

Course Outcomes

B. Tech. (2014 Scheme)

3rd Semester

Computer Architecture and Organization (CS-14302)

- CO1 Apply the concepts of computer organization and its relevance to classical and modern problems of computer design.
- CO2 Utilise the knowledge of computer organization as a tool in the engineering of digital systems.
- CO3 Identify and analyse the design of various functional units of digital computer.
- CO4 Identify the role of operating system in interfacing with the computer hardware and the hardware resources.
- CO5 Analyse performance issues in processor and memory design of a digital computer.
- CO6 Examine the performance improvement of processor using instruction level parallelism.

Digital Circuits & Logic Design (CS-14303)

- CO1 Apply knowledge of number systems, codes and Boolean algebra, combinational and sequential circuits to design digital logic circuits.
- CO2 Identify, formulate, and analyse engineering problems in the area of digital logic circuit design.
- CO3 Examine different theoretical investigations of complex digital circuits design using various methodologies.
- CO4 Make use of the techniques, skills, and modern engineering tools necessary for DCLD practices.
- CO5 Function on multi-disciplinary teams through digital circuit assignments.
- CO6 Design and inspect digital circuits to meet desired needs within realistic constraints.

Data Structures and Algorithms (CS-14304)

- CO1 Apply knowledge of statistics and programming skills to solve complex engineering problems related to data structures.
- CO2 Make use of Research based knowledge to identify the appropriate data structure and provide better solution to reduce space and time complexity.

- CO3 Identify, Formulate and analyse data structure to develop skills and understand their applications to perform operations on it.
- CO4 Design appropriate algorithm for autonomous realization of sub-programs to model complex engineering activities.
- CO5 Demonstrate various methods of organizing large amounts of data and recognize systematic way to retrieve data and solve problems.
- CO6 Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.

Object Oriented Programming using C++ (CS-14305)

- CO1 Design a system or component using dynamic memory management concepts to meet desired needs within realistic constraints.
- CO2 Compare and contrast procedure oriented programming with object oriented programming and proposing a solution for selection of appropriate approach to solve the problem.
- CO3 Identify the need of appropriate object oriented programming features and implementing the same to meet the real time need of optimal software's.
- CO4 Function on multidisciplinary teams through groups while working on minor projects concerning problems related to object oriented programming concepts.
- CO5 Utilize the concepts of file handling, templates and exception handling for developing a robust system to store and manage information.
- CO6 Specify abstract data types, their design, implementation and identifying the need of specific data type pertaining to current environment.

Digital Circuits & Logic Design Lab (CS-14306)

- CO1 Identify and apply the knowledge of logic gates and integrated circuits to solve related problems.
- CO2 Design and implement combinational & sequential circuits for engineering problems.
- CO3 Choose and compare the usage of appropriate techniques and tools to solve digital circuits problem.
- CO4 Apply the knowledge acquired to demonstrate the usage of digital circuits in computers at large.

- CO5 Utilize the knowledge and principles of digital electronics while working in multidisciplinary team formation.
- CO6 Discuss and explain the progress of DCLD experiments in form of written reports and through presentations.

Data Structures and Algorithms Lab (CS-14307)

- CO1 Apply knowledge of mathematics and programming skills to implement and analyze different data structures.
- CO2 Evaluate and analyze the time and space complexity of linear and non linear data structures.
- CO3 Design and implement efficient algorithms to solve computing problems in a high level programming language.
- CO4 Utilize knowledge of different data structures to identify and apply the appropriate data structures to solve a real world problem.
- CO5 Compare and analyze different solutions of complex engineering activities with an understanding of their advantages and limitations.
- CO6 Developing an awareness of the data structure for storing data and handling various operations on different applications in the broadest context of technology change.

Object Oriented Programming using C++ Lab (CS-14308)

- CO1 Design and develop programs using object oriented principles in Integrated Development Environment.
- CO2 Propose and evaluate different designs for solving problems using knowledge of object oriented programming and facilities available in Standard Template Library.
- CO3 Identify and selection of appropriate compilation tool according to the environment for creating programs developed using object oriented principles.
- CO4 Examine the erroneous conditions in the programs and debugging the programs using exception handling mechanisms.
- CO5 Design and develop an interactive system that could be able to store, manage and retrieve information using appropriate dynamic memory management techniques and concepts of file handling.
- CO6 Function individually and as a team member and communicating effectively for the design and implementation of project work using object oriented principles.

4th Semester

Discrete Structures (CS-14401)

- CO1 Apply knowledge of mathematical proofs, techniques and algorithms to solve complex engineering problem.
- CO2 Prove elementary properties of modular arithmetic and explain their application in analysis and interpretation of data and synthesis of information to provide valid conclusions.
- CO3 Create, select and apply appropriate techniques to model real world problems using graphs.
- CO4 Identify and formulate solutions of engineering problems related to counting and probability theory.
- CO5 Utilize the importance of discrete structure towards simulation of problems in multi disciplinary environments.
- CO6 Formulate proposition in words to symbolic expression and evaluate the truth value of compound proposition.

Operating Systems (CS-14402)

- CO1 Illustrate how computing resources like CPU and memory are managed by the operating system and describe the basic principles used in the design of modern operating systems.
- CO2 Summarise the full range of considerations in the design of file systems and summarise techniques for achieving synchronisation in an operation system.
- CO3 Explain the operational memory hierarchy and cost-performance trade-offs and the relative merits and suitability of each for complex user applications.
- CO4 Compare and contrast the common algorithms used for both pre-emptive and non-pre-emptive scheduling of tasks in operating systems, such as priority, performance comparison, and fair-share schemes.
- CO5 Evaluate and report appropriate design choices for solving real-world problems.
- CO6 Analyse the key trade-offs between multiple approaches to operating system design.

Computer Networks (CS-14403)

- CO1 Apply the knowledge of different network designs and various logical models of networking to solve problems of communication over different medium.
- CO2 Identify and analyze protocols concerning various network technologies over different medium and layers.
- CO3 Discuss algorithms for medium access sub layer to avoid collision and error problems

over different types of networks.

- CO4 Utilize knowledge of routing and congestion control algorithms to overcome various issues over different complex networking structures.
- CO5 Analyze various protocols to develop network related applications for future needs.
- CO6 Make use of various communication protocols that provide reliable, ordered and error checked delivery of a stream of octets.

Microprocessor Architecture and Programming (CS-14404)

- CO1 Understand the taxonomy of microprocessors and knowledge of contemporary microprocessors.
- CO2 Describe the architecture, bus structure and memory organization of 8085 as well as higher order microprocessors.
- CO3 Explore techniques for interfacing I/O devices to the microprocessor 8085 including several specific standard I/O devices such as 8251 and 8255 etc.
- CO4 Demonstrate programming using instruction set of 8085 microprocessor.
- CO5 Understand the various addressing modes of 8085 and 8086.
- CO6 Design structured, well commented, understandable assembly language programs to provide solutions to real world control problems.

Java Programming (CS-14405)

- CO1 Apply object oriented programming techniques to propose solution pertaining to real world problem.
- CO2 Identify and analyze the various aspects of a specific problem and apply the concepts of classes and objects to develop object oriented model.
- CO3 Utilize the concept of inheritance and polymorphism to formulate a solution for complex analytical problem.
- CO4 Examine the errors in the developed system and resolve them by applying the knowledge of exception handling.
- CO5 Design console based, GUI based and web based applications by implementing various concepts like event handling, applets and database connectivity.
- CO6 Utilize the concept of networking to develop systems for establishing communication between client and server.

Operating Systems Lab (CS-14406)

- CO1 Analyse the services, architectures and principles used in the design of modern operating systems.
- CO2 Execute Linux commands for files and directories, creating and viewing files, File

comparisons and Disk related commands.

- CO3 Utilize the concept of virtualization for creating a virtual machine and installing operating system on virtual machine.
- CO4 Demonstrate shell programming by using shell variables and shell keywords for automated system tasks.
- CO5 Identify the key characteristics of multiple approaches used for the design and development of the operating system.
- CO6 Apply system commands for performing the file manipulation, program execution, and printing text.

Computer Networks lab (CS-14407)

- CO1 Analyze and configure protocols concerning various network technologies over different mediums and layers.
- CO2 Apply the knowledge of different network components, transmission mediums and tools to solve various problems of communication.
- CO3 Design and develop different network design and logical models of networking to solve network related problems.
- CO4 Utilize knowledge of modern network simulation tools to propose solution for efficient working of networks for real world problems..
- CO5 Make use of various troubleshooting methods to overcome networking problems.
- CO6 Function in multidisciplinary teams through groups while working in different network environments with the help of resource sharing.

Microprocessors Architecture and Programming lab (CS-14408)

- CO1 Implement the basic programming for Arithmetic and Logical operations in 8085 and 8086 microprocessors.
- CO2 Explain the concepts of memory and I/O interfacing with microprocessor
- CO3 Examine the fundamentals of assembly language programming.
- CO4 Understand the concept of computer arithmetic instruction set by designing code for arithmetic, logical and data transfer operations.
- CO5 Solve basic binary math operations by using the instructions of microprocessor.
- CO6 Study to interface 8085 with I/O and other devices.

Java Programming Lab (CS-14409)

- CO1 Apply the knowledge of JAVA language syntax and semantics to write and execute Java programs.
- CO2 Analyse the different aspects of a specific problem and design Java programs based on object-oriented principles like classes, objects, constructors and inheritance.

- CO3 Using the concept of applets and event handling develop GUI interfaces for a computer program to interact with users and to implement the event-based GUI handling principles.
- CO4 Identify various erroneous conditions in the system and implement the merits of exception handling techniques to make the system bug free.
- CO5 Work in teams to apply the knowledge of event handling, applets, networking features and database connectivity to develop business-oriented web based solution.
- CO6 Design Java programs to design a system to meet industrial needs and to solve real world problems based on client-server communication.

General Fitness (CS-14401)

- CO1 Understand the need and importance of participation in co-curricular activities.
- CO2 Develop social and moral duties relevant to professional engineering practices by participation in various events.
- CO3 Explain the importance of participation in sports to teamwork and gain physical strength.
- CO4 Improve personality development skills by public speaking among students.
- CO5 Understand the impact of technological practices to overcome environmental and social problems.
- CO6 Identify problems faced and gained knowledge to overcome problems and gaining lifelong learning principles.

5th Semester

Relational Database Management System (CS-14501)

- CO1 Identify the user requirements from a typical business situation, and to document them.
- CO2 Analyse the data, processes, business rules in a business operation, and to design a non-redundant relational database.
- CO3 Examine the data and develop a database system through an information requirements analysis.
- CO4 Utilize information efficiently and effectively from a relational database system using a variety of data retrieval techniques.
- CO5 Design and develop a relational database system with appropriate functionality to process the data and with constraints to maintain data integrity and avoid data redundancy.
- CO6 Understand the implementation issues that accompany analytical problem solving.

Computer Graphics (CS-14502)

- CO1 Apply the concepts of mathematical foundations and programming to solve diverse problems related to computer graphics.
- CO2 Compare and contrast various computer graphic algorithms and their suitability to real world problems.
- CO3 Design and develop models for transformation of 2D and 3D objects.
- CO4 Identify the areas of computer graphics to apply advance algorithmic techniques for changing the formations of geometrical objects.
- CO5 Apply mathematics and physics in the design and development of graphics applications.
- CO6 Discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Design and Analysis of Algorithms (CS-14503)

- CO1 Understand and learn the basic fundamental techniques for designing algorithms.
- CO2 Learn various advanced techniques to design algorithms for solving complex problems.

- CO3 Design the algorithms using basic and advanced algorithm design techniques.
- CO4 Identify and design various existing algorithms based on advanced techniques.
- CO5 Analyse the algorithms based on time and space complexity to find optimal algorithm for a given problem.
- CO6 Categorize various problems based on the complexity and properties of algorithms that solves these problems.

Web Technologies (CS-14504)

- CO1 Apply the knowledge of web technology stack to deploy various web services.
- CO2 Analyze and evaluate web technology components for formulating web related problems.
- CO3 Design and develop client server internet application that accommodates user specific requirements and constraints analysis.
- CO4 Select latest web technologies and tools by conducting experiments with an understanding of the limitations.
- CO5 Apply advance concepts of web APIs to build web projects in multidisciplinary environments.
- CO6 Apply appropriate techniques to access security issues relevant to the design considerations of internet security.

Web Technologies (CS-14514)

- CO1 Create static website using HTML, CSS and add dynamic functionality to it by using PHP, JavaScript on real world problems.
- CO2 Test modern tools and resources such as wordpress, joomla, apache to identify environments currently available on the market to design websites.
- CO3 Implement the concepts such as cookies and sessions to create interactive web applications and build database connectivity using MySQL.
- CO4 Design and develop client server internet application that accommodates user specific requirements and constraints analysis.

- CO5 Apply the programming principles to implement communication and synchronization among processes to build web projects in multidisciplinary environments.
- CO6 Compose documentation and effective reports to interpret clear instructions of experiments.

Cryptography and Network Security (DECS-14506)

- CO1 Apply the knowledge of existing authentication protocols and key management techniques to provide security solutions.
- CO2 Identify and analyze network security attacks and counter measures to prevent those attacks.
- CO3 Evaluate network security models using available solutions such as PGP, SSL, IPSec to provide robust framework for security threats.
- CO4 Assess impact of system and web security threats to ensure secure transmission of data.
- CO5 Analyze the security requirements and solutions for maintaining Data integrity using modern techniques for data transmission.
- CO6 Testing and verification of cryptography aspects by integrating people, processes and technologies.

Wireless Networks (DECS-14507)

- CO1 Apply the knowledge of basic concepts of wireless networks to solve problems of communication
- CO2 Identify and analyze traffic theories, mobile radio propagation, channel coding and cellular concepts.
- CO3 Classify network protocols, ad hoc and sensor networks, wireless MAN's and LAN's.
- CO4 Make use of various cellular concepts in design and principles of cellular operations.
- CO5 Utilize the theories of physical layer and MAC layer in the architecture of PAN's.
- CO6 Apply the theories of network security technologies and their protocols for secure communication over wireless network

Ethical Hacking (DECS-14508)

- CO1 Apply the knowledge of security threats, attacks, ethical hacking to exploit the vulnerabilities related to computer system and networks.

- CO2 Examine the process an ethical hacker follows to identify loopholes in the existing system by using modern tools and develop a solution to fix the problems to make it a robust system.
- CO3 Evaluate existing security policies, procedures and infrastructure to prevent or mitigate the effects of data breach.
- CO4 Select appropriate algorithms of steganography and cryptography to assess safety issues and to ensure privacy, integrity and confidentiality by avoiding highly sophisticated cyber-attacks such as password cracking, eavesdropping, sniffing and spoofing.
- CO5 Make use of research-based ethical principles associated with cyber security practice to protect the restricted information from unauthorized access.
- CO6 Analyze scanning techniques, information gathering methodology and foot printing to detect live systems and to discover services running on target systems or wireless networks using web tools and testing.

Embedded Systems (DECS-14510)

- CO1 Apply the conceptual information of embedded system to modern trends of system design.
- CO2 Utilise the knowledge of core of the embedded systems like processor selection, selection of memory and communication interface to design a specific system.
- CO3 Identify and analyze different characteristics and attributes of embedded system.
- CO4 Use the knowledge of embedded system with 8051 and examine the factors for selecting microcontroller, memory organization, ports and interrupts.
- CO5 Choose an engineering approach of analog and digital electronics component to design embedded firmware.
- CO6 Identify and analyze the role of operating system in interfacing with hardware, handling processes and tasks, memory management, task communication/ synchronization and handling device drivers to choose specific RTOS.

Relational Database Management System Lab (CS-14511)

- CO1 Understand, analyze and apply common SQL statements including DDL, DML and DCL statements to perform different operations.
- CO2 Design different views of tables for different users and to apply embedded and nested queries.

- CO3 Design and implement a database for a given problem according to well known design principles that balance data retrieval performance with data consistency.
- CO4 Demonstrate and understand relational algebra in Database which is helpful to design related database software components.
- CO5 Identify the user requirements from a typical business situation, and to document them.
- CO6 Emphasize on team work and developing database applications using modern database tools.

Computer Graphics Lab (CS-14512)

- CO1 Understand the structure of modern computer graphics
- CO2 Develop and design drawings that demonstrate computer graphics and design skills
- CO3 Make use of the key algorithms for modelling and rendering graphical data.
- CO4 Develop, design and problem solving skills with application to computer graphics.
- CO5 Gain experience in constructing interactive computer graphics programs using OpenGL.
- CO6 Creating programs in C++ to implement various graphical features like clipping, filling, etc

Design and Analysis of Algorithms Lab (CS-14513)

- CO1 Construct algorithms using basic design techniques for searching, sorting and graph algorithms.
- CO2 Design algorithm using advanced techniques for solving complex problems.
- CO3 Identify the given problem and formulate and design algorithm for solving given problem.
- CO4 Use modern engineering tools and latest programming language to implement the designed algorithms.
- CO5 Apply knowledge and function on multi-disciplinary teams through mini projects based on various problems.
- CO6 Analyse the performance of various algorithms to choose the optimum algorithm.

6th Semester

Theory of Computation (CS-14601)

- CO1 Apply the knowledge of mathematics and statistics to solve complex engineering problems related to automata theory.
- CO2 Identify, formulate and analyze uses and Constraints of various computational models used in engineering practice.
- CO3 Make use of research based knowledge to abstract the models of computing and their powers to recognize the grammars.
- CO4 Design and evaluate abstract machines that demonstrate the properties of physical machines and be able to specify the possible inputs, processes and outputs of these machines.
- CO5 Compare and analyze different computational models including prediction and modelling to complex engineering activities with an understanding of the limitations.
- CO6 Recognize and comprehend formal reasoning about machines and languages to engage in independent and life-long learning in the broadest context of technological change

Advanced Database Systems (CS-14602)

- CO1 Apply and analyze knowledge of PL/SQL, transaction processing, concurrency control, query processing and optimization concepts to solve relevant database problems.
- CO2 Explain and motivate the usage of database tools in engineering practice.
- CO3 Interpret the perceived knowledge of advanced database concepts for development of databases.
- CO4 Utilize the knowledge of advanced database systems design concepts for independent engineering solutions.
- CO5 Identify the use and influence of advanced database system concepts and tools in the engineering practice.
- CO6 Discuss various advanced database concepts to develop an understanding of their application in database design.

Software Engineering (CS-14603)

- CO1 Plan a software engineering process life cycle, including the specification, design, and implementation.
- CO2 Elicit, analyse and specify software requirements through a productive working relationship with various stakeholders of the project.
- CO3 Analyse and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.
- CO4 Develop the code from the design and effectively apply relevant standards for quality

management and practice.

CO5 Formulate a testing strategy for a software system, employing techniques such as unit testing, test driven development and functional testing.

CO6 Identify modern engineering tools necessary for software reengineering and reverse engineering.

Advanced Database Systems Lab (CS-14610)

CO1 Implement query processing using PL/SQL programming concepts.

CO2 Create database and implement cursor management, error handling, packages and trigger.

CO3 Make use of query optimization techniques for efficient retrieval of data and also demonstrate the basic of query evaluation.

CO4 Illustrate the concept of object oriented and/or relational database and study of some existing object oriented and/or relational database system.

CO5 Identify and analyse any distributed and parallel database management system.

CO6 Apply data mining tool on the dataset to predict required patterns.

Software Engineering Lab (CS-14611)

CO1 Identify and apply the knowledge of system analysts to plan a feasibility study including requirement elicitation and specifications.

CO2 Recognize the cost/benefits of software planning, configuration management and handling risks.

CO3 Explore and select the appropriate planning and estimation models for better evaluation of the software projects

CO4 Analyze and understand various tools, their components and descriptions for project planning and designing purpose.

CO5 Design and evaluate various test cases for implementing testing techniques and effectively applying relevant standards for quality management.

CO6 Identify the most common pitfalls of code using debuggers and be able to locate, analyse, and fix the errors.

Simulation and modeling (DECS-14604)

CO1 Analyse a real world problem and apply modelling methodologies to develop a discrete-event simulation model.

CO2 Recognise the cost/benefits of computer simulation, the generation of meaningful results, decision making, and risks.

CO3 Interpret and contrast discrete-event techniques for implementing a solution to a simulation problem.

CO4 Compare and evaluate alternative system designs using sampling and regression.

- CO5 Formulate judgements and synthesize conclusions through research of a simulation topic.
- CO6 Improve the operation of a dynamic system according to simulation results

Digital Image Processing (DECS-14605)

- CO1 Develop a theoretical foundation of digital image representation, manipulation, encoding and pre- processing depending on the decoded quality.
- CO2 Apply the knowledge of mathematics, science and engineering principles to digital image processing.
- CO3 Compare and contrast various image processing techniques for processing these contemporary images as a life-long learning process.
- CO4 Develop a model to a real world by applying modern image processing tools such as MATLAB, OCTAVE.
- CO5 Determine latest trends in digital image technology and develop techniques for processing these contemporary images or a life-long learning process.
- CO6 Identify potential applications of image processing to advancement of knowledge in sciences and engineering with benefits in, e.g., policing, public safety, and social issues such as privacy.

Artificial Intelligence (DECS-14606)

- CO1 Understand the informed and uninformed problem types and apply search strategies to solve them.
- CO2 Apply and analyze AI techniques to solve real-world problems using expert knowledge.
- CO3 Design and evaluate intelligent expert models for perception and prediction from intelligent environment.
- CO4 Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
- CO5 Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.
- CO6 Examine the issues involved in knowledge bases, reasoning systems and planning.

.NET Technologies (DECS-14608)

- CO1 Understand the .Net programming concepts to design the solution for real world application.
- CO2 Apply the knowledge of .Net Framework and C# programming constructs to design and implement the various real world applications.
- CO3 Apply the programming principles to implement communication and synchronization among processes to build projects in multidisciplinary environments.

CO4 Test modern and advanced concept such as web services, WCF and WPF in project development.

CO5 Apply good programming ethics and responsibilities using .Net technology.

CO6 Identify the need and ability to engage in independent and life-long learning in the broadest context of .NET technologies.

Linux Administration (DECS-14609)

CO1 Apply the knowledge of Linux operating system and management techniques to provide security solutions.

CO2 Identify and analyze the core system services and internet services.

CO3 Evaluate management and manipulation of Linux operating system.

CO4 Assess impact of system and plan for preserving security in Linux operating system.

CO5 Analyze the benefits, functions and features of Linux operation system.

CO6 Determine the usage and management of the space in Linux operating system.

Simulation and modelling Lab (CS-14613)

CO1 Construct a model for a given set of data and analyze output produced to test validity of the model.

CO2 Apply numerical methods to interpret, extract, analyse and present simulation result.

CO3 Develop simulation programs to design a system that meets industrial requirements and solves real world problems based on client server communication.

CO4 Test modern simulation tools and resources to measure the performance of different simulation models.

CO5 Make use of problem solving approaches to work challenges and make decisions in teams.

CO6 Compose documentation and effective reports to interpret clear instructions of experiments.

Digital Image Processing Lab (DECS-14614)

CO1 Design and implement algorithms to perform basic image processing operations.

CO2 Construct and implement algorithms for advanced image processing such as compression, segmentation, representation etc.

CO3 Apply mathematical, scientific and engineering techniques to compare and contrast the features of digital images.

CO4 Apply knowledge of software tools such as MATLAB, OCATVE and other techniques with hands-on experience for processing digital images.

CO5 Develop programming skills to solve problems related to digital image processing.

CO6 Analyse the performance of image processing algorithms and systems.

Artificial Intelligence Lab (DECS-14615)

CO1 Apply the good programming skills to formulate the solutions for computational problems using Python.

CO2 Design and develop solutions for informed and uninformed search problems in AI.

CO3 Utilize advanced package like NLTK for implementing artificial intelligence.

CO4 Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.

CO5 Develop a minor project in multidisciplinary areas to demonstrate team work through reports and presentation.

CO6 Design and develop an Expert System that operates in a realistic problem domain and communicate effectively in a team or individual and prepare reports.

.NET Technologies Lab (DECS-14617)

CO1 Apply the .Net programming concepts to design the solution for real world application
CO2 Develop the working knowledge of C# programming construct and the .NET framework

on real world problems.

CO3 Test modern tools and resources to identify environments currently available on the market to design websites.

CO4 Implement the concepts of web services, WPF and WCF to create interactive applications and build database connectivity using ADO.NET.

CO5 Apply the programming principles to implement communication and synchronization among processes to build web projects in multidisciplinary environments.

CO6 Compose documentation and effective reports to interpret clear instructions of experiments.

Linux administration Lab (DECS-14618)

CO1 Demonstrate the Installation and configuration of Linux Operating System.

CO2 Explain the configuration and administration of various servers in Linux Operating System.

CO3 Organize configuration and maintain various environment variables in Linux Operating System.

CO4 Formulate and manage database, tables, files and folders in Linux Operating

System.

CO5 Classify the Linux File System in Linux.

CO6 Select, choose and manage the resources and security of a computer running Linux at a basic level.

OECS-14601 Software Project Management

CO1 Understand and apply the activities involved in the management of software projects. CO2 Analyse the various software development environments and risk management.

CO3 Develop and apply the key strategies to monitor, control and quality assurance of software projects.

CO4 Select the appropriate planning and estimation models to better evaluate the software projects.

CO5 Create a strong working knowledge of ethics and professional responsibility.

CO6 Develop effective organisational, leadership and change skills for managing projects, teams and stakeholders.

7th/8th Semester

Advanced Computer Networks (CS-14701)

- CO1 Apply the knowledge of various modes of communication to solve problems of data communication over different medium using various technologies.
- CO2 Understand and utilize various communication protocols that provides reliable, ordered, and error-checked delivery of a stream of octets.
- CO3 Design and implement various algorithms of network to ease the communication problems over different geographical areas and evaluate the level of security.
- CO4 Compare different routing protocols and propose the optimal solution concerning different structures of networks.
- CO5 Design and implementation of routing and transport layer protocols for advanced multi hop networks for smooth flow of data over different networks.
- CO6 Utilize knowledge of modern mobile adhoc network techniques to propose solutions for mobile networking demands.

Compiler Design (CS-14702)

- CO1 Apply knowledge of system programming and mathematics to solve problems related to language translation.
- CO2 Identify, formulate and solve engineering problems in the area of language translation and compiler design.
- CO3 Formulate machine code by considering the system design components and functionalities involved in compilation.
- CO4 Inspect runtime structure used to represent constructs of programming language during compilation process.
- CO5 Make use of compiler phases to develop an understanding of their use in building tools used for engineering practice.
- CO6 Developing an awareness of the functionality and complexity of modern compilers to engage in independent and life-long learning in the broadest context of technological change.

Cyber Laws and IPR (CS-14703)

- CO1 Apply the knowledge of cyber security systems to solve the complex problems of cybercrime.
- CO2 Apply reasoning informed by concepts of e-commerce to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

- CO3 Make use of Intellectual Property Rights and commit to professional ethics and responsibilities and norms of the engineering practice.
- CO4 Recognize the need for patents and to engage in life-long learning in the broadest context of cyber security.
- CO5 Examine the legal and policy developments in various countries for cyber space and synthesis of the information to provide valid conclusions.
- CO6 Identify and analyze national and international cyber issues reaching substantiated conclusions using first principles of cyber security.

Advanced Computer Networks Lab (CS-14715)

- CO1 Apply the knowledge of packet analyzer to distinguish the different types of data traffic.
- CO2 Utilize knowledge of modern network simulation tools to configure the switches, VLANs, Trunk Ports and routers.
- CO3 Analyze performance of various communication protocols
- CO4 Design and develop different network design and logical models of networking to solve network related problems.
- CO5 Understand the working of Network Management Software.
- CO6 Analyze and Configure Adhoc Network between different computers.

Parallel computing (DECS-14704)

- CO1 Apply the knowledge of parallel architectures, programming models and algorithmic principles to design software solutions for parallel processing problems.
- CO2 Analyze the efficiency of parallel algorithm to improve the performance for its best utilization.
- CO3 Identify the requirements of parallel programming models to develop parallel applications.
- CO4 Make use of modern methods and techniques on heterogeneous platforms to propose valid conclusions.
- CO5 Classify parallel processing systems with appropriate consideration for scheduling, synchronization, hardware, interconnect networks and programming models.
- CO6 Develop parallel versions of existing algorithms using a group of processors in order to achieve load balancing and communication among processes.

Mobile Computing (DECS-14705)

- CO1 Analyze the process and architecture of mobile computing and communication to interpret the functioning.

- CO2 Apply advance data communication methods and networking protocols for wireless and mobile environment.
- CO3 Construct solutions for mobile networking problems and make decisions using suitable engineering methodologies.
- CO4 Create the awareness of lifelong learning, business ethics, and current marketing scenarios by proposing solutions in the mobile's technological change.
- CO5 Evaluate both theoretical and practical issues of mobile computing by conducting investigations of complex problems.
- CO6 Identify the important issues and concerns of mobile computing for society.

Cloud Computing (DECS-14706)

- CO1 Compare and contrast the different computing paradigms.
- CO2 Make use of core technologies of cloud computing in selection of cloud deployment model.
- CO3 Classify the various service models of cloud.
- CO4 Assess the various issues and challenges in context of cloud security.
- CO5 Compare and contrast open cloud platforms with commercial cloud platforms.
- CO6 Design and plan a cloud using open cloud platforms.

Big Data and Business Analytics (DECS-14707)

- CO1 Apply knowledge of statistics, science and programming skills, to solve of complex analytical problems related to big data and business analytics.
- CO2 Identify, formulate, and analyse business analytical problems concerning and demanding big data.
- CO3 Design and evaluate fully distributed model of big data to solve real time problems.
- CO4 Make use of research-based knowledge to identify the appropriate data collection methods, apply statistical methods to analyse, synthesis and interpretation of data, to provide valid conclusions.
- CO5 Utilise knowledge of modern tools such as Hadoop, NoSQL, and Artificial intelligence techniques to propose solutions for business analytic demands.
- CO6 Function in multi-disciplinary teams through groups while working on mini-project concerning business analytical problems.

Data Warehousing & Data Mining (DECS-14708)

- CO1 Apply and analyze various data warehouse and data mining techniques to solve real world data issues.
- CO2 Compare and contrast various data warehouse and data mining techniques & tools

for different types of databases.

CO3 Identify the need data warehouse and data mining techniques & tools for designing and developing different types of databases.

CO4 Explain the purpose of adapting to the data warehouse and data mining techniques.

CO5 Discuss various case studies to identify needs and patterns for business domains.

CO6 Examine and explain various applications & trends of data warehouse and data mining techniques in various domains.

Natural Language Processing (DECS-14709)

CO1 Apply the knowledge of mathematics and engineering to understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information.

CO2 Understand approaches to discourse, generation, dialogue and summarization within NLP.

CO3 Discuss the key concepts from natural language processing and to describe and analyse language, POS tagging and context free grammar for English language.

CO4 Identify the capabilities and limitations of current natural language technologies and implements some of the algorithms and techniques that underlie these technologies.

CO5 Be familiar with different NLP Concepts and resources for doing research in NLP.

CO6 Illustrate the concepts of morphology, syntactic analysis, semantic interpretation and pragmatics of the language, demonstrating them with different approaches.

Machine Learning (DECS-14710)

CO1 Explain machine learning with its types and, design decision tree learning algorithms for real problems.

CO2 Design algorithms based on Bayesian learning and hidden Markov model for the solution of engineering problems

CO3 Demonstrate instance based learning and neural networks for learning linear and non-linear activation functions

CO4 Apply support vector machine classification algorithm to optimize hyper-plane with maximum margin.

CO5 Develop solutions for real life problems related with unclassified and unsupervised learning

CO6 Discuss applications of machine learning algorithms designed for technical and social problems

Parallel computing Lab (DECS-14717)

CO1 Analyze the complexity of parallel algorithm to improve the performance of the code for its best utilization.

- CO2 Test modern tools and resources on heterogeneous platforms to propose valid conclusions.
- CO3 Experiment with parallel versions of existing algorithms using a group of processors to develop optimized code in different parallel programming support environments such as CUDA, Open MP, MPI.
- CO4 Compile the parallel code to debug and fix the errors with appropriate consideration for scheduling, Load balancing, hardware, interconnect networks and programming models.
- CO5 Apply the programming principles to implement communication and synchronization among processes to build projects in multidisciplinary environments.
- CO6 Design documentation and effective reports to interpret clear instructions of experiments.

Mobile Computing Lab (DECS-14718)

- CO1 Select appropriate components and networks for simulation environment for particular real life application that meet the specified needs.
- CO2 Create and analyse mobile and wireless network using computational engineering tools by working in a team or individually.
- CO3 Design and develop solutions using problem solving principles, logic and systematic methodologies.
- CO4 Evaluate the architecture and principles of operation of computer systems and networks and document the same in reports.
- CO5 Combine new knowledge in the field of computer science by using appropriate research methodologies to manage projects in multidisciplinary environments.
- CO6 Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for sustainable development.

Cloud Computing Lab (DECS-14719)

- CO1 Make use of CloudSim toolkit for performing different experiments
- CO2 Apply CloudAnalyst simulation tool to perform various tasks.
- CO3 Compare and contrast the various cloud simulation tools.
- CO4 Assess the performance of cloud computing application.
- CO5 Develop energy efficiency model of cloud datacenter using Green Cloud simulation tool.
- CO6 Apply the CloudReports tool to simulate Infrastructure as a Service (IaaS) provider.

Big Data and Business Analytics Lab (CS- 14720)

- CO1 Design and setup standalone and fully distributed model of big data to meet and analyse the data specific to real time problems.
- CO2 Apply programming skills develop methodology to the solve of complex analytical problems related to big data and business analytics
- CO3 Use and apply knowledge of modern tools such as Hadoop, NoSQL, and Artificial intelligence techniques required for business analytics.
- CO4 Demonstrate knowledge and understanding of the principals of big data and business and function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings while handling diverse analytical problems.
- CO5 Communicate effectively on complex engineering activities with peers to discuss the progress through effective presentations and effectively written reports.
- CO6 Recognise and identify the need for, and have the preparation and effectively provide the analytical solutions to diverse fields and engage their self for life-long learning in the broadest context of technological change.

Data Warehousing & Data Mining Lab (DECS-14721)

- CO1 Analyze and make use of different features of R-Language to design and solve data warehouse and data mining problems.
- CO2 Select data warehouse and data mining techniques for solving different engineering problems.
- CO3 Examine and estimate the usage of data warehouse and data mining in engineering practice.
- CO4 Discuss the applications of data warehouse and data mining tools at large through provided case studies.
- CO5 Make use of knowledge acquired to determine the necessity of data warehouse and data mining in other areas while working in multi-disciplinary teams.
- CO6 Interpret and formulate the work done in form of written reports and through presentations.

Software Testing and Quality Assurance (DECS-14711)

- CO1 Discuss methods and procedures for software development that can be used to consistently produce high-quality software within realistic constraints.
- CO2 Identify test plan strategy for a software testing problem and work together as a team in preparing a report.
- CO3 Generate test cases from software requirements using various test processes for continuous quality improvement.

- CO4 Analyse the inputs and outputs of the testing process and solve these problems by designing software test models, criteria, strategies and methods.
- CO5 Apply techniques and skills on how to use modern software testing tools to support software testing projects.
- CO6 Understand the importance of standards in the quality management process and their impact on the final product.

Information Security (DECS-14712)

- CO1 Evaluate, analyze and apply the concepts of information security to safeguard information.
- CO2 Utilize appropriate cryptographic techniques to tackle and solve real world problems related to information security.
- CO3 Make use of advanced information security tools such as Wireshark, NMAP etc. to provide solutions to information security issues.
- CO4 Analyze and identify barriers in securing information and to provide solutions to overcome those barriers.
- CO5 Demonstrate the ethical principles of information security while engaging in life-long learning.
- CO6 Apply various approaches of information security to provide reliable and secure delivery of information for better communication.

Soft Computing (DECS-14713)

- CO1 Learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques.
- CO2 Scrutinize the roles of neural network, fuzzy logic and genetic algorithms to build intelligent machines.
- CO3 Identify and select a suitable soft computing technology to solve the problem.
- CO4 Apply soft computing techniques as computational tools to solve a variety of problems related to optimization and machine learning.
- CO5 Elaborate the basics of evolutionary computing paradigms and their application to engineering optimization problems.
- CO6 Evaluate and compare solutions by various soft computing approaches for a given problem.

Agile Software Development (DECS-14714)

- CO1 Understand concept of agile software engineering and its advantages in software development.
- CO2 Define the core practices behind a number of specific agile methodologies.

- CO3 Understand the roles and responsibilities are in agile projects and their difference from projects following traditional methodologies.
- CO4 Describe implications of functional testing, unit testing, and continuous integration.
- CO5 Explain the role of design principles in agile software design.
- CO6 Understand the various tools available to agile teams to facilitate the project.