning techniques for NLP tasks, language modelling and machine translation
	CO3	Explain coreference and coherence for text processing
	CO4	Build question-answering systems, chatbots and dialogue systems

	CO5	Apply deep learning models for building speech recognition and text-to-speech systems
<b>CCW331 Business Analytics</b>	CO1	Explain the real world business problems and model with analytical solutions.
	CO2	Identify the business processes for extracting Business Intelligence
	CO3	Apply predictive analytics for business fore-casting
	CO4	Apply analytics for supply chain and logistics management
	CO5	Use analytics for marketing and sales.
<b>CCS349 Image and Video Analytics</b>	CO1	Understand the basics of image processing techniques for computer vision and video analysis.
	CO2	Explain the techniques used for image pre-processing.
	CO3	Develop various object detection techniques.
	CO4	Understand the various face recognition mechanisms.
	CO5	Elaborate on deep learning-based video analytics.
<b>CCS338 Computer Vision</b>	CO1	To understand basic knowledge, theories and methods in image processing and computer vision.
	CO2	To implement basic and some advanced image processing techniques in OpenCV.
	CO3	To apply 2D a feature-based based image alignment, segmentation and motion estimations.
	CO4	To apply 3D image reconstruction techniques
	CO5	To design and develop innovative image processing and computer vision applications.
<b>CCS334 Big Data Analytics</b>	CO1	Describe big data and use cases from selected business domains.
	CO2	Explain NoSQL big data management.
	CO3	Install, configure, and run Hadoop and HDFS
	CO4	Perform map-reduce analytics using Hadoop.
	CO5	Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

**ELECTIVE II**

<b>CCS375 Web Technologies</b>	CO1	Construct a basic website using HTML and Cascading Style Sheets
	CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
	CO3	Develop server side programs using Servlets and JSP.
	CO4	Construct simple web pages in PHP and to represent data in XML format.
	CO5	Develop interactive web applications.
<b>CCS332 App Development</b>	CO1	Develop Native applications with GUI Components.
	CO2	Develop hybrid applications with basic event handling.
	CO3	Implement cross-platform applications with location and data storage capabilities.
	CO4	Implement cross platform applications with basic GUI and event handling.
	CO5	Develop web applications with cloud database access.
<b>CCS336 Cloud Services Management</b>	CO1	Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
	CO2	Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
	CO3	Solve the real world problems using Cloud services and technologies
<b>CCS370 UI and UX Design</b>	CO1	Build UI for user Applications.
	CO2	Evaluate UX design of any product or application
	CO3	Demonstrate UX Skills in product development
	CO4	Implement Sketching principles
	CO5	Create Wireframe and Prototype
<b>CCS366 Software Testing and Automation</b>	CO1	Understand the basic concepts of software testing and the need for software testing
	CO2	Design Test planning and different activities involved in test planning
	CO3	Design effective test cases that can uncover critical defects in the application
	CO4	Carry out advanced types of testing
	CO5	Automate the software testing using Selenium and TestNG
<b>CCS374</b>	CO1	Understanding the basic concepts of web application security and the need for it

<b>Web Application Security</b>	CO2	Be acquainted with the process for secure development and deployment of web applications
	CO3	Acquire the skill to design and develop Secure Web Applications that use Secure APIs
	CO4	Be able to get the importance of carrying out vulnerability assessment and penetration testing
	CO5	Acquire the skill to think like a hacker and to use hackers tool sets
<b>CCS342 DevOps</b>	CO1	Understand different actions performed through Version control tools like Git.
	CO2	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
	CO3	Ability to Perform Automated Continuous Deployment
	CO4	Ability to do configuration management using Ansible
	CO5	Understand to leverage Cloud-based DevOps tools using Azure DevOps
<b>CCS358 Principles of Programming Languages</b>	CO1	Describe syntax and semantics of programming languages
	CO2	Explain data, data types, and basic statements of programming languages
	CO3	Design and implement subprogram constructs
	CO4	Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog
	CO5	Understand and adopt new programming languages

<b>ELECTIVE III</b>		
<b>CCS335 Cloud Computing</b>	CO1	Understand the design challenges in the cloud.
	CO2	Apply the concept of virtualization and its types.
	CO3	Experiment with virtualization of hardware resources and Docker.
	CO4	Develop and deploy services on the cloud and set up a cloud environment.
	CO5	Explain security challenges in the cloud environment.
<b>CCS372 Virtualization</b>	CO1	Analyse the virtualization concepts and Hypervisor
	CO2	Apply the Virtualization for real-world applications
	CO3	Install & Configure the different VM platforms

	CO4	Experiment with the VM with various software
<b>CCS341 Data Warehousing</b>	CO1	Design data warehouse architecture for various Problems
	CO2	Apply the OLAP Technology
	CO3	Analyse the partitioning strategy
	CO4	Critically analyze the differentiation of various schema for given problem
	CO5	Frame roles of process manager & system manager
<b>CCS367 Storage Technologies</b>	CO1	Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
	CO2	Illustrate the usage of advanced intelligent storage systems and RAID
	CO3	Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
	CO4	Examine the different role in providing disaster recovery and remote replication technologies
	CO5	Infer the security needs and security measures to be employed in information storage management
<b>CCS365 Software Defined Networks</b>	CO1	Describe the motivation behind SDN
	CO2	Identify the functions of the data plane and control plane
	CO3	Design and develop network applications using SDN
	CO4	Orchestrate network services using NFV
	CO5	Explain various use cases of SDN and NFV
<b>CCS368 Stream Processing</b>	CO1	Understand the applicability and utility of different streaming algorithms.
	CO2	Describe and apply current research trends in data-stream processing.
	CO3	Analyze the suitability of stream mining algorithms for data stream systems.
	CO4	Program and build stream processing systems, services and applications.
	CO5	Solve problems in real-world applications that process data streams.
<b>CCS362 Security and Privacy in Cloud</b>	CO1	Understand the cloud concepts and fundamentals.
	CO2	Explain the security challenges in the cloud.
	CO3	Define cloud policy and Identity and Access Management.

	CO4	Understand various risks and audit and monitoring mechanisms in the cloud.
	CO5	Define the various architectural and design considerations for security in the cloud.

<b>ELECTIVE IV</b>		
<b>CCS344 Ethical Hacking</b>	CO1	To express knowledge on basics of computer based vulnerabilities
	CO2	To gain understanding on different foot printing, reconnaissance and scanning methods.
	CO3	To demonstrate the enumeration and vulnerability analysis methods
	CO4	To gain knowledge on hacking options available in Web and wireless applications.
	CO5	To acquire knowledge on the options for network protection.
	CO6	To use tools to perform ethical hacking to expose the vulnerabilities.
<b>CCS343 Digital and Mobile Forensics</b>	CO1	Have knowledge on digital forensics. CO2: Know about digital crime and investigations.
	CO2	Know about digital crime and investigations.
	CO3	Be forensic ready
	CO4	Investigate, identify and extract digital evidence from iOS devices.
	CO5	Investigate, identify and extract digital evidence from Android devices.
<b>CCS363 Social Network Security</b>	CO1	Develop semantic web related simple applications
	CO2	Address Privacy and Security issues in Social Networking
	CO3	Explain the data extraction and mining of social networks
	CO4	Discuss the prediction of human behavior in social communities
	CO5	Describe the applications of social networks
<b>CCS351 Modern Cryptography</b>	CO1	Interpret the basic principles of cryptography and general cryptanalysis.
	CO2	Determine the concepts of symmetric encryption and authentication.
	CO3	Identify the use of public key encryption, digital signatures,

		and key establishment.
	CO4	Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
	CO5	Express the use of Message Authentication Codes.
<b>CB3591 Engineering Secure Software Systems</b>	CO1	Identify various vulnerabilities related to memory attacks.
	CO2	Apply security principles in software development.
	CO3	Evaluate the extent of risks.
	CO4	Involve selection of testing techniques related to software security in the testing phase of software development.
	CO5	Use tools for securing software.
<b>CCS339 Cryptocurrency and Blockchain Technologies</b>	CO1	Understand emerging abstract models for Blockchain Technology
	CO2	Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
	CO3	It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
	CO4	Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
<b>CCS354 Network Security</b>	CO1	Classify the encryption techniques
	CO2	Illustrate the key management technique and authentication.
	CO3	Evaluate the security techniques applied to network and transport layer
	CO4	Discuss the application layer security standards.
	CO5	Apply security practices for real time applications.
<b>CCS362 Security and Privacy in Cloud</b>	CO1	Understand the cloud concepts and fundamentals.
	CO2	Explain the security challenges in the cloud.
	CO3	Define cloud policy and Identity and Access Management.
	CO4	Understand various risks and audit and monitoring mechanisms in the cloud.
	CO5	Define the various architectural and design considerations for security in the cloud.

