# DEPARTMENT OF COMPUTER SCIENCE

## B.SC. COMPUTER SCIENCE

## Program Objective (PO)

**PO1 SCIENCE KNOWLEDGE**: Apply the awareness of mathematics, statistics, science, electronics, computer science basics, and a specialty to the solution of complex problems

**PO2 PROBLEM ANALYSIS**: categorize, formulate, research literature, and investigate complex problems reaching substantiated conclusions using principles of mathematics, natural sciences and computer sciences Diagrammatic and graphical representation and interpretation of data. Knowledge of data collection and classification. Analysis of qualitative data. Develops logical and critical thinking skill. able to work with graphs and identify certain parameters and properties of the given graphs.

**PO3 DESCRIBE / DESIGN/DEVELOPMENT OF SOLUTIONS**: Design solutions for complex computer science problems and design system components or processes and programs that meet the specified needs with appropriate consideration for public health and safety and cultural, societal, and environmental considerations. i.e., to Discuss /design software development fundamentals, including programming, data structures, algorithms and complexity computations of descriptive statistics manually and by using MS Excel and interpretations of the results. To design recursive programming algorithms.

**PO4 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. i.e., Illustrate the concepts of systems fundamentals, including architectures and organization, operating systems, networking and communication.

To apply inferential statistical methods for real data sets. To fit various statistical models and to find the best model.

Concept of probability and fitting of probability distributions to the given data Conversion of big data into compact size with help of mathematical techniques.

Systematic approach to deal with problems and get the optimized solution.

**PO5 MODERN TOOLS/SOFTWARE /PROGRAMMING LANGUAGUE USAGE**: Create, select, and apply appropriate techniques, resources, and modern IT tools, including prediction and modelling to complex activities, with an understanding of the limitations. i.e., Gain the knowledge about software

engineering fundamentals, including software analysis and design, evaluation and testing, and software engineering processes.

To study free statistical software's and use them for data analysis in projects.

Model sampling from various statistical distributions using MS Excel.

To study free mathematical software's for computations.

**PO6 ENVIRONMENT AND SUSTAINABILITY:** Understand the impact of the professional IT solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

**PO7 ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Science practice.

**PO8 COMMUNICATION**: Communicate effectively on complex activities with the science community and with the 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.

To represent networks of communication and data organization with the help of graph theory.

**PO9 INDIVIDUAL AND TEAM WORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

**PO10 PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the project 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. Make use of fundamentals of Application, including information management and intelligent applications.

**PO11 USAGE OF MATHEMATICS AND STATISTICS IN COMPUTER SCIENCE**: Describe mathematics fundamentals, including discrete structures, statistics and calculus.

Use of mathematical and statistical techniques for real life data.

Mathematical modules are used to analyze and simplify the digital circuits.

**PO12 USAGE OF ELECTRONIS IN COMPUTER SCIENCE**: Illustrate the Concepts of Microprocessors and microcontrollers.

## Program Specific Objective (PSO)

**PSO1** Apply knowledge by adding value of computing, Statistics, mathematics and electronics appropriate to the discipline for software development. (Value added courses).

**PSO2** To understand the importance and functions of different statistical organizations in the development of the nation.

**PSO3** Develop problem-solving abilities using computer. (Developing projects)

**PSO4** Design the application using programming languages. (Small programs)

**PSO5** Maintain Computer Hardware and Software System

**PSO6** Acquire knowledge of electronics components, devices and systems

**PSO7** Explore the knowledge of advanced technologies in electronics

# COURSE OUTCOMES

## F.Y.BSC COMPUTER SCIENCE 2019 PATTERN (SEMESTER-I)

### CS-101- Problem Solving Using Computer and 'C' programing

CO1 Use the fundamentals of C programming in trivial problem solving

CO2 Enhance skills on problem solving by analyzing a problem and by constructing algorithms

CO3 Choose the right data representation formats based on the requirements of the problem and Write the C code for a given algorithm.

CO4 Design, implement, test and debug programs that use calculations and selections

CO5 Identify solution to a problem and apply control structures and user defined functions for solving the ppm

CO6 Analyze programming problems to choose when regular loops should be used and when recursion will produce a better program

CO7 Design, implement, test and debug programs that use different, arrays

### CS102-Database Management System

CO1 Comprehensive knowledge of database model.

CO2 Solve real world problems using relational models.

CO3 Design E-R Model for given requirements and convert the same into database tables.

CO4 Be familiar with the relational database theory, and be able to write relational queries.

CO5 Master the basics of SQL and construct queries using SQL.

CO6 Master sound design principles for logical design of databases, including the E-R method and Normalization approach.

### CS103- Practical course on Problem Solving using Computer and 'C' programming and Database Management Systems.

CO1 Devise pseudocodes and flowchart for computational problems.

CO2 Write, debug and execute simple programs in 'C'

CO3 Create database tables in PostgreSQL

CO4 Write and execute simple, nested queries.

**MTC 111- Matrix Algebra**

CO1 To get equipped with the basic knowledge of various properties of matrices and how matrices help in solving problems in different dimensions.

CO2 To solve linear systems both by using computer and by hand using mathematical techniques.

CO3 To write cohesive and comprehensive solutions to exercises and be able to defend their arguments. Factorization of any square matrix in simpler LU-form

CO4 To solve problems related to areas and volume like the area of triangle and volume of a tetrahedron using determinants.

**MTC112 - Discrete Mathematics**

CO1 To recognize logical notation and perform logical proofs.

CO2 To evaluate Boolean functions and simplify expression using the properties of Boolean algebra; apply Boolean algebra to circuits and gating networks.

CO3 To Apply basic and advanced principles of counting. A student should be able to solve discrete mathematics problems that involve: computing permutations and combinations of a set, fundamental enumeration principles etc.

CO4 To apply recursive functions and solve recurrence relations.

**MTC 113 - Mathematics Practical**

CO1 To solve linear systems by using mathematical techniques.

CO2 To do Factorization of any square matrix in simpler LU-form.

CO3 To get Introduced to Free and Open-Source Software MAXIMA to perform basic mathematical operations and functions.

CO4 To learn computations with matrices, solution of linear systems using maxima

CO5 To learn logic equivalences, validity of arguments and quantifiers by using maxima.

CO6 To compute C.N.F and D.N.F, to verified Warshall's algorithm and relation matrix by using maxima.

CO7 To find permutation and combination by using commands of maxima software.

CO8 To find the solution of recursive relation by using maxima.

**ELC 111- Semiconductor Devices and Basic Electronic Systems**

CO1 To provide knowledge of technological aspects of electronics.

CO2 To study various types of semiconductor devices.

CO3 To study elementary electronic circuits and systems

CO4 To enrich knowledge through activities such as industrial visits, seminars, projects etc.

CO5 To help students to build-up a progressive and successful career.

**ELC 112 - Principles of Digital Electronics**

CO1 To get familiar with concepts of digital electronics.

CO2 To learn number systems and their representation.

CO3 To understand basic logic gates, Boolean algebra and K-maps.

CO4 To study arithmetic circuits, combinational circuits and sequential circuits

**ELC 113 – Electronics Practical Course**

CO1 To develop analytical abilities towards real world problems.

CO2 To help students to build-up a progressive and successful career.

CO3 To develop practical skill towards hardware system.

**CSST 111 - Descriptive Statistics I**

CO1 To acquaint students with some basic Concepts in Statistics.

CO2 To compute various measures of central tendency, dispersion, skewness and kurtosis.

CO3 To analyze data pertaining to attributes and to interpret their results

**CSST 112 Mathematical Statistics**

CO1 To introduce the students the basic concepts of probability, axiomatic theory of probability, conditional probability

CO2 To distinguish between random and non-random experiments.

CO3 To study discrete probability distribution and its real-life applications.

**CSST123 Statistics Practical**

CO1 To acquaint students with tabulation and construction of frequency distribution.

CO2 To draw graphs and diagrams by using MS Excel

CO3 To compute descriptive statistics manually and by using MS Excel

CO4 To fit binomial and Poisson distributions

CO5 To analyze data pertaining to attributes and to interpret their results

**F.Y.BSC COMPUTER SCIENCE 2019 PATTERN (SEMESTER-II)**

**CS-201- Advanced C Programming**

CO1 To understand code organization with complex data types and structures.

CO2 Implement Programs with pointers and perform pointer arithmetic

CO3 Demonstrate the use of Strings and string handling functions

CO4 Design, implement, test and debug programs that use structures and unions

CO5 Implement different Operations on files.

CO6 Apply skill of identifying appropriate programming constructs for problem Solving

**CS-202 - Relational Database Management System**

CO1 Design E-R Model for given requirements and convert the same into database tables.

CO2 Use database techniques such as SQL & PL/SQL.

CO3 Master the basics of PL/SQL Composite Data types like Procedures, Functions, Packages and Triggers.

CO4 Ability to code database transactions using SQL.

CO5 Skill to write PL/SQL programs

**CS-203- Practical Course on Advanced 'C' Programming and Relational Database Management Systems**

CO1 Write, debug and execute programs using advanced features in 'C'.

CO2 To use Code SQL & PL/SQL.

CO3 To perform advanced database operations.

**MTC 121 - Linear Algebra**

CO1 To solve problems in data sciences.

CO2 To apply their skills & knowledge, that is, translate information verbally into mathematical form, select & use appropriate mathematical formulae to process the information and draw conclusion.

CO3 To evaluate mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems.

CO4 To apply linear algebra concepts to model, solve, and analyze real-world situations.

**MTC 122 - Graph Theory**

CO1 To recognize different types of graphs and trees.

CO2 To define and relate basic notions in graph theory and apply different operations on the graph.

CO3 To represent a graph using an adjacency list and an adjacency matrix and apply graph theory to application problems such as computer networks

CO4 To apply basic knowledge to determine if a graph has a Euler graph or a Hamilton path or circuit.

CO5 To determine if a graph is a binary tree, N-array tree, or not a tree; use the properties of trees to classify trees, determine the level of a node, the height of a tree or sub tree and apply counting theorems to the edges and vertices of a tree.

CO6 to apply algorithms and theorems from graph theory on solving problems and apply knowledge to solve the computer Network.

**MTC 123 - Mathematics Practical**

CO1 To solve problems in data sciences.

CO2 To evaluate mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems.

CO3 To solve the examples of linear algebra using maxima.

CO4 To draw the various graphs using maxima software.

CO5 To find shortest path by verifying Dijkstra's algorithm by using Maxima

**ELC 121- Instrumentation System**

CO1 To provide knowledge instrumental system aspects of electronics.

CO2 To familiarize with current and recent devices used for systems.

CO3 To enrich knowledge through activities such as industrial visits, seminars, projects etc.

CO4 To develop analytical abilities towards real world problems

CO5 To help students to build-up a progressive and successful career.

**ELC 122- Basics of Computer Organization**

CO1 To study sequential circuits.

CO2 To teach fundamental concepts of computer system.

CO3 To get familiar with concepts of electronics hardware in computer.

CO4 To train students in skills related to computer industry and market.

**ELC 123 – Electronics Practical course**

CO1 To develop analytical abilities towards real world problems.

CO2 To help students to build-up a progressive and successful career.

CO3 To develop practical skill towards hardware system.

**CSST 121 - Descriptive Statistics II**

CO1 To compute the correlation coefficient for bivariate data and interpret it.

CO2 To fit simple and multiple linear Regression to given data and interpret it.

CO3 To study time series Analysis.

**CSST 122 - Continuous Probability Distributions and Testing of Hypothesis**

CO1 To study continuous probability distribution and its real life applications.

CO2 To test the hypotheses particularly about mean, variance and goodness of fit

CO3 To study simulation technique.

**CSST 123 - Statistics Practical**

CO1 To compute correlation coefficient, regression coefficients.

CO2 To fit nonlinear regression.

CO3 To fit Normal distributions.

CO4 To fit linear regression and nonlinear regression by using MS Excel.

CO5 To draw random samples from continuous distributions.

CO6 To test the hypotheses particularly about mean, variance, correlation.

CO7 To analyze time series data.

**S.Y.BSC COMPUTER SCIENCE 2019 PATTERN (SEMESTER-I)**

**CS-231- Data Structures and Algorithms - I**

CO1 Ability to analyze algorithms and algorithm correctness

CO2 Understand the concept of dynamic memory management, data types, algorithms, big O notation.

CO3 Be able to design and analyze the time and space efficiency of the data structure

CO4 Ability to summarize searching sorting techniques.

CO5 Demonstrate the concepts of Linked List and apply various operations on them.

CO6 Demonstrate The concepts of stacks and queue apply various operations on them.

CO7 Be capable to Identity the appropriate data structure for given problem

**CS-232 Software Engineering**

CO1 Compare and chose a process model for a software project development.

CO2 Identify requirements analyze and prepare models.

CO3 Able to elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project

CO4 Analyze and prepare the SRS, Design document, Project plan of a given software system

CO5 Develop the code from the design and perform testing, and quality management and practice

CO6 Able to use modern engineering tools necessary for software project management, time management and software reuse.

**CS-233-Practical course on CS 231 and CS 232**

CO1 Implementation of searching algorithms and sorting algorithms

CO2 Dynamic implementation of linked Lists, Merge two sorted lists. Addition of two Polynomials in a single variable.

CO3 Static and Dynamic implementation of Stack, Implementation of an algorithm that reverses string of characters and Infix to Postfix Conversions, Evaluation of postfix expression

CO4 Static and Dynamic implementation of Linear, Circular, priority Queue

CO5 Prepare detailed statement of problem for the selected mini project, Develops Software Requirement Specification for the project

CO6 Other artifacts: Class Diagram, activity diagram, sequence diagram, component diagram and any other diagrams as applicable to the project.

**MTC-231 Group and Coding Theory**

CO1 To recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and aware of history of mathematics and future role as part of our culture.

CO2 To demonstrate when a binary algebraic structure forms a group. Students will able to identify factor group and Implement group axioms

CO3 To apply the basic concepts to solve, and analyze real-world situations.

CO4 To apply their skills and knowledge, that is, translate information presented verbally into mathematical form. Student will use appropriate techniques of coding to do the programming in real life situation.

**MTC- 232 Numerical Techniques**

CO1 To recall basic facts about mathematics and display knowledge of conventions such as notations, terminology.

CO2 To get sufficient knowledge of fundamental principles, methods and a clear perception of mathematical ideas and tools and know how to use them by modelling, solving, and interpreting.

CO3 To develop mathematical tools for continuing further study in Computer Science.

CO4 To get equipped with mathematical modelling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.

**MTC-233 Mathematics Practical: Python Programming Language-I**

CO1 To know the basic concept of functions in Python.

CO2 To know how to work with string, lists and tuples.

CO3 To use basic functions like “if” and different types of loops.

CO4 To solve the examples of linear algebra using python.

CO5 To create simple and efficient Python codes that output the numerical solutions at the required degree of accuracy.

**ELC 231 - Microcontroller Architecture & Programming**

CO1 To get knowledge of basics of microcontroller.

CO2 To write programs for 8051 microcontrollers.

CO3 To interface I/O peripherals to 8051 microcontrollers.

CO4 To design small microcontroller-based projects

**ELC 232 - Digital Communication and Networking**

CO1 Define and explain terminologies of data communication

CO2 Understand the impact and limitations of various digital modulation techniques

CO3 To acknowledge the need of spread spectrum schemes.

CO4 Identify functions of data link layer and network layer while accessing communication link.

CO5 To choose appropriate and advanced techniques to build the computer network

**ELC 233 – Electronics Practical**

CO1 To design and build his/her own microcontroller-based projects.

CO2 To acquire skills of Embedded C programming

CO3 To know multiplexing and modulation techniques useful in developing wireless application

CO4 Do build and test own network and do settings.

**AECC-I Environment Science – I**

CO1 Gain knowledge about environment and ecosystem.

CO2 Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource

CO3 Gain knowledge about the conservation of biodiversity and its importance

**AECC-II Language Communication-I**

CO1 Students will learn about literature

CO2 Students will learn about Conversational Skill

CO3 Students will learn about Interview Techniques

## S.Y.BSC COMPUTER SCIENCE 2019 PATTERN (SEMESTER-II)

### CS-241- Data Structures and Algorithms – II

CO1 Ability to have knowledge of trees concepts

CO2 Implement Binary Search Trees and understand the basic concepts of self-balancing Binary Search Trees such as Red-Black and AVL trees.

CO3 Understand Graph Representation, Traversal and its applications

CO4 Implement graph traversal techniques and algorithms

CO5 Describe the hash function and concepts of collision and its resolution methods

CO6 Usage of appropriate data structures for problem solving

### CS-242-Computer Networks-I

CO1 Understand computer network basics, network architecture, TCP/IP and OSI reference models.

CO2 Identify and understand various techniques and modes of transmission

CO3 Describe data link protocols, multi-channel access protocols and IEEE 802 standards for LAN

CO4 Describe routing and congestion in network layer with routing algorithms

CO5 Discuss the elements and protocols of transport layer

CO6 Understand and classify IPV4 addressing scheme and IPV6.

### CS-243-Practical course on CS 241 and CS 242

C01 Implement Binary Search Tree (BST) to perform various operations on BST

CO2 Sort set of elements using Heap sort, encode a set of characters using Huffman encoding

CO3 Implement Graph as adjacency matrix and adjacency List, Graph traversals: BFS and DFS., Calculate in degree and out degree of vertices

CO4 Implementation of algorithms to find shortest path

CO5 Implementation of static hash table with Linear Probing, implementation of Static hash table with chaining. Implementation of linked hash table with chaining.

CO6 Networking Assignment

### MTC-241 Computational Geometry

CO1 To recognize basic geometrical figures and graphical displays, state important facts resulting from their studies

CO2 To recognize the key concepts, problems, techniques and data structures within computational geometry, including: Concepts (points, lines, planes, spheres, duality, subdivisions, etc.

CO3 To apply geometric techniques to real-world problems in graphics. Students will be able to apply their skills & knowledge, and analyse algorithms for small domain problems.

CO4 To recognize parametric equations for a space curve. Student should understand the concept of a parametric surface with the help of examples.

**MTC-242 Operation Research**

CO1 To find optimized solution to a given problem.

CO2 To be able to construct mathematical model.

CO3 To solve problems on optimizing the total output by maximizing profit and minimizing cost.

CO4 To solve aggregate planning problems using transportation model

**MTC-243 Mathematics Practical: Python Programming Language-II**

CO1 To use python in solving various types of graph plotting.

CO2 To use Graphical aspects of two dimensional transformation matrix using Matplotlib that deal with different problems in computational geometry.

CO3 To use Graphical aspects of three dimensional transformation matrix using matplotlib that deal with different problems in computational geometry.

CO4 To apply effect of concatenation of two dimensional and three dimensional transformations to solve, and analyse real-world situations.

CO5 To apply algorithms to solve problems of Operation Research using appropriate techniques in python.

**ELC 241 - Embedded System Design**

CO1 To understand the difference between general computing and the Embedded systems.

CO2 To know the fundamentals of embedded systems.

CO3 Understand the use of Single board Computer (Such as Raspberry Pi) for an embedded System application.

CO4 Familiar with the programming environment to develop embedded systems and their interfaces with peripheral devices.

CO5 To develop familiarity with tools used to develop in an embedded environment.

**ELC 242 - Wireless Communication and Internet of Things**

CO1 Know working of wireless technologies such as Mobile communication, GSM, GPRS.

CO2 Become familiar with 3G and 4G Cellular Network Technologies for Data Connections.

CO3 Understand working principles of short-range communication application.

CO4 Get introduce to upcoming technology of Internet of Things.

CO5 Explore themselves and develop new IoT based applications.

**ELC 243 – Electronics Practical**

CO1 To design and develop own smart applications using Raspberry-Pi

CO2 To write Python program for simple applications

CO3 To build own IoT based system

CO4 To understand design procedures of different electronic circuits as per requirement used in real life.

CO5 To develop practical skill towards embedded system.

**AECC-I Environment Science – II**

CO1 Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures

CO2 Students will learn about increase in population growth and its impact on environment

CO3 Gain knowledge about the environmental communication and public awareness

**AECC-II Language Communication-II**

CO1 Students will learn about Literature

CO2 Students will learn about Writing Skills

CO3 Students will learn about Soft Skills and Personality Development

**T.Y.BSC COMPUTER SCIENCE 2019 PATTERN (SEMESTER-I)**

**CS-351- Operating System-I (Sem-I)**

CO1 Adequate knowledge in operating system and it function, and overview of operating system

CO2 Thread Scheduling by operating system, for the design of kernel system calls supporting multi-processing and multi-threading systems

CO3 To understand design issues related to process management and various related algorithms and analyze the Process scheduling algorithms

CO4 Ability to understand the use synchronization techniques and tools needed for the design and implementation of operating system.

CO5 Adequate knowledge in operating system of memory management, with different schemes (paging, segmentation and virtual memory) used in operating system and also implantation page replacement algorithms

**CS-352- Computer Networks II**

CO1 Student will understand the different protocols of Application layer.

CO2 Develop understanding of technical aspect of Multimedia Systems

CO3 Develop various Multimedia Systems applicable in real time.

CO4 Identify information security goals.

CO5 Understand, compare and apply cryptographic techniques for data security.

**CS-357- Practical Based on CS-351**

CO1 To implement the concept of process scheduling with the help of simulation

CO2 To implement various operating system shell and working using C programming

CO3 To implement various process scheduling algorithms using C programming

CO4 To implement Simulation of demand paging using memory page replacement algorithms

**CS-353- Web Technology -I**

CO1 Implement Simple PHP programs to solve simple problems

CO2 Validate input in a PHP program.

CO3 Understand how to develop dynamic and interactive Web Page

CO4 understand the process of designing and implementing Web applications, using PHP

**CS-354- Foundation of Data Science**

CO1 Knowledge of basic concepts of data science and big data

CO2 To understand perform exploratory data analysis and demonstrate proficiency with statistical analysis of data.

CO3 To understand and implement the role of statistics in data science along with python programming

CO4 Knowledge about data pre-processing to detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization.

CO5 Knowledge about data visualization using basic data visualization tools and special data visualization tools

**CS-358- Practical course based on CS 353 and CS 354**

CO1 Understand how to develop dynamic and interactive Web Page

CO2 Prepare data for use with a variety of statistical methods and recognize how the quality of the data may affect conclusions

CO3 Perform exploratory data analysis using python programming

CO4 Implantation of data visualization techniques on data sets

**CS-355- Object Oriented Programming using Java – I**

CO1 Use the Object-Oriented Programming language

CO2 Use the syntax and semantics of java programming language and basic concepts of OOP.

CO3 Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.

CO4 Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.

CO5 Design event driven GUI and web related applications which mimic the real word scenarios.

CO6 To design User Interface using Swing and AWT

**CS-356- Theoretical Computer Science**

CO1 Design a finite automaton to recognize a given regular language.

CO2 Transform a language into regular expression or finite automaton or transition graph and define deterministic and nondeterministic finite automata.

CO3 Prove properties of regular languages and classify them

CO4 Define relationship between regular languages and context-free grammars.

CO5 Prove properties of regular languages and classify them.

CO6 Building a context-free grammar for pushdown automata.

CO7 Determine whether a given language is context-free language or not and Prove properties of context-free languages.

CO8 Design Turing machine and Post machine for a given language.

CO9 Students are exposed to a broad overview of the theoretical foundations of computer science.

**CS-359- Practical Course based on CS 355**

CO1 Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.

CO2 Read and make elementary modifications to Java programs that solve real-world problems.

CO3 Validate input in a Java program.

CO4 Understand how to develop dynamic and interactive Web Page

CO5 Validate input in a PHP program

**CS-3510- Python Programming**

CO1 Develop logic for problem solving

CO2 Determine the method to create and develop Python programs by utilizing data Structures like list, dictionaries, tuples and sets

CO3 To be familiar about the basic constructs of programming such as data, operation conditions, loops, functions etc.

CO4 To be familiar about the modules, package, working with files, exception handling

CO5 To write python programs and develop a small application project

**CS-3511- Blockchain Technology**

CO1 Understand the fundamentals of Blockchain Technology.

CO2 Understand the working of Remix-Ethereum IDE for Smart Contracts

CO3 Write a Simple Python program to create a Blockchain.

CO4 Learn Blockchain programming using Solidity language.

CO5 Basic knowledge of Smart Contracts and how they function.

CO6 Write a Simple Smart Contract for Bank with withdraw and deposit.

**T.Y.BSC COMPUTER SCIENCE 2019 PATTERN (SEMESTER-II)**

**CS-361- Operating System-II**

CO1 Implement the concept of deadlocks and deadlock handling

CO2 Knowledge to understand design issues related to File management by operating system using with the help of various schemes

CO3 Knowledge to understand design issues related to Disk Scheduling by operating system using with the help of various scheduling algorithms

CO4 To understand concept of Distributed Operating System and its architecture

CO5 To understand concept of mobile operating systems along with mobile OS architectures and comparative study of different mobile OS

**CS-362- Software Testing**

CO1 To understand various software testing methods and strategies

CO2 To understand a variety of software metrics, and identify defects and managing those defects for improvement in quality for given software.

CO3 To design test cases and test plans, review reports of testing for qualitative software.

CO4 To understand latest testing methods used in the software industries.

**CS-367- Practical Based on CS-361**

CO1 To implement Banker's algorithm of deadlock avoidance in processes of operating system using c programming

CO2 To implement File Allocation methods and free space management in storage using C programming

CO3 To implement various Disk scheduling algorithms using C programming

CO4 To implement Assignment based on distributed and mobile OS

**CS-363- Web Technologies – II**

CO1 Implement Simple PHP programs to solve simple problems

CO2 Build Dynamic Website

CO3 Using MVC based framework easy to design and handling the error in dynamic website.

CO4 Understand the process of designing and implementing Web applications, using PHP

**CS-364- Data Analytics**

CO1 Ability to analyze and identify best practices to handle data science

CO2 Ability to identify the characteristics of datasets and apply appropriate data model to handle data for various applications

CO3 Ability to select and implement machine learning techniques for the various applications using appropriate programming language

CO4 Ability to implement various data analytics techniques to analyze the data.

**CS-368- Practical course based on CS 363 and CS 364**

CO1 Understand how to develop dynamic and interactive Web Page using different technologies used at client-Side Scripting Language

CO2 Implement program to understand the behaviour of web pages using JavaScript and AJAX to make our application more dynamic.

CO3 Preform data analysis by choose relevant models and algorithms for respective datasets using python programming

CO4 Implement different classification, prediction, clustering algorithms using python programming

**CS-364- Object Oriented Programming using Java – II**

CO1 Use the Collection framework

CO2 To access open database through Java programs using Java Data Base Connectivity (JDBC) and develop the application

CO3 Understand and create dynamic web pages, using Servlets and JSP.

CO4 Develop a game application using multithreading

CO5 Work with basics of framework to develop secure web applications.

CO6 Understand socket programming concept

**CS-365- Compiler Construction**

CO1 Understand the process of scanning and parsing of source code.

CO2 Learn the conversion code written in source language to machine language.

CO3 Understand tools like LEX and YACC.

CO4 To learn working of compiler and non-compiler applications

CO5 To know about compiler generation tools and techniques

CO6 Generate intermediate code for statements in high level language.

CO7 Apply optimization techniques to intermediate code and generate machine code for high level language program

CO8 Design a compiler for a simple programming language

**CS-369- Practical Course based on CS 365**

CO1 Develop program using Collection framework.

CO2 To develop a game application using multithreading

CO3 Develop program using JDBC connectivity to access data from database and execute different queries to get required results.

CO4 Understand and create dynamic web pages, using Servlets and JSP.

CO5 Work with basics of framework to develop secure web applications.

**CS-3610- Software Testing Tools**

CO1 Understand the knowledge of software testing methods and strategies.

CO2 How to use testing methods as an effective tool in quality assurance of software

CO3 Develops skills to design test case plan for testing software.

CO4 Gain knowledge of latest testing tools

**CS-3611- Project**

CO1 Demonstrate a sound technical knowledge of their selected project topic.

CO2 Undertake problem identification, formulation and solution.

CO3 Design engineering solutions to complex problems utilizing a systems approach.

CO4 Project-based learning connects students to the real world.

CO5 Prepares students to accept and meet challenges in the real world, mirroring what professionals do every day.