B.Tech (Software Engineering)

Program Outcomes (POs)

PO1: Apply mathematics, science, engineering fundamentals and an engineering specialization to the conceptualization of engineering models.

PO2: Identify, formulate, research literature and solve complex engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO3: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PO5: Create, select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

PO6: Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.

PO7: Understand the impact of engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.

PO8: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

PO9: Understand and commit to professional ethics and responsibilities and norms of engineering practice.

PO10: 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.

PO11: Demonstrate a knowledge and understanding of management and business practices, such as risk and change management, and understand their limitations.

PO12: Recognize the need for, and have the ability to engage in independent and life-long learning.

Program Specific Outcomes (PSO)

PSO1: Ability to analyze the requirements, design, develop software programs. Also evaluate and recognize potential risks and provide creative solutions.

PSO2: Ability to apply their skills in the field of agile software development, Project management, Quality and cost management, DevOps, cultivating skills through higher studies and entrepreneurship.

Course Outcomes (COs)

2018-22 Batch

Semester	Course Code	Course Name	Course Outcomes (COs)
III	**18BS3CS02**	**Mathematics for Computer Science**	CO1: Solve logical reasoning to verify the correctness of the logical statements and Perform set operations to describe the languages. CO2: Use the concepts of relations, partially ordered sets and lattices in relational data bases and data structures. CO3: Examine the concepts of graphs to understand Mathematical structures and techniques in computer applications. CO4: Describe the foundations of probabilistic and statistical analysis mostly used in various applications in engineering and computer sciences. CO5: Use the concept of random variables, Distributions and its properties to analyze the statistical data.

	18HSS03	**Economics for Engineers**	CO1: Identify and explain economic concepts and theories related to the behavior of economic agents, markets, industry and firm structures, legal institutions, social norms, and government policies CO2: Demonstrate an awareness of the role in the global economics environment CO3: Employ theoretical knowledge with quantitative and qualitative evidence in order to explain past economic events and to formulate predictions on future ones CO4: Assess the consequences of economic activities and institutions for individual and social welfare CO5: Use the basic theories of economics in critical thinking and problem solving

	18CSI301	**Data Structures using C**	CO1: Describe Various types of data structures, operations and algorithms, Sorting and searching operations, File structures. CO2: Explain the concept of Dynamic memory management, data types, algorithms. CO3: Develop the programs choosing appropriate data structure to implement various operations of stacks, queues, linked lists and their applications. CO4: Use trees concepts to solve problems. CO5: Distinguish various graph algorithms and techniques for finding minimum path. CO6: Identify and use a suitable data structure and algorithm to solve a real world problem.
	18CSI302	**OOPS Using Java**	CO1: Explain the Basics of Java Environment and Programming basics CO2: Employ Object Oriented Programming concepts CO3: Design programs using Strings and Exception handling CO4: Design applications using Packages and interfaces. CO5: Develop Multithreaded Applications CO6: Develop I/O stream applications and GUI applications using Swing Fundamentals

	18CS3SP03	**Digital Electronics**	CO1: Describe number systems and its arithmetic operations and Illustrate Use of Boolean algebra. CO2: Illustrate truth table and logic circuits in SOP, POS form & conversion of SOS, POS forms into canonical forms CO3: Formulate and apply Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest POS and SOP forms. CO4: Explain the working of combinational and sequential circuits with characteristic equation and truth table. CO5: Design and implement combinational circuits CO6: Design and implement synchronous and asynchronous sequential circuits

	18CSI301L	**Data Structures Using C Lab**	CO1: Describe Various types of data structures, operations and algorithms. Sorting and searching operations. - File structures. CO2: Explain the concept of Dynamic memory management, data types, algorithms. CO3: Develop the programs choosing appropriate data structure to implement various operations of stacks, queues, linked lists and their applications. CO4: Use trees concepts to solve problems. CO5: Distinguish various graph algorithms and techniques for finding minimum path. CO6: Identify and use a suitable data structure and algorithm to solve a real world problem.
	18CSI302L	**OOPS Using Java Lab**	CO1: Explain the Basics of Java Environment and Programming basics CO2: Employ Object Oriented Programming concepts CO3: Design programs using Strings and Exception handling CO4: Design applications using Packages and interfaces. CO5: Develop Multithreaded Applications CO6: Develop I/O stream applications and GUI applications using Swing Fundamentals

	18CSI301L	**Digital Electronics Lab**	CO1: Describe number systems and its arithmetic operations and Illustrate Use of Boolean algebra. CO2: Illustrate truth table and logic circuits in SOP, POS form & conversion of SOS, POS forms into canonical forms CO3: Formulate and apply Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest POS and SOP forms. CO4: Explain the working of combinational and sequential circuits with characteristic equation and truth table. CO5: Design and implement combinational circuits CO6: Design and implement synchronous and asynchronous sequential circuits
	18MCC02	**Energy Studies**	CO1: Describe energy scenario and its importance to the society. CO2: State few energy management and energy conservation techniques in daily life. CO3: Explain energy policies. CO4:Discuss emerging technologies importance in today's energy scenario

IV	**18CS4SP04**	**Database Management Systems**	CO1: Define database concepts and its architectural components. CO2: Explain the various data models used for designing a database. CO3: Use entity relationship and relational models to design a database. CO4: Employ relational operations and entity relationship mapping concepts to design the behavior and structure of a database. CO5: Use transaction management concepts, inference rules and normalization to optimize database operations. CO6: Write SQL and PL/SQL codes to operate and manage database management system.

	18CSI401	**Design and Analysis of Algorithms**	CO1: Explain the process of designing and analyzing an algorithm through basic problem types and asymptotic notations. CO2: Identify the key characteristics of a given problem, suitable design approach and its impact on performance. CO3: Solve the given real time problems through an appropriate design strategy. CO4: Examine the space and time efficiency of an algorithm and compare with other design strategy. CO5: Select the best design strategy suitable for optimization problems. CO6: Demonstrate an algorithm using appropriate design strategies for problem solving.

	18CS4SP05	**Principles of Operating Systems**	CO1: Use the features of types of operating systems, functions, structure, and operations on the processes executing in the system to solve the problems. CO2: Employ the knowledge scheduling algorithms to solve the real life problems. CO3: Examine the deadlocks occurred in the real world applications and will be able to provide the remedial measures to avoid the deadlock situation. CO4: Employ the concepts of memory management including virtual memory and resource sharing among the user application processes. CO5: Solve the problems related to file system interface and implementation, disk management and protect the system. CO6: Use UNIX tools using features such as filters pipes, redirection, and regular expressions. Customize their UNIX working environment.

	18HSS04	**Business Communication and Presentation Skills**	CO1: Develop abilities to overcome common obstacles in public speaking. CO2: Demonstrate critical and innovative thinking. CO3: Demonstrate competency in oral, written and visualization. CO4: Explain the importance of research in developing your topic CO5: Use resources to gather information effectively.
	18CS4SP06	**Computer Organization and Architecture**	CO1: Identify basic computer elements & Explain the basic structure, organization of different computer units. CO2: Demonstrate programming proficiency using various addressing modes and instruction set. CO3: Design Micro programmed control unit and Develop Arithmetic algorithms. CO4: Discuss the concepts of Memory and I/O organization CO5: Compare the commercially available processor architectures (Pentium &Athlon) and examine the architectural features of advanced processors. CO6: Design and Simulate simple CPU using CPUSIM tool.

	18CS4SE01	**Software Engineering**	CO1: Explain the fundamental concepts of Software Engineering Lifecycle models. CO2: Summarize the software requirement specifications and the SRS documents. CO3: Describe software engineering layered technology and Process frame work. CO4: Examine the various design and development solutions with proper analysis. CO5: Demonstrate the competence in communication, planning, analysis, design, construction, and development of software as per the requirements. CO6: Demonstrate the software project management skills through case studies.
	18CS4SP05L	**Principles of Operating Systems Lab**	CO1: Describe and execute basic commands of shell script. CO2: Employ basic operations in shell scripts which are required for different applications CO3: Identify and understand concept of file systems in shell script CO4: Employ concept of creating new process from parent process CO5: Use concept of virtual file and execute basic commands on it CO6: Design communication mechanisms ipc and pipe on linux

	18CS4SP04L	**DBMS Lab**	CO1: Create database using database design principles CO2: Construct SQL statements to insert, retrieve and update data in a database CO3: Use access control mechanisms CO4: Use transaction control mechanisms CO5: Use synonym sequence, index and views CO6: Write PL/SQL triggers, procedures & functions
	18CSI401L	**Design and Analysis of Algorithms Lsb**	CO1: Illustrate simple java programs to explore different object oriented concepts. CO2: Demonstrate the Exception handling mechanism and multithreading concepts through programming. CO3: Use different algorithms such as sorting, graph related, combinatorial, etc., in a high level language. CO4: Examine different greedy techniques (Kruskal's algorithm, Prim's algorithm etc) through programming. CO5: Solve real world problems using dynamic programming approaches. CO6: Test the backtracking algorithms through programming.

V	**18CS5SP07**	**Computer Networks**	CO1: Describe basic computer network technology CO2: List the layers of the OSI model and TCP/IP and explain the functions of each layer CO3: Identify the design issues, perform error detection and correction. CO4: Employ the various routing algorithms for the different network designs. CO5: Compare and contrast the various protocols used in respective layers of OSI reference model. CO6: Design a network for the given scenario.
	18CS5SE02	**Web Technologies**	CO1: Classify the syntax and semantics of HTML and CSS to build web pages. CO2: Construct and visually format tables and forms using HTML and CSS. CO3: Develop XML web content for a specific scenario. CO4: Develop dynamic webpage by using Server side scripting language PHP. CO5: Examine the principles of object oriented development using PHP. CO6: Develop and deploy an application into the server.

	18CS5SE04	**Agile Software Development**	CO1: Describe the properties of relations and its importance in Agile practices, Programming, and Development. CO2: Examine a problem, identify and define the computing requirements appropriate to its solution. CO3: Apply knowledge of applications and Agile Methodologies appropriate to the discipline and its requirements. CO4: Design, implement, and evaluate a computer-based system, process, component, or program to meet desired user needs. CO5: Apply LSP, DIP principles, Agile modeling and designing lifecycle in a way that demonstrates work-culture. CO6: Design use case diagram through effective use of UML.
	18CS5SD01	**Theory of Computation**	CO1: Use basic concepts of formal languages of finite automata techniques CO2:Design Finite Automata's for different Regular Expressions and Languages CO3:Construct context free grammar for various languages CO4: Solve various problems of applying normal form techniques, push down automata andTuring Machines CO5: Participate in GATE, PGECET and other competitive examinations

	18SE5DE11	**Elective I: Cloud Computing**	CO1: Explain Characteristics of Cloud and Cloud Deployment models. CO2: Illustrate the Cloud service models with examples. CO3: Carryout the Seven-Step Model of Migration into a Cloud. CO4: Predict challenges and risk while migrating to cloud. CO5: Categories the legal issues and Cloud Compliance standards
	18CS5SE03	**Software Quality Management**	CO1: Summarize quality Frameworks in software engineering. CO2: Describe the properties of Defect Prevention Classification. CO3: Apply the properties of Quality Engineering. CO4: Infer the need of Software Architecture. CO5: Demonstrate the knowledge of Project-management, rules and Design.

	18CS5SE02L	**Web Technologies Lab**	CO1: Classify the syntax and semantics of HTML and CSS to build web pages. CO2: Construct and visually format tables and forms using HTML and CSS. CO3: Develop XML web content for a specific scenario. CO4: Develop dynamic webpage by using Server side scripting language PHP. CO5: Examine the principles of object oriented development using PHP. CO6: Develop and deploy an application into the server.
	18CS5SP08L	**IT Workshop (Python)**	CO1: Explain the basics of Python Programming. CO2: Use various data structures for solving real world problems. CO3: Create basic data structure of given problem in python programming CO4: Dissect the data transformation from one format to another format. CO5: Employ MVC design pattern in developing web applications CO6: Create web services and consume the web services using REST API call

VI	**18CS6SE05**	**Object Oriented Analysis and Design**	CO1: Apply the knowledge of Object Oriented Concepts to system analysis and design. CO2: Demonstrate the knowledge of application analysis for solving problems. CO3: Applying the concept of domain and application analysis for designing UML Diagrams. CO4: Compare the different communication patterns through object oriented models. CO5: Examine structural and behavioral diagrams for designing different aspects of a project. CO6: Create component and deployment diagrams for modeling the real time projects.
	18CS6SE06	**Software Testing**	CO1: Demonstrate the knowledge of applications and their software test phases. CO2: Explain to analyze a problem, bugs, identify and define the software testing requirements appropriate to its solution. CO3: Discuss the requisites of a design, implementation, and evaluation of a computer-based system, process, component, or program to meet desired needs CO4: Examine the components of Software testing foundations that demonstrates the complete application test Lifecycle CO5: Demonstrate the system design elements CO6: Create the test cases as per the requirements of software and test it.

	18CS6SE07	**Software Metrics**	CO1: Interpret the knowledge of Metrics and Software Measuring Defects appropriate to their respective zones. CO2: Identify and define the Software Metrics, Quality and Goals. CO3: Choose a metrics system for organization and collect data from sensory system. CO4: Compare data metrics based on graphical techniques and exploring data sets by emerging technology. CO5: Choose the Software Metrics Evaluation such as Six Sigma. CO6: Examine the process in the modeling and Probability of systems architecture
	18SE6DE31	**Server Administration**	CO1: Summarize the Installation and configuration of Nano and Core Versions of Windows Server 2016 and Recall Server activation models. CO2: Demonstrate the configuration of server for storage spaces and data deduplications. CO3: Demonstrate the configuration of server for container service Docker. CO4: Illustrate the installation and configuration of ADDS to create own domains. CO5: Employ policies to users and computers in domain level using GPO. CO6: Examine the server performance using monitoring tools and event logs.

	18AI6DE32	**Machine Learning**	CO1: Discuss the concept of supervised, unsupervised and semi-supervised learning algorithms. CO2: Describe the concept of Time Series Analysis and Forecasting. CO3: Demonstrate the algorithms of supervised learning such as decision tree, CART, KNN Classification etc. CO4: Solve the given problems by using Data Preprocessing and Clustering techniques. CO5: Compare the performance of Non-Linear algorithms such as SVM, Naïve Baye'setc for solving real time problems. CO6: Decide a suitable regression-based solution for real time dataset.
	18SE6DE21	**Mobile Application Development**	CO1: Outline the steps involved in the installation of android studio tool and explain the setup of various environmental files. CO2: Describe the components and folder structure of android application development CO3: Choose UI elements and event handlers in designing and developing android applications. CO4: Compare the various data storage techniques available in building apps. CO5: Use the lifecycle and APIs of services, broadcast receivers, Notifications and Alarm Services to build apps for given use case. CO6: Demonstrate the syntaxes

			and design principles of kotlin language to create simple programs/application in android.
	18CTOE611	**Information Security**	CO1: Explain the basic concepts and importance of information Security for an individual and to the organization/Enterprise. CO2: Identify some of the factors driving the need for information security CO3: Assess the security threats, attacks and manage the risks involved in the attacks using various risk assessment techniques CO4: Assess and critically evaluate techniques for network infrastructure security CO5: Illustrate the need of information asset classification CO6: Demonstrate the skills learned in the information security into the real-life scenarios.

	18AIOE611	**Data Visualization**	CO1: Describe the application of different visualization techniques for different business representation CO2: Identify the static graphical technique for the better understanding about the business problem. CO3: Demonstrate Design the multivariate statistical graphical technique for testing the assumptions of multivariate data CO4: Construct the validation techniques for better model fit. CO5: Construct Create the customization in graphical representation for user friendly graphics. CO6: Appraise with effective data visualizations in order to provide new insights into a research question or communicate information to the viewer.
VII		**Software Security**	CO1: Summarize the various threats, issues and sources of software insecurity. CO2: Interpret the contents of a secure software requirements document. CO3: Identify the challenges, security failures and attacker perspectives of a software. CO4: Choose secure coding practices and prevent common vulnerabilities from being injected into software. CO5: Employ governance and enterprise security framework for managing software security. CO6: Examine the secure software

			testing plan.
		Information Security	CO1: Describe the basic concepts and importance of information Security for an individual and to the organization. CO2: Identify the factors driving the need for information security. CO3: Examine the security threats, attacks and manage the risks involved using various risk assessment techniques. CO4: Choose an appropriate technique for network infrastructure security. CO5: Justify the need of information asset classification. CO6: Employ the principles in securing information and network infrastructure.
		Secure Programming	CO1: Describe the importance of security and the guiding principles in software. CO2: Identify the most frequent programming errors leading to software vulnerabilities. CO3: Choose the protection against security threats and software vulnerabilities. CO4: Explain the various secure coding techniques. CO5: Recognize the database and web application specific issues and the mitigation techniques. CO6: Employ the security test plan for the application testing.
		Cost Estimating Techniques	CO1: Summarize the fundamentals of software costing and pricing. CO2: Explain the process of software cost estimation.

			CO3: Choose the various data sources, collect data and store in database. CO4: Employ data normalization based on the different parameters. CO5: Examine the different linear regression models and learning curves for cost analysis. CO6: Employ functions to mitigate risk and uncertainty.
		Usability Engineering	CO1: Explain the usability concept, considerations and generations of usability. CO2: Discuss usability design guidelines, their foundations, assumptions, advantages, and weaknesses. CO3: Employ usability engineering lifecycle for designing a user-friendly software. CO4: Examine the usability evaluation skills required for usability testing. CO5: Choose industry standards in designing user-interfaces. CO6: Design usability test plan, based on modelling or requirements specification.
		Software Project Management	CO1: Describe the importance of software project management and its activities. CO2: Identify the project scope, objectives, characteristics, activities, risks involved CO3: Choose the software effort estimation technique and risk management framework. CO4: Schedule resources, allocate, monitor and manage resources as per the schedule. CO5: Examine the people behavior and decision making based on the effectiveness.

			CO6: Differentiate product and process quality management and employ techniques to enhance software quality.
		DevOps	CO1: Explain the history, objectives and configuration tools of DevOps. CO2: Choose the version control and configuration management tool that support DevOps. CO3: Configure the continuous integration with Jenkins and schedule jobs. CO4: Use Maven build tool for validating correctness of the project. CO5: Employ an application through Docker as container technology. CO6: Use DevOps lifecycle for faster delivery of projects.
		Software Security Lab	CO1: Demonstrate session hijacking and automation attack. CO2: Illustrate the SQP injection attacks. CO3: Demonstrate Secure Session Management with Cookies for Web Applications. CO4: Illustrate Buffer Overflows: Attacks and Defenses for the Vulnerability of the Decade. CO5: Exploiting Format String Vulnerabilities. CO6: Demonstrate Code quality analysis using SonarQube.
		Information Security Lab	CO1: Demonstrate the installation of honey pot, monitor and detect intruder in the network. CO2: Demonstrate man in the middle attack using ARP poisoning, detect ARP spoofing. CO3: Demonstrate HTTP protocol operations through wireshark and perform phishing attacks on web applications.

			CO4: Implement passive scanning and active scanning using Burp suit tool. CO5: Demonstrate detection and secure network systems from malicious software. CO6: Illustrate tan exploitation of vulnerable virtual machine images.
		Secure Programming Lab	CO1: Demonstrate the format string vulnerabilities, DHCP attack and prevention. CO2: Illustrate the Trojan building, scan the rootkit and exploit. CO3: Demonstrate the buffer overflow attacks and exploit the vulnerabilities. CO4: Demonstrate the exploitation of OWASP vulnerabilities. CO5: Illustrate the SQL injection, detection, exploitation and XSS attacks. CO6: Demonstrate XPath, command injection using web goat and advanced client side exploitation using BeFF.
VIII		**IT Infrastructure Technology**	CO1: Describe the evolution of IT Infrastructure and service management. CO2: Explain the terminologies and the process involved in service delivery to customers. CO3: Employ the strategic planning for project management and service management. CO4: Examine the service transitions, operations process for the resource and knowledge management in ITIL. CO5: Choose the IT Governance Framework for governance activities and risk management. CO6: Demonstrate the service delivery process through ITIL

			lifecycle.
		Software Configuration Management	CO1: Explain the components of software configuration management and its implementation. CO2: Describe the configuration management process model, life cycle, planning and implementation. CO3: Illustrate the documentation of configuration control, change proposal, and Configuration status accounting. CO4: Employ the principles for verification and audit, data management and maintenance. CO5: Discuss the phases of automating configuration management. CO6: Choose an automation tool for configuration management.
		Software Quality and Reliability	CO1: Describe the approaches and techniques to assess and improve process and/or product quality and reliability. CO2: Employ the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring. CO3: Choose the function for determining the loss function and tolerance level. CO4: Explain the quality function deployment, QFD matrix, TQM concepts and ISO 9000 standards. CO5: Illustrate the basic concepts and techniques of modern reliability engineering tools. CO6: Examine the economics of reliability engineering, maintenance costing and budgeting.