

**MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)****B.Tech. in Computer Science & Engineering (Data Science)****Scheme of Instruction and Examination***(Choice Based Credit System)*

Applicable from the Academic Year 2022-23

**III Semester**

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	EC331ES	Digital Electronics	3	0	0	40	60	3	3
2	CS301PC	Data Structures	3	0	0	40	60	3	3
3	CS302PC	Object Oriented Programming through Java	3	0	0	40	60	3	3
4	CS304PC	Discrete Mathematics	3	0	0	40	60	3	3
5	CS305PC	Computer Organization and Architecture	3	0	0	40	60	3	3
6	CS351PC	Data Structures Lab	0	0	3	40	60	3	1.5
7	CS353PC	Object Oriented Programming through Java Lab	0	0	3	40	60	3	1.5
8	CS356PC	Data visualization- R Programming	0	0	2	40	60	3	1
9	CS357PC	Node JS/ React JS/ Django	0	0	2	40	60	3	1
10	MC351HS	Gender Sensitization Lab	0	0	2	50	50	3	0
<b>Total Hours/Marks/Credits</b>			15	0	12	410	590	30	20

**IV Semester**

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MS401HS	Business Economics & Financial Analysis	3	0	0	40	60	3	3
2	MA402BS	Computer Oriented Statistical Methods	3	1	0	40	60	3	4
3	CS402PC	Operating Systems	3	0	0	40	60	3	3
4	CS404PC	Database Management Systems	3	0	0	40	60	3	3
5	CS405PC	Software Engineering	3	0	0	40	60	3	3
6	CS451PC	Operating Systems Lab	0	0	2	40	60	3	1
7	CS452PC	Database Management Systems Lab	0	0	2	40	60	3	1
8	CS456PC	Real-time Research Project/ Societal Related Project/Field-Based Research Project	0	0	4	50	-	-	2
9	MC401HS	Constitution of India	3	0	0	40	60	3	0
<b>Total Hours/Marks/Credits</b>			18	1	8	370	480	24	20

L: Lecture T: Tutorial D: Drawing P: Practical CIE - Continuous Internal Evaluation SEE - Semester End Examination

L	T	P	C
3	0	0	3

**III Semester Syllabus**  
**EC331ES: DIGITAL ELECTRONICS**  
**(Common to CSE, IT, CSBS, CSE (DATA SCIENCE))**

Pre-requisite: Number Systems, Mathematics

**Course Objectives:**

- To understand common forms of number representation in logic circuits
- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand the concepts of combinational logic circuits and sequential circuits.
- To understand the Realization of Logic Gates Using Diodes & Transistors

**Course Outcomes: Upon completion of the Course, students will be able to**

- Understand the numerical information in different forms and Boolean Algebra theorems
- Postulates of Boolean algebra and to minimize combinational functions
- Design and analyze combinational and sequential circuits
- Known about the logic families and realization of logic gates.

**UNIT – I**

**BOOLEAN ALGEBRA AND LOGIC GATES:** Digital Systems, Binary Numbers, Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes, Binary Storage and Registers, Binary logic.

Basic Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, other logic operations, Digital logic gates.

**UNIT – II**

**GATE – LEVEL MINIMIZATION:** The map method, Four-variable map, Five-Variable map, product of sums simplification Don't-care conditions, NAND and NOR implementation other Two-level implementations, Exclusive – Or function.

**UNIT – III**

**COMBINATIONAL LOGIC:** Combinational Circuits, Analysis procedure Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, magnitude comparator, Decoders, Encoders, Multiplexers, HDL for combinational circuits.

**UNIT – IV**

**SEQUENTIAL LOGIC:** Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, state Reduction and Assignment, Design Procedure. Registers, shift Registers, Ripple counters, synchronous counters, other counters.

**UNIT – V**

**MEMORIES AND ASYNCHRONOUS SEQUENTIAL LOGIC:** Introduction, Random-Access Memory, Memory Decoding, Error Detection and correction Read-only memory, Programmable logic Array programmable Array logic, Sequential Programmable Devices.

Introduction, Analysis Procedure, Circuits with Latches, Design Procedure, Reduction of state and Flow Tables, Race-Free state Assignment Hazards, Design Example.

**TEXT BOOKS:**

1. Digital Design – Third Edition, M. Morris Mano, Pearson Education/PHI.
2. Digital Principles and Applications Albert Paul Malvino Donald P. Leach TATA McGraw Hill Edition.
3. Fundamentals of Logic Design, Roth, 5th Edition, Thomson.

**REFERENCE BOOKS:**

1. Switching and Finite Automata Theory by Zvi. Kohavi, Tata McGraw Hill.
2. Switching and Logic Design, C.V.S. Rao, Pearson Education
3. Digital Principles and Design – Donald D.Givone, Tata McGraw Hill, Edition.
4. Fundamentals of Digital Logic and Micro Computer Design, 5th Edition Mrafiquzzaman John Willey

L	T	P	C
3	0	0	3

### III Semester Syllabus

## CS301PC: DATA STRUCTURES

(Common to CSE, IT, CSBS, CSE (AI&ML), CSE (DATA SCIENCE))

#### Prerequisites:

Programming for Problem Solving
---------------------------------

#### Course Objectives

- |  |
|--|
| <ul style="list-style-type: none"> <li>• Exploring basic data structures such as stacks and queues.</li> <li>• Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs.</li> <li>• Introduces sorting and pattern matching algorithms</li> </ul> |
|--|

#### Course Outcomes

- |  |
|--|
| <ul style="list-style-type: none"> <li>• Ability to select the data structures that efficiently model the information in a problem.</li> <li>• Ability to assess efficiency trade-offs among different data structure implementations or combinations.</li> <li>• Implement and know the application of algorithms for sorting and pattern matching.</li> <li>• Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.</li> </ul> |
|--|

#### UNIT - I

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array and linked representations.

#### UNIT - II

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching.  
Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing- linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

#### UNIT - III

Search Trees: Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, B-Trees, B+ Trees, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red –Black, Splay Trees.

#### UNIT - IV

Graphs: Graph Implementation Methods. Graph Traversal Methods.  
Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

#### UNIT - V

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

#### TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2 nd Edition, E. Horowitz, S. Sahni and Susan AndersonFreed, Universities Press.
2. An Introduction to Data Structures with Application, 2nd edition by Jean-Paul Tremblay, Paul Sorenson, Mc Graw Hill publications..

#### REFERENCE BOOK:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A.Forouzan,Cengage Learning.
2. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

L	T	P	C
3	0	0	3

### III Semester Syllabus

## CS302PC: OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Common to CSE, CSBS & CSE (DATA SCIENCE))

### Course Objectives

- To Understand the basic object-oriented programming concepts and apply them in problem solving.
- To Illustrate inheritance concepts for reusing the program.
- To Demonstrate multitasking by using multiple threads and event handling
- To Develop data-centric applications using JDBC.
- To Understand the basics of java console and GUI based programming

### Course Outcomes

- Demonstrate the behavior of programs involving the basic programming constructs like control structures, constructors, string handling and garbage collection.
- Demonstrate the implementation of inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords
- Use multithreading concepts to develop inter process communication.
- Understand the process of graphical user interface design and implementation using AWT or swings.
- Develop applets that interact abundantly with the client environment and deploy on the server.

### UNIT - I

Object oriented thinking and Java Basics- Need for oop paradigm, summary of oop concepts, coping with complexity, abstraction mechanisms. A way of viewing world – Agents, responsibility, messages, methods, History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, method binding, inheritance, overriding and exceptions, parameter passing, recursion, nested and inner classes, exploring string class.

### UNIT - II

Inheritance, Packages and Interfaces – Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring java.io.

**UNIT - III**

Exception handling and Multithreading-- Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. String handling, Exploring java.util. Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads. Enumerations, autoboxing, annotations, generics.

**UNIT - IV**

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, checkbox groups, choices,

lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

**UNIT - V**

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

**TEXT BOOKS:**

1. Java the complete reference, 7th edition, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson education.

**REFERENCE BOOKS:**

1. Core Java 2, Vol 1, Fundamentals, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education.
2. Core Java 2, Vol 2, Advanced Features, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education
3. Object Oriented Programming with Java, R.Buyya, S.T.Selvi, X.Chu, TMH

L	T	P	C
3	0	0	3

### III Semester Syllabus

## CS304PC: DISCRETE MATHEMATICS

### (Common to CSBS, CSE (DATA SCIENCE))

#### Course Objectives:

- Introduces elementary discrete mathematics for computer science and engineering.
- Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

#### Course Outcomes:

- Understand and construct precise mathematical proofs
- Apply logic and set theory to formulate precise statements
- Analyze and solve counting problems on finite and discrete structures
- Describe and manipulate sequences
- Apply graph theory in solving computing problems.

#### UNIT - I

**Mathematical logic:** Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

#### UNIT - II

**Set theory:** Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

#### UNIT - III

**Algebraic Structures:** Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

#### UNIT - IV

**Elementary Combinatorics:** Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

#### UNIT - V

**Graph Theory:** Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

**TEXT BOOKS:**

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1<sup>st</sup> ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe I. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2<sup>nd</sup> ed.

**REFERENCE BOOKS:**

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, Pearson education, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill publishing co.



L	T	P	C
3	0	0	3

### III Semester Syllabus

## CS305PC: COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CSE, CSBS, CSE (AI&ML), CSE (DATA SCIENCE))

#### Co-requisite:

A Course on “Digital Electronics”.

#### Course Objectives

- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations.
- Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multi processors

#### Course Outcomes

- Understand the basics of instruction sets and their impact on processor design.
- Demonstrate an understanding of the design of the functional units of a digital computer system.
- Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
- Design a pipeline for consistent execution of instructions with minimum hazards.
- Recognize and manipulate representations of numbers stored in digital computers

#### UNIT - I

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

#### UNIT - II

Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

**UNIT - III**

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.  
Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms,  
Floating–point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

**UNIT - IV**

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.  
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

**UNIT - V**

Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.  
Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache Coherence.

**TEXT BOOK:**

1. Computer System Architecture – M. Morris Mano, Third Edition, Pearson/PHI.
2. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGrawHill.

**REFERENCE BOOKS:**

1. Computer Organization and Design: The Harware / Software Interface by Patterson, Fifth Edition. MIPS.
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
3. Structured Computer Organization – Andrew S. Tanenbaum, 4 th Edition, PHI/Pearson.

L	T	P	C
0	0	3	1.5

### III Semester Syllabus

## CS351PC: DATA STRUCTURES LAB

### (Common to CSE, IT, CSBS, CSE (DATA SCIENCE))

**Prerequisites:**

A Course on “Programming for problem solving”.

**Course Objectives:**

- It covers various concepts of C programming language
- It introduces searching and sorting algorithms
- It provides an understanding of data structures such as stacks and queues.

**Course Outcomes:**

- Ability to develop C programs for computing and real-life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.
- Ability to Implement searching and sorting algorithms

**List of Experiments:**

1. Write a program that uses functions to perform the following operations on singly linkedlist.:
  - i) Creation      ii) Insertion      iii) Deletion      iv) Traversal
2. Write a program that uses functions to perform the following operations on doubly linkedlist.:
  - i) Creation      ii) Insertion      iii) Deletion      iv) Traversal
3. Write a program that uses functions to perform the following operations on circular linkedlist.:
  - i) Creation      ii) Insertion      iii) Deletion      iv) Traversal
4. Write a program that implement stack (its operations) using
  - i) Arrays      ii) Pointers
5. Write a program that implement Queue (its operations) using
  - i) Arrays      ii) Pointers
6. Write a program that implements the following sorting methods to sort a given list of integers in ascending order
  - i) Quick sort      ii) Heap sort      iii) Merge sort
7. Write a program to implement the tree traversal methods( Recursive and Non Recursive).
8. Write a program to implement
  - i) Binary Search tree      ii) B Trees      iii) B+ Trees      iv) AVLtrees      v) Red - Black trees
9. Write a program to implement the graph traversal methods.
10. Implement a Pattern matching algorithms using Boyer- Moore, Knuth-Morris-Pratt

**TEXT BOOKS:**

1. Fundamentals of Data Structures in C, 2<sup>nd</sup> Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

**REFERENCE BOOK:**

1. Data Structures: A Pseudocode Approach with C, 2<sup>nd</sup> Edition, R. F. Gilberg and B. A. Forouzan, Cengage Learning.

L	T	P	C
0	0	3	1.5

### III Semester Syllabus

## CS353PC: OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (Common to CSE, CSBS, CSE (DATA SCIENCE))

#### Prerequisites:

1. A course on “Computer Programming”.
2. A course on “Data Structures”.

#### Course Objectives:

- To write programs using abstract classes.
- To write programs for solving real world problems using the java collection framework.
- To write multithreaded programs.
- To write GUI programs using swing controls in Java.
- To introduce java compiler and eclipse platform

#### Course Outcomes:

- Able to illustrate OOP concepts in Java.
- Able to write programs using Abstract classes.
- Able to write multithreaded programs and Event handling.
- Able to write programs for solving real world problems using the java collection frame work.
- Able to write GUI programs using swing controls in Java.

#### Note:

1. Use LINUX and MySQL for the Lab Experiments. Though not mandatory, encourage the use of the Eclipse platform.
2. The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed.

#### List of Experiments:

1. Use Eclipse or Net bean platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,\*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
3. A) Develop an applet in Java that displays a simple message.  
B) Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” is clicked.
4. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.
5. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
6. Write a Java program for the following: Create a doubly linked list of elements.

Delete a given element from the above list. Display the contents of the list after deletion.

7. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “Stop” or “Ready” or “Go” should appear above the buttons in the selected color. Initially, there is no message shown.
8. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
9. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas.  
Write a java program to display the table using Labels in Grid Layout.
10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).
11. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).
12. Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.
13. Write a Java program to list all the files in a directory including the files present in all its subdirectories.

**Text Books:**

1. Java for Programmers, P. J. Deitel and H. M. Deitel, 10th Edition Pearson education.
2. Java Programming, D. S. Malik and P. S. Nair, Cengage Learning.

**REFERENCE BOOKS:**

1. Thinking in Java, Bruce Eckel, Pearson Education.
2. Core Java vol1 Nineth Edition , CAY S.Horstmann and G Cornell, Pearson

L	T	P	C
0	0	2	1

### III Semester Syllabus

## CS356PC: DATA VISUALIZATION - R PROGRAMMING

(Common to CSE, IT, CSBS, CSE (DATA SCIENCE))

#### Course Objectives:

##### To Learn

- Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization
- To discern patterns and relationships in the data.
- To build Dashboard applications.
- To communicate the results clearly and concisely.
- To be able to work with different formats of data sets.

#### Course Outcomes:

##### Student will be able to

- Understand how to import data into Tableau.
- Understand Tableau concepts of Dimensions and Measures.
- Develop Programs and understand how to map Visual Layouts and Graphical Properties.
- Create a Dashboard that links multiple visualizations.
- Use graphical user interfaces to create Frames for providing solutions to real world problems.

#### Lab Problems:

1. Understanding Data, What is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.
3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.
7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.
8. Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

#### REFERENCE BOOKS:

1. Microsoft Power BI cookbook, Brett Powell, 2nd edition.
2. R Programming for Data Science by Roger D. Peng (References)
3. The Art of R Programming by Norman Matloff Cengage Learning India.

L	T	P	C
0	0	2	1

### III Semester Syllabus

## CS357PC: NODE JS/ REACT JS/ DJANGO

### (Common to CSBS, CSE (AI&ML), CSE (DATA SCIENCE))

**Prerequisites:**

Object Oriented Programming through Java, HTML Basics

**Course Objectives:**

- To implement the static web pages using HTML and do client side validation using JavaScript.
- To design and work with databases using Java
- To develop an end to end application using java full stack.
- To introduce Node JS implementation for server side programming.
- To experiment with single page application development using React.

**Course Outcomes:**

At the end of the course, the student will be able to,

- Build a custom website with HTML, CSS, and Bootstrap and little JavaScript.
- Demonstrate Advanced features of JavaScript and learn about JDBC
- Develop Server – side implementation using Java technologies like
- Develop the server – side implementation using Node JS.
- Design a Single Page Application using React.

**Exercises:**

1. Build a responsive web application for shopping cart with registration, login, catalog and cart pages using CSS3 features, flex and grid.
2. Make the above web application responsive web application using Bootstrap framework.
3. Use JavaScript for doing client – side validation of the pages implemented in experiment 1 and experiment 2.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.
5. Develop a java stand alone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.
6. Create an xml for the bookstore. Validate the same using both DTD and XSD.
7. Design a controller with servlet that provides the interaction with application developed in experiment 1 and the database created in experiment 5.
8. Maintaining the transactional history of any user is very important. Explore the various session tracking mechanism (Cookies, HTTP Session)
9. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.
10. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)
11. For the above application create authorized end points using JWT (JSON Web Token).
12. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.
13. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js
14. Create a TODO application in react with necessary components and deploy it into github.

**REFERENCE BOOKS:**

1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010
2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2nd Edition, 2008.
3. Vasanth Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2<sup>nd</sup> Edition, A Press.

L	T	P	C
0	0	2	0

### **III Semester Syllabus**

#### **MC351HS: GENDER SENSITIZATION LAB**

#### **(Common to CSE, IT, CSBS, CSE (DATA SCIENCE))**

#### **COURSE DESCRIPTION**

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

#### **Objectives of the Course**

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

#### **Learning Outcomes**

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labor and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence

#### **Unit-I: UNDERSTANDING GENDER**

Introduction: Definition of Gender-Basic Gender Concepts and Terminology- Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men  
- Preparing for Womanhood. Growing up Male. First lessons in Caste.

#### **Unit – II: GENDER ROLES AND RELATIONS**

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary



**Unit – III: GENDER AND LABOUR**

Division and Valuation of Labour-Housework: The Invisible Labor- “My Mother doesn’t Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work.

-Gender Development Issues-Gender, Governance and Sustainable Development- Gender and Human Rights- Gender and Mainstreaming

**Unit – IV: GENDER - BASED VIOLENCE**

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu*”.

Domestic Violence: Speaking Out/Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”

**Unit – V: GENDER AND CULTURE**

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues- Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and On ler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

**Note:** Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

- *Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on “Gender”.*
- **ESSENTIAL READING:** *The Textbook, “Towards a World of Equals: A Bilingual Textbook on Gender” written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.*

**ASSESSMENT AND GRADING:**

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%

L	T	P	C
3	0	0	3

## IV Semester Syllabus

### MS401HS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS (Common to CSE, IT, CSBS, CSE (DATA SCIENCE))

#### Course Objective:

- To make the students understand various Forms of Business and the Impact of Economic variables on the Business, Concepts of Business Economics and its significance.
- To gain knowledge on various concepts related to market dynamics namely Demand and Supply: Elasticity of Demand, and Demand Forecasting, and Supply Analysis.
- To disseminate the knowledge on Production, Cost, Market Structures and Pricing - Production Function, Laws of Production, Market structures, the concepts of cost and breakeven analysis.
- To acquaint the students with books of accounts and final statements.
- To enable the students analyze a company's financial situation through ratio analysis.

#### Course Outcome:

- Select a suitable business organization with available resources.
- Analyze various Aspects of Demand and Supply - elasticity of demand, demand forecasting and supply analysis.
- Gain knowledge of different market structures, production theories, cost variables and pricing methods.
- Prepare Books of accounts and Financial Statements.
- Analyze financial well-being of a business using financial ratios

#### Unit – I: Introduction to Business and Economics:

**Economics:** Significance of Economics, Micro and Macro Economic Concepts, National Income - Concepts and Importance, Inflation, Business Cycle - Features and Phases.

**Business:** Structure of Business Firm, Types of Business Entities: Sole Proprietorship – Partnership – Cooperative Societies - Limited Liability Companies; Sources of Capital – Conventional sources and Non-Conventional Sources of Finance.

**Business Economics:** Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

#### Unit – II: Demand and Supply Analysis:

**Demand Analysis:** Demand - Meaning, Determinants of Demand, Law of Demand, Exceptions to Law of Demand, Demand Function, Changes in Demand: Increase in Demand and decrease in Demand - Extension and Contraction in Demand.

**Elasticity of Demand:** Elasticity – Meaning, Types of Elasticity – Price Elasticity – Income Elasticity – Cross Elasticity–Advertising Elasticity of Demand, Factors affecting Elasticity of Demand, Measurement and Significance of Elasticity of Demand, Role of Elasticity of Demand in Decision Making.

**Demand Forecasting:** Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting – Survey Methods and Statistical Methods.

**Supply Analysis:** Supply – Meaning, Determinants of Supply, Supply Function and Law of Supply.

#### Unit – III: Production, Cost, Market Structures & Pricing:

**Production Analysis:** Production – Meaning, Factors of Production, Production Function, Production Function with one variable input and two variable inputs, Returns to Scale, Cobb-Douglas Production Function.

**Cost analysis:** Cost–Meaning, Types of Costs, Short run and Long run Cost Functions.

**Market Structures:** Nature of Competition. Features of Perfect competition, Monopoly, Oligopoly and Monopolistic Competition.

**Pricing:** Pricing -Meaning, Objectives of Pricing, and Pricing Methods – Cost based Pricing Methods – Demand based pricing methods – Competition based Pricing Methods – Strategy based Pricing Methods - Product Life Cycle based Pricing, Break Even Analysis (simple problems) and Cost Volume Profit Analysis.

**Unit – IV: Financial Accounting:**

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for Maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts along with Adjustments– Trading Account and Profit & Loss account – Balance Sheet (simple problems).

**Unit – V: Financial Analysis through Ratios:**

Concept of Ratio Analysis, Importance, Liquidity Ratios- Current Ratio – Quick Ratio – Absolute Liquid Ratio, Profitability Ratios – Gross Profit Ratio – Net Profit Ratio – Operating Ratio, Turnover Ratios – Stock Turnover Ratio – Debtors Turnover Ratio – Creditors Turnover Ratio, Leverage Ratios – Debt-to-Assets Ratio - Debt-Equity Ratio - Proprietary Ratios and Interpretation (simple problems).

**Suggested Readings:**

1. Geetika, Piyali Gosh, Purbaroy Choudhury, “Managerial Economics”, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.
2. Dhanesh K Khatri, “Financial Accounting”, Tata McGraw Hill, 2011.
3. Ramachandra Aryasri. A, “Business Economics and Financial Analysis”, McGraw Hill Education India Pvt. Ltd. 2020.

**Reference Books:**

1. P. L. Mehta, Managerial Economics, Analysis, Problems & Cases, 8th Edition, Sultan Chand & Sons, 2001.
2. S.N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.
3. D.D. Chaturvedi, S.L. Gupta, “Business Economics - Theory and Applications”, International Book House Pvt. Ltd. 2013.

L	T	P	C
3	1	0	4

**IV Semester Syllabus**  
**MA402BS: COMPUTER ORIENTED STATISTICAL METHODS**  
**(Common to CSBS, CSE (DATA SCIENCE))**

**Course Objectives:**

- The ideas of random variables and various discrete and continuous probability distributions and their properties
- The concept of theoretical distributions
- The sampling theory and Estimation
- Testing of hypothesis and making inferences
- The basic ideas of statistics including measures of central tendency, curve fitting, correlation and regression

**Course outcomes:** After completion of the course the student will be able to:

- Formulate and solve problems involving random variables. Apply the concepts of probability and distributions to case studies
- Understand the theoretical distributions
- Understand the concept of sampling and apply concept of estimation
- Testing of hypothesis to case studies
- Apply statistical methods for analyzing experimental data

**UNIT-I: Random Variables and Probability Distributions****10 L**

Random variables - Discrete and Continuous random variables and their distribution functions, Expectation, Variance, and standard deviation of random variables.

**UNIT-II: Theoretical Distributions****10 L**

Binomial, Poisson distributions and their properties -Poisson approximation to the Binomial distribution, Uniform distribution - Normal distributions and its properties - Normal approximation to Binomial distribution.

**UNIT-III: Fundamental Sampling Distributions and Estimation****10L**

Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, Theory of Estimation. Estimating the mean, standard error of a point estimate, prediction/ confidence interval.

**UNIT-IV: Testing of Hypothesis****10 L**

Test of significance- Basics of testing of hypothesis, Null and Alternate hypothesis, types of errors, level of significance, Critical region, Large sample test - single mean, single proportion, difference of means, difference of proportions; Small sample tests: Student's t-distribution, single mean, difference of means.

**UNIT-V: Applied Statistics****8 L**

Curve fitting by the method of least squares, fitting of straight lines, second degree parabolas and more general curves – Correlation and regression, Rank correlation.

**Suggested Readings:**

1. Ronald E.Walpole, Raymond H.Myers, Sharon L.Myers, Keying Ye, Probability & Statistics For Engineers & Scientists, 9<sup>th</sup> Ed. Pearson Publishers.
2. S C Gupta and VK Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

**Reference Books:**

1. T.T. Soong, Fundamentals of Probability and Statistics For Engineers, John Wiley & Sons, Ltd,2004.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press.
3. Miller and Freund's, Probability and Statistics for Engineers, 8<sup>th</sup> Edition, Pearson Educations.

L	T	P	C
3	0	0	3

**IV Semester Syllabus**  
**CS402PC: OPERATING SYSTEMS**  
*(Common to CSE, IT, CSBS, CSE (DATA SCIENCE))*

**Prerequisites:**

- A course on “Computer Programming and Data Structures”.
- A course on “Computer Organization and Architecture”.

**Course Objectives:****To Learn**

- Introduce operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- Introduce the issues to be considered in the design and development of operating system
- Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix

**Course Outcomes:****Student will be able to**

- Understand and Analyze OS structure and services.
- Compare different CPU scheduling algorithms.
- Recognize and resolve synchronization problems.
- Understand the Memory management Concepts.
- Illustrate the concepts in File Management System.

**UNIT - I**

**Operating System - Introduction,** Structures - Simple Batch, Multiprogrammed, Time- shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls and its types, system programs, OS Design and implementation, OS Structures.

**Process** – Process, Process states, PCB, Scheduling Queues, Schedulers, Operations on Processes, Threads.

**UNIT – II**

**CPU Scheduling:** Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec

**Deadlocks** - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

**UNIT - III**

**Process Management and Synchronization:** The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors

**Interprocess Communication Mechanisms:** IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

**UNIT - IV**

**Memory Management and Virtual Memory:** Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

**UNIT - V**

**File System Interface and Operations:** -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close, lseek, stat, ioctl system calls

**TEXT BOOKS:**

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

**REFERENCE BOOKS:**

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System A Design Approach- Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI

L	T	P	C
3	0	0	3

## IV Semester Syllabus

### CS404PC: DATABASE MANAGEMENT SYSTEMS

(Common to CSE, IT, CSBS, CSE (AI&ML), CSE (DATA SCIENCE))

**Prerequisites:**

A course on “Data Structures”.

**Course Objectives:**

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

**Course Outcomes:**

- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Able to understand integrity constraints and relational algebra.
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques

**UNIT - I**

**Database System Applications:** A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

**Introduction to Database Design:** Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

**UNIT - II**

**Introduction to the Relational Model:** Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical database design, introduction to views, destroying/altering tables and views. Relational Algebra, Tuple relational Calculus, Domain relational calculus.

**UNIT - III**

**SQL: QUERIES, CONSTRAINTS, TRIGGERS:** form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active databases.

**Schema Refinement:** Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, Fifth normal form.

**UNIT - IV**

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

**UNIT - V**

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes-Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

**TEXT BOOKS:**

1. Database System Concepts, Silberschatz, Korth, McGraw hill, V edition.3rd Edition
2. Introduction to Database Systems, C. J. Date, Pearson Education

**REFERENCE BOOKS:**

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7thEdition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill



L	T	P	C
3	0	0	3

## IV Semester Syllabus

### CS405PC: SOFTWARE ENGINEERING

#### (Common to CSE, CSBS, CSE (DATA SCIENCE))

#### Course Objectives

- The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

#### Course Outcomes

- Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
- Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

#### UNIT - I

**Introduction to Software Engineering:** The evolving role of software, changing nature of software, software myths. **A Generic view of process:** Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI). **Process models:** The waterfall model, Spiral model and Agile methodology

#### UNIT - II

**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

**Requirements engineering process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

#### UNIT - III

**Design Engineering:** Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

#### UNIT - IV

**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Metrics for Process and Products: Software measurement, metrics for software quality.

#### UNIT - V

**Risk management:** Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM. **Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

#### TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.

#### REFERENCE BOOKS:

1. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.
2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
3. Software Engineering principles and practice- Waman S Jawadkar, The McGraw- Hill Companies.

L	T	P	C
0	0	2	1

**IV Semester Syllabus**  
**CS451PC: OPERATING SYSTEMS LAB**  
*[Common to CSE, IT, CSBS & CSE (DATA SCIENCE)]*

**Prerequisites:**

1. A course on “Programming for Problem Solving”, A course on “Computer Organization and Architecture”.
2. A course on “Operating Systems”

**Course Objectives:**

To Learn

- To provide an understanding of the design aspects of operating system concepts through simulation
- Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix.

**Course Outcomes:**

Student will be able to:

- Write programs on various CPU scheduling algorithms
- Understand the usage of various Unix System calls
- Implement IPC mechanisms using system calls
- Implement Paging & segmentation of memory management
- Illustrate various page replacement algorithms

**List of Experiments:**

1. Write C programs to simulate the following CPU Scheduling algorithms a) FCFS b) SJF c) Round Robin d) priority
2. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, fcntl, seek, stat, opendir, readdir)
3. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.
4. Write a C program to implement the Producer – Consumer problem using semaphores using UNIX/LINUX system calls.
5. Write C programs to illustrate the following IPC mechanisms a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write C programs to simulate the following memory management techniques a) Paging b) Segmentation
7. Write C programs to simulate Page replacement policies a) FCFS b) LRU c) Optimal

**Text Books:**

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7<sup>th</sup> Edition, John Wiley
2. Advanced programming in the Unix environment, W.R.Stevens, Pearson education.

**Reference Books:**

1. Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System - A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI
4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education
5. UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education

L	T	P	C
0	0	2	1

**IV Semester Syllabus**  
**CS452PC: DATABASE MANAGEMENT SYSTEMS LAB**  
**(Common to CSE, IT, CSBS, CSE (AI&ML), CSE (DATA SCIENCE))**

**Course Objectives:**

- Introduce ER data model, database design and normalization
- Learn SQL basics for data definition and data manipulation

**Course Outcomes:**

- Design database schema for a given application and apply normalization
- Acquire skills in using SQL commands for data definition and data manipulation.
- Develop solutions for database applications using procedures, cursors and triggers

**List of Experiments:**

1. Concept design with E-R Model
2. Relational Model
3. Normalization
4. Practicing DDL commands
5. Practicing DML commands
6. A. Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints etc.)  
B. Nested, Correlated subqueries
7. Queries using Aggregate functions, GROUP BY, HAVING and Creation and dropping of Views.
8. Triggers (Creation of insert trigger, delete trigger, update trigger)
9. Procedures
10. Usage of Cursors

**TEXT BOOKS:**

1. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.
2. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.

**REFERENCE BOOKS:**

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7<sup>th</sup> Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

L	T	P	C
3	0	0	0

### IV Semester Syllabus

#### MC401HS: CONSTITUTION OF INDIA

(Common to EEE, CSE, IT, CSBS, CSE (DATA SCIENCE))

#### Course Objectives

- To understand the History of making of Indian Constitution and the role of drafting committee
- To list the salient features of the Preamble to the Constitution of India.
- To identify the importance of Fundamental Rights as well as Fundamental Duties
- To understand the powers and functions of Parliament, President, Council of Ministers, Governor, Judges, etc. and their qualifications.
- To have a thorough understanding of local self government and its associated agencies.
- To learn and realize the role and functionality of election commission and Institute and Bodies for the welfare of SC/ST/OBC and Women.

#### Course Outcomes: At the end of the course, student will be able to

- Describe the history of making of Indian Constitution and the role of drafting committee
- Explain the purpose of Preamble to the Constitution of India
- Outline the Fundamental Rights and Fundamental Duties of a Citizen
- Acquire Knowledge on functioning of Parliament , Executive and Judiciary System
- Comprehend and Evaluate the role of local self-Government and its associated agencies
- Assess and analyze the role and functioning of the Election Commission

#### Unit-I:

History of Making of the Indian Constitution- History of Drafting Committee.

#### Unit – II:

Philosophy of the Indian Constitution- Preamble Salient Features

#### Unit – III:

##### Contours of Constitutional Rights & Duties - Fundamental Rights

- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

#### Unit – IV:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

#### Unit – V:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**Unit – VI:**

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**Suggested Reading:**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015