

# **Department of Computer Science & Engineering**

## **COMPUTER SCIENCE AND ENGINEERING**

### **In Big Data and Analytic in association with IBM**

#### **Program Learning Outcomes (PLOs)**

PLO 1: An ability to apply knowledge & skill of mathematics, science and engineering.

PLO 2: An ability to identify, analyze, design, develop, implement and integrate software and hardware based computer systems

PLO 3: An ability to understand emerging technologies and related security issues in the computing paradigm.

PLO 4: An ability to acquire and apply the skill in modern techniques, methodologies and tools to be innovative and creative.

PLO 5: An ability to formulate, design & demonstrate strong logical, analytical and reasoning skills to adeptly solve problems

PLO 6: An ability to apply algorithmic principles and programming prowess in the development of software systems

PLO 7: An awareness of social, health, ethical, legal, financial, and professional responsibilities

PLO 8: An ability to analyze the local and global impact of computing discipline on environmental issues and sustainable development.

PLO 9: Recognition of the need for self-motivation and ability to engage in lifelong learning and professional development

PLO 10: An ability to effectively manage projects involving multidisciplinary and teams with ethnic diversity.

PLO 11: An ability to communicate effectively, both in written and verbal forms

PLO 12: An ability to demonstrate leadership and entrepreneurship qualities.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0101</b>	<b>TECHNICAL ENGLISH - I</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1:** Understand and appreciate the need of communication training.

**CLO2:** Use different strategies of effective communication.

**CLO3:** Select the most appropriate mode of communication for a given situation.

**CLO4:** Speak assertively and effectively.

**CLO5:** Correspond effectively through different modes of written communication.

**CLO6:** Write effective reports, proposals and papers.

**CLO7:** Present himself/ herself professionally through effective resumes and interviews.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0101</b>	<b>MATHEMATICS - I</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To apply advanced matrix knowledge to Engineering problems

**CLO2:** How to improve their ability in solving geometrical applications of differential calculus problems

**CLO3:** Understand equip themselves familiar with the functions of several variables

**CLO4:** To familiarize with the applications of differential equations

**CLO5:** Try expose to the concept of three dimensional analytical geometry

**CLO6:** Expose the students to the concept of convergence and divergence

**CLO7:** Learn to develop the ability to judge and apply appropriate tests to various infinite series

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0101</b>	<b>PHYSICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** To apply the Physics concepts in solving engineering problems

**CLO2:** How to educate scientifically the new developments in engineering and technology

**CLO3:** Try to emphasize the significance of Green technology through Physics principles

**CLO4:** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0101</b>	<b>CHEMISTRY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** The role of applied chemistry in the field of engineering.

**CLO2:** Get knowledge of water quality parameters and the treatment of water.

**CLO3:** Understand principles involves in corrosion and its inhibitions.

**CLO4:** Important analytical techniques, instrumentation and the applications.

**CLO5:** Knowledge with respect to the phase equilibria of different systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1:** To know about different materials and their properties

**CLO2:** Understand engineering aspects related to buildings

**CLO3:** Learn importance of surveying and the transportation systems

**CLO4:** Get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1001</b>	<b>S/W FOUNDATION &amp; EMERGING AREAS OF TECH.</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Understand Models in emerging technologies and using basic tools for application development

**CLO2:** Describe Model of Open Standard

**CLO3:** Describe importance of security and scope.

**CLO4:** Analyse Role of SQL queries.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0103</b>	<b>PHYSICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand scientific concepts in measurement of different physical variables

**CLO2:** Develop the skill in arranging and handling different measuring instruments and

**CLO3:** Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

**CLO4:** Apply the mathematical concepts/equations to obtain quantitative results

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand the basic concepts involved in the analyses

**CLO2:** Learn the basic concepts of measurement techniques.

**CLO3:** The synthesis, dynamics, chemical transformation and their applications

**CLO4:** To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0107</b>	<b>NCC/NSS/NSO/YOGA</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice.

**CLO2:** Understand discipline, gratitude towards country

**CLO3:** Practice YOGA poses and know how it is important

**CLO4:** Develop patriotic feeling for country

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1111</b>	<b>SOFTWARE FOUNDATION LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand Models in emerging technologies and using basic tools for application development

**CLO2:** Describe Model of Open Standard

**CLO3:** Learn importance of security and scope.

**CLO4:** Analyse Role of SQL queries

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**CLO1:** The basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.

**CLO2:** The production of simple models in the above trades.

**CLO3:** Be aware of the safety precautions while working in the workshop.

**CLO4:** Use different measuring, marking, cutting tools used in the workshop.

## **SEMESTER - II**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0102</b>	<b>TECHNICAL ENGLISH - II</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1:** To provide for the acquisition of basic communication skills in English in relation to the requirements of the students of Engineering and Technology.

**CLO2:** Analyse facilitate the holistic, integrated development of LSRW involved in language learning through a series of intensely practical tasks and activities.

**CLO3:** Get offer professionally sustainable language content by which to address the special needs of the target learners to ensure that they are adequately equipped with discorsal and grammatical competencies.

**CLO4:** Try to help acquire the use of language simultaneously through the electronic media such as the Internet so as to enable the learners to deal effectively with E-materials.

**CLO5:** Use to expose the learners to a wide range of lexical and grammatical skills needed for their special professional demands.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0108</b>	<b>VALUE EDUCATION</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**CLO1:** To help individuals think about and reflect on different values.

**CLO2:** Learn to deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.

**CLO3:** Try to inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** To familiarize the students with the basic organization of organisms and subsequent building to a living being.

**CLO2:** With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.

**CLO3:** To provide knowledge about biological problems that requires engineering expertise to solve them.

**CLO4:** Understand body parts according to machine working mechanism

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0102</b>	<b>MATHEMATICS - II</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Solve the differential equations of first and 2nd order and basic application problems described by these equations.

**CLO2:** Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.

**CLO3:** Try to Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.

**CLO4:** Solve systems of linear equations by using elementary row operations.

**CLO5:** Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the Eigen values and eigenvectors.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Understand electrical properties of materials,

**CLO2:** Learn the properties and applications of semi conducting materials,

**CLO3:** Analyse general properties and applications of magnetic and dielectric materials,

**CLO4:** Know the behaviour of materials on exposure to light,

**CLO5:** Understand general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0106</b>	<b>BASIC ENGINEERING - II</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the basic concepts of magnetic circuits, AC & DC circuits.

**CLO2:** Explain the working principle, construction, applications of DC & AC machines and measuring instruments.

**CLO3:** Gain knowledge about the fundamentals of wiring and earthing

**CLO4:** Fundamentals of electronic components, devices, transducers, Principles of digital electronics, and

**CLO5:** Principles of various communication systems

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0104</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** The importance of environmental education, ecosystem and ethics.

**CLO2:** Knowledge with respect to biodiversity and its conservation.

**CLO3:** To create awareness on various environmental pollution aspects and issues.

**CLO4:** Learn to educate the ways and means to protect the environment.

**CLO5:** Important environmental issues and protection

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1004</b>	<b>PROGRAMMING WITH JAVA</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Describe the fundamentals of object-oriented program.

**CLO2:** Apply Java language constructs that enable and enforce OO-related concepts such as data encapsulation, strict typing and type conversion, inheritance, and polymorphism

**CLO3:** To understand the concepts of OOP and Java Environment.

**CLO4:** Define the concepts, their role and implications in OOP features for Java.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0104</b>	<b>MATERIAL SCIENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** The students are expected to familiarize with various characterization techniques of materials.

**CLO2:** They should have developed better understanding of the underlying science behind the properties of various materials.

**CLO3:** To learn an introductory idea about new materials.

**CLO4:** To learn various types of fuels and their properties

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1114</b>	<b>JAVA LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Knowledge of the structure and model of the Java programming language

**CLO2:** Use the Java programming language for various programming technologies (understanding)

**CLO3:** Develop software in the Java programming language, (application)

**CLO4:** Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)

**CLO5:** Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

**CLO6:** Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>
(Only First Angle Projection is to be followed)					

**CLO1:** The construction of geometrical figures

**CLO2:** Learn the projection of 1D, 2D & 3D elements

**CLO3:** Sectioning of solids and development of surfaces

**CLO4:** Preparation and interpretation of building drawing



**CLO5:** Draw dimensioned orthographic and isometric projections of simple engineering objects.

**CLO6:** Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism;

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0211</b>	<b>MATHEMATICS - III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the rudiments of Fourier series

**CLO2:** The theory and problems of PDE

**CLO3:** Analyse applications of PDE to boundary value problems

**CLO4:** Fourier transforms and to their branches of engineering

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2001</b>	<b>DATA STRUCTURES USING C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Implement the basic data structures and solve problems using fundamental algorithms. 2. Implement various search and sorting techniques.

**CLO2:** Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.

**CLO3:** Evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

**CLO4:** Enable them to write algorithms for solving problems with the help of fundamental data structures.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2003</b>	<b>DISCRETE STRUCTURES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Perform operations on various discrete structures such as set, function and relation.

**CLO2:** Apply basic concepts of asymptotic notation in analysis of algorithm.

**CLO3:** Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real-world problems.

**CLO4:** Comprehend formal logical arguments and translate statements from a natural language into its symbolic structures in logic.

**CLO5:** Identify and prove various properties of rings, fields and group.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2:** Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.

**CLO3:** Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.

**CLO4:** Apply and create Relational Database Design process with Normalization and Denormalization of data.

**CLO5:** Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.

**CLO2:** Describe the design of a basic computer with instruction formats & addressing modes.

**CLO3:** Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.

**CLO4:** Interpret the concepts of pipelining, multiprocessors, and inter processor communication.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2003</b>	<b>PYTHON PROGRAMMING</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Understand the basic concepts of Python

**CLO2:** Learn how to write functions and pass arguments in Python

**CLO3:** Design object- oriented programs with Python classes.

**CLO4:** Define the structure and components of a Python program.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2111</b>	<b>DBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Designing a database

**CLO2:** Using DDL and DML commands can create database

**CLO3:** Backing up of files can be done

**CLO4:** Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO5:** Formulate query, using SQL, solutions to a broad range of query and data update problems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2113</b>	<b>DATA STRUCTURES LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Implementing Stack, Queue , Linked List , Binary tree

**CLO2:** Sorting and Searching Techniques

**CLO3:** Divide and Conquer, Dynamic Programming methods

**CLO4:** Greedy method , Traversals and Backtracking

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2115</b>	<b>PYTHON PROGRAMMING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand the basic concepts of Python

**CLO2:** Learn how to write functions and pass arguments in Python

**CLO3:** Design object- oriented programs with Python classes.

**CLO4:** Define the structure and components of a Python program.

## SEMESTER - IV

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2002</b>	<b>ESSENTIALS OF S/W ENGG. (OOAD &amp; SW LIFECYCLE)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CL01:** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CL02:** Explain the different views of software architecture

**CL03:** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CL04:** Use the UML to represent the design model

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2006</b>	<b>OPERATING SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CL01:** Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CL02:** Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.

**CL03:** Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.

**CL04:** Examine and categories various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.

**CL05:** Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2008</b>	<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Implement the different tree structures algorithm and analyze in context of asymptotic notation.

**CL02:** Identify basic properties of graphs and apply their algorithms to solve real life problems.

**CL03:** Demonstrate the usage of algorithms under several categories like string matching, randomized algorithms and genetic algorithms.

**CL04:** Implement various advanced data structures using C/Java/Python or related languages.

**CL05:** Demonstrate a familiarity with major Divide and conquer algorithms and data structures.

**CLO6:** To apply important Dynamic programming design paradigms and methods of analysis.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2004</b>	<b>BUSINESS INTELLIGENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** learn how analytics provided a solution to industries using real case studies

**CLO2:** Understand how business analysis software works, and its architecture

**CLO3:** Analyse a reporting application, its interface, and the different report types

**CLO4:** Create different types of active reports and advanced reports

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0202</b>	<b>PERSONALITY DEVELOPMENT - IV</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2114</b>	<b>OPERATING SYSTEMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Scheduling algorithms

**CLO2:** Deadlock algorithms and page replacement algorithms

**CLO3:** Memory management schemes, Thread and synchronization

**CLO4:** To study the process management and scheduling.

**CLO5:** Understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2118</b>	<b>ADA LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2:** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3:** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

**CLO4:** To demonstrate a familiarity with major Divide and conquer algorithms and data structures.

**CLO5:** Learn to apply important Dynamic programming design paradigms and methods of analysis.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2118</b>	<b>FCEAD USING IBM RATIONAL TOOL LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CLO2:** Explain the different views of software architecture

**CLO3:** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CLO4:** Use the UML to represent the design model

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2120</b>	<b>BUSINESS INTELLIGENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** learn how analytics provided a solution to industries using real case studies

**CLO2:** Understand how business analysis software works, and its architecture

**CLO3:** Analyse a reporting application, its interface, and the different report types

**CLO4:** Create different types of active reports and advanced reports

## **SEMESTER - V**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Design and construction of compilers and knowledge of working of major phases of compilation.

**CLO2:** Construct parsers.

**CLO3:** Implement a simple compiler for a language chosen.

**CLO4:** Classify various parameters passing scheme, explain memory management of a programming languages and perform code optimization.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

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**CLO1:** Conceptualize and explain the functionality of the different layers within a network architecture

**CLO2:** Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies, subnetting and routing mechanism.

**CLO3:** Demonstrate the operation of various routing protocols and their performance analysis.

**CLO4:** Illustrate design and implementation of datalink, transport and network layer protocols within a simulated/real networking environment.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3005</b>	<b>THEORY OF COMPUTATION</b>	3	1	0	4

**CLO1:** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2:** Disambiguate context-free grammars by mastering the concepts of context-free languages and push down automata.

**CLO3:** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

**CLO4:** Solve analytical problems in related areas of theory in computer science.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3007</b>	<b>ESSENTIALS OF HADOOP</b>	3	1	0	4

**CLO1:** Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2:** Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3:** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4:** To understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5:** Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6:** Ability to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3009</b>	<b>PLANNING ANALYTICS</b>	3	0	0	3

**CLO1:** Learn about Customize Business Rules, SKIPCHECK, FEEDERS, and Creation of applications in TM1

**CLO2:** Able to create new server, dimensions, cubes and import data using TM1.

**CLO3:** Understand how to model data using architecture and integrate TM1 with Cognos BI.

**CLO4:** Analyse data across cube and create complete model and use additional modeling techniques in TM1

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	0	0	2	1

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3113</b>	<b>COMPUTER NETWORK LAB</b>	0	0	2	1

On completion of this course, the students will be able to:-

**CLO1:** Understand the requirements of an enterprise and outline its major design areas

**CLO2:** Learn to Identify functional areas to construct high level modules for enterprise architecture and analyze them.

**CLO3:** Identify the networking devices, prepare a bill of materials and configure the devices as per the Core, Access and Distribution layers



**CLO4:** Design the Server Farm for an enterprise network and discuss up gradations if needed.

**CLO5:** Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.

**CLO6:** Test and monitor the enterprise network using a tool

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3117</b>		<b>COMPILER DESIGN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**CLO2:** To gain basic knowledge of Compiler, Assembler, Linker, Loader and Macro.

**CLO3:** Analyse and understand the fundamentals of the design of Compilers by applying mathematics and engineering principles.

**CLO4:** Design a system for parsing the sentences in a compiler grammar and developing a symbol table.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3113</b>	<b>HADOOP LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2:** Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3:** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4:** Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5:** To recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6:** learn to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3115</b>	<b>PLANNING ANALYTICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Learn about Customize Business Rules, SKIPCHECK, FEEDERS, and Creation of applications in TM1

**CLO2:** Able to create new server, dimensions, cubes and import data using TM1.

**CLO3:** Understand how to model data using architecture and integrate TM1 with Cognos BI.

**CLO4:** Analyse data across cube and create complete model and use additional modeling techniques in TM1

## **SEMESTER - VI**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3002</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

On completion of this course, the students will be able to:-

**CLO1:** Learn the basics and applications of artificial intelligence and categorize various problem domains, basic knowledge representation and reasoning methods.

**CLO2:** Analyze basic and advanced search techniques including game playing, evolutionary search algorithms, and constraint satisfaction. Learn and design intelligent agents for concrete computational problems.

**CLO3:** Design of programs in AI language(s).

**CLO4:** Acquire knowledge about the architecture of an expert system and design new expert systems for real life applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3006</b>	<b>DATA SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

On completion of this course, the students will be able to:-

**CL01:** Describe what Data Science is and the skill set needed to be data scientist.

**CL02:** Learn about HDFS and YARN building and make sense of how to function with them for limit and resource utilisation.

**CL03:** Understand MapReduce and its qualities and retain advanced Mapreduce thoughts.

**CL04:** Get a working learning of Jupyter Notebook

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3010</b>	<b>ADVANCED RDBMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

On completion of this course, the students will be able to:-

**CL01:** Master the basic concepts and appreciate the applications of database systems.

**CL02:** Understand the basics of SQL and construct queries using SQL.

**CL03:** Describe commercial relational database system (Oracle) by writing SQL using the system.

**CL04:** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.

**CL05:** learn sound design principles for logical design of databases, including the E- R method and normalization approach.

**CL06:** Understand basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CL07:** Acquire the basics of query evaluation techniques and query optimization.

**CL08:** Be familiar with the basic issues of transaction processing and concurrency control.

**CL09:** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to

**CL01:** To assess the overall knowledge level of Computer Science and engineering standards and guide them to take corrective measures where deficiencies are detected.

**CL02:**Types of reading strategies to enhance improve reading skills

**CL03:**Role of writing skills in effective communication

**CL04:** Learn Advantages & Disadvantages of written communication

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT -VI</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3114</b>	<b>ARTIFICIAL INTELLIGENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to

**CLO1:** To implement Heuristic functions & Prepositional Logic

**CLO2:** Describe A\* & AO\* algorithms

**CLO3:** Analyse an Expert system for medical diagnosis

**CLO4:** Understand and implement the concepts for uncertainty, knowledge representation and learning.

**CLO5:** Learn to design the application while deciding the level of requirement of each AI component (search, Planning, Learning, uncertainty).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3112</b>	<b>DATA SCIENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Describe what Data Science is and the skill set needed to be data scientist.

**CLO2:** Learn about HDFS and YARN building and make sense of how to function with them for limit and resource utilization.

**CLO3:** Understand MapReduce and its qualities and retain advanced Mapreduce thoughts.

**CLO4:** Get a working learning of Jupiter Notebook

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3114</b>	<b>ADVANCED RDBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Master the basic concepts and appreciate the applications of database systems.

**CLO2:** Understand basics of SQL and construct queries using SQL.

**CLO3:** Analyse commercial relational database system (Oracle) by writing SQL using the system.

**CLO4:** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.

**CLO5:** Master sound design principles for logical design of databases, including the E- R method and normalization approach.

**CLO6:** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CLO7:** Know the basics of query evaluation techniques and query optimization.

**CLO8:** Be familiar with the basic issues of transaction processing and concurrency control.

**CLO9:** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

## SEMESTER - VII

		L	T	P	C
<b>CBD 4001</b>	<b>BLOCKCHAIN</b>	3	0	0	3

**CLO1:** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2:** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3:** Analyse the properties of Block Chain models.

**CLO4:** Understand the vision of IoT and communication protocols from a global context.

**CLO5:** Design portable IoT using appropriate boards.

		L	T	P	C
<b>CBD 4003</b>	<b>PREDICTIVE ANALYTICS</b>	3	0	0	3

**CLO1:** To illustrate the interaction of multi-faceted fields like data mining, statistics and mathematics in the development of Predictive Analytics

**CLO2:** learn to acquaint the student with the concepts of Ordinary Least Squares & Generalized Least Squares

**CLO3:** How to make the student familiar with various data clustering and dimension reduction techniques.

**CLO4:** Apply and analyze how to use IoT functions, use advanced field operations, handle sequence data and improve efficiency.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4115</b>	<b>INDUSTRIAL TRAINING - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4117</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

**CLO1:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4121</b>	<b>PREDICTIVE ANALYTICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To illustrate the interaction of multi-faceted fields like data mining, statistics and mathematics in the development of Predictive Analytics

**CLO2:** Learn to acquaint the student with the concepts of Ordinary Least Squares & Generalized Least Squares

**CLO3:** How to make the student familiar with various data clustering and dimension reduction techniques.

**CLO4:** Apply and analyze how to use IoT functions, use advanced field operations, handle sequence data and improve efficiency.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4123</b>	<b>BLOCKCHAIN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2:** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts.

**CLO3:** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

**CLO4:** Understand and learn how bitcoin and other coins work in real world.

**CLO5:** learn how cryptography primitives drive blockchains and crypto-currency infrastructures.

**CLO6:** To know how cryptocurrency and blockchains will move for future directions (ex. Privacy,multiparty computation, anonymity).

### **SEMESTER - VIII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4114</b>	<b>PROJECT</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**CLO1:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## SYLLABUS OF DEPARTMENTAL ELECTIVES

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3020</b>	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Knowledge and understanding

- Outline the potential benefits of distributed systems
- Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

**CLO2:** Cognitive skills (thinking and analysis).

- Apply standard design principles in the construction of these systems
- Select appropriate approaches for building a range of distributed systems, including some that employ middleware

**CLO3:** Communication skills (personal and academic).

**CLO4:** Practical and subject specific skills (Transferable Skills).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3022</b>	<b>SYSTEM SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the relationship between system software and machine architecture.

**CLO2:** Know the design and implementation of assemblers

**CLO3:** Learn the design and implementation of linkers and loaders.

**CLO4:** To have an understanding of macro processors.

**CLO5:** Analyse an understanding of system software tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3024</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Describe and apply basic concepts related to software project planning, scope and feasibility.

**CLO2:** Analyze various project estimation techniques, especially size estimation (FP), effort estimation (COCOMO models), schedule estimation (GANTT charts), and cost estimation.

**CLO3:** Illustrate the concept of team structure and project communication management.

**CLO4:** Acquire knowledge about quality assurance, quality control, and risk management.

**CLO5:** Describe various project management activities such as tracking, project procurement, configuration management, monitoring.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CS 3026</b>	<b>GRID COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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**CL01:** Understand the genesis of grid computing

**CL02:** Know the application of grid computing

**CL03:** To understand the technology and tool kits for facilitating grid computing

**CL04:** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids;

**CL05:** Utilize grid computing and clustering middleware, such as Parallel Virtual Machine (PVM), Message Passing Interface (MPI), HPC Portals, and Peer-to-Peer networks for implementing virtual super computing resources;

**CL06:** To design a grid computing application in one of the key application areas i.e.g. Computer Animation, E-Research;

**CL07:** Understand install a grid computing environment; develop communications skills and accept the code of professional conduct and practice through short presentations and group work.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Understanding Object Basics, Classes and Objects, Inheritance

**CL02:** How software objects are altered to build software systems that are more robust

**CL03:** Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project

**CL04:** Understanding the issues and options in reuse

**CL05:** Using UML, a common language for talking about requirements, designs, and component interfaces.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Expose the students to the concepts of feed forward neural networks

**CL02:** To provide adequate knowledge about feedback networks.

**CL03:** Teach about the concept of fuzziness involved in various systems.

**CL04:** Get adequate knowledge about fuzzy set theory.

**CL05:** To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

**CL06:** Know adequate knowledge of application of fuzzy logic control to real time systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3032</b>	<b>CYBER SECURITY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CL02:** Underline the need of digital forensic and role of digital evidences.

**CL03:** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CL04:** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.

**CL05:** Apply the knowledge of IDS to secure network and performing router and network analysis

**CL06:** List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4019</b>	<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Comprehend and implement various cryptographic algorithms to protect the confidential data.

**CL02:** Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.

**CL03:** Apply security tools to locate and fix security leaks in a computer network/software.

**CL04:** Secure a web server and web application

**CL05:** Configure firewalls and IDS

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4021</b>	<b>BIG DATA &amp; ANALYTICS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

**CL02:** Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

**CL03:** Implement several Data Intensive tasks using the Map Reduce Paradigm

**CL04:** Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

**CL05:** Design algorithms to analyze big data like streams, Web.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4023</b>	<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

**CL02:** Know the principles and characteristics of wireless sensor networks (WSNs).

**CL03:** how proactive protocols function and their implications on data transmission delay and bandwidth consumption.

**CL04:** Student understands how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CL05:** Understands how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CL06:** Learn how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CL07:** Students are familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CL08:** Know acquired skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4025</b>	<b>DATA WAREHOUSING &amp; DATA MINING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Data pre-processing and data quality.

**CL02:** Modeling and design of data warehouses.

**CL03:** Algorithms for data mining.

**CL04:** Design data warehouse with dimensional modeling and apply OLAP operations.

**CL05:** Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4027</b>	<b>MOBILE COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Grasp the concepts and features of mobile computing technologies and applications

**CL02:** Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CL03:** Identify the important issues of developing mobile computing systems and applications

**CL04:** Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

**CL05:** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

**CL06:** Analyze and manage software built for deployment and demonstration.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4029</b>	<b>MACHINE LEARNING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.

**CL02:** Apply decision tree learning, bayesian learning and artificial neural network in real world problems.

**CL03:** Understand the use of genetic algorithms and genetic programming.

**CL04:** Apply inductive and analytical learning with perfect domain theories.

**CL05:** Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4031</b>	<b>OPEN SOURCE SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Understand concepts, strategies, and methodologies related to open source software development.

**CL02:** Learn the business, economy, societal and intellectual property issues of open source software.

**CL03:** Be familiar with open source software products and development tools currently available on the market.

**CL04:** To able utilize open source software for developing a variety of software applications, particularly Web applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4033</b>	<b>SOFTWARE TESTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CL02:** Implement various test processes for quality improvement

**CL03:** Design test planning.

**CL04:** Manage the test process

**CL05:** Apply the software testing techniques in commercial environment

**CL06:** Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4035</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Learn the Internet Programming, using Java Applets

**CLO2:** create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CLO3:** Apply event handling on AWT and Swing components.

**CLO4:** learn to access database through Java programs, using Java Data Base Connectivity (JDBC)

**CLO5:** Create dynamic web pages, using Servlets and JSP.

**CLO6:** Make a reusable software component, using Java Bean.

**CLO7:** Invoke the remote methods in an application using Remote Method Invocation (RMI).

**CLO8:** Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

**CLO9:** Develop Stateful, Stateless and Entity Beans.

**CLO10:** Use Struts frameworks, which gives the opportunity to reuse the codes for quick development.

**CLO11:** Map Java classes and object associations to relational database tables with Hibernate mapping files.

## SYLLABUS OF OPEN ELECTIVES

		L	T	P	C
LE 0201	GERMAN LANGUAGE PHASE - I	2	0	0	2

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		L	T	P	C
LE 0205	FRENCH LANGUAGE PHASE - I	2	0	0	2

**CLO1:** Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0202</b>	<b>GERMAN LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0206</b>	<b>FRENCH LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2012</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To be familiar with numerical solution of equations

**CLO2:** Get exposed to finite differences and interpolation

**CLO3:** learn through with the numerical Differentiation and integration

**CLO4:** To find numerical solutions of ordinary differential equations

**CLO5:** Be through with probability concepts and the corresponding distributions.

**CLO6:** Get exposed to the testing of hypothesis using distributions.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2002</b>	<b>ENGINEERING ECONOMICS AND MANAGEMENT</b>	3	1	0	4

**CLO1:** To apply theoretical economic concepts to practical business situation and to take decision in the Industrial Engineering Situation.

**CLO2:** An Engineer must demonstrate knowledge and understanding of the engineering and management

**CLO3:** Principle and Apply these to Engineeringwork environment, as a member and leader in a team,

**CLO4:** To manage projects and in multidisciplinary environments.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2004</b>	<b>INDUSTRIAL MANAGEMENT</b>	3	1	0	4

**CLO1:** Students will be able to perform the Management Functions.

**CLO2:** They can be able to compare selected Theories of Management.

**CLO3:** To perform the functions in the Marketing Mix.

**CLO4:** Students will be able to use basic Business Application Software.

**CLO5:** To assess ethical issues in Business situations.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2006</b>	<b>RELIABILITY AND QUALITY MANAGEMENT</b>	3	1	0	4

**CLO1:** Apply the Concept of SQC in Process Control for Reliable Component Production

**CLO2:** To provide an understanding of the working knowledge of the techniques for estimation, design,testing and quality management

**CLO3:** Identify risks, manage the change to assure quality in projects.

**CLO4:** Extract and analyse software requirements specifications for different projects.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2002</b>	<b>PRODUCTION AND OPERATION MANAGEMENT</b>	3	1	0	4

**CLO1:** Apply problem-solving and critical-thinking skills as required in materials and operations management.

**CLO2:** Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.

**CLO3:** To meet the specified needs with appropriate consideration for the public health and safety,

**CLO4:** Learn management principles and apply these to Engineering work environment,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2004</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Gain Knowledge and Skills needed to run a Business Successfully.

**CLO2:** Understand the different support system for business development.

**CLO3:** Get knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO4:** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2006</b>	<b>NON-CONVENTIONAL ENERGY RESOURCES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Acquired knowledge about different energy resources.

**CLO2:** Ability to convert the energy from one form to another form.

**CLO3 :** Learn how to use these energy resources

**CLO4:** Develop new effective to utilize energy

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2008</b>	<b>NANOTECHNOLOGY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** The various opportunities in the emerging field of nano electronics and nano technologies

**CLO2:** To know advantages and disadvantages of nano particles



**CLO3:** Analyse new technologies emerges with nanotechnology

**CLO4:** To know new and faster kinds of computers, more efficient power sources and life-saving medical treatment

**COMPUTER SCIENCE AND ENGINEERING**  
**In Big Data and Analytic in association with IBM**  
**[w. e. f. 2019-20]**

**SEMESTER - I**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0101</b>	<b>TECHNICAL ENGLISH - I</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1:** Understand and appreciate the need of communication training.

**CLO2:** Use different strategies of effective communication.

**CLO3:** Select the most appropriate mode of communication for a given situation.

**CLO4:** Speak assertively and effectively.

**CLO5:** Correspond effectively through different modes of written communication.

**CLO6:** Write effective reports, proposals and papers.

**CLO7:** Present himself/ herself professionally through effective resumes and interviews.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0101</b>	<b>MATHEMATICS - I</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To apply advanced matrix knowledge to Engineering problems

**CLO2:** Improve their ability in solving geometrical applications of differential calculus problems

**CLO3:** Equip themselves familiar with the functions of several variables

**CLO4:** To familiarize with the applications of differential equations

**CLO5:** Expose to the concept of three dimensional analytical geometry

**CLO6:** Learn to expose the students to the concept of convergence and divergence

**CLO7:** Try to develop the ability to judge and apply appropriate tests to various infinite series

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0101</b>	<b>PHYSICS</b>	3	0	0	3

**CLO1:** To apply the Physics concepts in solving engineering problems

**CLO2:** Educate scientifically the new developments in engineering and technology

**CLO3:** To emphasize the significance of Green technology through Physics principles

**CLO4:** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0101</b>	<b>CHEMISTRY</b>	3	0	0	3

**CLO1:** The role of applied chemistry in the field of engineering.

**CLO2:** Knowledge of water quality parameters and the treatment of water.

**CLO3:** The principles involves in corrosion and its inhibitions.

**CLO4:** Important analytical techniques, instrumentation and the applications.

**CLO5:** The knowledge with respect to the phase equilibria of different systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	4	0	0	4

**CLO1:** To know about different materials and their properties

**CLO2:** Analyze about engineering aspects related to buildings

**CLO3:** Understand importance of surveying and the transportation systems

**CLO4:** To get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1001</b>	<b>S/W FOUNDATION &amp; EMERGING AREAS OF TECH.</b>	3	0	0	3

**CLO1:** Understand Models in emerging technologies and using basic tools for application development

**CLO2:** Describe Model of Open Standard

**CLO3:** Learn importance of security and scope.

**CLO4:** Analyse Role of SQL queries.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	0	0	2	1

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0103</b>	<b>PHYSICS LAB</b>	0	0	2	1

**CLO1:** Understand scientific concepts in measurement of different physical variables

**CLO2:** Develop the skill in arranging and handling different measuring instruments and

**CLO3:** Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

**CLO4:** Apply the mathematical concepts/equations to obtain quantitative results

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	0	0	2	1

**CLO1:** Understand the basic concepts involved in the analyses

**CLO2:** Learn the basic concepts of measurement techniques.

**CLO3:** The synthesis, dynamics, chemical transformation and their applications

**CLO4:** To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0107</b>	<b>NCC/NSS/NSO/YOGA</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice.

**CLO2:** Understand discipline, gratitude towards country

**CLO3:** Practise YOGA poses and know how it is important

**CLO4:** Develop patriotic feeling for country

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1111</b>	<b>SOFTWARE FOUNDATION LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand Models in emerging technologies and using basic tools for application development

**CLO2:** Describe Model of Open Standard

**CLO3:** learn importance of security and scope.

**CLO4:** Analyse Role of SQL queries

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**CLO1:** The basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.

**CLO2:** The production of simple models in the above trades.

**CLO3:** Be aware of the safety precautions while working in the workshop.

**CLO4:** Use different measuring, marking, cutting tools used in the workshop.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0102</b>	<b>TECHNICAL ENGLISH - II</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1:** To provide for the acquisition of basic communication skills in English in relation to the requirements of the students of Engineering and Technology.

**CLO2:** Learn facilitate the holistic, integrated development of LSRW involved in language learning through a series of intensely practical tasks and activities.

**CLO3:** Try to offer professionally sustainable language content by which to address the special needs of the target learners to ensure that they are adequately equipped with discorsal and grammatical competencies.

**CLO4:** To help acquire the use of language simultaneously through the electronic media such as the Internet so as to enable the learners to deal effectively with E-materials.

**CLO5:** Expose the learners to a wide range of lexical and grammatical skills needed for their special professional demands.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0108</b>	<b>VALUE EDUCATION</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**CLO1:** To help individuals think about and reflect on different values.

**CLO2:** Understand to deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.

**CLO3:** Inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** To familiarize the students with the basic organization of organisms and subsequent building to a living being.

**CLO2:** With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.

**CLO3:** Analyse to provide knowledge about biological problems that requires engineering expertise to solve them.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0102</b>	<b>MATHEMATICS - II</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Solve the differential equations of first and 2nd order and basic application problems described by these equations.

**CLO2:** Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.

**CLO3:** Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.

**CLO4:** Solve systems of linear equations by using elementary row operations.

**CLO5:** Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the Eigen values and eigenvectors.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Understand electrical properties of materials,

**CLO2:** Learn the properties and applications of semi conducting materials,

**CLO3:** Analyze general properties and applications of magnetic and dielectric materials,

**CLO4:** Know the behaviour of materials on exposure to light,

**CLO5:** Get general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0106</b>	<b>BASIC ENGINEERING - II</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the basic concepts of magnetic circuits, AC & DC circuits.

**CLO2:** Explain the working principle, construction, applications of DC & AC machines and measuring instruments.

**CLO3:** Gain knowledge about the fundamentals of wiring and earthing

**CLO4:** Fundamentals of electronic components, devices, transducers, Principles of digital electronics, and

**CLO5:** Principles of various communication systems

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0104</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** The importance of environmental education, ecosystem and ethics.

**CLO2:** Knowledge with respect to biodiversity and its conservation.

**CLO3:** To create awareness on various environmental pollution aspects and issues.

**CLO4:** Educate the ways and means to protect the environment.

**CLO5:** Important environmental issues and protection

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1004</b>	<b>PROGRAMMING WITH JAVA</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Describe the fundamentals of object-oriented program.

**CLO2:** Apply Java language constructs that enable and enforce OO-related concepts such as data encapsulation, strict typing and type conversion, inheritance, and polymorphism

**CLO3:** Specify simple abstract data types and design implementations, using abstraction functions to document them.

**CLO4:** Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To guide thought process.

**CLO2:** How to groom students' attitude.

**CLO3:** Develop communication skill.

**CLO4:** To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0104</b>	<b>MATERIAL SCIENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** The students are expected to familiarize with various characterization techniques of materials.

**CLO2:** They should have developed better understanding of the underlying science behind the properties of various materials.

**CLO3:** Analyse general properties and applications of magnetic and dielectric materials,

**CLO4:** Know the behaviour of materials on exposure to light,

**CLO5:** Understand general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1114</b>	<b>JAVA LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Knowledge of the structure and model of the Java programming language

**CLO2:** Use the Java programming language for various programming technologies (understanding)

**CLO3:** Develop software in the Java programming language, (application)

**CLO4:** Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)

**CLO5:** Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

**CLO6:** Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>
(Only First Angle Projection is to be followed)					

**CLO1:** The construction of geometrical figures

**CLO2:** To know the projection of 1D, 2D & 3D elements

**CLO3:** Sectioning of solids and development of surfaces

**CLO4:** Preparation and interpretation of building drawing



**CLO5:** Draw dimensioned orthographic and isometric projections of simple engineering objects.

**CLO6:** Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism;

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0211</b>	<b>MATHEMATICS - III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** The rudiments of Fourier series

**CLO2:** Know the theory and problems of PDE

**CLO3:** The applications of PDE to boundary value problems

**CLO4:** Fourier transforms and to their branches of engineering

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2001</b>	<b>DATA STRUCTURES USING C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Implement the basic data structures and solve problems using fundamental algorithms. 2. Implement various search and sorting techniques.

**CLO2:** Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.

**CLO3:** Evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

**CLO4:** To enable them to write algorithms for solving problems with the help of fundamental data structures.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2003</b>	<b>DISCRETE STRUCTURES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Perform operations on various discrete structures such as set, function and relation.

**CLO2:** Apply basic concepts of asymptotic notation in analysis of algorithm.

**CLO3:** Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real-world problems.

**CLO4:** Comprehend formal logical arguments and translate statements from a natural language into its symbolic structures in logic.

**CLO5:** Identify and prove various properties of rings, fields and group.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2:** Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.

**CLO3:** learn Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.

**CLO4:** Apply and create Relational Database Design process with Normalization and Denormalization of data.

**CLO5:** Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.

**CLO2:** Describe the design of basic computer with instruction formats & addressing modes.

**CLO3:** Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.

**CLO4:** Interpret the concepts of pipelining, multiprocessors, and inter processor communication.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2003</b>	<b>PYTHON PROGRAMMING</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Understand the basic concepts of Python

**CLO2:** Learn how to write functions and pass arguments in Python

**CLO3:** Design object- oriented programs with Python classes.

**CLO4:** Define the structure and components of a Python program.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CLO1:** Acquire the important soft skills for employment  
**CLO2:** Take part in group discussions and job interviews confidently  
**CLO3:** Appear for placement aptitude tests confidently  
**CLO4:** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2111</b>	<b>DBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CLO1:** Designing a database  
**CLO2:** Using DDL and DML commands  
**CLO3:** Backing up of files  
**CLO4:** Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2113</b>	<b>DATA STRUCTURES LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CLO1:** Implementing Stack, Queue , Linked List , Binary tree  
**CLO2:** Sorting and Searching Techniques  
**CLO3:** Divide and Conquer, Dynamic Programming methods  
**CLO4:** Greedy method , Traversals and Backtracking

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2115</b>	<b>PYTHON PROGRAMMING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CLO1:** Understand the basic concepts of Python  
**CLO2:** Learn how to write functions and pass arguments in Python  
**CLO3:** Design object- oriented programs with Python classes.  
**CLO4:** Define the structure and components of a Python program.

## **SEMESTER - IV**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>

<b>CBD 2002</b>	<b>ESSENTIALS OF S/W ENGG. (OOAD &amp; SW LIFECYCLE)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CL01:** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CL02:** Explain the different views of software architecture

**CL03:** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CL04:** Use the UML to represent the design model

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2006</b>	<b>OPERATING SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CL01:** Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CL02:** Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.

**CL03:** Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.

**CL04:** Examine and categories various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.

**CL05:** Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2008</b>	<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Implement the different tree structures algorithm and analyze in context of asymptotic notation.

**CL02:** Identify basic properties of graphs and apply their algorithms to solve real life problems.

**CL03:** Demonstrate the usage of algorithms under several categories like string matching, randomized algorithms and genetic algorithms.

**CL04:** Implement various advanced data structures using C/Java/Python or related languages.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2004</b>	<b>BUSINESS INTELLIGENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

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**CLO1:** learn how analytics provided a solution to industries using real case studies

**CLO2:** Understand how business analysis software works, and its architecture

**CLO3:** Analyse a reporting application, its interface, and the different report types

**CLO4:** Create different types of active reports and advanced reports

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0202</b>	<b>PERSONALITY DEVELOPMENT - IV</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2114</b>	<b>OPERATING SYSTEMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Scheduling algorithms

**CLO2:** Deadlock algorithms and page replacement algorithms

**CLO3:** Memory management schemes, Thread and synchronization

**CLO4:** To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2118</b>	<b>ADA LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2:** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3:** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2118</b>	<b>FCEAD USING IBM RATIONAL TOOL LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CLO2:** Explain the different views of software architecture

**CLO3:** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CLO4:** Use the UML to represent the design model

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2120</b>	<b>BUSINESS INTELLIGENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** learn how analytics provided a solution to industries using real case studies

**CLO2:** Understand how business analysis software works, and its architecture

**CLO3:** Analyse a reporting application, its interface, and the different report types

**CLO4:** Create different types of active reports and advanced reports

## **SEMESTER - V**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Design and construction of compilers and knowledge of working of major phases of compilation.

**CLO2:** Construct parsers.

**CLO3:** Implement a simple compiler for a language chosen.

**CLO4:** Classify various parameters passing scheme, explain memory management of a programming languages and perform code optimization.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Conceptualize and explain the functionality of the different layers within a network architecture

**CLO2:** Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies, subnetting and routing mechanism.

**CLO3:** Demonstrate the operation of various routing protocols and their performance analysis.

**CLO4:** Illustrate design and implementation of datalink, transport and network layer protocols within a simulated/real networking environment.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3005</b>	<b>THEORY OF COMPUTATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2:** Disambiguate context-free grammars by mastering the concepts of context-free languages and push down automata.

**CLO3:** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

**CLO4:** Solve analytical problems in related areas of theory in computer science

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3007</b>	<b>ESSENTIALS OF HADOOP</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2:** To select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3:** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4:** Understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5:** Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6:** To integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3009</b>	<b>PLANNING ANALYTICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Learn about Customize Business Rules, SKIPCHECK, FEEDERS, and Creation of applications in TM1

**CLO2:** Able to create new server, dimensions, cubes and import data using TM1.

**CLO3:** Understand how to model data using architecture and integrate TM1 with Cognos BI.

**CLO4:** Analyse data across cube and create complete model and use additional modeling techniques in TM1

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3113</b>	<b>COMPUTER NETWORK LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Understand the requirements of an enterprise and outline its major design areas

**CLO2:** Identify functional areas to construct high level modules for enterprise architecture and analyze them.

**CLO3:** Know about the networking devices, prepare a bill of materials and configure the devices as per the Core, Access and Distribution layers

**CLO4:** Design the Server Farm for an enterprise network and discuss up gradations if needed.

**CLO5:** Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.

**CLO6:** Test and monitor the enterprise network using a tool

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** To enable the students to gather a first-hand experience on site.



**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task

			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3117</b>		<b>COMPILER DESIGN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**CLO2:** Understand of assembler, Macro, Loader & Linker..

**CLO3:** To know the fundamentals of Compiler, Lexical Analyzer and its design aspects.

**CLO4:** Gain the knowledge of parser and its various types.

**CLO5:** Design of Symbol tables using various data structures and understanding of error detection and recovery techniques.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3113</b>	<b>HADOOP LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2:** To select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3:** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4:** Understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5:** To recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6:** Ability to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3115</b>	<b>PLANNING ANALYTICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Learn about Customize Business Rules, SKIPCHECK, FEEDERS, and Creation of applications in TM1

**CLO2:** Able to create new server, dimensions, cubes and import data using TM1.

**CLO3:** Understand how to model data using architecture and integrate TM1 with Cognos BI.

**CLO4:** Analyse data across cube and create complete model and use additional modeling techniques in TM1

### SEMESTER - VI

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3002</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

On completion of this course, the students will be able to:-

**CLO1:** Learn the basics and applications of artificial intelligence and categorize various problem domains, basic knowledge representation and reasoning methods.

**CLO2:** Analyze basic and advanced search techniques including game playing, evolutionary search algorithms, and constraint satisfaction. Learn and design intelligent agents for concrete computational problems.

**CLO3:** Design of programs in AI language(s).

**CLO4:** Acquire knowledge about the architecture of an expert system and design new expert systems for real life applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3006</b>	<b>DATA SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Describe what Data Science is and the skill set needed to be data scientist.

**CLO2:** Learn about HDFS and YARN building and make sense of how to function with them for limit and resource utilisation.

**CLO3:** Understand MapReduce and its qualities and retain advanced Mapreduce thoughts.

**CLO4:** Get a working learning of Jupyter Notebook

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3010</b>	<b>ADVANCED RDBMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

On completion of this course, the students will be able to:-

**CLO1:** Master the basic concepts and appreciate the applications of database systems.

**CLO2:** To know the basics of SQL and construct queries using SQL.

**CLO3:** Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.

**CLO4:** Analyse the relational database theory, and be able to write relational algebra expressions for queries.

**CLO5:** Master sound design principles for logical design of databases, including the E- R method and normalization approach.

**CLO6:** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CLO7:** Know Master the basics of query evaluation techniques and query optimization.

**CLO8:** Be familiar with the basic issues of transaction processing and concurrency control.

**CLO9:** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to

**CLO1:** To assess the overall knowledge level of Computer Science and engineering standards and guide them to take corrective measures where deficiencies are detected.

**CLO2:**Types of reading strategies to enhance improve reading skills

**CLO3:**Role of writing skills in effective communication

**CLO4:** Learn Advantages & Disadvantages of written communication

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT -VI</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3114</b>	<b>ARTIFICIAL INTELLIGENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To implement Heuristic functions & Propositional Logic

**CLO2:** Design to implement A\* & AO\* algorithms

**CLO3:** Implement an Expert system for medical diagnosis

**CLO4:** To teach the fundamental techniques and principles in achieving the concepts of machine learning and AI.

**CLO5:** Enable students to have skills that will help them to solve complex real-world problems regarding Artificial Intelligence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3112</b>	<b>DATA SCIENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Describe what Data Science is and the skill set needed to be data scientist.

**CLO2:** Learn about HDFS and YARN building and make sense of how to function with them for limit and resource utilization.

**CLO3:** Understand MapReduce and its qualities and retain advanced Mapreduce thoughts.

**CLO4:** Get a working learning of Jupiter Notebook

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3114</b>	<b>ADVANCED RDBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

On completion of this course, the students will be able to:-

**CLO1:** Master the basic concepts and appreciate the applications of database systems.

**CLO2:** The basics of SQL and construct queries using SQL.

**CLO3:** To know commercial relational database system (Oracle) by writing SQL using the system.

**CLO4:** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.

**CLO5:** Learn Master sound design principles for logical design of databases, including the E- R method and normalization approach.

**CLO6:** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CLO7:** The basics of query evaluation techniques and and query optimization.

**CLO8:** Basic issues of transaction processing and concurrency control.

**CLO9:** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

## **SEMESTER - VII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4001</b>	<b>BLOCKCHAIN</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2:** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3:** Able to Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO4:** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4003</b>	<b>PREDICTIVE ANALYTICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** To illustrate the interaction of multi-faceted fields like data mining, statistics and mathematics in the development of Predictive Analytics

**CLO2:** Acquaint the student with the concepts of Ordinary Least Squares & Generalized Least Squares

**CLO3:** Learn to make the student familiar with various data clustering and dimension reduction techniques.

**CLO4:** Evaluate the Model on the basis of different Predictive Methods.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4115</b>	<b>INDUSTRIAL TRAINING - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4117</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

**CLO1:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4121</b>	<b>PREDICTIVE ANALYTICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Illustrate the interaction of multi-faceted fields like data mining, statistics and mathematics in the development of Predictive Analytics

**CLO2:** Acquaint the student with the concepts of Ordinary Least Squares & Generalized Least Squares

**CLO3:** To make the student familiar with various data clustering and dimension reduction techniques

**CLO4:** Evaluate the Model on the basis of different Predictive Methods.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4123</b>	<b>BLOCKCHAIN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2:** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts.

**CLO3:** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

**CLO4:** Learn to make the student familiar with various data clustering and dimension reduction techniques.

**CLO5:** Evaluate the Model on the basis of different Predictive Methods.

## **SEMESTER - VIII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CS 4114</b>	<b>PROJECT</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**CLO1:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3020</b>	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Knowledge and understanding

- Outline the potential benefits of distributed systems
- Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

**CLO2:** Cognitive skills (thinking and analysis).

- Apply standard design principles in the construction of these systems
- Select appropriate approaches for building a range of distributed systems, including some that employ middleware

**CLO3:** Communication skills (personal and academic).

**CLO4:** Practical and subject specific skills (Transferable Skills).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3022</b>	<b>SYSTEM SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To understand the relationship between system software and machine architecture.

**CLO2:** Know the design and implementation of assemblers

**CLO3:** Analyse the design and implementation of linkers and loaders.

**CLO4:** Acquire an understanding of macro processors.

**CLO5: Describe** to have an understanding of system software tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CS 3024</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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**CLO1:** Describe and apply basic concepts related to software project planning, scope and feasibility.

**CLO2:** Analyze various project estimation techniques, especially size estimation (FP), effort estimation (COCOMO models), schedule estimation (GANTT charts), and cost estimation.

**CLO3:** Illustrate the concept of team structure and project communication management.

**CLO4:** Acquire knowledge about quality assurance, quality control, and risk management.

**CLO5:** Describe various project management activities such as tracking, project procurement, configuration management, monitoring.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3026</b>	<b>GRID COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To understand the genesis of grid computing

**CLO2:** Know the application of grid computing

**CLO3:** Understand the technology and tool kits for facilitating grid computing

**CLO4:** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids;

**CLO5:** Utilise grid computing and clustering middleware, such as Parallel Virtual Machine (PVM), Message Passing Interface (MPI), HPC Portals, and Peer-to-Peer networks for implementing virtual super computing resources;

**CLO6:** Design a grid computing application in one of the key application areas

ii.e.g. Computer Animation, E-Research;

**CLO7:** Install a grid computing environment; develop communications skills and accept the code of professional conduct and practice through short presentations and group work.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Understanding Object Basics, Classes and Objects, Inheritance

**CLO2:** How software objects are altered to build software systems that are more robust

**CLO3:** Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project

**CLO4:** Understanding the issues and options in reuse

**CLO5:** Using UML, a common language for talking about requirements, designs, and component interfaces.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>



**CL01:** Expose the students to the concepts of feed forward neural networks

**CL02:** provide adequate knowledge about feedback networks.

**CL03:** To teach about the concept of fuzziness involved in various systems.

**CL04:** Analyse adequate knowledge about fuzzy set theory.

**CL05:** Define comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

**CL06:** To provide adequate knowledge of application of fuzzy logic control to real time systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3032</b>	<b>CYBER SECURITY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CL02:** Underline the need of digital forensic and role of digital evidences.

**CL03:** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CL04:** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.

**CL05:** Apply the knowledge of IDS to secure network and performing router and network analysis

**CL06:** List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4019</b>	<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Comprehend and implement various cryptographic algorithms to protect the confidential data.

**CL02:** Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.

**CL03:** Apply security tools to locate and fix security leaks in a computer network/software.

**CL04:** Secure a web server and web application

**CL05:** Configure firewalls and IDS

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4021</b>	<b>BIG DATA &amp; ANALYTICS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

**CLO2:** Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

**CLO3:** Implement several Data Intensive tasks using the Map Reduce Paradigm

**CLO4:** Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

**CLO5:** Design algorithms to analyze big data like streams, Web.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4023</b>	<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Student has an understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

**CLO2:** They have an understanding of the principles and characteristics of wireless sensor networks (WSNs).

**CLO3:** How proactive protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO4:** Understands how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO5:** Student understands how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO6:** To understand how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO7:** They are familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO8:** Acquired skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4025</b>	<b>DATA WAREHOUSING &amp; DATA MINING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Data pre-processing and data quality.

**CLO2:** Modeling and design of data warehouses.

**CLO3:** Algorithms for data mining.

**CLO4:** Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>

<b>CS 4027</b>	<b>MOBILE COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Grasp the concepts and features of mobile computing technologies and applications

**CLO2:** Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3:** Identify the important issues of developing mobile computing systems and applications

**CLO4:** Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

**CLO5:** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

**CLO6:** Organize and manage software built for deployment and demonstration.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4029</b>	<b>MACHINE LEARNING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.

**CLO2:** Apply decision tree learning, bayesian learning and artificial neural network in real world problems.

**CLO3:** Understand the use of genetic algorithms and genetic programming.

**CLO4:** Apply inductive and analytical learning with perfect domain theories.

**CLO5:** Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4031</b>	<b>OPEN SOURCE SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To know the concepts, strategies, and methodologies related to open source software development.

**CLO2:** Understand the business, economy, societal and intellectual property issues of open source software.

**CLO3:** Be familiar with open source software products and development tools currently available on the market.

**CLO4:** Be able to utilize open source software for developing a variety of software applications, particularly Web applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4033</b>	<b>SOFTWARE TESTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CL02:** Implement various test processes for quality improvement

**CL03:** Design test planning.

**CL04:** Manage the test process

**CL05:** Apply the software testing techniques in commercial environment

**CL06:** Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4035</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Learn the Internet Programming, using Java Applets

**CL02:** create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CL03:** Apply event handling on AWT and Swing components.

**CL04:** learn to access database through Java programs, using Java Data Base Connectivity (JDBC)

**CL05:** Create dynamic web pages, using Servlets and JSP.

**CL06:** Make a reusable software component, using Java Bean.

**CL07:** Invoke the remote methods in an application using Remote Method Invocation (RMI).

**CL08:** Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

**CL09:** Develop Stateful, Stateless and Entity Beans.

**CL010:** Use Struts frameworks, which gives the opportunity to reuse the codes for quick development.

**CL011:** Map Java classes and object associations to relational database tables with Hibernate mapping files.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0201</b>	<b>GERMAN LANGUAGE PHASE - I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0205</b>	<b>FRENCH LANGUAGE PHASE - I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0202</b>	<b>GERMAN LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0206</b>	<b>FRENCH LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CL02:** Have Fluency in reading and writing.

**CL03:** Use language creatively and spontaneously.

**CL04:** Know the culture of the countries where the French language is spoken

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2012</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	3	1	0	4

**CL01:** To be familiar with numerical solution of equations

**CL02:** Get exposed to finite differences and interpolation

**CL03:** To be thorough with the numerical Differentiation and integration

**CL04:** Find numerical solutions of ordinary differential equations

**CL05:** Be thorough with probability concepts and the corresponding distributions.

**CL06:** Get exposed to the testing of hypothesis using distributions.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2002</b>	<b>ENGINEERING ECONOMICS AND MANAGEMENT</b>	3	1	0	4

**CL01:** To apply theoretical economic concepts to practical business situation and to take decisions in the Industrial Engineering Situation.

**CL02:** An Engineer must demonstrate knowledge and understanding of the engineering and management

**CL03:** Principle and Apply these to Engineering work environment, as a member and leader in a team,

**CL04:** To manage projects and in multidisciplinary environments.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2004</b>	<b>INDUSTRIAL MANAGEMENT</b>	3	1	0	4

**CL01:** Students will be able to perform the Management Functions.

**CL02:** To compare selected Theories of Management.

**CL03:** Perform the functions in the Marketing Mix.

**CL04:** Students will be able to use basic Business Application Software.

**CL05:** Assess ethical issues in Business situations.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2006</b>	<b>RELIABILITY AND QUALITY MANAGEMENT</b>	3	1	0	4

**CLO1:** Apply the Concept of SQC in Process Control for Reliable Component Production

**CLO2:** To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management

**CLO3:** Identify risks, manage the change to assure quality in projects.

**CLO4:** Extract and analyse software requirements specifications for different projects.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2002</b>	<b>PRODUCTION AND OPERATION MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Apply problem-solving and critical-thinking skills as required in materials and operations management.

**CLO2:** Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.

**CLO3:** To meet the specified needs with appropriate consideration for the public health and safety,

**CLO4:** Learn management principles and apply these to Engineering work environment,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2004</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Gain Knowledge and Skills needed to run a Business Successfully.

**CLO2:** Understand the different support system for business development.

**CLO3:** Get knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO4:** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2006</b>	<b>NON-CONVENTIONAL ENERGY RESOURCES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Acquired knowledge about different energy resources.

**CLO2:** Ability to convert the energy from one form to another form.

**CLO3 :** Learn how to use these energy resources

**CLO4:** Develop new effective to utilize energy

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2008</b>	<b>NANOTECHNOLOGY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** The various opportunities in the emerging field of nano electronics and nano technologies

**CLO2:** To know advantages and disadvantages of nano particles

**CLO3:** Analyse new technologies emerges with nanotechnology

**CLO4:** To know new and faster kinds of computers, more efficient power sources and life-saving medical treatment

## **COMPUTER SCIENCE AND ENGINEERING**

**In Block Chain & IoT in association with IBM  
[w. e. f. 2021-2022]**

### **ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (EPEOs)**

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises;
4. Increasing responsibilities of technical and managerial leadership in their work organizations;
5. Professional development through a commitment to career-long learning.

### **PROGRAM LEARNING OUTCOMES (PLOs)**

1. An ability to identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences
2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
4. an ability to adapt and work with multidisciplinary teams and communicate effectively;



5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks.
6. an understanding of professional and ethical responsibility;
7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

**PEO1.** To nurture strong understanding in logical, mathematical and analytical reasoning among students coupled with problem solving attitude that prepares them to productively engage in research and higher learning.

**PEO2.** To build strong foundation in the field of Computer Science and Engineering among students to be creative and innovative.

**PEO3.** To prepare students capable of designing and developing real-world computing applications with high societal influence and impact.

**PEO4.** To provide students with academic environment that enables them to understand the significance of life-long learning in varied situations and teams in global perspective.

**PEO5.** To inculcate ethical practices, professionalism and environmental awareness for sustainable development among students enabling them for prospective employment in their chosen line of profession globally.

**PEO6.** To instill communication and management skill that generates entrepreneurship and / or leadership qualities.

## **B.TECH - COMPUTER SCIENCE ENGINEERING PROGRAMME LEARNING OUTCOMES**

1. An ability to apply knowledge & skill of mathematics, science and engineering.
2. An ability to identify, analyze, design, develop, implement and integrate software and hardware based computer systems.
3. An ability to understand emerging technologies and related security issues in the computing paradigm.
4. An ability to acquire and apply the skill in modern techniques, methodologies and tools to be innovative and creative.
5. An ability to formulate, design & demonstrate strong logical, analytical and reasoning skills to adeptly solve problems
6. An ability to apply algorithmic principles and programming prowess in the development of software systems.

7. An awareness of social, health, ethical, legal, financial, and professional responsibilities.
8. An ability to analyze the local and global impact of computing discipline on environmental issues and sustainable development
9. Recognition of the need for self-motivation and ability to engage in lifelong learning and professional development
10. An ability to effectively manage projects involving multidisciplinary and teams with ethnic diversity.
11. An ability to communicate effectively, both in written and verbal forms.
12. An ability to demonstrate leadership and entrepreneurship qualities.

### **SEMESTER - I & SEMESTER - II**

<b>FUNDAMENTALS OF COMPUTER &amp; C PROGRAMMING</b>	
<b>Course Code: 21CS101</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CL01:** Understand the fundamental concepts of computers, both hardware and software.

**CL02:** Learn and understand the major system software's that help in developing of an application.

**CL03:** Apply and analyse the basic programming constructs in context of C programming language.

**CL04:** Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions

**CL05:** Create and manipulate a database or data storage through files.

**CL06:** Develop a methodological way of problem solving.

**CL07:** Learn a programming approach to solve problems.

<b>C PROGRAMMING LAB</b>	
<b>Course Code: 21CS151</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.

**CLO2:** Introduction to C Programming using Control Statements and Repetition Statement

**CLO3:** Apply and practice logical formulations to solve some simple problems leading to specific applications.

**CLO4:** Design effectively the required programming components that efficiently solve computing problems in real world.

**CLO5:** Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

<b>PROGRAMMING WITH JAVA</b>	
Course Code: 21CAM1004	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1:** Understand the vision of Object Oriented Programming from industry context.

**CLO2:** Apply Object Oriented Programming using Java using java I.D.E.

**CLO3:** Analyze multithreading programming of Java Language to create more robust and fast applications.

**CLO4:** Evaluate the application of Web Server and Application Server and how to deploy Web Applications.

**CLO5:** Build and create Web Applications using front end as html, css and java script and backend using Java Servlets and J.S.P(Java Server Pages). Creating projects by establishing database connection with IBM DB2 or MySql.

<b>ENGINEERING MATHEMATICS-I</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:21AS101	
Credits: 4	
L T P : 3 1 0	
Prerequisite: Nil	

**CLO1:** Apply the knowledge of calculus, Gamma & Beta functions for analyzing engineering problems.

**CLO2:** Solve first order differential equation analytically using standard method.

**CLO3:** Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.

**CLO4:** Obtain series solution of differential equation and explain application of Bessel's function

**CLO5:** Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stoke's theorems.

<b>ENGINEERING MATHEMATICS-II</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code:21AS201</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: Engineering Mathematics-I</b>	

**CLO1:** Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process.

**CLO2:** Apply Laplace transforms to find the solution of differential equations.

**CLO3:** Solve different problems with help of Fourier series.

**CLO4:** Know, analytic functions and conformal mapping of complex variables.

**CLO5:** Evaluate complex integration and residues.

<b>ENGINEERING PHYSICS</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS102/202</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.

**CLO2:** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

**CLO3:** Student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.

**CLO4:** The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar cell.

<b>ENGINEERING PHYSICS LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Use the different measuring devices and meters to record the data with precision

**CLO2:** Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

**CLO3:** Apply the mathematical concepts/equations to obtain quantitative results

**CLO4:** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

<b>ENGINEERING CHEMISTRY</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS103/203</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Understand to identify the quality of water and how to improve the quality of water.

**CLO2:** Rationalize bulk properties and processes using thermodynamic considerations.

**CLO3:** Get preliminary understanding on introductory idea about nano materials.

**CLO4:** Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism of corrosion.

<b>ENGINEERING CHEMISTRY LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Understand the basic concepts of measurement techniques.

**CLO2:** Learn the basic concepts of measurement techniques.

**CLO3:** The synthesis, dynamics, chemical transformation and their applications

**CLO4:** To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

<b>BASIC ELECTRONICS ENGINEERING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EC101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** To learn the fundamental concepts of semiconductor devices

**CLO2:** An ability to apply the concept of diode in clipper and clamper circuits

**CLO3:** Acquire the skills of constructing the different transistors configurations

**CLO4:** learn the basic concepts of integrated circuits

**CLO5:** To compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates

**CLO6:** Acquire the knowledge of microprocessors.

<b>BASIC ELECTRONICS ENGINEERING LAB</b>
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<b>(COMMON TO ALL BRANCHES)</b>	
<b>Course Code: 21EC151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Measure voltage, frequency and phase of any waveform using CRO.

**CLO2:** Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.

**CLO3:** Analyze the characteristics of different electronic devices such as diodes, transistors and operational amplifiers

**CLO4:** To develop skill to build and verify digital circuits

<b>BASIC ELECTRICAL ENGINEERING</b> <b>(COMMON TO ALL BRANCHES)</b>	
<b>Course Code: 21EE101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Learn about transient analysis of RLC circuits with DC excitation.

**CLO2:** Realize the requirement of transformers in transmission and distribution of electric power and other applications.

**CLO3:** Develop an idea on Magnetic circuits, Electromagnetism

**CLO4:** Learn about measuring instruments, single phase and polyphase AC circuits.

<b>BASIC ELECTRICAL ENGINEERING LAB</b> <b>(COMMON TO ALL BRANCHES)</b>	
<b>Course Code: 21EE151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1:** Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

**CLO2:** Understand the calibration of energy meter.

**CLO3:** Design to open circuit and short circuit test of single-phase transformer.

**CLO4:** Analyse RLC series and parallel circuits

<b>COMMUNICATIVE ENGLISH</b> <b>(COMMON TO ALL BRANCHES)</b>
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<b>Course Code: 21HS101/201</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Learners will be able to write effectively using correct grammatical structures.

**CLO2:** They will be able to read and speak fluently in English.

**CLO3:** To know the nuances of effective presentations.

**CLO4:** Engage in group discussions, debate, deliver speeches and such others.

**CLO5:** Learners will be able to write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>COMMUNICATIVE ENGLISH LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Learners will be able to write effectively using correct grammatical structures.

**CLO2:** They will be able to read and speak fluently in English.

**CLO3:** To know the nuances of effective presentations.

**CLO4:** Engage in group discussions, debate, deliver speeches and such others.

**CLO5:** Learners will be able to write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>INDIAN CONSTITUTION &amp; POLITY</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 21HS102/202</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.

**CLO2:** Differentiate different aspects of Indian Legal System and its related bodies



**CLO3:** Appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.

**CLO4:** Know about the enforcement remedies available under the Constitution of India

**CLO5:** To apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy

**CLO6:** Apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

<b>YOGA &amp; PHYSICAL EDUCATION</b> Practices (COMMON TO ALL BRANCHES EXCEPT)	
<b>Course Code:21SE151</b>	
<b>Credits: 1</b>	
<b>L T P: 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1:** Increased balance, strength, and flexibility

**CLO2:** A beginning sense of alignment in the body

**CLO3:** Competence of all five breath techniques and variations

**CLO4:** An internal sense of focus and clarity in the movement meditation

**CLO5:** Understanding of the cultural and philosophical approaches to yoga

**CLO6:** Desire to learn, excel and continue studies on the art of yoga

**CLO7:** Basic knowledge of Basketball, Cricket, Football , Volleyball, Badminton & Table Tennis

<b>BASIC MECHANICAL ENGINEERING</b> (Common to all Branches)	
<b>Course Code: 21ME101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1:** Understand the concepts of thermodynamics.

**CLO2:** Apply principles of thermodynamics to real engineering problems.

**CLO3:** Understand the basics of powertrain applications.

**CLO4:** Grasp the elements of robotics.

**CLO5:** The working principles of various measuring tools and devices.

<b>BASIC MECHANICAL ENGINEERING LAB</b>	
(Common to all Branches)	
<b>Course Code: 21ME151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Students would be able to the working of thermal power plants.

**CLO2** They would be able to the working of 2 and 4 stroke IC engines.

**CLO3** To different automobile parts, gears and gear trains.

**CLO4** Analyse the working of Refrigeration and Air Conditioning cycles.

**CLO5** Students would be able to the working principles of flow meters and U-tube manometers.

**CLO6** To identify and apply suitable tools for machining processes including turning, facing.

**CLO7** Able to Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) Processes required to manufacture a product from the raw materials.

**CLO8** Use different measuring, marking, cutting tools used in the workshop.

**CLO9** Be aware of the safety precautions while working in the workshop.

<b>ENGINEERING GRAPHICS &amp; DESIGN LAB</b>	
(Common to all Branches)	
<b>Course Code: 21ME153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand orthographic projections of points and lines in any position through AutoCAD.

**CLO2** Imagine and convert isometric view into orthographic projections and vice versa. **CLO3** Should be able to understand the simple machine components and draw its projections

**CLO4** Analyse to Draw sections of solids including cylinders, cones, prisms and pyramids.

### **SEMESTER - III**

<b>ENGINEERING MATHEMATICS - III</b>	
Course Code: 21AS301	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Solve different types of partial differential equations.

**CLO2** Find solutions of boundary value problems including heat and wave equations.

**CLO3** Apply and analyze Fourier transforms with different applications.

**CLO4** Evaluate the problems using z-transforms.

**CLO5** Understand linear algebra and its application to Engineering.

<b>PYTHON PROGRAMMING</b>	
Course Code: 21CAM2009	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** Able to Understand the vision of Python from a global context

**CLO2** Understand the content that how to write loops, decision statements, write functions and pass arguments in Python.

**CLO3** To Learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.

**CLO4** Learn how to read and write files in Python. Will learn how to create Pandas DataFrames, calculate aggregates, and merge multiple tables.

**CLO5** How to import in-built library and use matplotlib for graph representation and how regular pattern matching will be done.

**CLO6** Understand the concepts of algorithm of Machine learning and learn how to train the models.

<b>DATA STRUCTURES USING C</b>	
Course Code: 21CS2001	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyse the algorithms to determine the time and computation complexity and justify the correctness.

**CLO2** Implement the given search problem, i.e., Linear and Binary Search.

**CLO3** Able to Write and analyse an algorithm for different sorting techniques and compare their performance in term of Space complexity, Time complexity and application.

**CLO4** Implement any given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.

**CLO5** Able to Implement Graph search and traversal algorithms and determine the time and computation complexity.

**CLO6** Identify the best data structure to be used for any particular application and design and analyses the application in terms of time and space complexity.

<b>DISCRETE STRUCTURES</b>	
Course Code: 21CS2003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Model logic statements arising in algorithm correctness and real-life situations and manipulate them using the formal methods of propositional and predicate logic.

**CLO2** Relate the ideas of mathematical induction to recursion and recursively defined structures.

**CLO3** Identify and model the relation between sets.

**CLO4** Demonstrate in practical applications the use of basic counting principles.

**CLO5** Establish and solve recurrence relations that arise in counting problems including the problem of determining the time complexity of recursively defined algorithms

**CLO6** Deduce properties that establish particular graphs as Planar, Eulerian, and Hamiltonian.

**CLO7** Able to Formalizes the sets with the binary operations.

**CLO8** Understand the application of number theory in cryptography.

## **DATABASE MANAGEMENT SYSTEMS**

Course Code: 21CS2005

Pre-Requisite : NIL

L T P : 3 0 0

Credits: 3

**CLO1** Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Design the database schema with the use of appropriate data types for storage of data in database

**CLO3** Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.

**CLO4** Create Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respect data into RDBMS and on the data.

**CLO5** Understand and apply the concept of transaction, concurrency control and recovery in database.

**CLO6** Able to Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

## **COMPUTER ARCHITECTURE & ORGANIZATION**

Course Code: 21CS2007	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Analyse the basic operational concepts of Functional unit, Instruction format and Addressing mode.

**CLO2** Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.

**CLO3** Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.

**CLO4** Understand the need for an interface and instruction cycle phases. Implement the hardwired and microprogrammed control unit for analyse the performance.

**CLO5** Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithm for given design requirements.

**CLO6** Compare and contrast memory mapping and IO mapping techniques. Describe the differentiate different modes of data transfer. Appraise the synchronous and asynchronous bus for performance and arbitration.

<b>PYTHON PROGRAMMING LAB</b>	
Course Code: 21CAM2115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1:** To use lists, tuples, and dictionaries in Python programs

**CLO2:** learn how to identify Python object types.

**CLO3:** To read and write files in Python. Will learn how to create Pandas DataFrames, calculate aggregates, and merge multiple tables.

**CLO4:** Understand how to import in-built library and use matplotlib for graph representation and how regular pattern matching will be done.

**CLO5:** Know the concepts of algorithm of Machine learning and learn how to train the models.

<b>DATABASE MANAGEMENT SYSTEMS LAB</b>	
Course Code: 21CS2111	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1 Transform** an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.

**CLO2 Use** an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO3 Formulate** query, using SQL, solutions to a broad range of query and data update problems.

**CLO4** Design and implement database applications on their own.

**CLO5** Able to Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.

**CLO6** Analyze and Select storage and recovery techniques of database system.

<b>DATA STRUCTURES USING C LAB</b>	
Course Code: 21CS2113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the importance of data structures and abstract data type, and their basic usability in different applications.

**CLO2** Implement various kinds of searching and sorting techniques, and know when to choose which technique.

**CLO3** Analyze and differentiate different algorithms based on their time complexity.

**CLO4** Understand various data structure such as stacks, queues, linked lists, trees, graphs, etc. to solve various computing problems.

<b>ESSENTIALS OF BLOCKCHAIN &amp; IOT -LEVEL-I</b>	
Course Code: 21CS0201	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

## **TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of training students will be able to:

1. Understand how bitcoin and other coins work in real world.

196609496. Analyse the properties of Block Chain models.
196609608. Understand the vision of IoT and communication protocols from a global context.
196610280. Design portable IoT using appropriate boards.

**CLO1** Understand how blockchain solutions are transforming the industry landscape.

**CLO2** Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.

**CLO3** Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.

**CLO4** Design and develop for a permissioned blockchain.

**CLO5** Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.

<b>EFFECTIVE COMMUNICATION SKILLS</b>	
Course Code: 21SS351	
Pre-Requisite : Basic English	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcome (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1. To communicate effectively and interact with people with confidence.
- TLO2. To demonstrate and differentiate between various forms of communication.
- TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) □	TLO1	TLO2	TLO3
TRAINING OBJECTIVES (TO) '			
T01			
T02			
T03			



## **SEMESTER - IV**

### **CLOUD APPLICATION DEVELOPMENT**

Course Code: 21CAM2004

Pre-Requisite : NIL

L T P : 3 0 0

Credits: 3

**CLO1** To know the vision of Cloud Computing from a global context.

**CLO2** Understand various compute options on IBM Cloud by market perspective of Cloud Computing.

**CLO3** Analyze architecture and implementation of APIs with services of IBM Cloud in Cloud Computing.

**CLO4** Integrate the Node.js application with Watson services over IBM Cloud.

**CLO5** Build and create state of the art architecture in Kubernetes cluster.

### **AGILE DEVELOPMENT METHODOLOGIES**

Course Code: 21CAF2006

Pre-Requisite : NIL

L T P : 3 0 0

Credits: 3

**CLO1** Understand the vision of Agile Development Methodologies from a global context.

**CLO2** Apply Agile in market so that output can be made better for any input.

**CLO3** Analyze various tools and techniques in order to introduce automation.

**CLO4** Evaluate the application of Agile in Industrial and Commercial sectors.

**CLO5** To Build and create the service instances using IBM services and setting up the DevOps on IBM Cloud. Creating projects and research activities based on different principles of AI.

### **THEORY OF COMPUTATION**

Course Code: 21CS2004

Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2** Understand the basics of regular expression and its equivalence.

**CLO3** Disambiguate context-free grammars by mastering the concepts of context- free languages and push- down automata

**CLO4** Study the concepts of Push Down Automata and its applications.

**CLO5** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

<b>OPERATING SYSTEMS</b>	
Course Code: 21CS2006	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2** Understand the process management policies and scheduling of processes by CPU .

**CLO3** Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading.

**CLO4** Describe and analyze the memory management and its allocation policies.

**CLO5** Identify use and evaluate the storage management policies with respect to different storage management technologies.

<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	
Course Code: 21CS2008	

Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

**CLO2** Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

**CLO3** To Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

**CLO4** Able to Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

**CLO5** Analyse Model any engineering problem using graph and write the corresponding algorithm to solve the problems.

<b>TEAMWORK &amp; INTERPERSONAL SKILLS</b>	
Course Code: 21SS452	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcome: -**

**After the completion of the training, the student will have ability:**

- **TLO1.** To be confident working in a team and leading it as well.
- **TLO2.** To categorise the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energise himself to bounce back from such situations.

- **TLO3.** The student will get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- **TLO4.** The student will be able to face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>CLOUD APPLICATION DEVELOPMENT LAB</b>	
Course Code: 21CAM2120	
Pre-Requisite : Basic Knowledge of Cloud Services	
L T P : 0 0 2	
Credits: 1	

**CLO1** Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

**CLO2:** Configuring IAM (identity access management) service on IBM cloud.

**CLO3:.** Configuration of a server to fetch files from local file system using Nodejs.

**CLO4:** Implementation of containerization using Docker.

<b>AGILE DEVELOPMENT LAB</b>	
Course Code: 21CAF2118	
Pre-Requisite : Software Development Methodology	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

**CLO2:** To learn different tools so that they can cope up with industry standard and requirements.

**CLO3:** Enable students to have skills that will help them to solve complex real-world problems and

**CLO4:** Introduce them to a new world of problem-solving techniques.

<b>OPERATING SYSTEM LAB</b>	
Course Code: 21CS2114	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO1** Demonstrate the various operations of file system.

**CLO2** Understand and Implement Memory management schemes, Thread and synchronization

**CLO3** Implement Deadlock algorithms and page replacement algorithms.

**CLO4** Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.

**CLO5** Implement Scheduling algorithms.

<b>ANALYSIS AND DESIGN OF ALGORITHMS LAB</b>	
Course Code: 21CS2118	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO1** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
Course Code: 21CS0202	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **TRAINING LEARNING OUTCOMES (TLOS): -**

**After the completion of training, the students will be able to:**

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Understand the basics and need of AI and Machine learning in global view.
- Understand, apply and evaluate the supervised learning techniques.
- Design and implement the different applications using the concepts of AI and ML.

<b>LIVE PROJECT-I &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0204	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1:** To gather a first-hand experience on sites.

**CLO2:** Apply the concepts learnt to design and create a application.

**CLO3:** They can be able to compare selected Theories of Management.

**CLO3:** To perform the functions in the Marketing Mix.

**CLO4:** Students will be able to use basic Business Application Software.

## SEMESTER - V

<b>APPLICATION &amp; CLOUD SECURITY</b>	
Course Code: 21CMF4003	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the vision of Cloud and its security.

**CLO2** Understand the implementation of Forensic Science.

**CLO3** Apply and analyze architecture with data management over cloud platforms.

**CLO4** Evaluate the application of cloud security with its phases.

**CLO5** To Build a secure architecture and analyzing it with different phases of security.

Course Code: 21CBM3001	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** Able to Understand the vision of Cloud Computing from a global context.

**CLO2** Understand various compute options on IBM Cloud by market perspective of Cloud Computing.

**CLO3** Evaluate containers and implement an application with micro services architecture.

**CLO4** Build and create state of the art architecture in Kubernetes cluster.

<b>COMPILER DESIGN</b>	
Course Code: 21CS3001	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand of assembler, Macro, Loader & Linker.

**CLO2** To Know the fundamentals of Compiler, Lexical Analyzer and its design aspects.

**CLO3** To Gain the knowledge of parser and its various types.

**CLO4** Design Symbol tables using various data structures and understanding of error detection and recovery techniques.

**CLO5** Analyze and Design the methods of developing a Code Optimizer.

**CLO6** Understand the usage of various Code Generation Tools.

<b>COMPUTER NETWORKS</b>	
Course Code: 21CS3003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Describe the functions of each layer in OSI and TCP/IP model.

**CLO2** Describe the functions of data link layer and explain the protocols.

**CLO3** Classify the routing protocols and analyze how to assign the IP addresses for the given network.

**CLO4** Describe the Session layer design issues and Transport layer services.

**CLO5** Explain the functions of Application layer and Presentation layer paradigms and Protocols.

<b>PRESENTATION &amp; SPEAKING SKILLS</b>	
Course Code: 21SS553	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	



## Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

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**TLO1.** The student will be confident in presenting himself in front of audience.

- **TLO2.** The student will become professional in his approach towards work culture.
- **TLO3.** The level of communication skills will be further enhanced in the student's conversation with others.

COMPUTER NETWORK LAB	
Course Code: 21CS3113	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand and learn how to determine the network statistics of their machines.

**CLO2** Learn about the working of a packet sniffer that is Wireshark.

**CLO3** Understand the in-depth working and role of network protocols.

**CLO4** Design and understand the working of TCP three way handshaking protocol.

**CLO5** Analysis and understand UDP based applications.

LIVE PROJECT-II & INDUSTRIAL VISIT	
Course Code: 21CS0303	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create a application.

**CLO3** A student may also create live project under the supervision of Institutional faculty (in-house or other institutes of repute).

**CLO4** A student may create live project as an internship project. In that case, the student will be monitored on periodic basis

<b>COMPILER DESIGN LAB</b>	
Course Code: 21CS3117	
Pre-Requisite : Basic Programming Knowledge	
L T P : 0 0 2	
Credits: 1	

**CLO1** Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.

**CLO2** Learn applications of different compiler writing tools to implement the different Phases of compiler.

**CLO3** Work in the development phase of new computer languages in industry and designing symbol tables.

**CLO4** Design Top-down, Bottom-up parsing Techniques.

**CLO5** Learn the process of translating a modern high-level language to executable code.

<b>APPLICATION &amp; CLOUD SECURITY LAB</b>	
Course Code: 21CMF4007	
Pre-Requisite : Basic Knowledge of Application Programming and security	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the vision of Cloud and its security.

**CLO2** Able to Understand the implementation of Forensic Science.

**CLO3** Apply and analyze architecture with data management over cloud platforms.

**CLO4** Evaluate the application of cloud security with its phases.

**CLO5** Build a secure architecture and analyzing it with different phases of security.

<b>DOCKERS &amp; KUBERNATES LAB</b>	
Course Code: 21CBM3115	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	

### **COURSE LEARNING OUTCOMES (CLO)**

The syllabus adhere to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand Containers in DevOps.
2. Analyse Orchestration tools.
3. Implement in AWS and KUBERNETES
4. Understand the Linux Containers and Virtualization.

<b>DESIGN THINKING AND AUGMENTED VIRTUAL REALITY-LEVEL- II &amp; III</b>	
<b>Course Code: 21CS0301</b>	
<b>Prerequisite: NIL</b>	
<b>L T P : 0 0 2</b>	
<b>Credits: 1</b>	

### **TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of training the students will be able to:

- Understand and critically apply the concepts and methods of business processes.
- Analyzing design thinking history and its various concepts.
- Understand, analyzing and create models with users collaboration to apply design thinking concepts.
- To know the role and importance of graphics in VR, AR and MR.
- Explore the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

### **SEMESTER - VI**

<b>IOT BASED APPLICATION DEVELOPMENT</b>	
<b>Course Code: 21CBM3002</b>	
<b>Pre-Requisite : NIL</b>	
<b>L T P : 2 0 0</b>	

Credits: 2	
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**CLO1** Able to Understand the IBM Watson IoT Platform.

**CLO2** Understand and apply IoT concepts over IBM Watson IoT Platform.

**CLO3** Apply the IoT concepts over Node-red and analyzing the network protocols in its working.

**CLO4** To Understand and apply the programming interface to connect IoT devices using Rest API for analysis and evaluation.

**CLO5** Analytics services on IBM Cloud and applying to create better solution.

<b>NOSQL and MongoDB</b>	
Course Code: 21CAF3010	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the vision of Big Data from a global context.

**CLO2** Understand and apply MongoDB in Market perspective of Big Data.

**CLO3** Apply and analyze architecture and APIs with use of Devices, Gateways and Data Management in data.

**CLO4** Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.

**CLO5** Able to Build and create fundamental concepts in the context of a number of different NOSQL products.

<b>IDENTITY AND ACCESS MANAGEMENT</b>	
Course Code: 21CBM3014	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

- CLO1** Able to Understand the use of IAM in Enterprises from a global context.
- CLO2** Understand and apply LDAP from industry perspective of Identity and Access Management.
- CLO3** Apply and analyze SINGLE SIGN-ON (SSO) CONCEPTs architecture and Protocols.
- CLO4** Evaluate the application of IAM in Enterprises by applying federation rules and Multi Factor Authentication.
- CLO5** Create and apply **Integrated IAM Governance with Intelligence and Accountability** in IAM. Create projects and research activities based IDAM.

<b>SOFTWARE ENGINEERING</b>	
Course Code: 21CS3004	
Pre-Requisite : Concept of OOP and Methodology	
L T P : 3 0 0	
Credits: 3	

- CLO1** Able to Analyze software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification.
- CLO2** Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model.
- CLO3** Apply testing principles on software project and understand the maintenance concepts.
- CLO4** Identify risks, manage the change to assure quality in software projects.
- CLO5** Think critically about ethical and social issues in software engineering for different applications.

<b>MANAGEMENT AND ORGANISATIONAL BEHAVIOUR</b>	
Course Code: 21BS301	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

- CLO1** Able to Understand the concept of management
- CLO2** Learn about different management skills requirements for the corporate world.

**CLO3** Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.

**CLO4** Understand the human behaviour and its contribution at work place

**CLO5** To know about the competitiveness in businesses.

<b>PROFESSIONAL WRITING SKILLS</b>	
Course Code: 21SS655	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcome: -**

**After the completion of the training, the student will have ability:**

- TL01. The student will understand the importance of professional writing required in workplace.
- TL02. Explore different formats in resume, cover letters & other business related letters.
- TL03. Develop knowledge, skills and understanding people in-group and individually.
- TL04. Able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

<b>IOT BASED APPLICATION LAB</b>	
Course Code: 21CBM3116	
Pre-Requisite : Browser, Window OS, IBM Cloud account	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the IBM Watson IoT Platform.

**CLO2** Understand and apply IoT concepts over IBM Watson IoT Platform.

**CLO3** Apply the IoT concepts over Node-red and analyzing the network protocols in its working.

**CLO4** Learn the programming interface to connect IoT devices using Rest API for analysis and evaluation.

**CLO5** Understand the analytics services on IBM Cloud and applying to create better solution.

<b>NOSQL AND MONGODB LAB</b>	
Course Code: 21CAF3012	
Pre-Requisite : A basic knowledge of programming concepts such as command line and shell commands, functions, variables and boolean operators	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the vision of Big Data from a global context.

**CLO2** Understand and apply MongoDB in Market perspective of Big Data.

**CLO3** Apply and analyze architecture and APIs with use of Devices, Gateways and Data Management in data.

**CLO4** Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.

**CLO5** Able to Build and create fundamental concepts in the context of a number of different NOSQL products.

<b>IDENTITY &amp; ACCESS MANAGEMENT LAB</b>	
Course Code: 21CBM3120	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Develop function oriented and object oriented program design

**CLO2** Implement program using turbo C software

**CLO3** learn about Secure experience for every user, asset and data interaction providing a foundation for a zero trust strategy.

**CLO4** To learn how to Secure the hybrid multicloud enterprise and digital transformation.

<b>SOFTWARE ENGINEERING LAB</b>	
Course Code: 21CS3118	
Pre-Requisite : Programming for Problem Solving	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to prepare SRS document, design document, test cases and software configuration management and risk management related document.

**CLO2** Develop function oriented and object oriented software design using tools like rational rose.

**CLO3** Generate a high-level design of the system from the software requirements

**CLO4** Have experience and/or awareness of testing problems and will be able to develop a simple testing report

<b>BIG DATA ANALYTICS, TOOLS AND TECHNIQUES- LEVEL-III</b>	
Course Code: 21CS0302	
Prerequisite: NIL	
L T P : 0 0 2	
Credits: 1	

## **TRAINING LEARNING OUTCOMES (TLO)**

After completion of training, students would be able to:

1. Understand the vision of Big Data from a global context.  
196610336. Understand and apply Hadoop in Market perspective of Big Data.  
196610392. Evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.  
196608656. Apply and analyze architecture and APIs with use of Devices, Gateways and Data Management in Big data.



<b>IV</b>	<b>HIVE AND PIG</b> Architecture, Installation, Configuration, Hive vs RDBMS, Why Pig, Use case of Pig, Pig Components, Data Model.	Building and create state of the art architecture in Big Data. Hadoop, Creating projects and research activities based on Pig& Hive
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## LEARNING RESOURCES

- Gelman, Andrew, and Jennifer Hill. Data Analysis Using Regression and Multilevel/Hierarchical Models. 1st ed. Cambridge, UK: Cambridge University Press, 2006. ISBN: 9780521867061.
- Gelman, Andrew, John B. Carlin, Hal S. Stern, and Donald B. Rubin. Bayesian Data Analysis. 2nd ed. New York, NY: Chapman & Hall, 2003. ISBN: 9781584883883
- Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data” by EMC Education Services
- Analytics: Data Science, Data Analysis and Predictive Analytics for Business” by Daniel Covington.
- Machine Learning for Big Data: Hands-On for Developers and Technical Professionals” by Jason Bell.

## LIVE PROJECT-III & INDUSTRIAL VISIT

Course Code: 21CS0304	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create a application.

**CLO3** To provide hands-on experience at site where Computer Science and engineering projects are executed.

**SEMESTER -**

<b>ANALYTICS USING IOT DATA (PREDICTIVE ANALYTICS)</b>	
Course Code: 21CBF4003	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand and critically apply the concepts and methods of analytics.

**CLO2** Understand and apply IBM Watson in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.

**CLO3** Apply and analyze how to use IoT functions, use advanced field operations, handle sequence data and improve efficiency.

**CLO4** Evaluate the Model on the basis of different Predictive Methods.

**CLO5** To Build and create advanced analytical model using IoT data that leverage historical data to uncover real-time insights to predict future events.

<b>BLOCKCHAIN DEVELOPMENT</b>	
Course Code: 21CBM4005	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand how blockchain solutions are transforming the industry landscape.

**CLO2** Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.

**CLO3** Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.

**CLO4** Design and develop for a permissioned blockchain.

**CLO5** Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.

<b>INTERPERSONAL SKILLS: STRATEGIES</b>
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<b>(COMMON TO ALL BRANCHES)</b>	
Course Code: 21SS756	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcome (TLO): -**

**After the completion of the training, the student will have ability:**

- **TLO1.** The student will develop knowledge, skills and understanding people in-group and individually.
- **TLO2.** The student will be able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.
- **TLO3.** To work with people even with conflicts and reducing the differences among them by reaching to an equilibrium.

<b>ANALYTICS USING IOT DATA LAB</b>	
Course Code: 21CBF4007	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

<b>BLOCKCHAIN DEVELOPMENT LAB</b>	
Course Code: 21CBM4009	
Pre-Requisite : Basics of HTML and Java Scripts	
L T P : 0 0 2	
Credits: 1	

CLO1 Able to Understand how blockchain solutions are transforming the industry landscape.  
CLO2 Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.

CLO3 Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.

CLO4 Design and develop for a permissioned blockchain.

CLO5 Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.

<b>INDUSTRY SESSION : SECURITY GOVERNANCE AND LAW</b>	
Course Code: 21CBM4011	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Identify all articles and schedules in constitution of security governance

**CLO2** Able for the assigned/identified real world problems in security governance

**CLO3** Introduce the tools required to manage and analyze the recovered data.

**CLO4** To teach the fundamental techniques and principles in making the cloning of the entire harddrive and perform the analysis to check for any tamper or fraud

**CLO5** Enable students to have skills that will help them to solve complex security governance scenarios

<b>LIVE PROJECT-IV &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS4115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create a application.

**CLO3** To provide hands-on experience at site where Computer Science and engineering projects are executed.

<b>MINOR PROJECT</b>	
Course Code: 21CS4117	
Pre-Requisite : NIL	
L T P : 0 0 8	
Credits: 4	

**CLO1** Able to Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Able to Write technical reports.

**CLO4** To Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## **SEMESTER - VIII**

<b>MAJOR PROJECT</b>	
Course Code: 21CS4114	
Pre-Requisite : Programming Language	
L T P : 0 0 24	
Credits: 12	

**CLO1** Able to Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Able to Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Able to Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## **SYLLABUS OF PROFESSIONAL ELECTIVE COURSES**

<b>DISTRIBUTED OPERATING SYSTEM</b>	
Course Code: 21CS3020	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Gain knowledge of distributed operating system architecture.

**CLO2** Implement distributed client server applications using remote method invocation.

**CLO3** Have knowledge of Synchronization and Deadlock.

**CLO4** To Have sufficient knowledge about file access.

**CLO5** Understand Shared Memory Technique, security, and distributed file systems.

<b>SOFTWARE PROJECT MANAGEMENT</b>	
Course Code: 21CS3024	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling.

**CLO2** Apply basic concepts related to software project planning, scope and feasibility.

**CLO3** Analyse of various project management activities such as tracking, project procurement, configuration management, monitoring.

**CLO4** Acquire knowledge about quality assurance, quality control, and risk management.

<b>GRID COMPUTING</b>	
Course Code: 21CS3026	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the genesis & know the applications of grid computing.

**CLO2** Understand the technology and tool kits for facilitating grid computing.

**CLO3** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids.

**CLO4** Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research.

**CLO5** Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.

<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	
Course Code: 21CS3028	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate knowledge of structural and behavioral modeling techniques.

**CLO2** Able to Demonstrate knowledge of a model-based software development methodology.

**CLO3** Create application of the methodology and the modeling techniques in a significant software design project.

**CLO4** Demonstrate knowledge of design patterns and their application in a software design project.

**CLO5** To Demonstrate knowledge of Design and Testing Process Improvement Models.

<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	
Course Code: 21CS3030	
Pre-Requisite : Soft Computing Course	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the mathematics behind the design of perceptron.

**CLO2** Correlate the need of extension of MLP to CNN.

**CLO3** Design and analyse the importance of kernel functions, RNN and memories.

**CLO4** Differentiate between fuzzy sets and crisp sets.

**CLO5** Apply and analyse the applications of fuzzy to reasoning and clustering

<b>CYBER SECURITY</b>	
Course Code: 21CS3032	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis.

<b>DESIGN THINKING</b>	
Course Code: 21CS3034	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand and critically apply the concepts and methods of business processes.

**CLO2** Able to Understand and apply IBM Blueworks live and process designer tool concepts.

**CLO3** Understand and analyzing design thinking history and its various concepts.

**CLO4** To Understand, analyzing and create models with users collaboration to apply design thinking concepts.

**CLO5** Build the process model that is used to implement process application and use different mural template to apply design thinking concepts for solving real world problem.

<b>PREDICTIVE ANALYTICS</b>	
Course Code: 21CS3036	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand and critically apply the concepts and methods of Predictive analytics.



**CLO2** Able to Understand and apply IBM SPSS Modeler in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.

**CLO3** Apply and analyse how to use functions, deal with missing values, use advanced field operations, handle sequence data and improve efficiency.

**CLO4** Evaluate the Model on the basis of different Predictive Methods.

**CLO5** Build and create advanced analytical model that leverage historical data to uncover real-time insights to predict future events.

<b>BUSINESS INTELLIGENCE</b>	
Course Code: 21CS3038	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the vision of Business Intelligence from a global context.

**CLO2** Able to Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.

**CLO3** Apply and analyse various prompt types and conditionally render objects in reports

**CLO4** Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.

**CLO5** Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

<b>INTERNET OF THINGS</b>	
Course Code: 21CS3040	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the vision of IoT and communication protocols from a global context.

**CLO2** Understand and apply IoT protocols.

**CLO3** Apply and analyze sensor networks and their components to IoT domain.

**CLO4** Design portable IoT using appropriate boards.

**CLO5** Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.

**CLO6** Build and create state of the art architecture in IoT.

<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	
Course Code: 21CS4019	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Present the exploitation present in the security.

**CLO2** Discuss various types of attacks and their characteristics.

**CLO3** Illustrate the basic concept of encryption and decryption for secure data transmission.

**CLO4** Analyze various cryptography techniques and its applications.

**CLO5** Develop solutions for security problems.

<b>SOFTWARE TESTING</b>	
Course Code: 21CS4033	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate the fundamentals of software testing using real world examples

**CLO2** Identify and apply relevant testing techniques suitable for a real world scenario

**CLO3** Investigate the different levels in testing

**CLO4** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO5** Use practical knowledge to test software and understand the trade-offs between testing techniques

**CLO6** Implement Test Automation process and experiment with testing tools.

<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	
Course Code: 21CS4023	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. To specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.

**CLO2** Familiarize with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO3** Able to Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).

**CLO4** Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.

**CLO5** Analyse the congestion control mechanism at transport layer and to acquire skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

<b>ADVANCED JAVA PROGRAMMING</b>	
Course Code: 21CS4035	
Pre-Requisite : Core Java Programming	
L T P : 3 1 0	
Credits: 4	

**CLO1** Learn the graphics and animation on the web pages, using Java Applets.

**CLO2** Able to Learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings Usage.

**CLO3** To Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.

**CLO4** Design the server side programming using Servlets and JSP

**CLO5** Use the invocation of the remote methods in an application using RMI.

<b>NASSCOM ASSOCIATE ANALYTICS - II</b>	
Course Code: <b>CS4037</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the tools, technologies & programming languages which is used in day to day analytics cycle.

**CLO2** Analyze and use the best tools to make sense from available raw data.

**CLO3** To provide knowledge of the tools, technologies & programming languages which is used in day to day business analytics cycle.

<b>DATA WAREHOUSING &amp; DATA MINING</b>	
Course Code: 21CS4025	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the functionality of the various data mining and data warehousing component.

**CLO2** Design data warehouse with dimensional modelling and apply OLAP operations.

**CLO3** Able to Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

**CLO4** Describe complex data types with respect to spatial and web mining.

**CLO5** Extract knowledge using data mining techniques.

**CLO6** Apply the Data Mining principles and techniques for real time applications.

<b>MOBILE COMPUTING</b>	
Course Code: 21CS4027	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Grasp the concepts and features of mobile computing technologies and applications.

**CLO2** Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Able to Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

<b>MACHINE LEARNING USING R</b>	
Course Code:21CS4029	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Learn the fundamentals of R-programming and probability.

**CLO2** Understand the basics and need of Machine learning in global view.

**CLO3** Demonstrate in-depth knowledge of methods and theories in the field of machine learning.

**CLO4** Understand, apply and evaluate the supervised learning techniques.

**CLO5** Apply, analyze and evaluate the ensemble learning and unsupervised learning techniques

**CLO6** Understand the concepts of reinforcement learning and transfer learning.

**CLO7** To implement the machine learning techniques for building different applications.

<b>OPEN SOURCE SOFTWARE</b>	
Course Code: 21 <b>CS4031</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the difference between open source software and commercial software.

**CLO2** Identify, install and run Linux operating system.

**CLO3** Install and manage applications.

**CLO4** Identify, install open source web technologies Apache, MySql, PHP.

**CLO5** Develop web applications using LAMP.

**CLO6** Write session control PHP code for a website.

<b>NASSCOM ASSOCIATE ANALYTICS - III</b>	
Course Code: 21 <b>CS4039</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the tools, technologies & programming languages which is used in day to day analytics cycle.

**CLO2** Analyze and use the best tools to make sense from available raw data.

**CLO3** This course provides knowledge of the advanced concepts of tools, technologies & programming languages which is used in day to day business analytics cycle.

## SYLLABUS OF OPEN ELECTIVE COURSES

<b>GERMAN LANGUAGE PHASE I</b>	
<b>Course Code:</b> 21FLGR301	
<b>Credits:</b> 2	
<b>L T P:</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO4** To Know the culture of the countries where the German language is spoken.

**CLO5** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>GERMAN LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLGR401	
<b>Credits:</b> 2	
<b>L T P:</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Get awareness about cross-cultural and intercultural difference.

<b>FRENCH LANGUAGE PHASE I</b>	
<b>Course Code:</b> 21FLFR301	
<b>Credits:</b> 2	
<b>L T P : 2 0 0</b>	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** To Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Know the culture of the countries where the French language is spoken.

<b>FRENCH LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLFR401	
<b>Credits:</b> 2	
<b>L T P : 2 0 0</b>	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Know the culture of the countries where the French language is spoken.

<b>ENTREPRENEURSHIP &amp; NEW VENTURE MANAGEMENT</b>	
<b>Course Code:</b> SEC-FT-01	
<b>Pre-Requisite :</b> NIL	
<b>L T P : 3 0 0</b>	
<b>Credits:</b> 3	

**CLO1** Able to Understand the different support system for business development.

**CLO2** Gain knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO3** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

**CLO4** Understand the basic of Business project report, Fund raising and SWOT analysis.

<b>SUSTAINABLE GROWTH &amp; DEVELOPMENT</b>	
<b>Course Code:</b> 21ESUG202	
<b>Credits:</b> 3	
<b>L T P : 3 0 0</b>	
<b>Prerequisite:</b> Basics understanding of environment and natural ecosystems	



**CLO1** Able to Develop an awareness about our environment and elicit collective response for its protection.

**CLO2** Understand the different types of environmental pollution problems and their sustainable solutions.

**CLO3** Work in the area of sustainability for research and education.

**CLO4** Have a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

<b>WASTE MANAGEMENT</b>	
<b>Course Code:</b> 21ESUG203	
<b>Credits:</b> 3	
<b>L T P C :</b> 3 0 0	
<b>Prerequisite:</b> Basics understanding about Waste	

**CLO1** Able to Develop an awareness about solid waste and management practices

**CLO2** Design feasible solutions for waste management

**CLO3** Understand waste management practices, law and regulation related to solid waste management

<b>MICROPROCESSOR AND INTERFACING</b>	
<b>Course Code:</b> 21EC390	
<b>Credits:</b> 3	
<b>L T P C :</b> 3 0 0	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Understand the architecture of microprocessors and micro controller

**CLO2** Understand the programming model of microprocessors and micro controllers

**CLO3** Interface different external peripheral devices with microprocessors and micro controllers

**CLO4** Analyze a problem and formulate appropriate computing solution for processor or controller based application.

**CLO5** Develop an assembly language program for specified application.

## **CURRICULUM & SYLLABUS**



**CHOICE BASED CREDIT SYSTEM (CBCS)**  
**FOR**  
**BACHELOR OF TECHNOLOGY (B.Tech.)**  
**(4 Year Undergraduate Degree Programme)**  
**IN**  
**COMPUTER SCIENCE AND ENGINEERING**  
**In Cloud & Mobile Computing in association with IBM**

**[w. e. f. 2019-20]**

## SEMESTER - I

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0101</b>	<b>TECHNICAL ENGLISH - I</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

- CLO1** Able to Understand and appreciate the need of communication training.
- CLO2** Use different strategies of effective communication.
- CLO3** Select the most appropriate mode of communication for a given situation.
- CLO4** Speak assertively and effectively.
- CLO5** Correspond effectively through different modes of written communication.
- CLO6** Write effective reports, proposals and papers.
- CLO7** Present himself/ herself professionally through effective resumes and interviews.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0101</b>	<b>MATHEMATICS - I</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

- CLO1** Able to apply advanced matrix knowledge to Engineering problems
- CLO2** Improve their ability in solving geometrical applications of differential calculus problems
- CLO3** Equip themselves familiar with the functions of several variables
- CLO4** To familiarize with the applications of differential equations
- CLO5** Expose to the concept of three dimensional analytical geometry
- CLO6** Able to expose the students to the concept of convergence and divergence
- CLO7** To develop the ability to judge and apply appropriate tests to various infinite series.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0101</b>	<b>PHYSICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

- CLO1** Able to understand the general scientific concepts required for technology
- CLO2** Physics concepts in solving engineering problems
- CLO3** To educate scientifically the new developments in engineering and technology.
- CLO4** Emphasize the significance of Green technology through Physics principles

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0101</b>	<b>CHEMISTRY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** The role of applied chemistry in the field of engineering.

**CLO2** Knowledge of water quality parameters and the treatment of water.

**CLO3** The principles involves in corrosion and its inhibitions.

**CLO4** To Important analytical techniques, instrumentation and the applications.

**CLO5** Knowledge with respect to the phase equilibria of different systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1** Able to know about different materials and their properties

**CLO2** To know about engineering aspects related to buildings

**CLO3** Able to know about importance of surveying and the transportation systems

**CLO4** Get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1001</b>	<b>S/W FOUNDATION &amp; EMERGING AREAS OF TECH.</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand Models in emerging technologies and using basic tools for application development

**CLO2** Describe Model of Open Standard

**CLO3** To Describe importance of security and scope.

**CLO4** Analyse Role of SQL queries

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to guide thought process.

**CLO2** To groom students' attitude.

**CLO3** Learn to develop communication skill.

**CLO4** To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0103</b>	<b>PHYSICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand scientific concepts in measurement of different physical variables

**CLO2** Develop the skill in arranging and handling different measuring instruments and

**CLO3** Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to Understand the basic concepts involved in the analyses

**CLO2** Impart the knowledge and understanding of principles of measurement techniques.

**CLO3** Understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

**CLO4** The synthesis, dynamics, chemical transformation and their applications

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0107</b>	<b>NCC/NSS/NSO/YOGA</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to Gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice

**CLO2:** Practise YOGA poses and know how it is important

**CLO3:** Develop patriotic feeling for country

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1111</b>	<b>SOFTWARE FOUNDATION LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to Understand Models in emerging technologies and using basic tools for application development

**CLO2** Describe Model of Open Standard

**CLO3** Describe importance of security and scope.

**CLO4** Analyse Role of SQL queries

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

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**CLO1** Able to the basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.

**CLO2** To know the production of simple models in the above trades.

**CLO3:**Be aware of the safety precautions while working in the workshop.

**CLO4:**Use different measuring, marking, cutting tools used in the workshop

## SEMESTER - II

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0102</b>	<b>TECHNICAL ENGLISH - II</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

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**CLO1** Able to provide for the acquisition of basic communication skills in English in relation to the requirements of the students of Engineering and Technology.

**CLO2** Analyse facilitate the holistic, integrated development of LSRW involved in language learning through a series of intensely practical tasks and activities.

**CLO3** To offer professionally sustainable language content by which to address the special needs of the target learners to ensure that they are adequately equipped with discursal and grammatical competencies.

**CLO4** Learn to help acquire the use of language simultaneously through the electronic media such as the Internet so as to enable the learners to deal effectively with E-materials.

**CLO5** To expose the learners to a wide range of lexical and grammatical skills needed for their special professional demands.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0108</b>	<b>VALUE EDUCATION</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**CLO1** Able to help individuals think about and reflect on different values.

**CLO2** To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.

**CLO3** Enable inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** Able to familiarize the students with the basic organization of organisms and subsequent building to a living being.

**CLO2** Get this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.

**CLO3** To provide knowledge about biological problems that require engineering expertise to solve them

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0102</b>	<b>MATHEMATICS - II</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Solve the differential equations of first and 2nd order and basic application problems described by these equations.

**CLO2** Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.

**CLO3** Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.

**CLO4** Solve systems of linear equations by using elementary row operations.

**CLO5** Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigenvectors.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand electrical properties of materials,

**CLO2** Able to Understand the properties and applications of semi conducting materials,

**CLO3** Explain general properties and applications of magnetic and dielectric materials,

**CLO4** To know the behaviour of materials on exposure to light,



**CLO5** Analyse general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0106</b>	<b>BASIC ENGINEERING - II</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Understand the basic concepts of magnetic circuits, AC & DC circuits.

**CLO2** Explain the working principle, construction, applications of DC & AC machines and measuring instruments.

**CLO3** To Gain knowledge about the fundamentals of wiring and earthing

**CLO4** Analyse Fundamentals of electronic components, devices, transducers,

**CLO5** Understand Principles of digital electronics

**CLO6** Principles of various communication systems

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0104</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Able to The importance of environmental education, ecosystem and ethics.

**CLO2** Knowledge with respect to biodiversity and its conservation.

**CLO3** To create awareness on various environmental pollution aspects and issues.

**CLO4** Educate the ways and means to protect the environment.

**CLO5** Know Important environmental issues and protection

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1004</b>	<b>PROGRAMMING WITH JAVA</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Describe the fundamentals of object-oriented program.

**CLO2** Apply Java language constructs that enable and enforce OO-related concepts such as data encapsulation, strict typing and type conversion, inheritance, and polymorphism

**CLO3** Applying and analyzing multithreading programming of Java Language to create more robust and fast applications.

**CLO4** Evaluate the application of Web Server and Application Server and how to deploy Web Applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to guide thought process.

**CLO2** To groom students' attitude.

**CLO3** Evaluate develop communication skill.

**CLO4** Know to build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0104</b>	<b>MATERIAL SCIENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** The students are expected to familiarize with various characterization techniques of materials. They should have developed better understanding of the underlying science behind the properties of various materials.

**CLO2:** Analyse general properties and applications of magnetic and dielectric materials,

**CLO3:** Know the behaviour of materials on exposure to light,

**CLO4:** Understand general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 1114</b>	<b>JAVA LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Knowledge of the structure and model of the Java programming language

**CLO2** Use the Java programming language for various programming technologies (understanding)

**CLO3** Develop software in the Java programming language, (application)

**CLO4** Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)

**CLO5** Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

**CLO6** Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>
(Only First Angle Projection is to be followed)					

**CLO1** The construction of geometrical figures

**CLO2** The projection of 1D, 2D & 3D elements

**CLO3** Sectioning of solids and development of surfaces

**CLO4** Preparation and interpretation of building drawing

**CLO5** Draw dimensioned orthographic and isometric projections of simple engineering objects.

**CLO6** Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism;

### **SEMESTER - III**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0211</b>	<b>MATHEMATICS - III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Evaluate the rudiments of Fourier series

**CLO2** Know the theory and problems of PDE

**CLO3** The applications of PDE to boundary value problems

**CLO4** Find Fourier transforms and to their branches of engineering

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2001</b>	<b>DATA STRUCTURES USING C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Evaluate the basic data structures and solve problems using fundamental algorithms.

**CLO2** Implement various search and sorting techniques.

**CLO3** To Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.

**CLO4** Analyze, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2003</b>	<b>DISCRETE STRUCTURES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Perform operations on various discrete structures such as set, function and relation.

**CLO2** Apply basic concepts of asymptotic notation in analysis of algorithm.

**CLO3** Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real-world problems.

**CLO4** Comprehend formal logical arguments and translate statements from a natural language into its symbolic structures in logic.

**CLO5** Identify and prove various properties of rings, fields and group.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.

**CLO3** Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.

**CLO3** Apply and create Relational Database Design process with Normalization and Denormalization of data.

**CLO4** Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.

**CLO2** Describe the design of basic computer with instruction formats & addressing modes.

**CLO3** Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.

**CLO4** Interpret the concepts of pipelining, multiprocessors and inter processor communication.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2003</b>	<b>PYTHON PROGRAMMING</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** Understand the basic concepts of Python

**CLO2** Learn how to write functions and pass arguments in Python

**CLO3** Design object- oriented programs with Python classes.

**CLO4** Define the structure and components of a Python program.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** On completion of this course, the students will be able to:-

**CLO2** Able to guide thought process.

**CLO3** To groom students' attitude.

**CLO4** Develop communication skill.

**CLO5** To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2111</b>	<b>DBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Designing a database

**CLO2** Using DDL and DML commands

**CLO3** Able to Backing up of files

**CLO4** Draw and analyse table and its command

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2113</b>	<b>DATA STRUCTURES LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Implementing Stack, Queue , Linked List , Binary tree

**CLO2** Sorting and Searching Techniques

**CLO3** Able to Divide and Conquer, Dynamic Programming methods

**CLO4** Evaluate Greedy method , Traversals and Backtracking

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2115</b>	<b>PYTHON PROGRAMMING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**:-**

**CLO1** Understand the basic concepts of Python

**CLO2** Learn how to write functions and pass arguments in Python

**CLO3** Design object- oriented programs with Python classes.

**CLO4** Define the structure and components of a Python program.

#### **SEMESTER - IV**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2002</b>	<b>ESSENTIALS OF S/W ENGG. (OOAD &amp; SW LIFECYCLE)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CLO2** Explain the different views of software architecture

**CLO3** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CLO4** Use the UML to represent the design model

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2006</b>	<b>OPERATING SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2** Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.

**CLO3** Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.

**CLO4** Examine and categorise various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.

**CLO5** Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2008</b>	<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Implement the different tree structures algorithm and analyze in context of asymptotic notation.

**CLO2** Identify basic properties of graphs and apply their algorithms to solve real life problems.

**CLO3** Demonstrate the usage of algorithms under several categories like string matching, randomized algorithms and genetic algorithms.

**CLO4** Implement various advanced data structures using C/Java/Python or related languages.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CCM 2004</b>	<b>CLOUD APPLICATION DEVELOPMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Understand cloud computing and infrastructure as a service, platform as a service, and software as a service

**CLO2** Create and manage IBM Cloud account with IBM Cloud CLI and Cloud Foundry CLI

**CLO3** Describe how to setup and use the IBM Cloud plug-in for Eclipse and Deploy an application from local workstation using the IBM Cloud CLI.

**CLO4** Develop cloud application for Node. Js

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2114</b>	<b>OPERATING SYSTEMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Implement Scheduling algorithms

**CLO2** Implement Deadlock algorithms and page replacement algorithms

**CLO3** Implement Memory management schemes, Thread and synchronization

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2118</b>	<b>ADA LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 2118</b>	<b>FCEAD using IBM Rational Tool Lab</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CLO2** Explain the different views of software architecture

**CLO3** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CLO4** Use the UML to represent the design model

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CCM 2120</b>	<b>CLOUD COMPUTING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand cloud computing and infrastructure as a service, platform as a service, and software as a service

**CLO2** Create and manage IBM Cloud account with IBM Cloud CLI and Cloud Foundry CLI

**CLO3** Describe how to setup and use the IBM Cloud plug-in for Eclipse and Deploy an application from local workstation using the IBM Cloud CLI.

**CLO4** Develop cloud application for Node.js

## **SEMESTER - V**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Design and construction of compilers and knowledge of working of major phases of compilation.

**CLO2** Construct parsers.

**CLO3** Implement a simple compiler for a language chosen.



**CLO4** Classify various parameters passing scheme, explain memory management of a programming languages and perform code optimization.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Conceptualise and explain the functionality of the different layers within a network architecture

**CLO2** Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies, subnetting and routing mechanism.

**CLO3** Demonstrate the operation of various routing protocols and their performance analysis.

**CLO4** Illustrate design and implementation of datalink, transport and network layer protocols within a simulated/real networking environment.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3005</b>	<b>THEORY OF COMPUTATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2** Disambiguate context-free grammars by mastering the concepts of context-free languages and push-down automata.

**CLO3** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

**CLO4** Solve analytical problems in related areas of theory in computer science

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3007</b>	<b>ESSENTIALS OF HADOOP</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** To identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2** Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO3** Understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO4** To recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO5** Integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CCM 3009</b>	<b>ENTERPRISE MOBILE APPLICATION DEVELOPMENT</b>	3	0	0	3

**CLO1** Understand different approaches to mobile application development

**CLO2** Identify the client and server components of the Ajax web application architecture

**CLO3** Understand Ajax and JavaScript frameworks

**CLO4** Learn mobile development architectures and understand the development framework

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	0	0	2	1

**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently.

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3113</b>	<b>COMPUTER NETWORK LAB</b>	0	0	2	1

**CLO1** Understand the requirements of an enterprise and outline its major design areas

**CLO2** Identify functional areas to construct high level modules for enterprise architecture and analyze them.

**CLO3** Identify the networking devices, prepare a bill of materials and configure the devices as per the Core, Access and Distribution layers

**CLO4** Design the Server Farm for an enterprise network and discuss up gradations if needed.

**CLO5** Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.

**CLO6** Test and monitor the enterprise network using a tool

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	0	0	2	1

**CLO1** Able to enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3117</b>	<b>COMPILER DESIGN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**CLO2** Gain the knowledge of parser and its various types.

**CLO3** Design Symbol tables using various data structures and understanding of error detection and recovery techniques.

**CLO4** Analyze and Design the methods of developing a Code Optimizer.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3113</b>	<b>HADOOP LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2** Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4** Understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5** Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6** Integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CCM 3115</b>	<b>APPLICATION DEVELOPMENT LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand different approaches to mobile application development

**CLO2** Identify the client and server components of the Ajax web application architecture

**CLO3** Understand Ajax and JavaScript frameworks

**CLO4** Learn mobile development architectures and understand the development framework.

## **SEMESTER - VI**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3002</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyse the factors that influenced the advancements of AI in recent years

**CLO2** Describe the field of AI and its subfields machine learning, NLP and computer vision

**CLO3** Demonstrate the types of machine learning: Supervise learning, unsupervised learning, and deep learning.

**CLO4** Explain the factors that lead to the growing popularity of chatbots.

**CLO5** Describe how Watson technology is being applied to solve real world problems

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3010</b>	<b>ADVANCED RDBMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Master the basic concepts and appreciate the applications of database systems.

**CLO2** Learn the basics of SQL and construct queries using SQL.

**CLO3** Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.

**CLO4** Analyse the relational database theory, and be able to write relational algebra expressions for queries.

**CLO5** Master sound design principles for logical design of databases, including the E- R method and normalization approach.

**CLO6** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CLO7** Master the basics of query evaluation techniques and query optimization.

**CLO8** Be familiar with the basic issues of transaction processing and concurrency control.

**CLO9** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to assess the overall knowledge level of Computer Science and engineering standards and guide them to take corrective measures where deficiencies are detected.

**CLO2:**Types of reading strategies to enhance improve reading skills

**CLO3:**Role of writing skills in effective communication

**CLO4:** Learn Advantages & Disadvantages of written communication

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT -VI</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3112</b>	<b>ARTIFICIAL INTELLIGENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Analyse the factors that influenced the advancements of AI in recent years

**CLO2** Describe the field of AI and its subfields machine learning, NLP and computer vision

**CLO3** Demonstrate the types of machine learning: Supervise learning, unsupervised learning, and deep learning.

**CLO4** Explain the factors that lead to the growing popularity of chatbots.

**CLO5** Describe how Watson technology is being applied to solve real world problems

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 3114</b>	<b>ADVANCED RDBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Master the basic concepts and appreciate the applications of database systems.

**CLO2** Learn the basics of SQL and construct queries using SQL.

**CLO3** Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.

**CLO4** Evaluate the relational database theory, and be able to write relational algebra expressions for queries.

**CLO5** Master sound design principles for logical design of databases, including the E- R method and normalization approach.

**CLO6** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CLO7** Master the basics of query evaluation techniques and query optimization. **CLO8** Able to Be familiar with the basic issues of transaction processing and concurrency control.

**CLO9** Able to (optional) Master working successfully on a team by design and development of a database application system as part of a team.

## SEMESTER - VII

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4001</b>	<b>BLOCKCHAIN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CL02** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CL03** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4003</b>	<b>FOUNDATION COURSE IN APPLICATION &amp; CLOUD SECURITY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Fundamentals of cloud computing architectures based on current standards, protocols, and best practices

**CL02** Identify the known threats, risks, vulnerabilities and privacy issues associated with

**CL03** Cloud and evolve appropriate safeguards and countermeasures

**CL04** Design Cloud security architectures that assures secure isolation of compute, network and storage infrastructures, comprehensive data protection, end-to-end identity and access management, monitoring and auditing processes and compliance with industry and regulatory mandates.

**CL05** Cloud computing security guidelines set forth by ISO, NIST, ENISA and Cloud Security Alliance (CSA)

**CL06** Prepares for Cloud Security - CBK Certifications from Cloud Security Alliance (CSA).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CBD 4113</b>	<b>BLOCKCHAIN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CL01** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CL02** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.on cloud computing solutions for an enterprise.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4115</b>	<b>INDUSTRIAL TRAINING - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>(Training to be undergone after VI Semester)</b>					

**CLO1** Able to enable the students to gather a first-hand experience on site

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task..

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4117</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

**CLO1** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Able to Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## **SEMESTER - VIII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4114</b>	<b>PROJECT</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>



**CLO1** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

#### **SYLLABUS OF DEPARTMENTAL ELECTIVES**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3020</b>	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Knowledge and understanding

- Outline the potential benefits of distributed systems
- Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

**CLO2** Able to Cognitive skills (thinking and analysis).

- Apply standard design principles in the construction of these systems
- Select appropriate approaches for building a range of distributed systems, including some that employ middleware

**CLO3** Able to Communication skills (personal and academic).

**CLO4** Able to Practical and subject specific skills (Transferable Skills).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3022</b>	<b>SYSTEM SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to understand the relationship between system software and machine architecture.

**CLO2** To know the design and implementation of assemblers

**CLO3** Analyse the design and implementation of linkers and loaders.

**CLO4** Able to have an understanding of macro processors.

**CLO5** They have an understanding of system software tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3024</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Describe and apply basic concepts related to software project planning, scope and feasibility.

**CL02** Analyze various project estimation techniques, especially size estimation (FP), effort estimation (COCOMO models), schedule estimation (GANTT charts), and cost estimation.

**CL03** Illustrate the concept of team structure and project communication management.

**CL04** Acquire knowledge about quality assurance, quality control, and risk management.

**CL05** Describe various project management activities such as tracking, project procurement, configuration management, monitoring.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3026</b>	<b>GRID COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Able to understand the genesis of grid computing

**CL02** To know the application of grid computing

**CL03** Understand the technology and tool kits for facilitating grid computing

**CL03** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids;

**CL04** Able to utilise grid computing and clustering middleware, such as Parallel Virtual Machine (PVM), Message Passing Interface (MPI), HPC Portals, and Peer-to-Peer networks for implementing virtual super computing resources;

**CL05** Design a grid computing application in one of the key application areas e.g.Computer Animation, E-Research;

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Understanding Object Basics, Classes and Objects, Inheritance

**CL02** How software objects are altered to build software systems that are more robust

**CL03** Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project

**CL04** Understanding the issues and options in reuse

**CL05** Using UML, a common language for talking about requirements, designs, and component interfaces

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Expose the students to the concepts of feed forward neural networks

**CL02** Able to provide adequate knowledge about feedback networks.

**CL03** To teach about the concept of fuzziness involved in various systems.

**CL04** Have adequate knowledge about fuzzy set theory.

**CL05** To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

**CL06** Able to provide adequate knowledge of application of fuzzy logic control to real time systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3032</b>	<b>CYBER SECURITY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CL02** Underline the need of digital forensic and role of digital evidences.

**CL03** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CL04** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications/devices like Windows/Unix system.

**CL05** Apply the knowledge of IDS to secure network and performing router and network analysis

**CL06** List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4019</b>	<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Comprehend and implement various cryptographic algorithms to protect the confidential data.

**CL02** Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.

**CL03** Apply security tools to locate and fix security leaks in a computer network/software.

**CL04** Secure a web server and web application

**CL05** Configure firewalls and IDS

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4021</b>	<b>BIG DATA &amp; ANALYTICS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

**CL02** Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

**CL03** Implement several Data Intensive tasks using the Map Reduce Paradigm

**CL04** Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

**CL05** Design algorithms to analyze big data like streams, Web

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4023</b>	<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Student has an understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

**CL02** The principles and characteristics of wireless sensor networks (WSNs).

**CL03** How proactive protocols function and their implications on data transmission delay and bandwidth consumption.

**CL04** To know how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CL05** Understands how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CL06** Analyse reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CL07** To familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CL08** Student have acquired skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4025</b>	<b>DATA WAREHOUSING &amp; DATA MINING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Data pre-processing and data quality.

**CL02** Modeling and design of data warehouses.

**CLO3** Algorithms for data mining.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4027</b>	<b>MOBILE COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Grasp the concepts and features of mobile computing technologies and applications

**CLO2** Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Identify the important issues of developing mobile computing systems and applications

**CLO4** Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

**CLO5** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

**CLO6** Organize and manage software built for deployment and demonstration.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4029</b>	<b>MACHINE LEARNING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.

**CLO2** Apply decision tree learning, bayesian learning and artificial neural network in real world problems.

**CLO3** Understand the use of genetic algorithms and genetic programming.

**CLO4** Apply inductive and analytical learning with perfect domain theories.

**CLO5** Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4031</b>	<b>OPEN SOURCE SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyse concepts, strategies, and methodologies related to open source software development.

**CLO2** Understand the business, economy, societal and intellectual property issues of open source software.

**CLO3** Be familiar with open source software products and development tools currently available on the market.

**CLO4** Be able to utilize open source software for developing a variety of software applications, particularly Web applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4033</b>	<b>SOFTWARE TESTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO2** Implement various test processes for quality improvement

**CLO3** Analyse Design test planning.

**CLO4** Evaluate Manage the test process

**CLO5** Apply the software testing techniques in commercial environment

**CLO6** Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4035</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Learn the Internet Programming, using Java Applets

**CLO2** create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CLO3** Apply event handling on AWT and Swing components.

**CLO4** learn to access database through Java programs, using Java Data Base Connectivity (JDBC)

**CLO5** Create dynamic web pages, using Servlets and JSP.

**CLO6** Make a reusable software component, using Java Bean.

**CLO7** Invoke the remote methods in an application using Remote Method Invocation (RMI).

**CLO8** Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

**CLO9** Develop Stateful, Stateless and Entity Beans.

**CLO10** Use Struts frameworks, which gives the opportunity to reuse the codes for quick development.

**CLO11** Map Java classes and object associations to relational database tables with Hibernate mapping files

## **SYLLABUS OF OPEN ELECTIVES**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0201</b>	<b>GERMAN LANGUAGE PHASE - I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** Develop pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2** Know the culture of the countries where the German language is spoken.

**CLO3** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0205</b>	<b>FRENCH LANGUAGE PHASE - I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2** Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Know the culture of the countries where the French language is spoken.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0202</b>	<b>GERMAN LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** Able to Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2** Read and write short, simple texts.

**CLO3** Have Fluency in reading and writing.

**CLO4** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0206</b>	<b>FRENCH LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2012</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Get the familiar with numerical solution of equations

**CLO2** To get exposed to finite differences and interpolation

**CLO3** Able to be thorough with the numerical Differentiation and integration

**CLO4** find numerical solutions of ordinary differential equations

**CLO5** Be thorough with probability concepts and the corresponding distributions.

**CLO6** Get exposed to the testing of hypothesis using distributions.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2002</b>	<b>ENGINEERING ECONOMICS AND MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to apply theoretical economic concepts to practical business situation and to take decision in the Industrial Engineering Situation.

**CLO2:** An Engineer must demonstrate knowledge and understanding of the engineering and management

**CLO3:** Principle and Apply these to Engineeringwork environment, as a member and leader in a team,

**CLO4:** To manage projects and in multidisciplinary environments.



		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2004</b>	<b>INDUSTRIAL MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Students will be able to perform the Management Functions.

**CLO2:** To compare selected Theories of Management.

**CLO3:** Perform the functions in the Marketing Mix.

**CLO4:** Students will be able to use basic Business Application Software.

**CLO5:** Assess ethical issues in Business situations..

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2006</b>	<b>RELIABILITY AND QUALITY MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Apply the Concept of SQC in Process Control for Reliable Component Production

**CLO2:** To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management

**CLO3:** Identify risks, manage the change to assure quality in projects.

**CLO4:** Extract and analyse software requirements specifications for different projects.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2002</b>	<b>PRODUCTION AND OPERATION MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Apply problem-solving and critical-thinking skills as required in materials and operations management.

**CLO2:** Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.

**CLO3:** To meet the specified needs with appropriate consideration for the public health and safety,

**CLO4:** Learn management principles and apply these to Engineering work environment,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2004</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Gain Knowledge and Skills needed to run a Business Successfully.

**CLO2:** Understand the different support system for business development.

**CLO3:** Get knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO4:** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2006</b>	<b>NON-CONVENTIONAL ENERGY RESOURCES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Acquired knowledge about different energy resources.

**CLO2** Ability to convert the energy from one form to another form.

**CLO3 :** Learn how to use these energy resources

**CLO4:** Develop new effective to utilize energy

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2008</b>	<b>NANOTECHNOLOGY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to The various opportunities in the emerging field of nano electronics and nano technologies

**CLO2:** To know advantages and disadvantages of nano particles

**CLO3:** Analyse new technologies emerges with nanotechnology

**CLO4:** To know new and faster kinds of computers, more efficient power sources and life-saving medical treatment

# **CURRICULUM & SYLLABUS**



**CHOICE BASED CREDIT SYSTEM (CBCS)  
FOR  
BACHELOR OF TECHNOLOGY (B.Tech.)  
(4 Year Undergraduate Degree Programme)  
IN  
COMPUTER SCIENCE & ENGINEERING WITH  
SPECIALIZATION IN CLOUD ENGINEERING &  
DEVOPS AUTOMATION IN ASSOCIATION WITH  
XEBIA  
[w. e. f. 2021-2022]**

**FACULTY OF ENGINEERING AND TECHNOLOGY  
SRM UNIVERSITY DELHI-NCR, SONEPAT  
39, Rajiv Gandhi Education City, Sonapat  
Haryana-131029**

**SRM UNIVERISTY DELHI-NCR, SONEPAT**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**

**ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (EPEOs)**

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises;
4. Increasing responsibilities of technical and managerial leadership in their work organizations;
5. Professional development through a commitment to career-long learning.

**ENGINEERING PROGRAM LEARNING OUTCOMES (EPLOs)**

1. An ability to identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences
2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
4. an ability to adapt and work with multidisciplinary teams and communicate effectively;
5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks.
6. an understanding of professional and ethical responsibility;
7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

**B.TECH - COMPUTER SCIENCE& ENGINEERING WITH SPECIALIZATION IN  
CLOUD ENGINEERING & DEVOPS AUTOMATION IN ASSOCIATION WITH  
XEBIAPROGRAMME EDUCATIONAL OBJECTIVES**

*PEO1.*To nurture strong understanding in logical, mathematical and analytical reasoning among students coupled with problem solving attitude that prepares them to productively engage in research and higher learning.

*PEO2.*To build strong foundation in the field of Computer Science and Engineering among students to be creative and innovative.

*PEO3.*To prepare students capable of designing and developing real-world computing applications with high societal influence and impact.

*PEO4.*To provide students with academic environment that enables them to understand the significance of life-long learning in varied situations and teams in global perspective.

*PEO5.* To inculcate ethical practices, professionalism and environmental awareness for sustainable development among students enabling them for prospective employment in their chosen line of profession globally.

*PEO6.*To instil communication and management skill that generates entrepreneurship and / or leadership qualities.

**B.TECH - COMPUTER SCIENCE& ENGINEERING WITH SPECIALIZATION IN  
CLOUD ENGINEERING & DEVOPS AUTOMATION IN ASSOCIATION WITH  
XEBIAPROGRAMME LEARNING OUTCOMES**

1. An ability to apply knowledge & skill of mathematics, science and engineering.
2. An ability to identify, analyze, design, develop, implement and integrate software and hardware based computer systems.
3. An ability to understand emerging technologies and related security issues in the computing paradigm.
4. An ability to acquire and apply the skill in modern techniques, methodologies and tools to be innovative and creative.
5. An ability to formulate ,design &demonstrate strong logical, analytical and reasoning skills to adeptly solve problems
6. An ability to apply algorithmic principles and programming prowess in the development of software systems.
7. An awareness of social, health, ethical, legal, financial, and professional responsibilities.

8. An ability to analyze the local and global impact of computing discipline on environmental issues and sustainable development
9. Recognition of the need for self-motivation and ability to engage in lifelong learning and professional development
10. An ability to effectively manage projects involving multidisciplinary and teams with ethnic diversity.
11. An ability to communicate effectively, both in written and verbal forms.
12. An ability to demonstrate leadership and entrepreneurship qualities.

### **SEMESTER - I & SEMESTER - II**

<b>ENGINEERING MATHEMATICS-I</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code:21AS101</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Apply the knowledge of calculus, Gamma & Beta functions for analyzing engineering problems.

**CLO2** Solve first order differential equation analytically using standard method.

**CLO3** Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.

**CLO4** To Obtain series solution of differential equation and explain application of Bessel's function

**CLO5** Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stoke's theorems.

<b>ENGINEERING MATHEMATICS-II</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code:21AS201</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: Engineering Mathematics-I</b>	

**CLO1** Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process.

**CLO2** Apply Laplace transforms to find the solution of differential equations.

**CLO3** Solve different problems with help of Fourier series.

**CLO4** Know, analytic functions and conformal mapping of complex variables.

**CLO5** Evaluate complex integration and residues.

<b>ENGINEERING PHYSICS</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS102/202</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.

**CLO 2** Able to an understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

**CLO3** They would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.

**CLO4** Analyse course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar cell.

<b>ENGINEERING PHYSICS LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Use the different measuring devices and meters to record the data with precision

**CLO2** Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

**CLO3** Apply the mathematical concepts/equations to obtain quantitative results



<b>ENGINEERING CHEMISTRY</b> (COMMON TO ALL BRANCHES)
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<b>Course Code: 21AS103/203</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand to identify the quality of water and how to improve the quality of water.  
**CLO2** Rationalize bulk properties and processes using thermodynamic considerations.  
**CLO3** Get preliminary understanding on introductory idea about nano materials.  
**CLO4** Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism of corrosion.

<b>ENGINEERING CHEMISTRY LAB</b> (COMMON TO ALL BRANCHES)
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<b>Course Code: 21AS153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the basic concepts of measurement techniques.  
**CLO2** The synthesis, dynamics, chemical transformation and their applications  
**CLO3** To impart the knowledge and understanding of principles of measurement techniques. 2. To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

<b>FUNDAMENTALS OF COMPUTER &amp; C PROGRAMMING</b> (COMMON TO ALL BRANCHES)
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<b>Course Code: 21CS101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the fundamental concepts of computers, both hardware and software.  
**CLO2** Learn and understand the major system software's that help in developing of an application.

**CLO3** Apply and analyse the basic programming constructs in context of C programming language.

**CLO4** Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions

**CLO5** Create and manipulate a database or data storage through files.

**CLO6** Develop a methodological way of problem solving.

**CLO7** Learn a programming approach to solve problems.

<b>C PROGRAMMING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21CS151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.

**CLO2** Introduction to C Programming using Control Statements and Repetition Statement

**CLO3** Apply and practice logical formulations to solve some simple problems leading to specific applications.

**CLO4** Design effectively the required programming components that efficiently solve computing problems in real world.

**CLO5** Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

<b>BASIC ELECTRONICS ENGINEERING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EC101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** learn the fundamental concepts of semiconductor devices

**CLO2** An ability to apply the concept of diode in clipper and clamper circuits

**CLO3** Acquire the skills of constructing the different transistors configurations

**CLO4** learn the basic concepts of integrated circuits

**CLO5** Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates

**CLO6** To acquire the knowledge of microprocessors.

<b>BASIC ELECTRONICS ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code:</b> 21EC151/251	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Measure voltage, frequency and phase of any waveform using CRO.

**CLO2** Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.

**CLO3** Analyze the characteristics of different electronic devices such as diodes, transistors and operational amplifiers

**CLO4** To develop skill to build and verify digital circuits

<b>BASIC ELECTRICAL ENGINEERING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EE101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learn about transient analysis of RLC circuits with DC excitation.

**CLO2** Realize the requirement of transformers in transmission and distribution of electric power and other applications.

**CLO3** Develop an idea on Magnetic circuits, Electromagnetism

**CLO4** Learn about measuring instruments, single phase and polyphase AC circuits

<b>BASIC ELECTRICAL ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code:</b> 21EE151/251	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

**CLO2** Understand the calibration of energy meter.

**CLO3** To Understand open circuit and short circuit test of single-phase transformer.

**CLO4** Analyse RLC series and parallel circuits

<b>COMMUNICATIVE ENGLISH</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS101/201</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** To write effectively using correct grammatical structures.

**CLO2** Student can read and speak fluently in English.

**CLO3** To know the nuances of effective presentations.

**CLO4** Engage in group discussions, debate, deliver speeches and such others.

**CLO5** write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>COMMUNICATIVE ENGLISH LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code:21HS151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** To write effectively using correct grammatical structures.

**CLO2** Learners will be able to read and speak fluently in English.

**CLO3** Know the nuances of effective presentations.

**CLO4** To engage in group discussions, debate, deliver speeches and such others.

**CLO5** Write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>INDIAN CONSTITUTION &amp; POLITY</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 21HS102/202</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.

**CLO2** Differentiate different aspects of Indian Legal System and its related bodies

**CLO3** appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.

**CLO4** Know about the enforcement remedies available under the Constitution of India

**CLO5** Apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy

**CLO6** Apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

<b>YOGA &amp; PHYSICALEDUCATION</b> Practices (COMMON TO ALL BRANCHES EXCEPT)	
<b>Course Code:21SE151</b>	
<b>Credits: 1</b>	
<b>L T P: 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Increased balance, strength, and flexibility

**CLO2** A beginning sense of alignment in the body

**CLO3** Competence of all five breath techniques and variations

**CLO4** An internal sense of focus and clarity in the movement meditation

**CLO5** Understanding of the cultural and philosophical approaches to yoga

**CLO6** Desire to learn, excel and continue studies on the art of yoga

**CLO7** Basic knowledge of Basketball, Cricket, Football , Volleyball, Badminton & Table Tennis

<b>BASIC MECHANICAL ENGINEERING</b> (Common to all Branches)	
<b>Course Code: 21ME101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the concepts of thermodynamics.

**CLO2** Apply principles of thermodynamics to real engineering problems.

**CLO3** Understand the basics of power train applications.

**CLO4** Grasp the elements of robotics.

**CLO5** Understand the working principles of various measuring tools and devices.

<b>BASIC MECHANICAL ENGINEERING LAB</b> (Common to all Branches)	
<b>Course Code: 21ME151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

- CLO1** The working of thermal power plants.  
**CLO2** The working of 2 and 4 stroke IC engines.  
**CLO3** Different automobile parts, gears and gear trains.  
**CLO4** The working of Refrigeration and Air Conditioning cycles.  
**CLO5** The working principles of flow meters and U-tube manometers.

<b>MECHANICAL WORKSHOP LAB</b> (Common to all Branches)	
<b>Course Code: 21ME152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

- CLO1** Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) Processes required to manufacture a product from the raw materials.  
**CLO2** To Use different measuring, marking, cutting tools used in the workshop.  
**CLO3** Be aware of the safety precautions while working in the workshop.

<b>ENGINEERING GRAPHICS &amp; DESIGN LAB</b> (Common to all Branches)	
<b>Course Code: 21ME153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

- CLO1** Understand orthographic projections of point and lines in any position through Auto CAD.  
**CLO2** Imagine and convert isometric view into orthographic projections and vice versa.  
**CLO3** To understand the simple machine component and draw its projections

<b>DEVOPS OVERVIEW</b>	
<b>Course Code: 21CD102</b>	
<b>Pre-Requisite : NIL</b>	
<b>L T P : 2 0 0</b>	
<b>Credits: 2</b>	

- CLO1** Understand the how software development is done using traditional methods like Waterfall.  
**CLO2** How agile serves as a better alternative to traditional methods and how agile methods have evolved over time.

**CLO3** Understand the definition and basic concepts of DevOps; how DevOps and agile help in developing and delivering better quality products.

**CLO4** A reasons for adopting DevOps and concepts like MVP, continuous integration and continuous delivery, Major DevOps principles like Culture, Automation, Measurement and Sharing.

<b>SOURCE CODE MANAGEMENT LABORATORY</b>	
Course Code: 21CD112	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the concepts of Programming language.

**CLO2** Learn the basics of C declarations, operators and expressions.

**CLO3** Learn on the manipulation of strings, functions and pointers

**CLO4** Apply concepts and techniques for implementation

### **SEMESTER - III**

<b>ENGINEERING MATHEMATICS - III</b>	
Course Code: 21AS301	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Solve different types of partial differential equations.

**CLO2** Find solutions of boundary value problems including heat and wave equations.

**CLO3** Apply and analyze Fourier transforms with different applications.

**CLO4** Evaluate the problems using z-transforms.

**CLO5** Understand linear algebra and its application to Engineering.

<b>DATA STRUCTURES USING C</b>	
Course Code: 21CS2003	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyse the algorithms to determine the time and computation complexity and justify the correctness.

**CLO2** Implement the given search problem, i.e., Linear and Binary Search.

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**CLO3** Write and analyse an algorithm for different sorting techniques and compare their performance in term of Space complexity, Time complexity and application.

**CLO4** Implement any given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.

**CLO5** Implement Graph search and traversal algorithms and determine the time and computation complexity.

**CLO6** Identify the best data structure to be used for any particular application and design and analyses the application in terms of time and space complexity.

### **DATABASE MANAGEMENT SYSTEMS**

Course Code: 21CS2005

Pre-Requisite : NIL

L T P : 3 0 0

Credits: 3

**CLO1** Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Design the database schema with the use of appropriate data types for storage of data in database

**CLO3** Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.

**CLO4** Apply and create Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respect data into RDBMS and on the data.

**CLO5** To understand and apply the concept of transaction, concurrency control and recovery in database.

**CLO6** Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

### **COMPUTER ARCHITECTURE & ORGANIZATION**

Course Code: 21CS2007

Pre-Requisite : NIL

L T P : 3 1 0

Credits: 4

**CLO1** Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.



**CLO2** Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.

**CLO3** Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.

**CLO4** Understand the need for an interface and instruction cycle phases. Implement the hardwired and microprogrammed control unit for analyse the performance.

**CLO5** Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithm for given design requirements.

**CLO6** Compare and contrast memory mapping and IO mapping techniques. Describe the different modes of data transfer. Appraise the synchronous and asynchronous bus for performance and arbitration.

<b>SOURCE CODE MANAGEMENT &amp;DEVELOPMENT AUTOMATION</b>	
Course Code: 21CD201	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand the traditional toolkit for DevOps.

**CLO2** Learn the history and overview of source code management.

**CLO3** Learn the Control systems of DevOps.

**CLO4** Understand the Automation.

**CLO5** Learn to interact with Linux Environment.

**CLO6** Analyse the make and make files.

**CLO7** Evaluate the advantage of Automation in database backups.

<b>DATABASE MANAGEMENT SYSTEMS LAB</b>	
Course Code: 21CS2111	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Transform an information model into a relational database schema and to use a data

**CLO2** definition language and/or utilities to implement the schema using a DBMS.

**CLO3** Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO4** Formulate query, using SQL, solutions to a broad range of query and data update problems.

**CLO5** Design and implement database applications on their own.

**CLO6** Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.

**CLO7** Analyze and Select storage and recovery techniques of database system.

<b>DATA STRUCTURES USING C LAB</b>	
Course Code: 21CS2113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the importance of data structures and abstract data type, and their basic usability in different applications.

**CLO2** Implement various kinds of searching and sorting techniques, and know when to choose which technique.

**CLO3** Analyze and differentiate different algorithms based on their time complexity.

**CLO4** Understand various data structure such as stacks, queues, linked lists, trees, graphs, etc. to solve various computing problems.

<b>SOURCE CODE MANAGEMENT &amp;DEVELOPMENT AUTOMATION LAB</b>	
Course Code: 21CD215	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand and Install the version control systems.

**CLO2** Learn the Git operations.

**CLO3** Learn on the Git configuration, History, Merge Resolution, and Branching.

**CLO4** Git concepts and techniques for implementation in various Operating Systems.

**CLO5** Understand the concepts of Automation.

**CLO6** Learn to interact with Linux Environment.

**CLO7** understands the make and make files.

<b>ESSENTIALS OF BLOCKCHAIN &amp; IOT -LEVEL-I</b>	
<b>Course Code:21CS0201</b>	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**TRAINING LEARNING OUTCOMES (TLOS): -**

1. To understand and learn how bitcoin and other coins work in real world.
2. Understand the vision of IoT and communication protocols from a global context.
3. To evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.
4. Design portable IoT using appropriate boards.

<b>EFFECTIVE COMMUNICATION SKILLS</b>	
Course Code: 21SS351	
Pre-Requisite: Basic English	
L T P: 0 0 2	
Credits: 1	

**Training Learning Outcome (TLO)**

**After the completion of the training, the student will have ability:**

1. To communicate effectively and interact with people with confidence.
2. Demonstrate and differentiate between various forms of communication.
3. Apply effective communication skills confidently which a student need to get ahead in job and life.

## SEMESTER - IV

THEORY OF COMPUTATION	
Course Code: 21CS2004	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance

**CLO2** With National Education Policy (NEP). After completion of course, students would be able to:

**CLO3** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO4** Student understands the basics of regular expression and its equivalence.

**CLO5** is ambiguous context-free grammars by mastering the concepts of context-free Languages and push-down automata.

**CLO6** study the concepts of Push down Automata and its applications.

**CLO7** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

OPERATING SYSTEMS	
Course Code: 21CS2006	
No. of Lectures (Hrs./Week): 4	
Total No. of Lectures: 60	
Credits: 3	

**CLO1** Understand basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2** Understand the process management policies and scheduling of processes by **CLO3** Able to Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading.

**CLO4** Describe and analyze the memory management and its allocation policies.

**CLO5** Identify use and evaluate the storage management policies with respect to different storage management technologies.

<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	
Course Code: 21CS2008	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

**CLO2** Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

**CLO3** Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

**CLO4** Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

**CLO5** Able to a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

<b>ADVANCED LINUX</b>	
Course Code: 21CD202	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the role of a Linux system administrator and the tasks performed by them.

**CLO2** Understand the Linux file system hierarchy in detail.

**CLO3** Know the Linux package management systems and Linux configuration and maintenance.

**CLO4** Participants will learn about Linux monitoring tools.

<b>BUILD and RELEASE MANAGEMENT</b>	
Course Code: 21CD204	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the dependency management.

**CLO2** Learn a repository and its associated tools.

**CLO3** Understands documentation and reporting.

**CLO4** Test Framework and a release cycle

<b>TEAMWORK &amp; INTERPERSONAL SKILLS</b>	
Course Code: 21SS452	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcome:**

**After the completion of the training, the student will have ability:**

1. To be confident working in a team and leading it as well.
2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
3. The student will get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
4. The student will be able to face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>OPERATING SYSTEMS LAB</b>	
Course Code: 21CS2114	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Demonstrate the various operations of file system.

**CLO2** Understand and Implement Memory management schemes, Thread and synchronization

**CLO3** Implement Deadlock algorithms and page replacement algorithms.

**CLO4** Able to Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.

**CLO5** Implement Scheduling algorithms.

<b>ANALYSIS AND DESIGN OF ALGORITHMS LAB</b>	
Course Code: 21CS2118	
Pre-Requisite : Data Structures	
L T P : 0 0 2	
Credits: 1	

**CLO1** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

<b>ADVANCED LINUX LAB</b>	
Course Code: 21CD212	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the need of Linux environment.

**CLO2** Know the role of administrator.

**CLO3** Able to Understand Linux file system hierarchy.

**CLO4** Learn package management system, configuration and maintenance.

<b>BUILD and RELEASE MANAGEMENT LAB</b>	
Course Code: 21CD214	
Pre-Requisite: NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the dependency management.

**CLO2** learn a release cycle.

**CLO3** Understand documentation and reporting.

**CLO4** Get Understand the process of various testing and code coverage report generation.

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
<b>Course Code:21CS0202</b>	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **TRAINING LEARNING OUTCOMES (TLOS): -**

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
2. Understands the basics and need of AI and Machine learning in global view.
3. Apply and evaluate the supervised learning techniques.
4. Design and implement the different applications using the concepts of AI and ML

<b>LIVE PROJECT-I</b>	
Course Code: 21CS0204	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **LEARNING OUTCOME:**

1. To enable the students to gather a first-hand experience on sites.
2. They will be able to apply the concepts learnt to design and create a application.
3. To know the requirements in project

### **SEMESTER - V**

<b>COMPILER DESIGN</b>	
Course Code: 21CS3001	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

**CLO2** Understanding of assembler, Macro, Loader & Linker.



**CLO3** Able to Understanding the fundamentals of Compiler, Lexical Analyzer and its design aspects.

**CLO4** Gained the knowledge of parser and its various types.

**CLO5** Designing of Symbol table using various data structures and understanding of error

**CLO6** Able to Detection and recovery techniques.

**CLO7** Analyzing and Designing the methods of developing a Code Optimizer.

**CLO8** Understanding the usage of various Code Generation Tools.

<b>COMPUTER NETWORKS</b>	
Course Code: 21CS3003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

**CLO2** Describe the functions of each layer in OSI and TCP/IP model.

**CLO3** To Describe the functions of data link layer and explain the protocols.

**CLO4** Classify the routing protocols and analyze how to assign the IP addresses for the given network.

**CLO5** Describe the Session layer design issues and Transport layer services.

**CLO6** Explain the functions of Application layer and Presentation layer paradigms and Protocols.

<b>CONTINUOUS INTEGRATION AND CONTINUOUS DEPLOYMENT</b>	
Course Code: 21CD301	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand the Integration and Continuous deployment.

**CLO2** Able to Understands static code analysis.

**CLO3** Learn anatomy of continuous delivery pipeline.

**CLO4** Able to Learn the Continuous Testing.

<b>AGILE PRACTICES</b>	
Course Code: 21CD303	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand common Agile Practices in DevOps.

**CLO2** Able to Understand test driven development.

**CLO3** Learn its programming.

<b>PRESENTATION &amp; SPEAKING SKILLS</b>	
Course Code: 21SS553	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

1. The student will be confident in presenting himself in front of audience.
2. The student will become professional in his approach towards work culture.
3. The level of communication skills will be further enhanced in the student's conversation with others.

<b>COMPUTER NETWORKS LAB</b>	
Course Code: 21CS3113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand and learn how to determine the network statistics of their machines.

**CLO2** Learn about the working of a packet sniffer that is Wireshark.

**CLO3** Understand the in-depth working and role of network protocols.

**CLO4** Design and understand the working of TCP three way handshaking protocol.

**CLO5** Design and understand UDP based applications.

<b>LIVE PROJECT-II</b>	
Course Code: 21CS0303	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**LEARNING OUTCOME:**

1. To enable the students to gather a first-hand experience on sites.
2. They will be able to apply the concepts learnt to design and create a application.
3. to know requirements of project

<b>COMPILER DESIGN LAB</b>	
Course Code: 21CS3117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

**CLO1** Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.

**CLO2** Application of different compiler writing tools to implement the different Phases of compiler.

**CLO3** work in the development phase of new computer languages in industry and designing symbol tables.

**CLO4** Design Top-down, Bottom-up parsing Techniques.

**CLO5** learn the process of translating a modern high-level language to executable code

<b>CONTINUOUS INTEGRATION AND CONTINUOUS DEPLOYMENT LAB</b>	
Course Code: 21CD311	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand Installation of Jenkins/Java/Maven

**CLO2** Able to Creating Pipelines

**CLO3** Using Plugins in Jenkins

**CLO4** Understand Jenkin Backup Process

<b>DESIGN THINKING AND AUGMENTED VIRTUAL REALITY - LEVEL-II &amp; III</b>	
Course Code:21CS0301	
Prerequisite: NIL	
L T P : 0 0 2	
Credits: 1	

**TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of TRAINING the students will be able to:

1. Understand and critically apply the concepts and methods of business processes.
2. Analyzing design thinking history and its various concepts.
3. Understand, analyzing and create models with users collaboration to apply design thinking concepts.
4. Understands the role and importance of graphics in VR, AR and MR.
5. Know the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

**SEMESTER - VI**

<b>ARTIFICIAL INTELLIGENCE</b>	
Course Code: 21CS3002	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to syllabus adhere to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

**CLO2** Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

**CLO3** Solve problems like constraint satisfaction search and optimization problem.

**CLO4** Deduce through logic and reasoning algorithms.

**CLO5** Handle uncertainty.

**CLO6** Understand the role of planning and learning in automated control and smart applications.

**CLO7** Formalize a given problem in the language/framework of different AI methods.

**CLO8** Design and carry out an empirical evaluation of different algorithms on a problem formalization

<b>TEST AUTOMATION</b>	
Course Code: 21CD302	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the Testing in DevOps.

**CLO2** Understand to the Design Test Cases.

**CLO3** Learn various approaches to Test the Software.

**CLO4** Understand the Test Case Design.

<b>APPLICATION CONTAINERIZATION</b>	
Course Code: 21CD304	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand Containers in DevOps.

**CLO2** Understand Orchestration tools.

**CLO3** Able to Understand and implement in AWS and KUBERNETES

**CLO4** Understand the Linux Containers and Virtualization.

<b>MANAGEMENT AND ORGANISATIONAL BEHAVIOUR</b>	
Course Code: 21BS301	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the concept of management

**CLO2** Learn about different management skills requirements for the corporate world.

**CLO3** Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.

**CLO4** Understand the human behavior and its contribution at work place

**CLO5** Able to Understand the competitiveness in businesses.

PROFESSIONAL WRITING SKILLS	
Course Code: 21SS655	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### Training Learning Outcome:

**After the completion of the training, the student will have ability:**

1. The student will understand the importance of professional writing required in workplace.
2. The student will explore different formats in resume, cover letters & other business related letters.
3. The student will develop knowledge, skills and understanding people in-group and individually.
4. The student will be able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

ARTIFICIAL INTELLIGENCE LAB	
Course Code: 21CS3114	
Pre-Requisite : Basics of any Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the requirement of search strategies in AI.

**CLO2** Implement the concepts for uncertainty, knowledge representation and learning.

**CLO3** Learn to design the application while deciding the level of requirement of each AI component (search, Planning, Learning, uncertainty).

**CLO4** Learn and understand the mapping and interaction among various AI components for an automated/ smart application.

TEST AUTOMATION LAB	
Course Code: 21CD312	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Design test scenarios for varied applications

**CLO2** Integrate automation Scripts

**CLO3** Build & Execute Automation Scripts

**CLO4** Understand the Build & Execute Automation Scripts in Ecommerce.

<b>APPLICATION CONTAINERIZATION LAB</b>	
Course Code: 21CD314	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand containers in DevOps.

**CLO2** Learn its containerization.

**CLO3** Understand Orchestration tools.

**CLO4** To Understand the Deployment process.

<b>BIG DATA ANALYTICS, TOOLS AND TECHNIQUES- LEVEL-III</b>	
Course Code:21CS0302	
Prerequisite: NIL	
L T P : 0 0 2	
Credits: 1	

### **TRAINING LEARNING OUTCOMES (TLO)**

1. After completion of TRAINING, students would be able to:
2. Understand the vision of Big Data from a global context.
3. To understand and apply Hadoop in Market perspective of Big Data.
4. To evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.
5. Applying and analyzing architecture and APIs with use of Devices, Gateways and Data Management in Big data.

<b>LIVE PROJECT-III</b>	
Course Code: 21CS0304	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **LEARNING OUTCOME:**

1. To enable the students to gather a first-hand experience on sites.
2. They will be able to apply the concepts learnt to design and create a application.
3. Get knowledge of requirements in project

### **SEMESTER -VII**

<b>SYSTEM PROVISIONING AND CONFIGURATION MANAGEMENT</b>	
Course Code: 21CD401	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the provisioning.

**CLO2** Understand configuration management.

**CLO3** Learn automation, preventing errors, tracking of changes.

**CLO4** Understand the provisioning on Cloud.

<b>CLOUD COMPUTING</b>	
Course Code: 21CS4003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	



**CLO1** Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

**CLO2** Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

**CLO3** Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.

**CLO4** Analyze various cloud programming models and apply them to solve problems on the cloud.

**CLO5** Enable students exploring some important cloud computing driven commercial systems and applications.

**CLO6** Expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

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<b>INTERPERSONAL SKILLS: STRATEGIES (COMMON TO ALL BRANCHES)</b>	
Course Code: 21SS756	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **Training Learning Outcome (TLO):**

**After the completion of the training, the student will have ability:**

1. The student will develop knowledge, skills and understanding people in-group and individually.
2. The student will be able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.
3. To work with people even with conflicts and reducing the differences among them by reaching to an equilibrium.

<b>CLOUD COMPUTING LAB</b>	
Course Code: 21CS4113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Explain the fundamental principles of cloud computing and its related Concepts

**CLO2** Able to Analyze Prominent Cloud computing technologies available in the marketplace.

**CLO3** Discuss virtualization technologies along with the architectural models of cloud computing.

**CLO4** Leverage the prominent Cloud computing technologies available in the market place.

**CLO5** Demonstrate different features of cloud platforms used in Industry.

**CLO6** Understand how energy efficiency achieved in cloud computing using green computing and understand the mechanism needed to harness cloud computing in the respective endeavors.

**CLO7** Apply suitable applications to leverage the strength of cloud computing.

**CLO8** Develop the applications of cloud Computing that can harness the power of cloud computing.

<b>LIVE PROJECT-IV</b>	
Course Code: 21CS4115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### **LEARNING OUTCOME:**

1. To enable the students to gather a first-hand experience on site.
2. They will be able to apply the concepts learnt to design and create a application.
3. Get knowledge of requirements in project

<b>SYSTEM PROVISIONING AND CONFIGURATION MANAGEMENT LAB</b>	
Course Code: 21CD411	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand Provisioning on Cloud.

**CLO2** Learn Automation, Preventing Errors, Tracking of Changes.

**CLO3** Understand Configuration Management.

**CLO4** To Understand the AWS security and policy.

<b>MINOR PROJECT</b>	
Course Code: 21CS4117	
Pre-Requisite : NIL	
L T P : 0 0 8	
Credits: 4	

### **LEARNING OUTCOME:**

1. Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.
2. Design and implement automated solutions for the assigned/identified real world problems.
3. Write technical reports.
4. Practice and develop skills in time management and reporting within an industrial or research laboratory setting.
5. Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

### **SEMESTER -VIII**

### **SYSTEM MONITORING**

Course Code: 21CD402

Continuous valuation: 60 Marks

Pre-Requisite : NIL

End Semester Examination: 40 Marks

L T P : 3 0 0

Credits: 3

**CLO1** Understand tenets of System Monitoring.

**CLO2** To Understand Monitoring Strategies.

**CLO3** Understand the Application and Log Monitoring.

**CLO4** Learn core components of Monitoring tools.

### **APPLIED DEVOPS**

Course Code: 21CD404

Pre-Requisite : NIL

L T P : 3 0 0

Credits: 3

**CLO1** Able to Understand Applied DevOps.

**CLO2** Understand the Cloud.

**CLO3** Learn real world applications of DevOps.

**CLO4** Understand the Continuous Monitoring

### **MAJOR PROJECT**

Course Code: 21CS4114

Pre-Requisite : NIL

L T P : 0 0 24

Credits: 12

**CLO1** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## SYLLABUS OF PROFESSIONAL ELECTIVE COURSES - I

PYTHON PROGRAMMING	
Course Code: 21CD321	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CL01** Able to Understand to set up Python environment.

**CL02** Understand the Programming fundamentals.

**CL03** To Understand the Pre-Processing steps with Python.

**CL04** Learn the statistical Modeling with Python.

BIG DATA OVERVIEW	
Course Code: 21CD323	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CL01** Understand the types of data generated.

**CL02** Learn the Data Lake Essentials.

**CL03** Understand the Scalability.

**CL04** Explore the Big Data Ecosystem.

## SYLLABUS OF PROFESSIONAL ELECTIVE COURSES - II

SUPERVISED LEARNING	
Course Code: 21CD322	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CL01** Able to Understand the Machine Learning Concepts.

**CL02** Understand the Regression Techniques.

**CL03** o Learn the different types of Supervised Algorithms.

**CL04** Applications of Supervised Learning.

<b>DOMAIN-DRIVEN APPROACH TO DESIGN AND IMPLEMENT MICROSERVICES</b>	
Course Code: 21CD324	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the SOA

**CLO2** Learn the basics of Software Architectures and its Micro services components.

**CLO3** Understand the Domain Driven Approach to Design.

**CLO4** Implementation Micro services in real world application.

### **SYLLABUS OF PROFESSIONAL ELECTIVE COURSES - III**

<b>GRID COMPUTING</b>	
Course Code: 21CS3026	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** To understand the genesis & know the application of grid computing.

**CLO2** Know the technology and tool kits for facilitating grid computing.

**CLO3** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids.

**CLO4** To design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research.

**CLO5** Install a grid computing environment; develop communications skills and accept the code of professional conduct and practice through short presentations and group work.

<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	
Course Code: 21CS3028	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate knowledge of structural and behavioral modeling techniques.

**CLO2** Get knowledge of a model-based software development methodology.

**CLO3** Application of the methodology and the modeling techniques in a significant software design project.

**CLO4** Demonstrate knowledge of design patterns and their application in a software design project.

**CLO5** Analysis knowledge of Design and Testing Process Improvement Models.

<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	
Course Code: 21CS3030	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the mathematics behind the design of perceptron.

**CLO2** Correlate the need of extension of MLP to CNN.

**CLO3** Design and analyze the importance of kernel functions, RNN and memories.

**CLO4** Differentiate between fuzzy sets and crisp sets.

**CLO5** Apply and Analyze the applications of fuzzy to reasoning and clustering

<b>CYBER SECURITY</b>	
Course Code: 21CS3032	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis.

<b>PREDICTIVE ANALYTICS</b>	
Course Code: 21CS3036	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand and critically apply the concepts and methods of Predictive analytics.

**CLO2** To understand and apply IBM SPSS Modeler in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.

**CLO3** Applying and analyzing how to use functions, deal with missing values, use advanced field operations, handle sequence data and improve efficiency.

**CLO4** To evaluate the Model on the basis of different Predictive Methods.

**CLO5** Building and create advanced analytical model that leverage historical data to uncover real-time insights to predict future events.

<b>BUSINESS INTELLIGENCE</b>	
Course Code: 21CS3038	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the vision of Business Intelligence from a global context.

**CLO2** To understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.

**CLO3** Applying and analyzing various prompt types and conditionally render objects in reports.



**CLO4** To evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.

**CLO5** Building and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

<b>INTERNET OF THINGS</b>	
Course Code: 21CS3040	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the vision of IoT and communication protocols from a global context.

**CLO2** Able to Understand and apply IoT protocols.

**CLO3** Apply and analyze sensor networks and their components to IoT domain.

**CLO4** Design portable IoT using appropriate boards.

**CLO5** Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.

**CLO6** Build and create state of the art architecture in IoT.

#### **SYLLABUS OF PROFESSIONAL ELECTIVE COURSES - IV**

<b>DIGITAL PRODUCT ENGINEERING and DESIGN THINKING</b>	
Course Code: 21CD421	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the Digital Transformation and its Advantages

**CLO2** Understand the Product Management & Service Mindset Elements.

**CLO3** Design Thinking and Minimum Viable Product.

**CLO4** Learn the Agile & Lean.

<b>SOFTWARE CRAFTMANSHIP OVERVIEW</b>	
Course Code: 21CD423	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

**CLO1** Learn the Object Oriented Programming concepts.

**CLO2** Understand the Best practices in Coding.

**CLO3** Able to Understand the Code Formatting

**CLO4** Analyse the different of Testing Methods.

## SYLLABUS OF PROFESSIONAL ELECTIVE COURSES - V

NETWORK SECURITY & CRYPTOGRAPHY	
Course Code: 21CS4019	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Present the exploitation present in the security.

**CLO2** Discuss various types of attacks and their characteristics.

**CLO3** Illustrate the basic concept of encryption and decryption for secure data transmission.

**CLO4** Able to Analyze various cryptography techniques and its applications.

**CLO5** Develop solutions for security problems.

WIRELESS ADHOC AND SENSOR NETWORK	
Course Code: 21CS4023	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. To specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.

**CLO2** To make students familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO3** Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).

**CLO4** Able to understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.

**CLO5** Able to understand the congestion control mechanism at transport layer and to acquire skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

<b>ADVANCED JAVA PROGRAMMING</b>	
Course Code: 21CS4035	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to learn the graphics and animation on the web pages, using Java Applets. To learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & To learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.

**CLO2** learn the server side programming using Servlets and JSP.

**CLO3** Analysis the invocation of the remote methods in an application using RMI.

<b>DATA WAREHOUSING &amp; DATA MINING</b>	
Course Code: 21CS4025	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the functionality of the various data mining and data warehousing component.

**CLO2** Design data warehouse with dimensional modelling and apply OLAP operations.

**CLO3** Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

**CLO4** Describe complex data types with respect to spatial and web mining.

**CLO5** Extract knowledge using data mining techniques.

**CLO6** Technical knowhow of the Data Mining principles and techniques for real time applications.

<b>MOBILE COMPUTING</b>	
Course Code: 21CS4027	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

- CLO1** Grasp the concepts and features of mobile computing technologies and applications.
- CLO2** Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support
- CLO3** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

<b>OPEN SOURCE SOFTWARE</b>	
Course Code: 21CS4031	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

- CLO1** Understand the difference between open source software and commercial software.
- CLO2** Identify, install and run Linux operating system.
- CLO3** Install and manage applications.
- CLO4** Identify, install open source web technologies Apache, MySql, PHP.
- CLO5** Develop web applications using LAMP.
- CLO6** Write session control PHP code for a website.

<b>ADVANCED INTERNET OF THINGS</b>	
Course Code: 21CS4041	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

- CLO1** Understand the IBM Watson IoT Platform.
- CLO2** Able to understand and apply IoT concepts over IBM Watson IoT Platform.
- CLO3** Understanding and Applying the IoT concepts over Node-red and analyzing the Network protocols in its working.
- CLO4** Apply the programming interface to connect IoT devices using a Rest API for analysis and evaluation.
- CLO5** Able to understand the analytics services on IBM Cloud and applying to create a better solution.

<b>ADVANCED BLOCKCHAIN</b>	
Course Code: 21CS4047	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.

**CLO2** Understand how blockchain solutions are transforming the industry landscape.

**CLO3** Design and develop for a permissioned blockchain

**CLO4** Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.

**CLO5** Acquire hands-on expertise using popular blockchain open source technology, including Hyper ledger Fabric.

### **SYLLABUS OF PROGRAM ELECTIVE COURSES - VI**

<b>MODERN ARCHITECTURE PATTERNS</b>	
Course Code: 21CD422	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand the software architecture.

**CLO2** Learn the software design.

**CLO3** Understand the Architecture Pattern

**CLO4** Able to Understand the Microkernel and Micro services.

<b>MODERN WEB and MOBILE FRAMEWORKS</b>	
Course Code: 21CD424	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the traditional HTML version and integration of CSS with HTML to enhance the design facet.

**CLO2** Understand Java script, Use of Java script with CSS, Learn the Syntax Rules and gain insights on functions.

**CLO3** Learn the History of Frontend Architecture.

**CLO4** Understand the Backend Architecture - Node.js.

### **SYLLABUS OF OPEN ELECTIVES**

<b>GERMAN LANGUAGE PHASE I</b>	
Course Code: 21FLGR301	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** After completion of this student will be able to read and write short, simple texts.

**CLO2** student will have Fluency in reading and writing.

**CLO3** After completion of this student will be able to understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO4** Student will be able to know the culture of the countries where the German language is spoken.

**CLO5** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>GERMAN LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLGR401	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** After completion of this student will be able to read and write short, simple texts.

**CLO2** student will have Fluency in reading and writing.

**CLO3** They will be able to use language creatively and spontaneously.

**CLO4** Get awareness of cross-cultural and intercultural difference.

<b>FRENCH LANGUAGE PHASE I</b>	
Course Code: 21FLFR301	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** After completion of this student will be able to read and write short, simple texts.

**CLO2** Student will have Fluency in reading and writing.

**CLO3** This will be able understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO4** To know the culture of the countries where the French language is spoken.

<b>FRENCH LANGUAGE PHASE II</b>	
Course Code: 21FLFR401	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

**CLO1** After completion of this student will be able to read and write short, simple texts.

**CLO2** Student will have Fluency in reading and writing.

**CLO3** This student will able to use language creatively and spontaneously.

**CLO4** To know the culture of the countries where the French language is spoken.

<b>ENTREPRENEURSHIP &amp; NEW VENTURE MANAGEMENT</b>	
Course Code: SEC-FT-01	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

#### **COURSE EDUCATIONAL OBJECTIVES AND OUTCOMES:**

- To learn about and get an insight of Entrepreneurs and Entrepreneurship development.
- To understand the basic of Business project report, Fund raising and SWOT analysis.
- Understand the different support system for business development.
- Gain knowledge and acquire skill for setting up an enterprise and learn how the management works.

<b>SUSTAINABLE GROWTH &amp; DEVELOPMENT</b>	
Course Code: 21ESUG202	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CL01** To develop an awareness about our environment and elicit collective response for its protection.

**CL02** Understand the different types of environmental pollution problems and their sustainable solutions.

**CL03** Able to work in the area of sustainability for research and education.

**CL04** Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

<b>WASTE MANAGEMENT</b>	
Course Code: 21ESUG203	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CL01** Able to develop an awareness about solid waste and management practices

**CL02** Design feasible solutions for waste management

**CL03** Students will have understanding of waste management practices, law and regulation related to solid waste management.

<b>MICROPROCESSORS AND INTERFACING</b>	
Course Code: 21EC390	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CL01** Understand the architecture of microprocessors and micro controller

**CL02** Able to Understand the programming model of microprocessors and micro controllers

**CL03** Interface different external peripheral devices with microprocessors and micro controllers

**CL04** Analyze a problem and formulate appropriate computing solution for processor or controller based application.

**CL05** Develop an assembly language program for specified application





## **CURRICULUM & SYLLABUS**



**CHOICE BASED CREDIT SYSTEM (CBCS)  
FOR  
BACHELOR OF TECHNOLOGY (B.Tech.)  
(4 Year Undergraduate Degree Programme)  
IN  
COMPUTER SCIENCE AND ENGINEERING**

**In Data Science and Artificial Intelligence in association with IBM  
[w. e. f. 2021-2022]**

**FACULTY OF ENGINEERING AND TECHNOLOGY  
SRM UNIVERSITY DELHI-NCR, SONEPAT  
39, Rajiv Gandhi Education City, Sonapat  
Haryana-131029**

## SEMESTER - I & SEMESTER - II

<b>FUNDAMENTALS OF COMPUTER &amp; C PROGRAMMING</b>	
<b>Course Code: 21CS101</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the fundamental concepts of computers, both hardware and software.

**CLO2** Learn and understand the major system software's that help in developing of an application.

**CLO3** Apply and analyse the basic programming constructs in context of C programming language.

**CLO4** Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions

**CLO5** Create and manipulate a database or data storage through files.

**CLO6** Develop a methodological way of problem solving.

**CLO7** Learn a programming approach to solve problems.

<b>C PROGRAMMING LAB</b>	
<b>Course Code: 21CS151</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

:

**CLO1** Able to Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.

**CLO2** Introduction to C Programming using Control Statements and Repetition Statement

**CLO3** Apply and practice logical formulations to solve some simple problems leading to specific applications.

**CLO4** Design effectively the required programming components that efficiently solve computing problems in real world.

**CLO5** Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

<b>PROGRAMMING WITH JAVA</b>	
<b>Course Code: 21CAM1004</b>	
<b>Pre-Requisite : NIL</b>	

L T P : 2 0 0	
Credits: 2	

**CLO1** Understand the vision of Object Oriented Programming from industry context.

**CLO2** Able to Understand and apply Object Oriented Programming using Java using java I.D.E.

**CLO3** Apply and analyze multithreading programming of Java Language to create more robust and fast applications.

**CLO4** Evaluate the application of Web Server and Application Server and how to deploy Web Applications.

**CLO5** Build and create Web Applications using front end as html, css and java script and backend using Java Servlets and J.S.P(Java Server Pages). Creating projects by establishing database connection with IBM DB2 or MySQL.

<b>PROGRAMMING WITH JAVA LAB</b>	
Course Code: 21CAM1114	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO2** Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.

**CLO3** Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.

**CLO4** Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

<b>ENGINEERING MATHEMATICS-I</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:21AS101	
Credits: 4	
L T P : 3 1 0	
Prerequisite: Nil	

**CLO1** Apply the knowledge of calculus, Gamma & Beta functions for analyzing engineering problems.

**CLO2** Solve first order differential equation analytically using standard method.

**CLO3** Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.

**CLO4** Obtain series solution of differential equation and explain application of Bessel's function

**CLO5** Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stoke's theorems.

<b>ENGINEERING MATHEMATICS-II</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code:21AS201</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: Engineering Mathematics-I</b>	

**CLO1** Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process.

**CLO2** Apply Laplace transforms to find the solution of differential equations.

**CLO3** Solve different problems with help of Fourier series.

**CLO4** Know, analytic functions and conformal mapping of complex variables.

**CLO5** Evaluate complex integration and residues.

<b>ENGINEERING PHYSICS</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS102/202</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Able to The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.

**CLO2** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

**CLO3** o The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.

**CLO4** The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar cell.

<b>ENGINEERING PHYSICS LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Use the different measuring devices and meters to record the data with precision

**CLO2** Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

**CLO3** Apply the mathematical concepts/equations to obtain quantitative results

<b>ENGINEERING CHEMISTRY</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS103/203</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand to identify the quality of water and how to improve the quality of water.

**CLO2** Rationalize bulk properties and processes using thermodynamic considerations.

**CLO3** Get preliminary understanding on introductory idea about nano materials.

**CLO4** Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism of corrosion.

<b>ENGINEERING CHEMISTRY LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the basic concepts of measurement techniques.

**CLO2** The synthesis, dynamics, chemical transformation and their applications

**CLO3** To impart the knowledge and understanding of principles of measurement techniques.

<b>BASIC ELECTRONICS ENGINEERING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EC101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** learn the fundamental concepts of semiconductor devices

**CLO2** An ability to apply the concept of diode in clipper and clamper circuits

**CLO3** Acquire the skills of constructing the different transistors configurations

**CLO4** learn the basic concepts of integrated circuits

**CLO5** Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates

**CLO6** Acquire the knowledge of microprocessors.

<b>BASIC ELECTRONICS ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code:21EC151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Measure voltage, frequency and phase of any waveform using CRO.

**CLO2** Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.

**CLO3** Analyze the characteristics of different electronic devices such as diodes, transistors and operational amplifiers

**CLO4** Develop skill to build and verify digital circuits

<b>BASIC ELECTRICAL ENGINEERING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EE101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learn about transient analysis of RLC circuits with DC excitation.

**CLO2** Realize the requirement of transformers in transmission and distribution of electric power and other applications.

**CLO3** Develop an idea on Magnetic circuits, Electromagnetism

**CLO4** Learn about measuring instruments, single phase and polyphase AC circuits

<b>BASIC ELECTRICAL ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EE151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

**CLO2** Able to Understand the calibration of energy meter.

**CLO3** Understand open circuit and short circuit test of single-phase transformer.

**CLO4** Analyse RLC series and parallel circuits



<b>COMMUNICATIVE ENGLISH</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS101/201</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learners will be able to write effectively using correct grammatical structures.

**CLO2** To read and speak fluently in English.

**CLO3** Know the nuances of effective presentations.

**CLO4** To engage in group discussions, debate, deliver speeches and such others.

**CLO5** write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>COMMUNICATIVE ENGLISH LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learners will be able to write effectively using correct grammatical structures.

**CLO2** To read and speak fluently in English.

**CLO3** Know the nuances of effective presentations.

**CLO4** To engage in group discussions, debate, deliver speeches and such others.

**CLO5** write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>INDIAN CONSTITUTION &amp; POLITY</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 21HS102/202</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.

**CLO2** Differentiate different aspects of Indian Legal System and its related bodies

**CLO3** appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.

**CLO4** Know about the enforcement remedies available under the Constitution of India

**CLO5** Apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy

**CLO6** Able to apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

<b>to be skilful in executing democratic leadership, developing skill in programme development to be able for self-employment, (COMMON TO ALL BRANCHES EXCEPT)</b>	
<b>Course Code:21SE151</b>	
<b>Credits: 1</b>	
<b>L T P: 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.

**CLO2** Differentiate different aspects of Indian Legal System and its related bodies

**CLO3** To be skilful in executing democratic leadership, developing skill in programme development to be able for self-employment,

<b>YOGA &amp; PHYSICAL EDUCATION Practices (COMMON TO ALL BRANCHES EXCEPT)</b>	
<b>Course Code:21SE151</b>	Continuous Evaluation: 60 Marks
<b>Credits: 1</b>	End Semester Examination: 40 Marks
<b>L T P: 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Identify and explore basic concepts of yoga and understand their applicability & scope and the importance of the role of physical education

**CLO2** Differentiate different aspects of yoga

**CLO3** To analyses different poses and their affects on body

<b>BASIC MECHANICAL ENGINEERING</b> (Common to all Branches)	
<b>Course Code: 21ME101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the concepts of thermodynamics.

**CLO2** Apply principles of thermodynamics to real engineering problems.

**CLO3** Understand the basics of powertrain applications.

**CLO4** Grasp the elements of robotics.

**CLO5** Understand the working principles of various measuring tools and devices.

<b>BASIC MECHANICAL ENGINEERING LAB</b> (Common to all Branches)	
<b>Course Code: 21ME151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Able to working of thermal power plants.

**CLO2** Know how work on 2 and 4 stroke IC engines.

**CLO3** Different automobile parts, gears and gear trains.

**CLO4** Evaluate working of Refrigeration and Air Conditioning cycles.

**CLO5** Explain working principles of flow meters and U-tube manometers.

<b>MECHANICAL WORKSHOP LAB</b> (Common to all Branches)
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<b>Course Code: 21ME152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) Processes required to manufacture a product from the raw materials.

**CLO2** Use different measuring, marking, cutting tools used in the workshop.

**CLO3** Be aware of the safety precautions while working in the workshop.

<b>ENGINEERING GRAPHICS &amp; DESIGN LAB</b> (Common to all Branches)	
<b>Course Code: 21ME153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand orthographic projections of points and lines in any position through AutoCAD.

**CLO2** Imagine and convert isometric view into orthographic projections and vice versa.

**CLO3** Should be able to understand the simple machine components and draw its projections

### **SEMESTER - III**

<b>ENGINEERING MATHEMATICS - III</b>	
<b>Course Code: 21AS301</b>	
<b>Pre-Requisite : NIL</b>	
<b>L T P : 3 1 0</b>	
<b>Credits: 4</b>	

**CLO1** Solve different types of partial differential equations.

**CLO2** Find solutions of boundary value problems including heat and wave equations.

**CLO3** Apply and analyze Fourier transforms with different applications.

**CLO4** Evaluate the problems using z-transforms.

**CLO5** Understand linear algebra and its application to Engineering.

<b>PYTHON PROGRAMMING</b>	
Course Code: 21CAM2009	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** Understand the vision of Python from a global context

**CLO2** Understand the content that how to write loops, decision statements, write functions and pass arguments in Python.

**CLO3** Learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.

**CLO4** Learn how to read and write files in Python. Will learn how to create Pandas Data Frames, calculate aggregates, and merge multiple tables.

**CLO5** Understand how to import in-built library and use matplotlib for graph representation and how regular pattern matching will be done.

**CLO6** Analyse the concepts of algorithm of Machine learning and learn how to train the models.

<b>DATA STRUCTURES USING C</b>	
Course Code: 21CS2001	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyze the algorithms to determine the time and computation complexity and justify the correctness.

**CLO2** Implement the given search problem, i.e., Linear and Binary Search.

**CLO3** Write and analyze an algorithm for different sorting techniques and compare their performance in term of Space complexity, Time complexity and application. Implement any given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.

**CLO4** Implement Graph search and traversal algorithms and determine the time and computation complexity.

**CLO5** Identify the best data structure to be used for any particular application and design and analyses the application in terms of time and space complexity.

• Data Structures Using C and C++ – Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, PHI Publications.
• Theory and problem of programming with C, Byron C Gottfried, TMH.
• Data Structures using C, Reema Thareja, Oxford Publications.
• Data structures and Algorithms Made Easy” 5th edition by Narasimha Karumanchi, Career monk publications

DISCRETE STRUCTURES	
Course Code: 21CS2003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Model logic statements arising in algorithm correctness and real-life situations and manipulate them using the formal methods of propositional and predicate logic.

**CLO2** Relate the ideas of mathematical induction to recursion and recursively defined structures.

**CLO3** Identify and model the relation between sets.

**CLO4** Demonstrate in practical applications the use of basic counting principles.

**CLO5** Establish and solve recurrence relations that arise in counting problems including the problem of determining the time complexity of recursively defined algorithms

**CLO6** Deduce properties that establish particular graphs as Planar, Eulerian, and Hamiltonian.

**CLO7** Formalizes the sets with the binary operations.

**CLO8** Understand the application of number theory in cryptography.

<b>DATABASE MANAGEMENT SYSTEMS</b>	
Course Code: 21CS2005	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Design the database schema with the use of appropriate data types for storage of data in database

**CLO3** Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.

**CLO4** Apply and create Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respect data into RDBMS and on the data.

**CLO5** Understand and apply the concept of transaction, concurrency control and recovery in database.

**CLO6** Able to Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	
Course Code: 21CS2007	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.

**CLO2** Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.

**CLO3** Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.

**CLO4** Understand the need for an interface and instruction cycle phases. Implement the hardwired and microprogrammed control unit for analyse the performance.

**CLO5** Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithm for given design requirements.

**CLO6** Compare and contrast memory mapping and IO mapping techniques. Describe the differentiate different modes of data transfer. Appraise the synchronous and asynchronous bus for performance and arbitration.

PYTHON PROGRAMMING LAB	
Course Code: 21CAM2115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1:** Understand the basic concepts of Python

**CLO2:** Learn how to write functions and pass arguments in Python

**CLO3:** Design object- oriented programs with Python classes.

**CLO4:** Define the structure and components of a Python program.

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 21CS2111	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1 Transform** an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.

**CLO2 Use** an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO3 Formulate** query, using SQL, solutions to a broad range of query and data update problems.

**CLO4** Design and implement database applications on their own.



**CLO5** Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.

**CLO6** Analyze and Select storage and recovery techniques of database system.

<b>DATA STRUCTURES USING C LAB</b>	
Course Code: 21CS2113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the importance of data structures and abstract data type, and their basic usability in different applications.

**CLO2** Implement various kinds of searching and sorting techniques, and know when to choose which technique.

**CLO3** Analyze and differentiate different algorithms based on their time complexity.

**CLO4** Understand various data structure such as stacks, queues, linked lists, trees, graphs, etc. to solve various computing problems.

<b>INDUSTRY SESSION: DATA SCIENCE LAB</b>	
Course Code: 21CAM2117	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1 :** To identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences

**CLO2 :** An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.

**CLO3 :** To provide an overview of data science using python.

<b>ESSENTIALS OF BLOCKCHAIN &amp; IOT -LEVEL-I</b>	
<b>Course Code: 21CS0201</b>	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of training students will be able to:

1. Understand how bitcoin and other coins work in real world.
2. Analyse the properties of Block Chain models.
3. Understand the vision of IoT and communication protocols from a global context.
4. Design portable IoT using appropriate boards.

<b>EFFECTIVE COMMUNICATION SKILLS</b>	
Course Code: 21SS351	
Pre-Requisite : Basic English	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1 : Communicate effectively and interact with people with confidence.
- TLO2 : Demonstrate and differentiate between various forms of communication.
- TLO3 : To apply effective communication skills confidently which a student need to get ahead in job and life.

**SEMESTER - IV**

<b>CLOUD APPLICATION DEVELOPMENT</b>	
Course Code: 21CAM2004	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Understand the vision of Cloud Computing from a global context.

**CLO2** : To Understand various compute options on IBM Cloud by market perspective of Cloud Computing.

**CLO3** : Analyse architecture and implementation of APIs with services of IBM Cloud in Cloud Computing.

**CLO4** : Integrate the Node.js application with Watson services over IBM Cloud.

**CLO5** : Build and create state of the art architecture in Kubernetes cluster.

<b>AGILE DEVELOPMENT METHODOLOGY</b>	
Course Code: 21CAF2006	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Understand the vision of Agile Development Methodologies from a global context.

**CLO2** : To Understand and apply Agile in market so that output can be made better for any input.

**CLO3** : Apply and analyses various tools and techniques in order to introduce automation.

**CLO4** : Evaluate the application of Agile in Industrial and Commercial sectors.

**CLO5** : Build and create the service instances using IBM services and setting up the DevOps on IBM Cloud. Creating projects and research activities based on different principles of AI.

<b>THEORY OF COMPUTATION</b>	
Course Code: 21CS2004	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2** : Understand the basics of regular expression and its equivalence.

**CLO3** : Disambiguate context-free grammars by mastering the concepts of context-free languages and push-down automata

**CLO4** : Apply the concepts of Push down Automata and its applications.

**CLO5** : To Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

<b>OPERATING SYSTEMS</b>	
Course Code: 21CS2006	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2** : To Understand the process management policies and scheduling of processes by CPU.

**CLO3** : Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading. Describe and analyze the memory management and its allocation policies.

**CLO4** : Identify use and evaluate the storage management policies with respect to different storage management technologies.

<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	
Course Code: 21CS2008	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms

**CLO2** : Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

**CLO3** : Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

**CLO4** : Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

**CLO5** : Model a given engineering problem using graph and write the corresponding algorithm to solve the problems.

<b>TEAMWORK &amp; INTERPERSONAL SKILLS</b>	
Course Code: 21SS452	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcome: -**

**After the completion of the training, the student will have ability:**

- TLO1. : Confident working in a team and leading it as well.
- TLO2. : Categorise the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energise himself to bounce back from such situations.
- TLO3.: The student will get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TLO4. : Student will be able to face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>CLOUD APPLICATION DEVELOPMENT LAB</b>	
Course Code: 21CAM2120	
Pre-Requisite : Basic Knowledge of Cloud Services	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Understand the vision of Cloud Computing from a global context.

**CLO2** : To Understand various compute options on IBM Cloud by market perspective of Cloud Computing.

**CLO 03** : To provide an overview of Cloud Computing.

<b>AGILE DEVELOPMENT LAB</b>	
Course Code: 21CAF2118	Continuous Evaluation: 60 Marks
Pre-Requisite : Software Development Methodologies	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

**CLO1** : Understand the vision of AGILE DEVELOPMENT from a global context.

**CLO2** : To Understand various compute options On AGILE DEVPT.

**CLO3** : Provide an overview of Agile Development Methodologies.

<b>OPERATING SYSTEMS LAB</b>	
Course Code: 21CS2114	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Demonstrate the various operations of file system.

**CLO2** : Understand and Implement Memory management schemes, Thread and synchronization

**CLO3** : Implement Deadlock algorithms and page replacement algorithms.

**CLO4** : Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.

1. Implement Scheduling algorithms.

<b>ANALYSIS AND DESIGN OF ALGORITHMS LAB</b>	
Course Code: 21CS2118	
Pre-Requisite : Data Structures	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** : Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** : Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
<b>Course Code: 21CS0202</b>	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**TRAINING LEARNING OUTCOMES (TLOS): -**

**After the completion of training, the students will be able to:**

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Understands the basics and need of AI and Machine learning in global view.
- Understands, apply and evaluate the supervised learning techniques.
- Design and implement the different applications using the concepts of AI and ML

<b>LIVE PROJECT-I &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0204	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Gather a first-hand experience on sites.

**CLO2** : Apply the concepts learnt to design and create a application.

**CLO3** : To provide hands-on experience at site where Computer Science and engineering projects are executed.

**SEMESTER - V**

<b>MACHINE LEARNING USING R</b>	
Course Code: 21CAM3001	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Understand the vision of Machine Learning and R Programming from a global context.

**CLO2** : Have a good understanding of the fundamental of R Programming. Have an overview of the operators, variables, different data structures, understanding of the two main control structures: decisions and loops and functions etc.

**CLO3** : Design effective data visualizations in order to provide new insights into a research question or communicate information to the viewer.

**CLO4** : Learn Supervised, Unsupervised Machine Learning and relation of statistical modelling to machine learning, Learn to use optimization techniques to find the minimum error in your machine learning model, learn various machine learning algorithms like KNN, Decision Trees, SVM, Clustering in detail.

**CLO5** : Design and implement various machine learning model in a range of real-world applications. Creating projects and research activities based on Machine Learning using R.

<b>ESSENTIALS OF HADOOP</b>	
Course Code: 21CAF3005	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** : Understand the vision of Big Data from a global context.

**CLO2** : To Understand and apply Hadoop in Market perspective of Big Data.

**CLO3** : Applying and analyzing architecture and APIs with use of Devices, Gateways and Data Management in Big data.

**CLO4** : Evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.

**CLO5** : Build and create state of the art architecture in Big Data. Creating projects and research activities based on Pig, Hive, Pig Latin.



<b>COMPILER DESIGN</b>	
Course Code: 21CS3001	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Understand of assembler, Macro, Loader & Linker..

**CLO2** : To Understand the fundamentals of Compiler, Lexical Analyzer and its design aspects.

**CLO3** : Gain the knowledge of parser and its various types.

**CLO4** : Design of Symbol tables using various data structures and understanding of error detection and recovery techniques.

**CLO5** : Analyse and Design the methods of developing a Code Optimizer.

**CLO6** : Usage of various Code Generation Tools.

<b>COMPUTER NETWORKS</b>	
Course Code: 21CS3003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Describe the functions of each layer in OSI and TCP/IP model.

**CLO2** : To Describe the functions of data link layer and explain the protocols.

**CLO3** : Classify the routing protocols and analyze how to assign the IP addresses for the given network.

**CLO4** : The Session layer design issues and Transport layer services.

**CLO5** : Explain the functions of Application layer and Presentation layer paradigms and Protocols.

<b>PRESENTATION &amp; SPEAKING SKILLS</b>	
Course Code: 21SS553	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1. The student will be confident in presenting himself in front of audience.
- TLO2. The student will become professional in his approach towards work culture.
- TLO3. The level of communication skills will be further enhanced in the student's conversation with others.

<b>MACHINE LEARNING USING R LAB</b>	
Course Code: 21CAM3115	
Pre-Requisite : Basics of Python, R and Data Visualization	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Understand the concept of machine learning

**CLO2** : To Understand various functions and tools in R programming

**CLO3** : To provide an overview of Data Visualization and Machine Learning using R.

<b>HADOOP LAB</b>	
Course Code: 21CAF3113	
Pre-Requisite : Linux and SQL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Understand the vision of HADOOP

**CLO2** : To Understand various compute options on HADOOP using different tools

**CLO3** : Develop an understanding of the complete open-source Hadoop ecosystem and its near term future direction

<b>COMPUTER NETWORKS LAB</b>	
Course Code: 21CS3113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Understand and learn how to determine the network statistics of their machines.

**CLO2** : Learn about the working of a packet sniffer that is Wireshark.

**CLO3** : To Understand the in-depth working and role of network protocols.

**CLO4** : Design and understand the working of TCP three way handshaking protocol.

**CLO5** : Design and understand UDP based applications.

<b>LIVE PROJECT-II &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0303	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Gather a first-hand experience on sites.

**CLO2** : Apply the concepts learnt to design and create a application.

**CLO3** : To provide hands-on experience at site where Computer Science and engineering projects are executed.

<b>COMPILER DESIGN LAB</b>	
Course Code: 21CS3117	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.

**CLO2** : Application of different compiler writing tools to implement the different Phases of compiler.

**CLO3** : Work in the development phase of new computer languages in industry and designing symbol tables.

**CLO4** : Design Top-down, Bottom-up parsing Techniques.

**CLO5** Learn the process of translating a modern high-level language to executable code

<b>DESIGN THINKING AND AUGMENTED VIRTUAL REALITY-LEVEL- II &amp; III</b>	
<b>Course Code: 21CS0301</b>	
<b>Prerequisite: NIL</b>	
<b>L T P : 0 0 2</b>	
<b>Credits: 1</b>	

### **TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of training the students will be able to:

1. Understand and critically apply the concepts and methods of business processes.
2. To Understand and analyse design thinking history and its various concepts.
3. Analyse and create models with users collaboration to apply design thinking concepts.
4. The role and importance of graphics in VR, AR and MR.
5. Technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

### **SEMESTER - VI**

<b>ARTIFICIAL INTELLIGENCE</b>	
<b>Course Code: 21CAM3002</b>	
<b>Pre-Requisite : NIL</b>	
<b>L T P : 3 0 0</b>	
<b>Credits: 3</b>	

**CLO1** : Understand the vision of AI from a global context.

**CLO2** : To Understand and apply IBM Watson Services in Market perspective of Big Data.

**CLO3** : Apply and analyses architecture and APIs with use of WKS and Watson Assistant.

**CLO4** : Evaluate the application of AI and ML in Industrial and Commercial sectors.

**CLO5** : Build and create the service instances using IBM services and using APIs. Creating projects and research activities based on different principles of AI.

<b>NOSQL and MongoDB</b>	
Course Code: 21CAF3010	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Understand the vision of Big Data from a global context.

**CLO2** : To Understand and apply MongoDB in Market perspective of Big Data.

**CLO3** : Apply and analyses architecture and APIs with use of Devices, Gateways and Data Management in data.

**CLO4** : Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.

**CLO5** : Build and create fundamental concepts in the context of a number of different NOSQL products.

<b>SOFTWARE ENGINEERING</b>	
Course Code: 21CS3004	
Pre-Requisite : Concept of OOP and Methodology	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Analyze software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification.

**CLO2** : Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model.

**CLO3** : Apply testing principles on software project and understand the maintenance concepts.

**CLO4** : Identify risks, manage the change to assure quality in software projects.

**CLO5** : Think critically about ethical and social issues in software engineering for different applications

<b>MANAGEMENT AND ORGANISATIONAL BEHAVIOUR</b>	
Course Code: 21BS301	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** : Understand the concept of management

**CLO2** : Learn about different management skills requirements for the corporate world.

**CLO3** : Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.

**CLO4** : To Understand the human behaviour and its contribution at work place

**CLO5** : The competitiveness in businesses.

<b>PROFESSIONAL WRITING SKILLS</b>	
Course Code: 21SS655	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcomes: -**

**After the completion of the training, the student will have ability:**

- TL01. The student will understand the importance of professional writing required in workplace.
- TL02. The student will explore different formats in resume, cover letters & other business related letters.

- TLO3. The student will develop knowledge, skills and understanding people in-group and individually.
- TLO4. The student will be able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

<b>ARTIFICIAL INTELLIGENCE LAB</b>	
Course Code: 21CAM3116	
Pre-Requisite : Python and Machine Learning	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Describe what Artificial Intelligence.

**CLO2** : Learn about Machine Learning and NLP Concepts.

**CLO3** : Understand and Framing NLC.

**CLO4** : Design BOTs.

<b>NOSQL AND MONGODB LAB</b>	
Course Code: 21CAF3012	
Pre-Requisite : Line and Shell Commands, Programming Concepts	
L T P : 0 0 2	
Credits: 1	

**CLO1** : To attain the knowledge of virtualization through virtualization technologies.

**CLO2** : Interpret the concept of Map reduce framework using SQL and NO SQL databases.

**CLO3** : NOSQL AND MONGODB LAB

<b>SOFTWARE ENGINEERING LAB</b>	
Course Code: 21CS3118	
Pre-Requisite : A course on “Programming for Problem Solving”	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Prepare SRS document, design document, test cases and software configuration management and risk management related document.

**CLO2** : Develop function oriented and object oriented software design using tools like rational rose.

**CLO3** : Generate a high-level design of the system from the software requirements

**CLO4** : Have experience and/or awareness of testing problems and will be able to develop a simple testing report

<b>INDUSTRY SESSION : DEEP LEARNING LAB</b>	
Course Code: 21CAM3014	
Pre-Requisite: <b>linear algebra, probability, basics of machine learning.</b>	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences

**CLO2** : Ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.

**CLO3** : To provide an overview of Neural Networks.

<b>BIG DATA ANALYTICS, TOOLS AND TECHNIQUES- LEVEL-III</b>	
Course Code: 21CS0302	
Prerequisite: NIL	
L T P : 0 0 2	
Credits: 1	

### **TRAINING LEARNING OUTCOMES (TLO)**

After completion of training, students will be able to:

1. Understand the vision of Big Data from a global context.
2. Understand and apply Hadoop in Market perspective of Big Data.
3. Evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.



4. Apply and analyse architecture and APIs with use of Devices, Gateways and Data Management in Big data.

<b>LIVE PROJECT-III &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0304	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Gather a first-hand experience on sites.

**CLO2** : Apply the concepts learnt to design and create a application.

**CLO3** : To provide hands-on experience at site where Computer Science and engineering projects are executed.

#### **SEMESTER - VII**

<b>DATA SCIENCE (PREDICTIVE ANALYSIS)</b>	
Course Code: 21CAF4005	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Understand how the quantum computing fits the big picture.

**CLO2** : To understand quantum computing industry applications.

**CLO3** : Explain the difference between classical and quantum computing with the importance of IBM Q Network and its strategic partners.

**CLO4** : Explore which companies are betting on quantum and how.

**CLO5** : How quantum-enhanced feature spaces can help with feature mapping and Explore Aqua risk analysis for finance module.

<b>QUANTUM COMPUTING</b>	
Course Code: 21CAM4003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Understand how the quantum computing fits the big picture.

**CLO2** : To understand quantum computing industry applications.

**CLO3** : Explain the difference between classical and quantum computing with the importance of IBM Q Network and its strategic partners.

**CLO4** : Explore which companies are betting on quantum and how.

**CLO5** : How quantum-enhanced feature spaces can help with feature mapping and Explore Aqua risk analysis for finance module.

<b>INTERPERSONAL SKILLS: STRATEGIES (COMMON TO ALL BRANCHES)</b>	
Course Code: 21SS756	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination: 30 Marks
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcome (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1. The student will develop knowledge, skills and understanding people in-group and individually.
- TLO2. The student will be able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.
- TLO3. To work with people even with conflicts and reducing the differences among them by reaching to an equilibrium.

<b>QUANTUM COMPUTING LAB</b>	
Course Code: 21CAM4007	
Pre-Requisite : Basic Quantum Mechanism	
L T P : 0 0 2	

**CLO1** : Access and navigate IBM Q Experience.

CL02 : Identify Superposition, Entanglement, and Noise.

CL03 : Swap the gates of qubits.

CL04 : Code an Algorithm with Aqua

CL05 : Perform calls to Aqua

DATA SCIENCE LAB	
Course Code: 21CAF4009	
Pre-Requisite : Knowledge of Analytics and Visualization	
L T P : 0 0 2	
Credits: 1	

CL01 : To provide an overview of Data Science using Python.

CL02 : To introduce the students with the importance of Machine Learning using and importance of their

improvement.

CL03 : To introduce the students with the importance of Data Visualization in Machine Learning using

Python programming.

CL04 : To teach the students different tools and libraries of Python Programming so that they can cope up

with industry standard and requirements.

CL05 : To enable students to have skills that will help them to solve complex real-world problems and

introduce them to a new world of problem-solving techniques.

<b>INDUSTRY SESSION: BLOCKCHAIN</b>	
Course Code: 21CAM4011	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Understand how blockchain solutions are transforming the industry landscape.

**CLO2** : Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.

**CLO3** : Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.

**CLO4** : Design and develop for a permissioned blockchain.

**CLO5** : Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.

<b>LIVE PROJECT-IV &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS4115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** : Gather a first-hand experience on sites.

**CLO2** : Apply the concepts learnt to design and create a application.

**CLO3** : To provide hands-on experience at site where Computer Science and engineering projects are executed.

<b>MINOR PROJECT</b>	
Course Code: 21CS4117	
Pre-Requisite : NIL	
L T P : 0 0 8	
Credits: 4	

**CLO1** : Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** : Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** : Write technical reports.

**CLO4** : Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** : Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

### **SEMESTER - VIII**

<b>MAJOR PROJECT</b>	
Course Code: 21CS4114	
Pre-Requisite : NIL	
L T P : 0 0 24	
Credits: 12	

**CLO1** : Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** : Design and implement automated solutions for the assigned/identified real world problems.

3. Write technical reports.

**CLO3** : Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO4** : Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

### **SYLLABUS OF PROFESSIONAL ELECTIVE COURSES**

<b>DISTRIBUTED OPERATING SYSTEM</b>	
Course Code: 21CS3020	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Gain knowledge of distributed operating system architecture.

**CLO2** : Implement distributed client server applications using remote method invocation.

**CLO3** : Have knowledge of Synchronization and Deadlock.

**CLO4** : Have sufficient knowledge about file access.

**CLO5** : Understand Shared Memory Technique, security, and distributed file systems.

<b>SOFTWARE PROJECT MANAGEMENT</b>	
Course Code: 21CS3024	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** : Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling.

**CLO2** : Apply basic concepts related to software project planning, scope and feasibility.

**CLO3** : Analyse of various project management activities such as tracking, project procurement, configuration management, monitoring.

**CLO4** : Acquire knowledge about quality assurance, quality control, and risk management.

<b>GRID COMPUTING</b>	
Course Code: 21CS3026	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the genesis & know the applications of grid computing.

**CLO2** Understand the technology and tool kits for facilitating grid computing.

**CLO3** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids.

**CLO4** Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research.

**CLO5** Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.

<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	
Course Code: 21CS3028	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate knowledge of structural and behavioral modeling techniques.

**CLO2** Able to Demonstrate knowledge of a model-based software development methodology.

**CLO3** Create application of the methodology and the modeling techniques in a significant software design project.

**CLO4** Demonstrate knowledge of design patterns and their application in a software design project.

**CLO5** To Demonstrate knowledge of Design and Testing Process Improvement Models.

<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	
Course Code: 21CS3030	
Pre-Requisite : Soft Computing Course	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the mathematics behind the design of perceptron.

**CLO2** Correlate the need of extension of MLP to CNN.

**CLO3** Design and analyse the importance of kernel functions, RNN and memories.

**CLO4** Differentiate between fuzzy sets and crisp sets.

**CLO5** Apply and analyse the applications of fuzzy to reasoning and clustering

<b>CYBER SECURITY</b>	
Course Code: 21CS3032	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various Applications /devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis.

<b>DESIGN THINKING</b>	
Course Code: 21CS3034	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand and critically apply the concepts and methods of business processes.

**CLO2** Understand and apply IBM Blue works live and process designer tool concepts.

**CLO3** Analyzing design thinking history and its various concepts.

**CLO4** Able to Understand, analyzing and create models with users collaboration to apply design thinking concepts.

**CLO5** Build the process model that is used to implement process application and use different mural template to apply design thinking concepts for solving real world problem.

<b>BUSINESS INTELLIGENCE</b>	
Course Code: 21CS3038	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the vision of Business Intelligence from a global context.



**CLO2** Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.

**CLO3** Apply and analyse various prompt types and conditionally render objects in reports .

**CLO4** Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.

**CLO5** Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

<b>INTERNET OF THINGS</b>	
Course Code: 21CS3040	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the vision of IoT and communication protocols from a global context.

**CLO2** Apply IoT protocols.

**CLO3** Apply and analyze sensor networks and their components to IoT domain.

**CLO4** Design portable IoT using appropriate boards.

**CLO5** Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.

**CLO6** Build and create state of the art architecture in IoT.

<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	
Course Code: 21CS4019	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Present the exploitation present in the security.

**CLO2** Discuss various types of attacks and their characteristics.

**CLO3** Illustrate the basic concept of encryption and decryption for secure data transmission.

**CLO4** Analyze various cryptography techniques and its applications.

**CLO5** Develop solutions for security problems.

<b>SOFTWARE TESTING</b>	
Course Code: 21CS4033	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate the fundamentals of software testing using real world examples

**CLO2** Identify and apply relevant testing techniques suitable for a real world scenario

**CLO3** Investigate the different levels in testing

**CLO4** To Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO5** Use practical knowledge to test software and understand the trade-offs between testing techniques

**CLO6** Implement Test Automation process and experiment with testing tools.

<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	
Course Code: 21CS4023	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. To specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.

**CLO2** Familiarize with the mechanisms for implementing security and trust mechanisms in

- MANETs and WSNs.

**CLO3** Enhance the basic knowledge about the principles and characteristics of wireless

- sensor networks (WSNs).

**CLO4** Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.

**CLO5** Able to Understand the congestion control mechanism at transport layer and to acquire skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

<b>ADVANCED JAVA PROGRAMMING</b>	
Course Code: 21 <b>CS4035</b>	
Pre-Requisite : Core Java Programming	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Learn the graphics and animation on the web pages, using Java Applets.

**CLO2** Learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings Usage.

**CLO3** Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.

**CLO4** Design the server side programming using Servlets and JSP

**CLO5** Use the invocation of the remote methods in an application using RMI.

<b>NASSCOM ASSOCIATE ANALYTICS - II</b>	
Course Code: <b>CS4037</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the tools, technologies & programming languages which is used in day to day analytics cycle.

**CLO2** Analyze and use the best tools to make sense from available raw data.

**CLO3** To provide knowledge of the tools, technologies & programming languages which is used in day to day business analytics cycle.

<b>DATA WAREHOUSING &amp; DATA MINING</b>	
Course Code: 21CS4025	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the functionality of the various data mining and data warehousing component.

**CLO2** Design data warehouse with dimensional modelling and apply OLAP operations.

**CLO3** Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

**CLO4** Describe complex data types with respect to spatial and web mining.

**CLO5** Extract knowledge using data mining techniques.

**CLO6** Apply the Data Mining principles and techniques for real time applications.

<b>MOBILE COMPUTING</b>	
Course Code: 21 <b>CS4027</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Grasp the concepts and features of mobile computing technologies and applications.

**CLO2** Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

<b>OPEN SOURCE SOFTWARE</b>	
Course Code: 21 <b>CS4031</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the difference between open source software and commercial software.

**CLO2** Identify, install and run Linux operating system.

**CLO3** Install and manage applications.

**CLO4** Identify, install open source web technologies Apache, MySql, PHP.

**CLO5** Develop web applications using LAMP.

**CLO6** Write session control PHP code for a website.

<b>NASSCOM ASSOCIATE ANALYTICS - III</b>	
Course Code: 21 <b>CS4039</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the tools, technologies & programming languages which is used in day to day analytics cycle.

**CLO2** Analyze and use the best tools to make sense from available raw data.

**CLO3** To provide knowledge of the tools, technologies & programming languages which is used in day to day business analytics cycle.

### **SYLLABUS OF OPEN ELECTIVE COURSES**

<b>GERMAN LANGUAGE PHASE I</b>	
<b>Course Code:</b> 21FLGR301	
<b>Credits:</b> 2	
<b>L T P:</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO4** Know the culture of the countries where the German language is spoken.

**CLO5** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>GERMAN LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLGR401	
<b>Credits:</b> 2	
<b>L T P:</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Get awareness about cross-cultural and intercultural difference.

<b>FRENCH LANGUAGE PHASE I</b>	
<b>Course Code:</b> 21FLFR301	
<b>Credits:</b> 2	
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Know the culture of the countries where the French language is spoken.

<b>FRENCH LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLFR401	
<b>Credits:</b> 2	
<b>L T P : 2 0 0</b>	
<b>Prerequisite:</b> NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Use language creatively and spontaneously.

**CLO4** Know the culture of the countries where the French language is spoken.

<b>ENTREPRENEURSHIP &amp; NEW VENTURE MANAGEMENT</b>	
<b>Course Code:</b> SEC-FT-01	
<b>Pre-Requisite :</b> NIL	
<b>L T P : 3 0 0</b>	
<b>Credits:</b> 3	

**CLO1** Able to Understand the different support system for business development.

**CLO2** Gain knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO3** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

<b>SUSTAINABLE GROWTH &amp; DEVELOPMENT</b>	
<b>Course Code:</b> 21ESUG202	
<b>Credits:</b> 3	
<b>L T P : 3 0 0</b>	
<b>Prerequisite:</b> Basics understanding of environment and natural ecosystems	

**CLO1** Develop an awareness about our environment and elicit collective response for its protection.

**CLO2** Understand the different types of environmental pollution problems and their sustainable solutions.

**CLO3** Work in the area of sustainability for research and education.

**CLO4** Have a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

<b>WASTE MANAGEMENT</b>	
<b>Course Code:21ESUG203</b>	
<b>Credits: 3</b>	
<b>L T P C : 3 0 0</b>	
<b>Prerequisite:</b> Basics understanding about Waste	

**CL01** Able to Develop an awareness about solid waste and management practices

**CL02** Design feasible solutions for waste management

**CL03** Understand waste management practices, law and regulation related to solid waste management.

<b>MICROPROCESSOR AND INTERFACING</b>	
<b>Course Code:21EC390</b>	
<b>Credits: 3</b>	
<b>L T P C : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CL01** Able to Understand the architecture of microprocessors and micro controller

**CL02** Understand the programming model of microprocessors and micro controllers

**CL03** Interface different external peripheral devices with microprocessors and micro controllers

**CL04** Analyze a problem and formulate appropriate computing solution for processor or controller based application.

**CL05** Develop an assembly language program for specified application.



# COMPUTER SCIENCE AND ENGINEERING

(w.e.f. Session 2017-18 onwards)

## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING FACULTY OF ENGINEERING AND TECHNOLOGY

### SEMESTER - I

		L	T	P	C
MA 0101	MATHEMATICS - I	3	1	0	4

#### INSTRUCTIONAL OBJECTIVES

At the end of the course, student should be able

- To apply advanced matrix knowledge to Engineering problems
- To improve their ability in solving geometrical applications of differential calculus problems
- Equip themselves familiar with the functions of several variables
- To familiarize with the applications of differential equations
- To expose to the concept of three dimensional analytical geometry
- Expose the students to the concept of convergence and divergence
- To develop the ability to judge and apply appropriate tests to various infinite series

		L	T	P	C
CY 0101	CHEMISTRY	3	0	0	3

#### INSTRUCTIONAL OBJECTIVES

The students should be conversant with

1. The role of applied chemistry in the field of engineering.
2. The knowledge of water quality parameters and the treatment of water.
3. The principles involves in corrosion and its inhibitions.
4. Important analytical techniques, instrumentation and the applications.

5. Knowledge with respect to the phase equilibria of different systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

To familiarize with

1. The basic machine elements
2. The Sources of Energy and Power Generation
3. The various manufacturing processes

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1001</b>	<b>INTRODUCTION TO COMPUTER AND PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

The students should be conversant with

1. The working of computer the field of IT.
2. The knowledge of functional units of the computer system.
3. The basic concepts involved in computer programming.
4. Important programming aspects i.e loops, array, control statement.
5. Knowledge with respect to the software development phase of different programming approaches

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To guide thought process.
2. Groom students' attitude.
3. Develop communication skill.
4. To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0103</b>	<b>PHYSICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

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

1. Understand scientific concepts in measurement of different physical variables
2. Develop the skill in arranging and handling different measuring instruments and
3. Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. Students should be able to understand the basic concept and its applications.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Get preliminary understanding on introductory idea about nano materials.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

### **INSTRUCTIONAL OBJECTIVES**

To familiarize with

1. The basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.
2. The production of simple models in the above trades.
3. Be aware of the safety precautions while working in the workshop.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>

## INSTRUCTIONAL OBJECTIVES

To familiarize with

1. The construction of geometrical figures
2. The projection of 1D, 2D & 3D elements
3. Sectioning of solids and development of surfaces
4. Preparation and interpretation of building drawing

## SEMESTER - II

		L	T	P	C
GE 0108	VALUE EDUCATION	1	0	0	1

## INSTRUCTIONAL OBJECTIVES

- To help individuals think about and reflect on different values.
- Deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.
- To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them.

		L	T	P	C
GE 0102	BIOLOGY FOR ENGINEERS	2	0	0	2

## INSTRUCTIONAL OBJECTIVES

1. To familiarize the students with the basic organization of organisms and subsequent building to a living being.
2. With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.
3. Nervous and immune systems will be taught as examples of this signaling machinery.

		L	T	P	C
MA 0102	MATHEMATICS - II	3	1	0	4

## INSTRUCTIONAL OBJECTIVES

1. At the conclusion of the course, students should have understood Multiple Integrals ,
2. Laplace Transforms, Vector Calculus and Functions of a complex variable including contour integration
3. Able to apply to all their Engineering problems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

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

1. Understand electrical properties of materials,
2. Know the properties and applications of semi conducting materials,
3. Understand general properties and applications of magnetic and dielectric materials,
4. Analyse the behaviour of materials on exposure to light,
5. Understand general properties and application of modern engineering and bio materials, and
6. Get familiarized with the concepts of Nano Science and Technology.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0104</b>	<b>PRINCIPLES OF ENVIRONMENTAL SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

1. The importance of environmental education, ecosystem and ethics.
2. Knowledge with respect to biodiversity and its conservation.
3. To create awareness on various environmental pollution aspects and issues.
4. Educate the ways and means to protect the environment.
5. Important environmental issues and protection

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1004</b>	<b>OBJECT ORIENTED PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

The students should be conversant with

1. The working of OOPS programming approach.

2. The knowledge of object oriented programming style.
3. The basic concepts involved in computer programming.
4. Important programming aspects i.e object, class, inheritance and polymorphism.
5. Knowledge with respect to the software development phase of OOPS.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To guide thought process.
2. Groom students' attitude.
3. Develop communication skill.
4. To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1114</b>	<b>OOPS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

The students should be conversant with

1. The working of OOPS programming approach.
2. The knowledge of object oriented programming style.
3. The basic concepts involved in computer programming.
4. Important programming aspects i.e object, class, inheritance and polymorphism.
5. Knowledge with respect to the software development phase of OOPS.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>
(Only First Angle Projection is to be followed)					

### **INSTRUCTIONAL OBJECTIVES**

To familiarize with

1. The construction of geometrical figures
2. The projection of 1D, 2D & 3D elements
3. Sectioning of solids and development of surfaces
4. Preparation and interpretation of building drawing

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

### INSTRUCTIONAL OBJECTIVES

To familiarize with

1. The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
2. The production of simple models in the above trades.
3. Be aware of the safety precautions while working in the workshop.

### SEMESTER - III

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0201</b>	<b>GERMAN LANGUAGE PHASE - I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### INSTRUCTIONAL OBJECTIVES

1. Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V
2. To developing a fundamental conversation with any German national.
3. For communicating to other country native

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0205</b>	<b>FRENCH LANGUAGE PHASE - I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### INSTRUCTIONAL OBJECTIVE

1. Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.
2. Use language creatively and spontaneously.
3. Know the culture of the countries where the French language is spoken.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0211</b>	<b>MATHEMATICS - III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### INSTRUCTIONAL OBJECTIVES

After the completion of the course, the students should be able to apply

- The rudiments of Fourier series
- The theory and problems of PDE
- The applications of PDE to boundary value problems
- Fourier transforms and to their branches of engineering

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2001</b>	<b>DATA STRUCTURES USING C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, student should be able to understand

1. Several data structures concepts like stack, queues, linked list, trees and files
2. Applications of data structures
3. Problem solving using data structure tools and techniques.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2003</b>	<b>DISCRETE STRUCTURES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, student should be able

1. To understand Logic and mathematical reasoning and to count /enumerate objects in a systematic way. To understand Mathematical induction and recursion.
2. Know Set theory, relations and functions and to Read, understand and construct mathematical arguments.
3. Get Recurrence Relation, Generating functions and Algebraic Systems and their applications in coding theory - Group codes.
4. To understand to apply graph theory to solve real-world problems like traveling salesman problem and networks and the maximum flow problem -
5. Explain Boolean algebra and its application to switching theory. To understand grammars, finite state machines and Turing Machines.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

- To provide a general introduction to relational model
- To learn about ER diagrams
- To learn about Query processing and Transaction Processing
- Create table and know commands

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>



<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### INSTRUCTIONAL OBJECTIVES

1. Gives a knowledge of various architectures
2. CPU, Control unit, I/O Processing
3. Memory and its types
4. Design of the above components

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### INSTRUCTIONAL OBJECTIVES

1. To guide thought process.
2. Groom students' attitude.
- 3 Develop communication skill.
4. To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2111</b>	<b>DBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### INSTRUCTIONAL OBJECTIVES

1. Designing a database
2. Using DDL and DML commands
3. Backing up of files

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2113</b>	<b>DATA STRUCTURES LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### INSTRUCTIONAL OBJECTIVES

1. Implementing Stack, Queue , Linked List , Binary tree
2. Sorting and Searching Techniques
3. Divide and Conquer, Dynamic Programming methods
4. Greedy method , Traversals and Backtracking

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2115</b>	<b>PROGRAMMING USING MATLAB</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

### INSTRUCTIONAL OBJECTIVES

1. To learn & practice the MATLAB.
2. Analyse tools of matlab software
3. Explain theorem

### SEMESTER - IV

		L	T	P	C
LE 0202	GERMAN LANGUAGE PHASE - II	2	1	0	3

### INSTRUCTIONAL OBJECTIVES

1. Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V
2. developing a fundamental conversation with any German national.
3. Easy to communicate and get knowledge

		L	T	P	C
LE 0206	FRENCH LANGUAGE PHASE - II	2	1	0	3

### INSTRUCTIONAL OBJECTIVE

1. Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.
2. Have Fluency in reading and writing.
3. Use language creatively and spontaneously.
4. Know the culture of the countries where the French language is spoken.

		L	T	P	C
CS 2002	MICROPROCESSOR & INTERFACING	3	0	0	3

### INSTRUCTIONAL OBJECTIVES

In this course, students learn the following topics:

1. Architecture of 8086 & 8088 microprocessors
2. Instruction sets of 8086/88 and programming.
3. Math Coprocessor & I/O processor and multiprocessor configuration
4. Interfacing of microprocessor with various peripheral devices

		L	T	P	C
CS 2004	THEORY OF COMPUTATION	3	1	0	4

### INSTRUCTIONAL OBJECTIVES

1. Study of Finite Automata, Regular Expressions, Grammars
2. Pushdown Automata, Turing Machines
3. Undecidability problems

		L	T	P	C
CS 2006	OPERATING SYSTEMS	3	0	0	3

### INSTRUCTIONAL OBJECTIVES

The students learn about:

1. Structure and functions of OS
2. Process scheduling, Deadlocks
3. Device management
4. Memory management
5. File systems

		L	T	P	C
CS 2008	ANALYSIS AND DESIGN OF ALGORITHMS	3	1	0	4

### INSTRUCTIONAL OBJECTIVES

1. Divide and Conquer , Dynamic Programming techniques
2. Backtracking , NP complete problems
3. Various analysis of algorithms

		L	T	P	C
CS 2010	JAVA PROGRAMMING	3	1	0	4

### INSTRUCTIONAL OBJECTIVES

1. Demonstrate proficient use of a text editor to independently create, store, and edit Java source programs (applications and applets) from instructor supplied specifications, which illustrate comprehension of object oriented programming concepts.
2. Compile Java source programs and to debug the source program using compiler generated error/warning messages so that no errors or warnings are generated.
3. Include in their Java source program, clear, concise, internal documentation, in the form of commentary statements.
4. Write a Java program and correct all logic errors to achieve the correct/desired output illustrating.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0202</b>	<b>PERSONALITY DEVELOPMENT - IV</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To guide thought process.
2. Groom students' attitude.
- 3 Develop communication skill.
4. To build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2112</b>	<b>MICROPROCESSOR LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To do any kind of operations (8 bit addition, subtraction, Multiplication and division) with 8085 microprocessor
2. To implement interfacing of 8086 with various peripheral devices
3. To acquire the knowledge of microprocessors.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2114</b>	<b>OPERATING SYSTEMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. Scheduling algorithms
2. Deadlock algorithms and page replacement algorithms
3. Memory management schemes, Thread and synchronization

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2116</b>	<b>JAVA PROGRAMMING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To learn & practice the Object Oriented concepts like Inheritance, Overloading etc.
2. practice Interfaces and Packages
3. To know Java applet programming

### **SEMESTER - V**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To study the concepts of Assembler, Macro Processor, Loader and Linker
2. learn about the various phases of compiler and syntax analysis
3. Analyse the various parsing techniques
4. Explain the semantic analysis, translation of statements
5. To learn about Generating and Optimizing codes

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To understand the concepts of data communications.
2. Study the functions of different layers.
3. To make the students to get familiarized with different protocols and network components.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3005</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, student should be able,

- To be familiar with numerical solution of equations
- Get exposed to finite differences and interpolation
- To be thorough with the numerical Differentiation and integration
- Find numerical solutions of ordinary differential equations

- Be thorough with probability concepts and the corresponding distributions.
- Get exposed to the testing of hypothesis using distributions.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3007</b>	<b>COMPUTER GRAPHICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To provide main notions of graphics
2. Learn Formal framework to draw basic elements
3. To study graphics system along with completeness

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course the students will be able to

- Acquire the important soft skills for employment
- Take part in group discussions and job interviews confidently.
- Appear for placement aptitude tests confidently
- Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To enable the students to gather a firsthand experience on site.
2. To provide hands-on experience at site where Computer Science and engineering projects are executed.
3. Apply the concepts learnt to design and create a application.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3021</b>	<b>SYSTEM MODELLING AND SIMULATION</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

1. Mathematical models for simulation
2. Random numbers generation
3. Analysis of simulation data and modeling
4. Applications of Simulation, and, simulation software

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3023</b>	<b>DIGITAL IMAGE PROCESSING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. Image fundamentals and techniques
2. To learn various Image enhancement , restoration and compression techniques
3. To learn various Image segmentation , representation and description methods

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3025</b>	<b>VISUAL PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. Basics of Windows Programming
2. Visual Basic ,Visual C++ and Visual JAVA Programming
3. Java Applets and Networking concepts

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3027</b>	<b>SOFT COMPUTING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. Basics of AI and ANN
2. Neuro fuzzy systems and its applications
3. Genetics algorithms and its applications

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3029</b>	<b>OPERATIONS RESEARCH TECHNIQUES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

At the end of the course the students will be able to know

1. Concepts of Linear programming technique
2. Applications and use of Assignment, Transportation and Replacement models
3. Techniques of PERT, CPM
4. Detailed knowledge of Inventory control
5. Gain strong knowledge in principles of queuing theory.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3031</b>	<b>PRINCIPLES OF PROGRAMMING LANGUAGES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

1. Concepts of High level languages and its grammar
2. Analyse Imperative languages ( Pascal and C)
3. Study of Object oriented Programming ( C++ and JAVA)
4. Read Functional Programming ( Haskell / Lisp)
5. Study of Logic Programming ( Prolog and SQL)

## **SEMESTER - VI**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3002</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To study the concepts of Artificial Intelligence
2. Methods of solving problems using Artificial Intelligence
3. Introduce the concepts of Expert Systems and machine learning.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3004</b>	<b>SOFTWARE ENGINEERING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **INSTRUCTIONAL OBJECTIVES**

1. Planning and Estimation of Software projects
2. Software Requirements Specification, Software Design Concepts
3. Implementation issues, Validation and Verification Procedures
4. Maintenance of Software and methodologies

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To assess the overall knowledge level of Computer Science and engineering standards
2. .Guide them to take corrective measures where deficiencies are detected.
3. Have vocabulary knowledge



		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT -VI</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course the students will be able to

1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3114</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **INSTRUCTIONAL OBJECTIVES**

1. To implement Heuristic functions & Propositional Logic
2. Analyse A\* & AO\* algorithms
3. To implement an Expert system for medical diagnosis

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3022</b>	<b>SYSTEM SOFTWARE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **OBJECTIVES**

1. To understand the relationship between system software and machine architecture.
2. To know the design and implementation of assemblers
3. Explain the design and implementation of linkers and loaders.
4. To have an understanding of macro processors.
5. Understanding of system software tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3024</b>	<b>VIRTUAL REALITY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

1. Geometric Modeling and Virtual environment.
2. Virtual Hardware and Software.
3. Virtual Reality applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

To provide the students with sufficient knowledge for

1. Understanding Object Basics, Classes and Objects, Inheritance
2. How software objects are altered to build software systems that are more robust
3. Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project
4. Understanding the issues and options in reuse
5. Using UML, a common language for talking about requirements, designs, and component interfaces.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **COURSE OBJECTIVE: -**

- To expose the students to the concepts of feed forward neural networks
- Have adequate knowledge about feedback networks.
- To teach about the concept of fuzziness involved in various systems.
- To provide adequate knowledge about fuzzy set theory.
- Get comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
- To provide adequate knowledge of application of fuzzy logic control to real time systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3032</b>	<b>SOFTWARE ARCHITECTURE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONAL OBJECTIVES**

To provide the students sufficient knowledge for

1. Ability to understand the Software Architectural perspective and how it differs from lower-level design
2. Analyse the need for a Software Architecture.
3. Ability to understand current era Software Architectures

4. Develop and apply an Software Architectural Development Fishbone Diagram
5. Understand and apply various Software Size and Complexity Estimation Techniques wrt Reqs
6. Develop architectural approaches from basic requirements
7. Analyse trade-offs among multiple architectural alternatives
8. Ability to incorporate complete requirements into a Software Architecture

### **SEMESTER - VII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4117</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>5</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. To guide the students such a way that the students carry out a comprehensive work on the chosen topic which will stand them in good stead as they face real life situations.
2. Design and implement automated solutions for the assigned/identified real world problems.
3. Write technical reports.
4. Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4023</b>	<b>INDUSTRIAL MANAGEMENT &amp; ECONOMICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. To apply theoretical economic concepts to practical business situations and to take decision in the Industrial Engineering Situation.
2. Analyse micro and macro economics
3. Get info about industrial management

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4029</b>	<b>SOFTWARE TESTING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. Planning and Estimation of Software projects
2. Software Requirements Specification, Software Design Concepts
3. Implementation issues ,Validation and Verification Procedures

4. Maintenance of Software and methodologies

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4031</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### INSTRUCTIONAL OBJECTIVES

1. To learn Java Applets, Beans and Networking concepts
2. Analyse Advanced Java Networking concepts
3. To know the JDBC and Graphics in Java

## SEMESTER - VIII

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4114</b>	<b>PROJECT</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>

### INSTRUCTIONAL OBJECTIVES

1. To guide the students such a way that the students carry out a comprehensive work on the chosen topic which will stand them in good stead as they face real life situations.
2. Recognition of the need for self-motivation and ability to engage in lifelong learning and professional development
3. An ability to effectively manage projects involving multidisciplinary and teams with ethnic diversity.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4022</b>	<b>ATM NETWORKS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### INSTRUCTIONAL OBJECTIVES

1. To study the various topologies, Protocol Architectures and basics of ATM cells.
2. learn about the routing issues and various algorithms to control congestion.
3. Know about wireless ATM and the current trends in ATM.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4026</b>	<b>GRID COMPUTING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### INSTRUCTIONAL OBJECTIVES

1. To understand the genesis of grid computing
2. Learn the application of grid computing

3. To understand the technology and tool kits for facilitating grid computing

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4028</b>	<b>AGENT BASED SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. To provide a comprehensive introduction to agents and multiagent systems.
2. It covers a broad range of distributed artificial intelligence topics including agent architectures, agent interaction and communication, and applications of agent- based systems.
3. It lays the foundations for advanced courses such as Multi-Agent Semantic Web Systems

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4032</b>	<b>ROBOTICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. To use microcontrollers for robotics
2. Analyse different type of sensors for robots
3. To design robots in a real time environment

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4036</b>	<b>REAL TIME SYSTEM DESIGN</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **INSTRUCTIONAL OBJECTIVES**

1. Basics of Real time systems
2. Real time memory and design considerations
3. Integration of Hardware and software in real time applications

# **CURRICULUM & SYLLABUS**



**CHOICE BASED CREDIT SYSTEM (CBCS)  
FOR  
BACHELOR OF TECHNOLOGY (B.Tech.)  
(4 Year Undergraduate Degree Programme)  
IN  
COMPUTER SCIENCE AND ENGINEERING**

**In Cloud & Mobile Based Application in association with IBM  
[w. e. f. 2021-2022]**

**FACULTY OF ENGINEERING AND TECHNOLOGY  
SRM UNIVERSITY DELHI-NCR, SONEPAT  
39, Rajiv Gandhi Education City, Sonapat  
Haryana-131029**

**SRM UNIVERISTY DELHI-NCR, SONEPAT**

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (EPEOs)**

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises;
4. Increasing responsibilities of technical and managerial leadership in their work organizations;
5. Professional development through a commitment to career-long learning.

## **ENGINEERING PROGRAM LEARNING OUTCOMES (EPLOs)**

1. An ability to identify, formulate, and solve real time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences
2. To use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
3. Apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability
4. Adapt and work with multidisciplinary teams and communicate effectively;
5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks.
6. An understanding of professional and ethical responsibility;
7. Acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

## **B.TECH - COMPUTER SCIENCE AND ENGINEERING PROGRAMME LEARNING OUTCOMES**

1. An ability to apply knowledge & skill of mathematics, science and engineering.
2. Identify, analyze, design, develop, implement and integrate software and hardware based computer systems.
3. Understand emerging technologies and related security issues in the computing paradigm.
4. An ability to acquire and apply the skill in modern techniques, methodologies and tools to be innovative and creative.



5. Formulate ,design & demonstrate strong logical, analytical and reasoning skills to adeptly solve problems
6. To apply algorithmic principles and programming prowess in the development of software systems.
7. An awareness of social, health, ethical, legal, financial, and professional responsibilities.
8. Analyze the local and global impact of computing discipline on environmental issues and sustainable development
9. Recognition of the need for self-motivation and ability to engage in lifelong learning and professional development
10. An ability to effectively manage projects involving multidisciplinary and teams with ethnic diversity.
11. To communicate effectively, both in written and verbal forms.
12. Demonstrate leadership and entrepreneurship qualities.

## **SEMESTER - I & SEMESTER - II**

<b>FUNDAMENTALS OF COMPUTER &amp; C PROGRAMMING</b>	
<b>Course Code: 21CS101</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Able to Understand the fundamental concepts of computers, both hardware and software.

**CLO2** Able to Learn and understand the major system software's that help in developing of an application.

**CLO3** Able to Apply and analyse the basic programming constructs in context of C programming language.

**CLO4** Able to Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions

**CLO5** Able to Create and manipulate a database or data storage through files.

**CLO6** Able to Develop a methodological way of problem solving.

**CLO7** Able to Learn a programming approach to solve problems.

<b>C PROGRAMMING LAB</b>	
<b>Course Code: 21CS151</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.

**CLO2** Introduction to C Programming using Control Statements and Repetition Statement

**CLO3** Apply and practice logical formulations to solve some simple problems leading to specific applications.

**CLO4** Design effectively the required programming components that efficiently solve computing problems in real world.

**CLO5** Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

<b>PROGRAMMING WITH JAVA</b>	
<b>Course Code: 21CAM1004</b>	
<b>Pre-Requisite : NIL</b>	
<b>L T P : 2 0 0</b>	
<b>Credits: 2</b>	

**CLO1** Understand the vision of Object Oriented Programming from industry context.

**CLO2** Apply Object Oriented Programming using Java using java I.D.E.

**CLO3** Applying and analyzing multithreading programming of Java Language to create more robust and fast applications.

**CLO4** Evaluate the application of Web Server and Application Server and how to deploy Web Applications.

**CLO5** Build and create Web Applications using front end as html, css and java script and backend using Java Servlets and J.S.P(Java Server Pages). Creating projects by establishing database connection with IBM DB2 or MySql.

<b>PROGRAMMING WITH JAVA LAB</b>	
Course Code: 21CAM1114	
Pre-Requisite : C Programming Language	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the vision of Object Oriented Programming from industry context.

**CLO2** Apply Object Oriented Programming using Java using java I.D.E.

**CLO3** Analyze multithreading programming of Java Language to create more robust and fast applications.

<b>ENGINEERING MATHEMATICS-I</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:21AS101	
Credits: 4	
L T P : 3 1 0	
Prerequisite: Nil	

**CLO1** Apply the knowledge of calculus, Gamma & Beta functions for analyzing engineering problems.

**CLO2** Solve first order differential equation analytically using standard method.

**CLO3** Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.

**CLO4** Obtain series solution of differential equation and explain application of Bessel's function

**CLO5** Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stoke's theorems.

<b>ENGINEERING MATHEMATICS-II</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:21AS201	
Credits: 4	
L T P : 3 1 0	
Prerequisite: Engineering Mathematics-I	

**CLO1** Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process.

**CLO2** Apply Laplace transforms to find the solution of differential equations.

**CLO3** Solve different problems with help of Fourier series.

**CLO4** Know, analytic functions and conformal mapping of complex variables.

**CLO5** Evaluate complex integration and residues.

1.

<b>ENGINEERING PHYSICS</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS102/202</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.

**CLO2** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

**CLO3** The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.

**CLO4** The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar cell.

<b>ENGINEERING PHYSICS LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Use the different measuring devices and meters to record the data with precision

**CLO2** Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

**CLO3** Apply the mathematical concepts/equations to obtain quantitative results

<b>ENGINEERING CHEMISTRY</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS103/203</b>	
<b>Credits: 4</b>	
<b>L T P : 3 1 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand to identify the quality of water and how to improve the quality of water.

**CLO2** Rationalize bulk properties and processes using thermodynamic considerations.

**CLO3** Get preliminary understanding on introductory idea about nano materials.

**CLO4** Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism of corrosion.

<b>ENGINEERING CHEMISTRY LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21AS153/253</b>	Continuous Evaluation: 60 Marks
<b>Credits: 1</b>	End Semester Examination: 40 Marks
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the basic concepts of measurement techniques.

**CLO2** The synthesis, dynamics, chemical transformation and their applications

**CLO3** To impart the knowledge and understanding of principles of measurement techniques.

<b>BASIC ELECTRONICS ENGINEERING</b>	
(COMMON TO ALL BRANCHES)	
<b>Course Code: 21EC101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learn the fundamental concepts of semiconductor devices

**CLO2** An ability to apply the concept of diode in clipper and clamper circuits

**CLO3** Acquire the skills of constructing the different transistors configurations

**CLO4** Learn the basic concepts of integrated circuits

**CLO5** Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates

**CLO6** Acquire the knowledge of microprocessors.

<b>BASIC ELECTRONICS ENGINEERING LAB</b>	
(COMMON TO ALL BRANCHES)	
<b>Course Code:21EC151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Measure voltage, frequency and phase of any waveform using CRO.

**CLO2** To Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.

**CLO3** Analyze the characteristics of different electronic devices such as diodes, transistors and operational amplifiers

**CLO4** To develop skill to build and verify digital circuits

<b>BASIC ELECTRICAL ENGINEERING</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EE101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learn about transient analysis of RLC circuits with DC excitation.

**CLO2** Realize the requirement of transformers in transmission and distribution of electric power and other applications.

**CLO3** Develop an idea on Magnetic circuits, Electromagnetism

**CLO4** Learn about measuring instruments, single phase and polyphase AC circuits

<b>BASIC ELECTRICAL ENGINEERING LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21EE151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**CLO1** Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

**CLO2** Able to Understand the calibration of energy meter.

**CLO3** Understand open circuit and short circuit test of single-phase transformer.

**CLO4** Analyse RLC series and parallel circuits

<b>COMMUNICATIVE ENGLISH</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS101/201</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Learners will be able to write effectively using correct grammatical structures.

**CLO2** To read and speak fluently in English.

**CLO3** Know the nuances of effective presentations.

**CLO4** Engage in group discussions, debate, deliver speeches and such others.

**CLO5** To write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>COMMUNICATIVE ENGLISH LAB</b> (COMMON TO ALL BRANCHES)	
<b>Course Code: 21HS151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CL01** Able to Learners will be able to write effectively using correct grammatical structures.

**CL02** To read and speak fluently in English.

**CL03** Know the nuances of effective presentations.

**CL04** To engage in group discussions, debate, deliver speeches and such others.

**CL05** To write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

<b>INDIAN CONSTITUTION &amp; POLITY</b> (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
<b>Course Code: 21HS102/202</b>	
<b>Credits: 2</b>	
<b>L T P : 2 0 0</b>	
<b>Prerequisite: NIL</b>	

**CL01** Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.

**CL02** Differentiate different aspects of Indian Legal System and its related bodies

**CL03** To appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.

**CL04** Know about the enforcement remedies available under the Constitution of India

**CL05** To apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy



**CLO6** To apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

<b>NATIONAL SERVICE SCHEME</b> (COMMON TO ALL BRANCHES EXCEPT)	
<b>Course Code:21SE151</b>	
<b>Credits: 1</b>	
<b>L T P: 0 0 2</b>	
<b>Prerequisite: Nil</b>	

1. To be skilful in executing democratic leadership, developing skill in programme
2. uneducated, increasing awareness and desire to help sections of society.
3. Concept of regular activities, special camping, day camps, basis of adoption of village/slums

<b>YOGA &amp; PHYSICAL EDUCATION</b> Practices (COMMON TO ALL BRANCHES EXCEPT)	
<b>Course Code:21SE151</b>	
<b>Credits: 1</b>	
<b>L T P: 0 0 2</b>	
<b>Prerequisite: Nil</b>	

**Learning Outcomes:**

By the end of Semester, a student will have:

- Increased balance, strength, and flexibility
- A beginning sense of alignment in the body
- Competence of all five breath techniques and variations
- An internal sense of focus and clarity in the movement meditation
- Understanding of the cultural and philosophical approaches to yoga
- Desire to learn, excel and continue studies on the art of yoga
- Basic knowledge of Basketball, Cricket, Football, Volleyball, Badminton & Table Tennis

<b>BASIC MECHANICAL ENGINEERING</b> (Common to all Branches)	
<b>Course Code: 21ME101/201</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand the concepts of thermodynamics.

**CLO2** Apply principles of thermodynamics to real engineering problems.

**CLO3** Understand the basics of powertrain applications.

**CLO4** Grasp the elements of robotics.

**CLO5 Analyse** the working principles of various measuring tools and devices.

<b>BASIC MECHANICAL ENGINEERING LAB</b> (Common to all Branches)	
<b>Course Code: 21ME151/251</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1 Explain** The working of thermal power plants.

**CLO2** To know working of 2 and 4 stroke IC engines.

**CLO3** Able to Different automobile parts, gears and gear trains.

**CLO4** The working of Refrigeration and Air Conditioning cycles.

**CLO5** Evaluate The working principles of flow meters and U-tube manometers.

<b>MECHANICAL WORKSHOP LAB</b> (Common to all Branches)	
<b>Course Code: 21ME152/252</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Able to Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) processes required to manufacture a product from the raw materials.

**CLO2** Use different measuring, marking, cutting tools used in the workshop.

**CLO3** Be aware of the safety precautions while working in the workshop.

<b>ENGINEERING GRAPHICS &amp; DESIGN LAB</b> (Common to all Branches)	
<b>Course Code: 21ME153/253</b>	
<b>Credits: 1</b>	
<b>L T P : 0 0 2</b>	
<b>Prerequisite: NIL</b>	

**CLO1** Understand orthographic projections of points and lines in any position through AutoCAD.

**CLO2** Imagine and convert isometric view into orthographic projections and vice versa.

**CLO3** Should be able to understand the simple machine components and draw its projections

### **SEMESTER - III**

<b>ENGINEERING MATHEMATICS - III</b>	
<b>Course Code: 21AS301</b>	
<b>Pre-Requisite : NIL</b>	
<b>L T P : 3 1 0</b>	
<b>Credits: 4</b>	

**CLO1** Solve different types of partial differential equations.

**CLO2** Find solutions of boundary value problems including heat and wave equations.

**CLO3** Apply and analyze Fourier transforms with different applications.

**CLO4** Evaluate the problems using z-transforms.

**CLO5** Understand linear algebra and its application to Engineering.

<b>PYTHON PROGRAMMING</b>	
<b>Course Code: 21CAM2009</b>	
<b>Pre-Requisite : NIL</b>	

L T P : 2 0 0	
Credits: 2	

**CLO1** Understand the vision of Python from a global context

**CLO2** Analysis the content that how to write loops, decision statements, write functions and pass arguments in Python.

**CLO3** Learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.

**CLO4** Get to know how to read and write files in Python. Will learn how to create Pandas DataFrames, calculate aggregates, and merge multiple tables.

**CLO5** Understand how to import in-built library and use matplotlib for graph representation and how regular pattern matching will be done.

**CLO6** To Understand the concepts of algorithm of Machine learning and learn how to train the models.

DATA STRUCTURES USING C	
Course Code: 21CS2001	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyse the algorithms to determine the time and computation complexity and justify the correctness.

**CLO2** Implement the given search problem, i.e., Linear and Binary Search.

**CLO3** Write and analyse an algorithm for different sorting techniques and compare their performance in term of Space complexity, Time complexity and application.

**CLO4** Analysis any given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.

**CLO5** Implement Graph search and traversal algorithms and determine the time and computation complexity.

**CLO6** Identify the best data structure to be used for any particular application and design and analyses the application in terms of time and space complexity.

<b>DISCRETE STRUCTURES</b>	
Course Code: 21CS2003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Model logic statements arising in algorithm correctness and real-life situations and manipulate them using the formal methods of propositional and predicate logic.

**CLO2** Relate the ideas of mathematical induction to recursion and recursively defined structures.

**CLO3** Identify and model the relation between sets.

**CLO4** Demonstrate in practical applications the use of basic counting principles.

**CLO5** Establish and solve recurrence relations that arise in counting problems including the problem of determining the time complexity of recursively defined algorithms

**CLO6** Deduce properties that establish particular graphs as Planar, Eulerian, and Hamiltonian.

**CLO7** Formalizes the sets with the binary operations.

**CLO8** Understand the application of number theory in cryptography.

<b>DATABASE MANAGEMENT SYSTEMS</b>	
Course Code: 21CS2005	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Design the database schema with the use of appropriate data types for storage of data in database

**CLO3** To Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.

**CLO4** Apply and create Relational Database Design process with Normalization and Denormalization of data. Also, formulate SQL queries on the respect data into RDBMS and on the data.

**CLO5** Understand and apply the concept of transaction, concurrency control and recovery in database.

**CLO6** Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	
Course Code: 21CS2007	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.

**CLO2** Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.

**CLO3** Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.

**CLO4** Understand the need for an interface and instruction cycle phases. Implement the hardwired and microprogrammed control unit for analyse the performance.

**CLO5** Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithm for given design requirements.

**CLO6** Compare and contrast memory mapping and IO mapping techniques. Describe the differentiate different modes of data transfer. Appraise the synchronous and asynchronous bus for performance and arbitration.

PYTHON PROGRAMMING LAB	
Course Code: 21CAM2115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

### LEARNING OUTCOMES:

On completion of this course, the students will be able to:-

1. Apply the knowledge of basic python concepts to analyse the data and to derive meaningful results from raw datasets.
2. Understand the content that how to write loops, decision statements, write functions and pass arguments in Python.
3. Learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 21CS2111	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1 Transform** an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.

**CLO2 Use** an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO3 Formulate** query, using SQL, solutions to a broad range of query and data update problems.

**CLO4** Design and implement database applications on their own.

**CLO5** Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.

**CLO6** Analyze and Select storage and recovery techniques of database system.

<b>DATA STRUCTURES USING C LAB</b>	
Course Code: 21CS2113	
Pre-Requisite : C Programming	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the importance of data structures and abstract data type, and their basic usability in different applications.

**CLO2** Implement various kinds of searching and sorting techniques, and know when to choose which technique.

**CLO3** Analyze and differentiate different algorithms based on their time complexity.

**CLO4** Understand various data structure such as stacks, queues, linked lists, trees, graphs, etc. to solve various computing problems.

<b>INDUSTRY SESSION : CLOUD ESSENTIALS</b>	
Course Code: 21CMM2117	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the vision of Cloud Computing from a global context.

**CLO2** Analyses various compute options on IBM Cloud by market perspective of Cloud Computing.

**CLO3** Describe the choices that developers have when building cloud applications.

**CLO4** Build and create state of Cloud Foundry resources.

**CLO5** Perform research activities on Cloud Computing implementation.

<b>ESSENTIALS OF BLOCKCHAIN &amp; IOT -LEVEL-I</b>	
<b>Course Code: 21CS0201</b>	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	



- CLO1** Understand how bitcoin and other coins work in real world.
- CLO2** Analyse the properties of Block Chain models.
- CLO3** Understand the vision of IoT and communication protocols from a global context.
- CLO4** Design portable IoT using appropriate boards.

<b>EFFECTIVE COMMUNICATION SKILLS</b>	
Course Code: 21SS351	
Pre-Requisite : Basic English	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcome (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1. To communicate effectively and interact with people with confidence.
- TLO2. To demonstrate and differentiate between various forms of communication.
- TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

## **SEMESTER - IV**

<b>CLOUD APPLICATION DEVELOPMENT</b>	
Course Code: 21CAM2004	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

- CLO1** Able to Understand the vision of Cloud Computing from a global context.
- CLO2** Understand various compute options on IBM Cloud by market perspective of Cloud Computing.
- CLO3** Analyze architecture and implementation of APIs with services of IBM Cloud in Cloud Computing.
- CLO4** Integrate the Node.js application with Watson services over IBM Cloud.
- CLO5** Build and create state of the art architecture in Kubernetes cluster.

<b>AGILE DEVELOPMENT METHODOLOGIES</b>	
Course Code: 21CAF2006	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the vision of Agile Development Methodologies from a global context.

**CLO2** Understand and apply Agile in market so that output can be made better for any input.

**CLO3** Apply and analyze various tools and techniques in order to introduce automation.

**CLO4** Evaluate the application of Agile in Industrial and Commercial sectors.

**CLO5** Build and creating the service instances using IBM services and setting up the DevOps on IBM Cloud. Creating projects and research activities based on different principles of AI.

<b>THEORY OF COMPUTATION</b>	
Course Code: 21CS2004	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2** Understand the basics of regular expression and its equivalence.

**CLO3** Disambiguate context-free grammars by mastering the concepts of context-free languages and push-down automata

**CLO4** Study the concepts of Push Down Automata and its applications.

**CLO5** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

<b>OPERATING SYSTEMS</b>	
Course Code: 21CS2006	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2** Understand the process management policies and scheduling of processes by CPU

**CLO3** Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading.

**CLO4** Describe and analyze the memory management and its allocation policies.

**CLO5** Identify use and evaluate the storage management policies with respect to different storage management technologies.

<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	
Course Code: 21CS2008	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

**CLO2** Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

**CLO3** Explain the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

**CLO4** Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

**CLO5** Model any engineering problem using graph and write the corresponding algorithm to solve the problems.

<b>TEAMWORK &amp; INTERPERSONAL SKILLS</b>	
Course Code: 21SS452	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcome: -**

**After the completion of the training, the student will have ability:**

- TL01. To be confident working in a team and leading it as well.
- TL02. To categorise the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energise himself to bounce back from such situations.
- TL03. The student will get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TL04. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

<b>CLOUD APPLICATION DEVELOPMENT LAB</b>	
Course Code: 21CAM2120	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the vision of Cloud native application development from a global context.

**CLO2** Apply Kubernetes architecture in Market perspective of cloud native application development.

**CLO3** To develop the cloud application development skills, such as Node.js, REST architecture, JSON, Cloud Foundry and DevOps services

**CLO4** Enable students to have skills that will help them to solve complex real-world problems in for decision support.

<b>AGILE DEVELOPMENT LAB</b>	
Course Code: 21CAF2118	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the vision of Agile Development Methodologies from a global context.

**CLO2** Apply Agile in market so that output can be made better for any input.

**CLO3** Apply Agile in market so that output can be made better for any input.

**CLO4** Analyses various tools and techniques in order to introduce automation.

<b>OPERATING SYSTEMS LAB</b>	
Course Code: 21CS2114	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Demonstrate the various operations of file system.

**CLO2** Understand and Implement Memory management schemes, Thread and synchronization

**CLO3** Implement Deadlock algorithms and page replacement algorithms.

**CLO4** Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.

**CLO5** Implement Scheduling algorithms.

<b>ANALYSIS AND DESIGN OF ALGORITHMS LAB</b>	
Course Code: 21CS21118	
Pre-Requisite : Data Structures	
L T P : 0 0 2	
Credits: 1	

**CLO1** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II</b>	
<b>Course Code: 21CS0202</b>	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**TRAINING LEARNING OUTCOMES (TLOS): -**

After the completion of training, the students will be able to :

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Understand the basics and need of AI and Machine learning in global view.
- Understand, apply and evaluate the supervised learning techniques.
- Design and implement the different applications using the concepts of AI and ML

<b>LIVE PROJECT-I &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0204	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create a application.

**CLO3** To provide hands-on experience at site where Computer Science and engineering projects are executed.

## **SEMESTER - V**

<b>MICROSERVICES AND ARCHITECTURE</b>	
Course Code: 21CMM3001	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Understand the vision of Microservices architecture from a global context.

**CLO2** Able to Understand the client side scripting with DOM model along with its levels.

**CLO3** Analyses the Nodejs concepts and implement while creating server side applications.

**CLO4** Explain containers and implement an application with microservices architecture.

**CLO5** Build and create state of the art architecture in Kubernetes cluster.

<b>ESSENTIALS OF HADOOP</b>	
Course Code: 21CAF3005	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** Understand the vision of Big Data from a global context.

**CLO2** Apply Hadoop in Market perspective of Big Data.

**CLO3** Analyze architecture and APIs with use of Devices, Gateways and Data Management in Big data.

**CLO4** Evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.

**CLO5** Build and create state of the art architecture in Big Data. Creating projects and research activities based on Pig, Hive, Pig Latin.

<b>COMPILER DESIGN</b>	
Course Code: 21CS3001	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand of assembler, Macro, Loader & Linker..

**CLO2** Learn the fundamentals of Compiler, Lexical Analyzer and its design aspects.

**CLO3** Gain the knowledge of parser and its various types.

**CLO4** Design Symbol tables using various data structures and understanding of error detection and recovery techniques.

**CLO5** Analyze and Design the methods of developing a Code Optimizer.

**CLO6** Understand the usage of various Code Generation Tools.

<b>COMPUTER NETWORKS</b>	
Course Code: 21CS3003	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Describe the functions of each layer in OSI and TCP/IP model.

**CLO2** Describe the functions of data link layer and explain the protocols.

**CLO3** Classify the routing protocols and analyze how to assign the IP addresses for the given network.

**CLO4** Describe the Session layer design issues and Transport layer services.

**CLO5** Explain the functions of Application layer and Presentation layer paradigms and Protocols.



<b>PRESENTATION &amp; SPEAKING SKILLS</b>	
Course Code: 21SS553	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcomes (TLO): -**

**After the completion of the training, the student will have ability:**

- TLO1. The student will be confident in presenting himself in front of audience.
- TLO2. The student will become professional in his approach towards work culture.
- TLO3. The level of communication skills will be further enhanced in the student's conversation with others.

<b>MICROSERVICES ARCHITECTURE &amp; IMPLEMENTATION LAB</b>	
Course Code: 21CMM3115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the SOA

**CLO2** Learn the basics of Software Architectures and its Micro services components.

**CLO3** Understand the Domain Driven Approach to Design.

**CLO4** Implementation Micro services in real world application.

<b>HADOOP LAB</b>	
Course Code: 21CAF3113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand the vision of Big Data from a global context.

**CLO2** Apply Hadoop in Market perspective of Big Data.

**CLO3** Develop an understanding of the complete open-source Hadoop ecosystem and its near term future direction

**CLO4** To introduce the tools required to manage and analyze big data like Hadoop, NoSQL MapReduce

<b>COMPUTER NETWORKS LAB</b>	
Course Code: 21CS3113	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Understand and learn how to determine the network statistics of their machines.

**CLO2** Learn about the working of a packet sniffer that is Wireshark.

**CLO3** Able to Understand the in-depth working and role of network protocols.

**CLO4** Design and understand the working of TCP three way handshaking protocol.

**CLO5** To Design and understand UDP based applications.

<b>LIVE PROJECT-II &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0303	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create an application.

**CLO3** To provide hands-on experience at site where Computer Science and engineering projects are executed.

<b>COMPILER DESIGN LAB</b>	
Course Code: 21CS3117	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.

**CLO2** Learn applications of different compiler writing tools to implement the different Phases of compiler.

**CLO3** Work in the development phase of new computer languages in industry and designing symbol tables.

**CLO4** Able to Design Top-down, Bottom-up parsing Techniques.

**CLO5** Learn the process of translating a modern high-level language to executable code.

<b>DESIGN THINKING AND AUGMENTED VIRTUAL REALITY-LEVEL- II &amp; III</b>	
Course Code: 21CS0301	
Prerequisite: NIL	
L T P : 0 0 2	
Credits: 1	

### **TRAINING LEARNING OUTCOMES (TLOS)**

After the completion of training the students will be able to:

1. Understand and critically apply the concepts and methods of business processes.
2. Design thinking history and its various concepts.
3. Understand, analyzing and create models with users collaboration to apply design thinking concepts.

4. Explain the role and importance of graphics in VR, AR and MR.
5. Understand the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

## **SEMESTER - VI**

<b>CLOUD NATIVE APPLICATION DEVELOPMENT</b>	
Course Code: 21CMM3002	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** Understand the vision of Cloud native application development from a global context.

**CLO2** Apply Kubernetes architecture in Market perspective of cloud native application development.

**CLO3** Analyze RedHat Open Shift architecture and APIs with application development.

**CLO4** Evaluate the application of DevOps with Redhat Open Shift architecture in Industrial Automation.

**CLO5** Build and create state of continuous integration with pipelines of Redhat Open Shift architecture.

**CLO6** Create projects and research activities based on application development with Redhat OpenShift.

<b>NOSQL and MongoDB</b>	
Course Code: 21CAF3010	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the vision of Big Data from a global context.

**CLO2** Apply MongoDB in Market perspective of Big Data.

**CLO3** Apply and analyze architecture and APIs with use of Devices, Gateways and Data Management in data.

**CLO4** Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.

**CLO5** Build and create fundamental concepts in the context of a number of different NOSQL products.

<b>MOBILE APPLICATION DEVELOPMENT USING IOT</b>	
Course Code: 21 <b>CMM3014</b>	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

**CLO1** Able to Understand the IBM Watson IoT Platform.

**CLO2** Apply IoT concepts over IBM Watson IoT Platform.

**CLO3** Understanding and Applying the IoT concepts over Node-red and analyzing the network protocols in its working.

**CLO4** Evaluate the programming interface to connect IoT devices using Rest API for analysis and evaluation.

**CLO5** Understand the analytics services on IBM Cloud and applying to create better solution

<b>SOFTWARE ENGINEERING</b>	
Course Code: 21 <b>CS3004</b>	
Pre-Requisite : Concept of OOP and Methodology	
L T P : 3 0 0	
Credits: 3	

**CLO1** Analyze software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification.

**CLO2** Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model.

**CLO3** Apply testing principles on software project and understand the maintenance concepts.

**CLO4** Identify risks, manage the change to assure quality in software projects.

**CLO5** Think critically about ethical and social issues in software engineering for different applications

<b>MANAGEMENT AND ORGANISATIONAL BEHAVIOUR</b>	
Course Code: 21BS301	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

**CLO1** Able to Understand the concept of management

**CLO2** Learn about different management skills requirements for the corporate world.

**CLO3** Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.

**CLO4** Understand the human behaviour and its contribution at work place

**CLO5** Understand the competitiveness in businesses.

<b>PROFESSIONAL WRITING SKILLS</b>	
Course Code: 21SS655	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcome:**

**After the completion of the training, the student will have ability:**

- TL01. The student will understand the importance of professional writing required in workplace.
- TL02. Explore different formats in resume, cover letters & other business related letters.
- TL03. The student will develop knowledge, skills and understanding people in-group and individually.

- TLO4. To learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

<b>CLOUD NATIVE APPLICATION LAB</b>	
Course Code: 21CMM3120	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the vision of Cloud and its security.

**CLO2** Apply and analyze architecture with data management over cloud platforms.

**CLO3** Evaluate the application of DevOps with Redhat OpenShift architecture in Industrial Automation.

**CLO4** Build and create state of continuous integration with pipelines of Redhat OpenShift architecture.

<b>NoSQL and MongoDB LAB</b>	
Course Code: 21CAF3012	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.

**CLO2** Build and create fundamental concepts in the context of a number of different NOSQL products.

**CLO3** Apply and analyze architecture and APIs with use of Devices, Gateways and Data Management in data.

**CLO4** Evaluate the application of MongoDB in Industrial and Commercial Building Automation, evaluating Data performance using MapReduce and Real-World Design Constraints.

<b>MOBILE APPLICATION DEVELOPMENT USING IOT LAB</b>	
Course Code: 21CMM3116	
Pre-Requisite : Browser, Window OS, IBM Cloud account	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the MOBILE APPLICATION using IOT technique

**CLO2** Familiarize with the mechanisms for implementing mobile applications

**CLO3** To enable students to closer look at the building blocks of IoT architecture and at the capabilities that is provided by Watson IoT Platform.

**CLO4** To provides an overview of the analytics services available on IBM Cloud

<b>SOFTWARE ENGINEERING LAB</b>	
Course Code: 21CS3118	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to prepare SRS document, design document, test cases and software configuration management and risk management related document.

**CLO2** Develop function oriented and object oriented software design using tools like rational rose.

**CLO3** Generate a high-level design of the system from the software requirements



**CLO4** Have experience and/or awareness of testing problems and will be able to develop a simple testing report

<b>BIG DATA ANALYTICS, TOOLS AND TECHNIQUES- LEVEL-III</b>	
<b>Course Code: 21CS0302</b>	
<b>Prerequisite: NIL</b>	
<b>L T P : 0 0 2</b>	
<b>Credits: 1</b>	

### **TRAINING LEARNING OUTCOMES (TLO)**

After completion of course, students would be able to:

- Understand the vision of Big Data from a global context.
- Understand and apply Hadoop in Market perspective of Big Data.
- Evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.
- Apply and analyze architecture and APIs with use of Devices, Gateways and Data Management in Big data.

<b>LIVE PROJECT-III &amp; INDUSTRIAL VISIT</b>	
Course Code: 21CS0304	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create an application.

**CLO3** To provide hands-on experience at site where Computer Science and engineering projects are executed.

## **SEMESTER - VII**

<b>APPLICATION &amp; CLOUD SECURITY</b>	
Course Code: 21CMF4003	
Pre-Requisite : NIL	

L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the vision of Cloud and its security.

**CLO2** Able to Understand the implementation of Forensic Science.

**CLO3** Apply and analyze architecture with data management over cloud platforms.

**CLO4** Evaluate the application of cloud security with its phases.

**CLO5** Build a secure architecture and analyzing it with different phases of security.

<b>WEB SERVICES</b>	
Course Code: 21CMM4005	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the use of SOAP and REST web services in Enterprises from a global context.

**CLO2** Write SOAP web services from industry perspective of Web Services.

**CLO3** Apply and analyze Restful Web Services.

**CLO4** Evaluate the application of REST Web Services in university environment by Using JAX-RS and JAX-WS API's in java.

**CLO5** Create and Secure Web Services by Using Transport and Application level Security. Creating projects and research activities based on SOAP & REST API.

<b>INTERPERSONAL SKILLS: STRATEGIES (COMMON TO ALL BRANCHES)</b>	
Course Code: 21SS756	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**Training Learning Outcome (TLO): -**

**After the completion of the training, the student will have ability:**

- TL01. The student will develop knowledge, skills and understanding people in-group and individually.
- TL02. The student will be able to learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.
- TL03. To work with people even with conflicts and reducing the differences among them by reaching to an equilibrium.

<b>APPLICATION &amp; CLOUD SECURITY LAB</b>	
Course Code: 21CMF4007	
Pre-Requisite :Basic Knowledge of Application Programming and Security	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the vision of Cloud and its security.

**CLO2** Understand the implementation of Forensic Science.

**CLO3** Apply and analyze architecture with data management over cloud platforms.

**CLO4** Evaluate the application of cloud security with its phases.

**CLO5** Build a secure architecture and analyzing it with different phases of security.

<b>WEB SERVICES LAB</b>	
Course Code: 21CMM4009	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the use of SOAP and REST web services in Enterprises from a global context.

**CLO2** Write SOAP web services from industry perspective of Web Services.

**CLO3** Apply and analyze Restful Web Services.

**CLO4** Evaluate the application of REST Web Services in university environment by Using JAX-RS and JAX-WS API's in java.

**CLO5** Create and Secure Web Services by Using Transport and Application level Security. Creating projects and research activities based on SOAP & REST API.

INDUSTRY SESSION : ARTIFICIAL INTELLIGENCE	
Course Code: 21CMF4007	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Understand the vision of AI from a global context.

**CLO2** Apply IBM Watson Services in Market perspective of Big Data.

**CLO3** Analyze architecture and APIs with use of WKS and Watson Assistant.

**CLO4** Evaluate the application of AI and ML in Industrial and Commercial sectors.

LIVE PROJECT-IV & INDUSTRIAL VISIT	
Course Code: 21CS4115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

**CLO1** Able to Gather a first-hand experience on sites.

**CLO2** Apply the concepts learnt to design and create an application.

**CLO3** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

<b>MINOR PROJECT</b>	
Course Code: 21CS4117	
Pre-Requisite : NIL	
L T P : 0 0 8	
Credits: 4	

Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO1** Design and implement automated solutions for the assigned/identified real world problems.

**CLO2** Write technical reports.

**CLO3** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO4** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## **SEMESTER - VIII**

<b>MAJOR PROJECT</b>	
Course Code: 21CS4114	
Pre-Requisite : NIL	
L T P : 0 0 24	
Credits: 12	

**CLO1** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## SYLLABUS OF PROFESSIONAL ELECTIVE COURSES

DISTRIBUTED OPERATING SYSTEM	
Course Code: 21CS3020	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Gain knowledge of distributed operating system architecture.

**CLO2** Implement distributed client server applications using remote method invocation.

**CLO3** Have knowledge of Synchronization and Deadlock.

**CLO4** Have sufficient knowledge about file access.

**CLO5** Understand Shared Memory Technique, security, and distributed file systems.

SOFTWARE PROJECT MANAGEMENT	
Course Code: 21CS3024	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling.

**CLO2** Apply basic concepts related to software project planning, scope and feasibility.

**CLO3** Analyse of various project management activities such as tracking, project procurement, configuration management, monitoring.

**CLO4** Acquire knowledge about quality assurance, quality control, and risk management.

GRID COMPUTING	
Course Code: 21CS3026	
Pre-Requisite : NIL	

L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the genesis & know the applications of grid computing.

**CLO2** Understand the technology and tool kits for facilitating grid computing.

**CLO3** Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids.

**CLO4** Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research.

**CLO5** Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.

<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	
Course Code: 21CS3028	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate knowledge of structural and behavioral modeling techniques.

**CLO2** Able to Demonstrate knowledge of a model-based software development methodology.

**CLO3** Create application of the methodology and the modeling techniques in a significant software design project.

**CLO4** Demonstrate knowledge of design patterns and their application in a software design project.

**CLO5** To Demonstrate knowledge of Design and Testing Process Improvement Models.

<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	
Course Code: 21CS3030	
Pre-Requisite : Soft Computing Course	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the mathematics behind the design of perceptron.

**CLO2** Correlate the need of extension of MLP to CNN.

**CLO3** Design and analyse the importance of kernel functions, RNN and memories.

**CLO4** Differentiate between fuzzy sets and crisp sets.

**CLO5** Apply and analyse the applications of fuzzy to reasoning and clustering

<b>CYBER SECURITY</b>	
Course Code: 21CS3032	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis.

<b>DESIGN THINKING</b>	
Course Code: 21CS3034	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand and critically apply the concepts and methods of business processes.

**CLO2** Able to Understand and apply IBM Blueworks live and process designer tool concepts.

**CLO3** Analyzing design thinking history and its various concepts.

**CLO4** Understand, analyzing and create models with users collaboration to apply design thinking concepts.

**CLO5** Build the process model that is used to implement process application and use different mural template to apply design thinking concepts for solving real world problem.



<b>PREDICTIVE ANALYTICS</b>	
Course Code: 21CS3036	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand and critically apply the concepts and methods of Predictive analytics.

**CLO2** Apply IBM SPSS Modeler in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.

**CLO3** Analyse how to use functions, deal with missing values, use advanced field operations, handle sequence data and improve efficiency.

**CLO4** Evaluate the Model on the basis of different Predictive Methods.

**CLO5** Build and create advanced analytical model that leverage historical data to uncover real-time insights to predict future events.

<b>BUSINESS INTELLIGENCE</b>	
Course Code: 21CS3038	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the vision of Business Intelligence from a global context.

**CLO2** Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.

**CLO3** Apply and analyse various prompt types and conditionally render objects in reports.

**CLO4** Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.

**CLO5** Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

<b>INTERNET OF THINGS</b>	
Course Code: 21CS3040	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CL01** Able to Understand the vision of IoT and communication protocols from a global context.

**CL02** Understand and apply IoT protocols.

**CL03** Apply and analyze sensor networks and their components to IoT domain.

**CL04** Design portable IoT using appropriate boards.

**CL05** Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.

**CL06** Build and create state of the art architecture in IoT.

<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	
Course Code: 21 <b>CS4019</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CL01** Present the exploitation present in the security.

**CL02** Discuss various types of attacks and their characteristics.

**CL03** Illustrate the basic concept of encryption and decryption for secure data transmission.

**CL04** Analyze various cryptography techniques and its applications.

**CL05** Develop solutions for security problems.

<b>SOFTWARE TESTING</b>	
Course Code: 21CS4033	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Demonstrate the fundamentals of software testing using real world examples

**CLO2** Identify and apply relevant testing techniques suitable for a real world scenario

**CLO3** Investigate the different levels in testing

**CLO4** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO5** Use practical knowledge to test software and understand the trade-offs between testing techniques

**CLO6** Implement Test Automation process and experiment with testing tools.

<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	
Course Code: 21CS4023	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. To specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.

**CLO2** Familiarize with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO3** Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).

**CLO4** Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.

**CLO5** Understand the congestion control mechanism at transport layer and to acquire skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

<b>ADVANCED JAVA PROGRAMMING</b>	
Course Code: 21 <b>CS4035</b>	
Pre-Requisite : Core Java Programming	
L T P : 3 1 0	
Credits: 4	

**CLO1** Learn the graphics and animation on the web pages, using Java Applets.

**CLO2** Learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings Usage.

**CLO3** Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.

**CLO4** Design the server side programming using Servlets and JSP

**CLO5** Use the invocation of the remote methods in an application using RMI.

<b>NASSCOM ASSOCIATE ANALYTICS - II</b>	
Course Code: <b>CS4037</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the tools, technologies & programming languages which is used in day to day analytics cycle.

**CLO2** Analyze and use the best tools to make sense from available raw data.

**CLO3** To provide knowledge of the tools, technologies & programming languages which is used in day to day business analytics cycle.

<b>DATA WAREHOUSING &amp; DATA MINING</b>	
Course Code: 21CS4025	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the functionality of the various data mining and data warehousing component.

**CLO2** Design data warehouse with dimensional modelling and apply OLAP operations.

**CLO3** Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

**CLO4** Describe complex data types with respect to spatial and web mining.

**CLO5** Extract knowledge using data mining techniques.

**CLO6** Apply the Data Mining principles and techniques for real time applications.

<b>MOBILE COMPUTING</b>	
Course Code: 21 <b>CS4027</b>	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Grasp the concepts and features of mobile computing technologies and applications.

**CLO2** Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

<b>MACHINE LEARNING USING R</b>	
Course Code:21CS4029	
Pre-Requisite : NIL	

L T P : 3 1 0	
Credits: 4	

**CLO1** Learn the fundamentals of R-programming and probability.

**CLO2** Understand the basics and need of Machine learning in global view.

**CLO3** Demonstrate in-depth knowledge of methods and theories in the field of machine learning.

**CLO4** Understand, apply and evaluate the supervised learning techniques.

**CLO5** Apply, analyze and evaluate the ensemble learning and unsupervised learning techniques

**CLO6** Understand the concepts of reinforcement learning and transfer learning.

**CLO7** To implement the machine learning techniques for building different applications.

OPEN SOURCE SOFTWARE	
Course Code: 21CS4031	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Understand the difference between open source software and commercial software.

**CLO2** Identify, install and run Linux operating system.

**CLO3** Install and manage applications.

**CLO4** Identify, install open source web technologies Apache, MySql, PHP.

**CLO5** Develop web applications using LAMP.

**CLO6** Write session control PHP code for a website.

<b>NASSCOM ASSOCIATE ANALYTICS - III</b>	
Course Code: 21CS4039	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

**CLO1** Able to Understand the tools, technologies & programming languages which is used in day to day analytics cycle.

**CLO2** Analyze and use the best tools to make sense from available raw data.

**CLO3** To provide knowledge of the tools, technologies & programming languages which is used in day to day business analytics cycle.

## **SYLLABUS OF OPEN ELECTIVE COURSES**

<b>GERMAN LANGUAGE PHASE I</b>	
Course Code: 21FLGR301	
Credits: 2	
L T P: 2 0 0	
Prerequisite: NIL	

**CLO1** Able to Read and write short, simple texts.

**CLO2** Have Fluency in reading and writing.

**CLO3** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO4** Know the culture of the countries where the German language is spoken.

**CLO5** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>GERMAN LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLGR401	
<b>Credits:</b> 2	
<b>L T P:</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CL01** Read and write short, simple texts.

**CL02** Have Fluency in reading and writing.

**CL03** Use language creatively and spontaneously.

**CL04** Get awareness about cross-cultural and intercultural difference.

<b>FRENCH LANGUAGE PHASE I</b>	
<b>Course Code:</b> 21FLFR301	
<b>Credits:</b> 2	
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> NIL	

Read and write short, simple texts.

**CL01** Have Fluency in reading and writing.

**CL02** Use language creatively and spontaneously.

**CL03** Know the culture of the countries where the French language is spoken.

<b>FRENCH LANGUAGE PHASE II</b>	
<b>Course Code:</b> 21FLFR401	
<b>Credits:</b> 2	
<b>L T P :</b> 2 0 0	
<b>Prerequisite:</b> NIL	

**CL01** Able to Read and write short, simple texts.

**CL02** Have Fluency in reading and writing.

**CL03** Use language creatively and spontaneously.

**CL04** Know the culture of the countries where the French language is spoken.

<b>ENTERPRENEURSHIP &amp; NEW VENTURE MANAGEMENT</b>	
<b>Course Code:</b> SEC-FT-01	
<b>Pre-Requisite :</b> NIL	
<b>L T P :</b> 3 0 0	
<b>Credits:</b> 3	



**CLO1** Able to Understand the different support system for business development.

**CLO2** Gain knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO3** To understand the basic of Business project report, Fund raising and SWOT analysis.

<b>SUSTAINABLE GROWTH &amp; DEVELOPMENT</b>	
<b>Course Code:21ESUG202</b>	
<b>Credits: 3</b>	
<b>L T P : 3 0 0</b>	
<b>Prerequisite:</b> Basics understanding of environment and natural ecosystems	

**CLO1** Develop an awareness about our environment and elicit collective response for its protection.

**CLO2** Understand the different types of environmental pollution problems and their sustainable solutions.

**CLO3** Work in the area of sustainability for research and education.

**CLO4** Have a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

<b>WASTE MANAGEMENT</b>	
<b>Course Code:21ESUG203</b>	
<b>Credits: 3</b>	
<b>L T P C : 3 0 0</b>	
<b>Prerequisite:</b> Basics understanding about Waste	

**CLO1** Able to Develop an awareness about solid waste and management practices

**CLO2** Design feasible solutions for waste management

**CLO3** Understand waste management practices, law and regulation related to solid waste management.

<b>MICROPROCESSOR AND INTERFACING</b>	
<b>Course Code:21EC390</b>	
<b>Credits: 3</b>	

<b>L T P C : 3 0 0</b>	
<b>Prerequisite: NIL</b>	

- CLO1** Able to Understand the architecture of microprocessors and micro controller
- CLO2** Understand the programming model of microprocessors and micro controllers
- CLO3** Interface different external peripheral devices with microprocessors and micro controllers
- CLO4** Analyze a problem and formulate appropriate computing solution for processor or controller based application.
- CLO5** Develop an assembly language program for specified application

## B.Tech - CSE / 2019

### SEMESTER - I

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0101</b>	<b>TECHNICAL ENGLISH - I</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

- CLO1** Able to Understand and appreciate the need of communication training.
- CLO2** Use different strategies of effective communication.
- CLO3** Select the most appropriate mode of communication for a given situation.
- CLO4** Speak assertively and effectively.
- CLO5** Correspond effectively through different modes of written communication.
- CLO6** Write effective reports, proposals and papers.
- CLO7** Present himself/ herself professionally through effective resumes and interviews.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0101</b>	<b>MATHEMATICS - I</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To apply advanced matrix knowledge to Engineering problems

**CLO2:** How to improve their ability in solving geometrical applications of differential calculus problems

**CLO3:** Understand equip themselves familiar with the functions of several variables

**CLO4:** To familiarize with the applications of differential equations

**CLO5:** Try expose to the concept of three dimensional analytical geometry

**CLO6:** Expose the students to the concept of convergence and divergence

**CLO7:** Learn to develop the ability to judge and apply appropriate tests to various infinite series

<b>PH 0101</b>	<b>PHYSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**CLO1:** To apply the Physics concepts in solving engineering problems

**CLO2:** How to educate scientifically the new developments in engineering and technology

**CLO3:** Try to emphasize the significance of Green technology through Physics principles

**CLO4:** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0101</b>	<b>CHEMISTRY</b>	3	0	0	3

**CLO1:** The role of applied chemistry in the field of engineering.

**CLO2:** Get knowledge of water quality parameters and the treatment of water.

**CLO3:** Understand principles involves in corrosion and its inhibitions.

**CLO4:** Important analytical techniques, instrumentation and the applications.

**CLO5:** Knowledge with respect to the phase equilibria of different systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	4	0	0	4

**CL01** To know about different materials and their properties

**CL02** Get about engineering aspects related to buildings

**CL03** Analyses about importance of surveying and the transportation systems

**CL04** To get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1001</b>	<b>INTRODUCTION TO COMPUTER AND PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CL01** Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm/pseudocode.

**CL02** Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.

**CL03** Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.

**CL04** Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CL01:** Understand guide thought process.

**CL02:** Try to groom students' attitude.

**CL03:** To develop communication skill.

**CL04:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0103</b>	<b>PHYSICS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to Understand scientific concepts in measurement of different physical variables

**CLO2** Develop the skill in arranging and handling different measuring instruments and

**CLO3** Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand the basic concepts involved in the analyses

**CLO2:** Learn the basic concepts of measurement techniques.

**CLO3:** The synthesis, dynamics, chemical transformation and their applications

**CLO4:** To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

**REFERENCE:** Chemistry Department Manual

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0107</b>	<b>NCC/NSS/NSO/YOGA</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice.

**CLO2:** Understand discipline, gratitude towards country

**CLO3:** Practise YOGA poses and know how it is important

**CLO4:** Develop patriotic feeling for country

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1111</b>	<b>COMPUTER PROGRAMMING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to To understand the concepts of Programming language

**CLO2** learn the basics of C declarations, operators and expressions

**CLO3** To learn on the manipulation of strings, functions and pointers

**CLO4** To apply concepts and techniques for implementation

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**CLO1** Able to The basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.

**CLO2** The production of simple models in the above trades.

**CLO3** Use different measuring, marking, cutting tools used in the workshop.

**CLO4** Be aware of the safety precautions while working in the workshop.

## **SEMESTER - II**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0102</b>	<b>TECHNICAL ENGLISH - II</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1** To provide for the acquisition of basic communication skills in English in relation to the requirements of the students of Engineering and Technology.

**CLO2** To facilitate the holistic, integrated development of LSRW involved in language learning through a series of intensely practical tasks and activities.

**CLO3** Offer professionally sustainable language content by which to address the special needs of the target learners to ensure that they are adequately equipped with discorsal and grammatical competencies.

**CLO4** To help acquire the use of language simultaneously through the electronic media such as the Internet so as to enable the learners to deal effectively with E-materials

**CLO5** To expose the learners to a wide range of lexical and grammatical skills needed for their special professional demands.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0108</b>	<b>VALUE EDUCATION</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**CLO1** To help individuals think about and reflect on different values.

**CLO2** To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.

**CLO3** Inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** To familiarize the students with the basic organization of organisms and subsequent building to a living being.

**CLO2** With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for arouse daily activities.

**CLO3** To provide knowledge about biological problems that require engineering expertise to solve them

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0102</b>	<b>MATHEMATICS - II</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Solve the differential equations of first and 2nd order and basic application problems described by these equations.

**CLO2** Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.

**CLO3** Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.

**CLO4** Solve systems of linear equations by using elementary row operations.

**CLO5** Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigenvectors.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand electrical properties of materials,

**CLO2** Able to Understand the properties and applications of semi conducting materials,

**CLO3** Know general properties and applications of magnetic and dielectric materials,

**CLO4** Understand the behaviour of materials on exposure to light,

**CLO5** General properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0106</b>	<b>BASIC ENGINEERING - II</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1** Understand the basic concepts of magnetic circuits, AC & DC circuits.

**CLO2** Explain the working principle, construction, applications of DC & AC machines and measuring instruments.

**CLO3** Gain knowledge about the fundamentals of wiring and earthing

**CLO4** Fundamentals of electronic components, devices, transducers,

**CLO5** Principles of digital electronics, and

**CLO6** Principles of various communication systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0104</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** The importance of environmental education, ecosystem and ethics.

**CLO2** Knowledge with respect to biodiversity and its conservation.



**CLO3** To create awareness on various environmental pollution aspects and issues.

**CLO4** To educate the ways and means to protect the environment.

**CLO5** mportant environmental issues and protection

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1004</b>	<b>OBJECT ORIENTED PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.

**CLO2** Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.

**CLO3** Demonstrate use of file handling.

**CLO4** Analysis use of templates and exception handling.

**CLO5** Demonstrate use of windows programming concepts using C++

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** To guide thought process.

**CLO2** To groom students' attitude.

**CLO3** Develop communication skill.

**CLO4** Able to build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0104</b>	<b>MATERIAL SCIENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to The students are expected to familiarize with various characterization techniques of materials.

**CLO2** They should have developed better understanding of the underlying science behind the properties of various materials.

**CLO3** Get preliminary understanding on introductory idea about nano materials.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 1114</b>	<b>OOPS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to The working of OOPS programming approach.

**CLO2** The knowledge of object oriented programming style.

**CLO3** The basic concepts involved in computer programming.

**CLO4** Important programming aspects i.e object, class, inheritance and polymorphism.

**CLO5** Knowledge with respect to the software development phase of OOPS.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>
(Only First Angle Projection is to be followed)					

**CLO1** The construction of geometrical figures

**CLO2** The projection of 1D, 2D & 3D elements

**CLO3** Sectioning of solids and development of surfaces

**CLO4** Preparation and interpretation of building drawing

**CLO5** Draw dimensioned orthographic and isometric projections of simple engineering objects.

**CLO6** Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism;

### **SEMESTER - III**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0211</b>	<b>MATHEMATICS - III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** The rudiments of Fourier series

**CLO2** The theory and problems of PDE

**CLO3** The applications of PDE to boundary value problems

**CLO4** Fourier transforms and to their branches of engineering

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2001</b>	<b>DATA STRUCTURES USING C</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Implement the basic data structures and solve problems using fundamental algorithms.

**CLO2** Implement various search and sorting techniques.

**CLO3** Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.

**CLO4** Analyze, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2003</b>	<b>DISCRETE STRUCTURES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Perform operations on various discrete structures such as set, function and relation.

**CLO2** Apply basic concepts of asymptotic notation in analysis of algorithm.

**CLO3** Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real-world problems.

**CLO4** Comprehend formal logical arguments and translate statements from a natural language into its symbolic structures in logic.

**CLO5** Identify and prove various properties of rings, fields and group.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.

**CLO3** Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.

**CLO4** Apply and create Relational Database Design process with Normalization and Denormalization of data.

**CLO5** Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.

**CLO2** Describe the design of basic computer with instruction formats & addressing modes.

**CLO3** Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.

**CLO4** Interpret the concepts of pipelining, multiprocessors, and inter processor communication.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to guide thought process.

**CLO2** To groom students' attitude.

**CLO3** Able to develop communication skill.

**CLO4** Have build confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2111</b>	<b>DBMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- 
- CLO1** Able to Designing a database
- CLO2** Using DDL and DML commands
- CLO3** Backing up of files+
- CLO4** Can create table and know commands

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2113</b>	<b>DATA STRUCTURES LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CLO1** Implementing Stack, Queue , Linked List , Binary tree
- CLO2** Sorting and Searching Techniques
- CLO3** Able to Divide and Conquer, Dynamic Programming methods
- CLO4** Greedy method , Traversals and Backtracking

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2115</b>	<b>PROGRAMMING USING MATLAB</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

- CLO1** Become familiar with fundamental operations in Matlab
- CLO2** Perform statistical data analysis, data interpolation by Matlab, solve differentiation equation with Matlab
- CLO3** Acquire a reasonable level of competence in designing optimization algorithms, solve linear programming, constrained and unconstrained optimization problems by Matlab
- CLO4** Able to Apply Matlab to solve practical engineering problems Master used skills in Matlab programming, code debugging

## SEMESTER - IV

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2002</b>	<b>MICROPROCESSOR &amp; INTERFACING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Able to Architecture of 8086 & 8088 microprocessors

**CLO2** Identify Instruction sets of 8086/88 and programming.

**CLO3** Math Coprocessor & I/O processor and multiprocessor configuration

**CLO4** Interfacing of microprocessor with various peripheral devices

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2006</b>	<b>OPERATING SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2** Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.

**CLO3** Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.

**CLO4** Examine and categorise various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.

**CLO5** Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>

<b>CS 2008</b>	<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Implement the different tree structures algorithm and analyze in context of asymptotic notation.

**CLO2** Identify basic properties of graphs and apply their algorithms to solve real life problems.

**CLO3** Demonstrate the usage of algorithms under several categories like string matching, randomized algorithms and genetic algorithms.

**CLO4** Implement various advanced data structures using C/Java/Python or related languages.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2010</b>	<b>JAVA PROGRAMMING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Demonstrate proficient use of a text editor to independently create, store, and edit Java source programs (applications and applets) from instructor supplied specifications, which illustrate comprehension of object oriented programming concepts.

**CLO2** Compile Java source programs and to debug the source program using compiler generated error/warning messages so that no errors or warnings are generated.

**CLO3** Include in their Java source program, clear, concise, internal documentation, in the form of commentary statements.

**CLO4** Write a Java program and correct all logic errors to achieve the correct/desired output illustrating.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0202</b>	<b>PERSONALITY DEVELOPMENT - IV</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2112</b>	<b>MICROPROCESSOR LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** A To do any kind of operations (8 bit addition, subtraction, Multiplication and division) with 8085 microprocessor

**CLO2** To implement interfacing of 8086 with various peripheral devices

**CLO3** Acquire the skills of constructing the different transistors configurations

**CLO4** To learn the basic concepts of integrated circuits

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2114</b>	<b>OPERATING SYSTEMS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Scheduling algorithms

**CLO2:** Deadlock algorithms and page replacement algorithms

**CLO3:** Memory management schemes, Thread and synchronization

**CLO4:** To study the process management and scheduling.

**CLO5:** Understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2116</b>	<b>JAVA PROGRAMMING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** To learn & practice the Object Oriented concepts like Inheritance, Overloading etc.

**CLO2** Learn & practice Interfaces and Packages

**CLO3** To learn & practice Java applet programming



## SEMESTER - V

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Design and construction of compilers and knowledge of working of major phases of compilation.

**CLO2:** Construct parsers.

**CLO3:** Implement a simple compiler for a language chosen.

**CLO4:** Classify various parameters passing scheme, explain memory management of a programming languages and perform code optimization..

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Conceptualise and explain the functionality of the different layers within a network architecture

**CLO2** Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies, subnetting and routing mechanism.

**CLO3** Demonstrate the operation of various routing protocols and their performance analysis.

**CLO4** Illustrate design and implementation of datalink, transport and network layer protocols within a simulated/real networking environment.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3005</b>	<b>THEORY OF COMPUTATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2:** Disambiguate context-free grammars by mastering the concepts of context-free languages and push down automata.

**CLO3:** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

**CLO4:** Solve analytical problems in related areas of theory in computer science

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently.

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3113</b>	<b>COMPUTER NETWORK LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand the requirements of an enterprise and outline its major design areas

**CLO2:** Identify functional areas to construct high level modules for enterprise architecture and analyze them.

**CLO3:** Know about the networking devices, prepare a bill of materials and configure the devices as per the Core, Access and Distribution layers

**CLO4:** Design the Server Farm for an enterprise network and discuss up gradations if needed.

**CLO5:** Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.

**CLO6:** Test and monitor the enterprise network using a tool

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3117</b>	<b>COMPILER DESIGN LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**CLO2:** To gain basic knowledge of Compiler, Assembler, Linker, Loader and Macro.

**CLO3:** Analyse and understand the fundamentals of the design of Compilers by applying mathematics and engineering principles.

**CLO4:** Design a system for parsing the sentences in a compiler grammar and developing a symbol table.

## **SEMESTER - VI**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3002</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01:** Learn the basics and applications of artificial intelligence and categorize various problem domains, basic knowledge representation and reasoning methods.

**CL02:** Analyze basic and advanced search techniques including game playing, evolutionary search algorithms, and constraint satisfaction. Learn and design intelligent agents for concrete computational problems.

**CL03:** Design of programs in AI language(s).

**CL04:** Acquire knowledge about the architecture of an expert system and design new expert systems for real life applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3004</b>	<b>SOFTWARE ENGINEERING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Able to Analyze software development process models, including agile models and traditional models like waterfall.

**CL02** Able to Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model

**CL03** Able to Apply and use various UML Models for software analysis, design and testing.

**CL04** Able to Acquire knowledge about the concepts of application of formal specification, CASE tools and configuration management for software development.

**CL05** Able to Analysis of software estimation techniques for creating project baselines.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3010</b>	<b>MULTIMEDIA AND WEB TECHNOLOGIES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CL01** Developed understanding of technical aspect of Multimedia Systems.

**CL02** Understand various file formats for audio, video and text media.

**CL03** Develop various Multimedia Systems applicable in real time.

**CL04** Design interactive multimedia software.

**CL05** Apply various networking protocols for multimedia applications.

**CL06** To evaluate multimedia application for its optimum performance.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to assess the overall knowledge level of Computer Science and engineering standards and guide them to take corrective measures where deficiencies are detected.

**CLO2:**Types of reading strategies to enhance improve reading skills

**CLO3:**Role of writing skills in effective communication

**CLO4:** Learn Advantages & Disadvantages of written communication

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT -VI</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3114</b>	<b>ARTIFICIAL INTELLIGENCE LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To implement Heuristic functions & Propositional Logic

**CLO2:** Design to implement A\* & AO\* algorithms

**CLO3:** Implement an Expert system for medical diagnosis

**CLO4:**To teach the fundamental techniques and principles in achieving the concepts of machine learning and AI.

**CLO5:** Enable students to have skills that will help them to solve complex real-world problems regarding Artificial Intelligence.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3116</b>	<b>MULTIMEDIA AND WEB TECHNOLOGIES LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Explain the history of the internet and related internet concepts that are vital in understanding web development.

**CLO2** Discuss the insights of internet programming and implement complete application over the web.

**CLO3** Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet.

**CLO4** Utilize the concepts of JavaScript and Java

**CLO5** Use web application development software tools i.e. Ajax, PHP and XML etc. and identify the environments currently available on the market to design web sites.

**CLO6** Define multimedia to potential clients.

**CLO7** Identify and describe the function of the general skill sets in the multimedia industry.

**CLO8** Able to Identify the basic components of a multimedia project.

**CLO9** Identify the basic hardware and software requirements for multimedia development and playback.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3118</b>	<b>SOFTWARE ENGINEERING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** To prepare SRS document, design document, test cases and software configuration management and risk management related document.

**CLO2** Develop function oriented and object oriented software design using tools like rational rose.

**CLO3** To perform unit testing and integration testing.

**CLO4** Apply various white box and black box testing techniques

**CLO5** Able to track the progress of a project using Openproj tool.

## **SEMESTER - VII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4003</b>	<b>CLOUD COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

- 
- CL01** To explain the basic concepts along with evolution and features of cloud computing.
- CL02** Demonstrate the concept of existing cloud paradigms and platforms.
- CL03** To explore the issues of cloud computing in addition with various cloud models.
- CL04** To attain the knowledge of virtualization through virtualization technologies.
- CL05** To interpret the concept of Map reduce framework using SQL and NO SQL databases.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4113</b>	<b>CLOUD COMPUTING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CL01** Develop and deploy cloud application using popular cloud platforms
- CL02** Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud.
- CL03** Explain and identify the techniques of big data analysis in cloud.
- CL04** Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real-world cloud computing problems.
- CL05** Write comprehensive case studies analysing and contrasting different cloud computing solutions.
- CL06** Make recommendations on cloud computing solutions for an enterprise.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4115</b>	<b>INDUSTRIAL TRAINING - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**(Training to be undergone after VI Semester)**

- CL01:** To enable the students to gather a first-hand experience on site.
- CL02:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4117</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

**CLO1:** Identify, formulate and analyze existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

## **SEMESTER - VIII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4114</b>	<b>PROJECT</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**CLO1** Identify, formulate and analyze existing problems in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.



**CLO5** Contributes to an ethical and professional work culture and also to learn to work in diverse teams.

## **SYLLABUS OF DEPARTMENTAL ELECTIVES**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3019</b>	<b>COMPUTER GRAPHICS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** To provide main notions of graphics

**CLO2** Learn Formal framework to draw basic elements

**CLO3** To study graphics system along with completeness

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3021</b>	<b>SYSTEM MODELLING AND SIMULATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Mathematical models for simulation

**CLO2** Explain Random numbers generation

**CLO3** Analysis of simulation data and modelling

**CLO4** Applications of Simulation, and, simulation software

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3023</b>	<b>DIGITAL IMAGE PROCESSING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Comprehend the need and usage of concepts of image processing.

**CLO2** Enhance the visual quality of given grey/color image using well known transformations and filters.

**CLO3** Distinguish between lossy and lossless image compression model.

**CLO4** Segment the regions of given image using various feature extraction algorithms in order to recognize object.

**CLO5** Demonstrate the use of MATLAB to create interactive image processing applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3025</b>	<b>VISUAL PROGRAMMING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** To define the fundamentals of animation, virtual reality and its related technologies.

**CLO2** Understand a typical graphics pipeline

**CLO3** To design an application with the principles of virtual reality

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3027</b>	<b>OPERATIONAL RESEARCH TECHNIQUES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Concepts of Linear programming technique

**CLO2** Know Applications and use of Assignment, Transportation and Replacement models

**CLO3** Techniques of PERT, CPM

**CLO4** Detailed knowledge of Inventory control

**CLO5** Gain strong knowledge in principles of queuing theory.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3029</b>	<b>PRINCIPLES OF PROGRAMMING LANGUAGES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Concepts of High level languages and its grammar

**CLO2** Analysis Study of Imperative languages ( Pascal and C)

**CLO3** Explain Study of Object oriented Programming ( C++ and JAVA)

**CLO4** Study of Functional Programming ( Haskell / Lisp)

**CLO5** Evaluate Logic Programming ( Prolog and SQL)

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3031</b>	<b>SOFT COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms.

**CLO2** Explain the concepts and meta-cognitive of soft computing.

**CLO3** Apply Soft computing techniques the solve character recognition, pattern classification, regression and similar problems.

**CLO4** Outline facts to identify process/procedures to handle real world problems using soft computing.

**CLO4** Evaluate various techniques of soft computing to defend the best working solutions.

**CLO5** Design hybrid system to revise the principles of soft computing in various applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3020</b>	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Knowledge and understanding

**CLO2** Outline the potential benefits of distributed systems

**CLO3** Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

**CLO4** Cognitive skills (thinking and analysis).

**CLO5** Apply standard design principles in the construction of these systems

**CLO6** Select appropriate approaches for building a range of distributed systems, including some that employ middleware

**CLO7** Communication skills (personal and academic).

**CLO8** Practical and subject specific skills (Transferable Skills).

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3022</b>	<b>SYSTEM SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the relationship between system software and machine architecture.

**CLO2:** Know the design and implementation of assemblers

**CLO3:** Learn the design and implementation of linkers and loaders.

**CLO4:** To have an understanding of macro processors.

**CLO5:** Analyse an understanding of system software tools.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3024</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Describe and apply basic concepts related to software project planning, scope and feasibility.

**CLO2** Analyze various project estimation techniques, especially size estimation (FP), effort estimation (COCOMO models), schedule estimation (GANTT charts), and cost estimation.

**CLO3** Illustrate the concept of team structure and project communication management.

**CLO4** Acquire knowledge about quality assurance, quality control, and risk management.

**CLO5** Describe various project management activities such as tracking, project procurement, configuration management, monitoring.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3026</b>	<b>GRID COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Understand the genesis of grid computing

**CLO2** To know the application of grid computing

**CLO3** Understand the technology and tool kits for facilitating grid computing

**CLO4** Enabling technologies such as high-speed links and storage area networks for building computer grids;

**CLO5** Utilize grid computing and clustering middleware, such as Parallel Virtual Machine (PVM), Message Passing Interface (MPI), HPC Portals, and Peer-to-Peer networks for implementing virtual super computing resources;

**CLO6** To design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research;

**CLO7** To install a grid computing environment; develop communications skills and accept the code of professional conduct and practice through short presentations and group work.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Understanding Object Basics, Classes and Objects, Inheritance

**CLO2** How software objects are altered to build software systems that are more robust  
Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project

**CLO3** Understanding the issues and options in reuse

**CLO4** Using UML, a common language for talking about requirements, designs, and component interfaces

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Expose the students to the concepts of feed forward neural networks

**CLO2:** To provide adequate knowledge about feedback networks.

**CLO3:** Teach about the concept of fuzziness involved in various systems.

**CLO4:** Get adequate knowledge about fuzzy set theory.

**CLO5:** To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

**CLO6:** Know adequate knowledge of application of fuzzy logic control to real time systems.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 3032</b>	<b>CYBER SECURITY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications/devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis

**CLO6** List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4019</b>	<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Comprehend and implement various cryptographic algorithms to protect the confidential data.

**CLO2** Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.

**CLO3** Apply security tools to locate and fix security leaks in a computer network/software.

**CLO4** Secure a web server and web application

**CLO5** Configure firewalls and IDS

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4021</b>	<b>BIG DATA &amp; ANALYTICS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

**CLO2:** Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

**CLO3:** Implement several Data Intensive tasks using the Map Reduce Paradigm

**CLO4:** Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

**CLO5:** Design algorithms to analyze big data like streams, Web.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4023</b>	<b>WIRELESS ADHOC AND SENSOR NETWORK</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

**CLO2:** Know the principles and characteristics of wireless sensor networks (WSNs).

**CLO3:** how proactive protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO4:** Student understands how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO5:** Understands how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO6:** Learn how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO7:** Students are familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO8:** Know acquired skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4025</b>	<b>DATA WAREHOUSING &amp; DATA MINING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Data pre-processing and data quality.

**CLO2:** Modeling and design of data warehouses.

**CLO3:** Algorithms for data mining.

**CLO4:** Design data warehouse with dimensional modeling and apply OLAP operations.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4027</b>	<b>MOBILE COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Grasp the concepts and features of mobile computing technologies and applications

**CLO2** Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Identify the important issues of developing mobile computing systems and applications

**CLO4** Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

**CLO5** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

**CLO6** Organize and manage software built for deployment and demonstration.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4029</b>	<b>MACHINE LEARNING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.

**CLO2** Apply decision tree learning, bayesian learning and artificial neural network in real world problems.

**CLO3** Understand the use of genetic algorithms and genetic programming.

**CLO4** Apply inductive and analytical learning with perfect domain theories.

**CLO5** Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4031</b>	<b>OPEN SOURCE SOFTWARE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Understand concepts, strategies, and methodologies related to open source software development.

**CLO2** Understand the business, economy, societal and intellectual property issues of open source software.

**CLO3** Be familiar with open source software products and development tools currently available on the market.



**CLO4** Be able to utilize open source software for developing a variety of software applications, particularly Web applications.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4033</b>	<b>SOFTWARE TESTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO2** Implement various test processes for quality improvement

**CLO3** Design test planning.

**CLO4** Manage the test process

**CLO5** Apply the software testing techniques in commercial environment

**CLO6** Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4035</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** To Learn the Internet Programming, using Java Applets

**CLO2** To create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CLO3** Apply event handling on AWT and Swing components.

learn to access database through Java programs, using Java Data Base Connectivity (JDBC)

**CLO4** Create dynamic web pages, using Servlets and JSP.

**CLO5** Make a reusable software component, using Java Bean.

**CLO6** Invoke the remote methods in an application using Remote Method Invocation (RMI).

**CLO7** Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

**CLO8** Develop Stateful, Stateless and Entity Beans.

**CLO9** Use Struts frameworks, which gives the opportunity to reuse the codes for quick development.

**CLO10** Map Java classes and object associations to relational database tables with Hibernate mapping files

## SYLLABUS OF OPEN ELECTIVES

		L	T	P	C
LE 0201	GERMAN LANGUAGE PHASE - I	2	0	0	2

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		L	T	P	C
LE 0205	FRENCH LANGUAGE PHASE - I	2	0	0	2

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

		L	T	P	C

<b>LE 0202</b>	<b>GERMAN LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0206</b>	<b>FRENCH LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 2012</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Get familiar with numerical solution of equations

**CLO2** Exposed to finite differences and interpolation

**CLO3** To be thorough with the numerical Differentiation and integration

**CLO4** To find numerical solutions of ordinary differential equations

- CLO5** Had to be thorough with probability concepts and the corresponding distributions.
- CLO6** Get exposed to the testing of hypothesis using distributions.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2002</b>	<b>ENGINEERING ECONOMICS AND MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

- CLO1:** To apply theoretical economic concepts to practical business situation and to take decisions in the Industrial Engineering Situation.
- CLO2:** An Engineer must demonstrate knowledge and understanding of the engineering and management
- CLO3:** Principle and Apply these to Engineeringwork environment, as a member and leader in a team,
- CLO4:** To manage projects and in multidisciplinary environments.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2004</b>	<b>INDUSTRIAL MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

- CLO1:** Students will be able to perform the Management Functions.
- CLO2:** They can be able to compare selected Theories of Management.
- CLO3:** To perform the functions in the Marketing Mix.
- CLO4:** Students will be able to use basic Business Application Software.
- CLO5:** To assess ethical issues in Business situations.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MB 2006</b>	<b>RELIABILITY AND QUALITY MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Apply the Concept of SQC in Process Control for Reliable Component Production

**CLO2:** To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management

**CLO3:** Identify risks, manage the change to assure quality in projects.

**CLO4:** Extract and analyse software requirements specifications for different projects.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2002</b>	<b>PRODUCTION AND OPERATION MANAGEMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Apply problem-solving and critical-thinking skills as required in materials and operations management.

**CLO2:** Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.

**CLO3:** To meet the specified needs with appropriate consideration for the public health and safety,

**CLO4:** Learn management principles and apply these to Engineering work environment,

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2004</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Gain Knowledge and Skills needed to run a Business Successfully.

**CLO2:** Understand the different support system for business development.

**CLO3:** Get knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO4:** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>

<b>ET 2006</b>	<b>NON-CONVENTIONAL ENERGY RESOURCES</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Acquired knowledge about different energy resources.

**CLO2:** Ability to convert the energy from one form to another form.

**CLO3 :** Learn how to use these energy resources

**CLO4:** Develop new effective to utilize energy

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ET 2008</b>	<b>NANOTECHNOLOGY</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** The various opportunities in the emerging field of nano electronics and nano technologies

**CLO2:** To know advantages and disadvantages of nano particles

**CLO3:** Analyse new technologies emerges with nanotechnology

**CLO4:** To know new and faster kinds of computers, more efficient power sources and life-saving medical treatment

**DevOps - 2019****SEMESTER - I**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE 0101</b>	<b>TECHNICAL ENGLISH - I</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1** Understand and appreciate the need of communication training.

**CLO2** Use different strategies of effective communication.

**CLO3** Select the most appropriate mode of communication for a given situation.

**CLO4** Speak assertively and effectively.

**CLO5** Correspond effectively through different modes of written communication.

**CLO6** Write effective reports, proposals and papers.

**CLO7** Present himself/ herself professionally through effective resumes and interviews.

<b>MA 0101</b>	<b>MATHEMATICS - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To apply advanced matrix knowledge to Engineering problems

**CLO2:** How to improve their ability in solving geometrical applications of differential calculus problems

**CLO3:** Understand equip themselves familiar with the functions of several variables

**CLO4:** To familiarize with the applications of differential equations

**CLO5:** Try expose to the concept of three dimensional analytical geometry

**CLO6:** Expose the students to the concept of convergence and divergence

**CLO7:** Learn to develop the ability to judge and apply appropriate tests to various infinite series

<b>PH 0101</b>	<b>PHYSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand the general scientific concepts required for technology

**CLO2** Apply the Physics concepts in solving engineering problems

**CLO3** Educate scientifically the new developments in engineering and technology

**CLO4** Able to emphasize the significance of Green technology through Physics principles

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0101</b>	<b>CHEMISTRY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** The role of applied chemistry in the field of engineering.

**CLO2:** Get knowledge of water quality parameters and the treatment of water.

**CLO3:** Understand principles involves in corrosion and its inhibitions.

**CLO4:** Important analytical techniques, instrumentation and the applications.

**CLO5:** Knowledge with respect to the phase equilibria of different systems.

<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1** To know about different materials and their properties

**CLO2** Analysis about engineering aspects related to buildings

**CLO3** Able to know about importance of surveying and the transportation systems

**CLO4** Get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal.

<b>CDV 1001</b>	<b>DEVOPS OVERVIEW</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand the traditional software development.

**CLO2** Learn the rise of agile methodologies.

**CLO3** Define and design purpose of DevOps.

<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

<b>PH 0103</b>	<b>PHYSICS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>



**CLO1** Understand scientific concepts in measurement of different physical variables

**CLO2** Develop the skill in arranging and handling different measuring instruments and

**CLO3** Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand the basic concepts involved in the analyses

**CLO2** Knowledge of water quality parameters and the treatment of water.

**CLO3** The principles involves in corrosion and its inhibitions.

**CLO4** To Important analytical techniques, instrumentation and the applications.

<b>GE 0107</b>	<b>NCC / NSS / NSO / YOGA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice

**CLO2:** Practise YOGA poses and know how it is important

**CLO3:** Develop patriotic feeling for country

<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**CLO1** The basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.

**CLO2** The production of simple models in the above trades.

**CLO3** To know the production of simple models in the above trades.

**CLO4** :Be aware of the safety precautions while working in the workshop.

## **SEMESTER - II**

<b>LE 0102</b>	<b>TECHNICAL ENGLISH - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1** Provide for the acquisition of basic communication skills in English in relation to the requirements of the students of Engineering and Technology.

**CLO2** Facilitate the holistic, integrated development of LSRW involved in language learning through a series of intensely practical tasks and activities.

**CLO3** To offer professionally sustainable language content by which to address the special needs of the target learners to ensure that they are adequately equipped with discursal and grammatical competencies.

**CLO4** Help acquire the use of language simultaneously through the electronic media such as the Internet so as to enable the learners to deal effectively with E-materials.

**CLO5** Expose the learners to a wide range of lexical and grammatical skills needed for their special professional demands.

<b>GE 0108</b>	<b>VALUE EDUCATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**CLO1** Deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.

**CLO2** Inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them.

**CLO3** Get knowledge good values and bad values

<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** To familiarize the students with the basic organization of organisms and subsequent building to a living being.

**CLO2** With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for arouse daily activities.

**CLO3** To provide knowledge about biological problems that require engineering expertise to solve them

<b>MA 0102</b>	<b>MATHEMATICS - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Solve the differential equations of first and 2nd order and basic application problems described by these equations.

**CLO2:** Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.

**CLO3:** Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.

**CLO4:** Solve systems of linear equations by using elementary row operations.

**CLO5:** Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the Eigen values and eigenvectors.

<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Understand electrical properties of materials,

**CLO2:** Learn the properties and applications of semi conducting materials,

**CLO3:** Analyse general properties and applications of magnetic and dielectric materials,

**CLO4:** Know the behaviour of materials on exposure to light,

**CLO5:** Understand general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology.

<b>GE 0106</b>	<b>BASIC ENGINEERING - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the basic concepts of magnetic circuits, AC & DC circuits.

**CLO2:** Explain the working principle, construction, applications of DC & AC machines and measuring instruments.

**CLO3:** Gain knowledge about the fundamentals of wiring and earthing

**CLO4:** Fundamentals of electronic components, devices, transducers, Principles of digital electronics, and

**CLO5:** Principles of various communication systems

<b>GE 0104</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** The importance of environmental education, ecosystem and ethics.

**CLO2** Knowledge with respect to biodiversity and its conservation.

**CLO3** To create awareness on various environmental pollution aspects and issues.

**CLO4** To educate the ways and means to protect the environment.

**CLO5** Important environmental issues and protection

<b>CDV 1004</b>	<b>SCM/GIT INTERNALS + BRANCHING MERGING STRATEGY (USE CASES)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand the traditional toolkit for DevOps.

**CLO2** Learn the history and overview of source code management

**CLO3** Learn the Control systems of DevOps.

<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

<b>PH 0104</b>	<b>MATERIAL SCIENCE LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** The students are expected to familiarize with various characterization techniques of materials.

**CLO2:** They should have developed better understanding of the underlying science behind the properties of various materials.

**CLO3:**To learn an introductory idea about new materials.

**CLO4:**To learn various types of fuels and their properties

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CDV 1114</b>	<b>SOURCE CODE MANAGEMENT Lab</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
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**CLO1** Understand the traditional toolkit for DevOps.

**CLO2** Learn the history and overview of source code management

**CLO3** Learn the Control systems of DevOps.

<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>
(Only First Angle Projection is to be followed)					

**CLO1** The construction of geometrical figures

**CLO2** The projection of 1D, 2D & 3D elements

**CLO3** Sectioning of solids and development of surfaces

**CLO4** Preparation and interpretation of building drawing

**CLO5** Draw dimensioned orthographic and isometric projections of simple engineering objects.

**CLO6** Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism;

### **SEMESTER - III**

<b>MA 0211</b>	<b>MATHEMATICS - III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** The rudiments of Fourier series

**CLO2** The theory and problems of PDE

**CLO3** The applications of PDE to boundary value problems

**CLO4** Fourier transforms and to their branches of engineering

<b>CS 2001</b>	<b>DATA STRUCTURES USING C</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Implement the basic data structures and solve problems using fundamental algorithms.

**CLO2** Implement various search and sorting techniques.

**CLO3** Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.

**CLO4** Analyze, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

<b>CS 2003</b>	<b>DISCRETE STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Perform operations on various discrete structures such as set, function and relation.

**CLO2** Apply basic concepts of asymptotic notation in analysis of algorithm.

**CLO3** Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real-world problems.

**CLO4** Comprehend formal logical arguments and translate statements from a natural language into its symbolic structures in logic.

**CLO5** Identify and prove various properties of rings, fields and group.

<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.

**CLO3** Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.

**CLO4** Apply and create Relational Database Design process with Normalization and Denormalization of data.

**CLO5** Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins,

<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.

**CLO2** Describe the design of basic computer with instruction formats & addressing modes.

**CLO3** Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.

**CLO4** Interpret the concepts of pipelining, multiprocessors, and inter processor communication.

<b>CDV 2001</b>	<b>DEVELOPMENT AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	0	2

**CLO1** Understand the Automation.

**CLO2** Learn to interact with Linux Environment.

**CLO3** To understands the make and makefiles.

<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

<b>CS 2111</b>	<b>DBMS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

**CLO1:** Designing a database

**CLO2:** Using DDL and DML commands can create database

**CLO3:** Backing up of files can be done

**CLO4:** Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO5:** Formulate query, using SQL, solutions to a broad range of query and data update problems.

CS 2113	DATA STRUCTURES LAB	L	T	P	C
		0	0	2	1

**CLO1** Implementing Stack, Queue , Linked List , Binary tree

**CLO2** Sorting and Searching Techniques

**CLO3** Divide and Conquer, Dynamic Programming methods

**CLO4** Greedy method , Traversals and Backtracking

CDV 2115	DEVELOPMENT AUTOMATION Lab	L	T	P	C
		0	0	2	1

**CLO1** Understand the Automation.

**CLO2** Learn to interact with Linux Environment.

**CLO3** To understands the make and make files.

## SEMESTER - IV

CDV 2002	ADVANCE LINUX	L	T	P	C
		3	0	0	3



- CLO1** Understand the role of administrator.
- CLO2** Learn package management system.
- CLO3** Understand configuration and maintenance.

<b>CS 2006</b>	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

- CLO1:** Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.
- CLO2:** Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.
- CLO3:** Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.
- CLO4:** Examine and categories various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.
- CLO5:** Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

<b>CS 2008</b>	<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1** Implement the different tree structures algorithm and analyze in context of asymptotic notation.
- CLO2** Identify basic properties of graphs and apply their algorithms to solve real life problems.
- CLO3** Demonstrate the usage of algorithms under several categories like string matching, randomized algorithms and genetic algorithms.
- CLO4** Implement various advanced data structures using C/Java/Python or related languages.

<b>CDV 2004</b>	<b>BUILD and RELEASE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

- CLO1** Understand the dependency management.
- CLO2** Learn a release cycle.
- CLO3** Understand documentation and reporting.

PD 0202	PERSONALITY DEVELOPMENT - IV	L	T	P	C
		0	0	2	1

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

CS 2114	OPERATING SYSTEMS LAB	L	T	P	C
		0	0	2	1

**CLO1:** Scheduling algorithms

**CLO2:** Deadlock algorithms and page replacement algorithms

**CLO3:** Memory management schemes, Thread and synchronization

**CLO4:** To study the process management and scheduling.

**CLO5:** Understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.

CS 2118	ANALYSIS & DESIGN OF ALORITHMS LAB	L	T	P	C
		0	0	2	1

**CLO1** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

CDV 2118	ADVANCE LINUX Lab	L	T	P	C
		0	0	2	1

- CLO1** Understand the role of administrator.
- CLO2** Learn package management system.
- CLO3** Understand configuration and maintenance.

<b>CDV 2120</b>	<b>BUILD and RELEASE MANAGEMENT LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

- CLO1** Understand the dependency management.
- CLO2** Learn a release cycle.
- CLO3** Understand documentation and reporting.

### **SEMESTER - V**

<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1:** Design and construction of compilers and knowledge of working of major phases of compilation.
- CLO2:** Construct parsers.
- CLO3:** Implement a simple compiler for a language chosen.
- CLO4:** Classify various parameters passing scheme, explain memory management of a programming languages and perform code optimization.

<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

- CLO1** Conceptualise and explain the functionality of the different layers within a network architecture
- CLO2** Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies, subnetting and routing mechanism.
- CLO3** Demonstrate the operation of various routing protocols and their performance analysis.
- CLO4** Illustrate design and implementation of datalink, transport and network layer protocols within a simulated/real networking environment.

CS 3005	THEORY OF COMPUTATION	L	T	P	C
		3	1	0	4

**CLO1:** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2:** Disambiguate context-free grammars by mastering the concepts of context-free languages and push down automata.

**CLO3:** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

**CLO4:** Solve analytical problems in related areas of theory in computer science

CDV 3007	Cont. Integration and Cont. Deployment/ Incl of Engg. Practices	L	T	P	C
		3	1	0	4

**CLO1** Understand the Integration and Continuous deployment.

**CLO2** Learn anatomy of continuous delivery pipeline.

**CLO3** Understands static code analysis.

CDV 3009	AGILE PRACTICES	L	T	P	C
		3	0	0	3

**CLO1** Understand common Agile Practices in DevOps.

**CLO2** Learn its programming.

**CLO3** Understand test driven development.

PD 0301	PERSONALITY DEVELOPMENT - V	L	T	P	C
		0	0	2	1

**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently.

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

CS 3113	COMPUTER NETWORK LAB	L	T	P	C
		0	0	2	1

**CLO1:** Understand the requirements of an enterprise and outline its major design areas

**CLO2:** Identify functional areas to construct high level modules for enterprise architecture and analyze them.

**CLO3:** Know about the networking devices, prepare a bill of materials and configure the devices as per the Core, Access and Distribution layers

**CLO4:** Design the Server Farm for an enterprise network and discuss up gradations if needed.

**CLO5:** Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.

**CLO6:** Test and monitor the enterprise network using a tool

<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

<b>CS 3117</b>	<b>COMPILER DESIGN LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**CLO2:** To gain basic knowledge of Compiler, Assembler, Linker, Loader and Macro.

**CLO3:** Analyse and understand the fundamentals of the design of Compilers by applying mathematics and engineering principles.

**CLO4:** Design a system for parsing the sentences in a compiler grammar and developing a symbol table.

<b>CDV 3113</b>	<b>Cont. Integration and Cont. Deployment LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand common Agile Practices in DevOps.

**CLO2** Learn its programming.

**CLO3** Understand test driven development.

<b>CDV 3115</b>	<b>PROJECT PHASE-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

#### **SEMESTER - VI**

<b>CS 3002</b>	<b>ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Learn the basics and applications of artificial intelligence and categorize various problem domains, basic knowledge representation and reasoning methods.

**CLO2:** Analyze basic and advanced search techniques including game playing, evolutionary search algorithms, and constraint satisfaction. Learn and design intelligent agents for concrete computational problems.

**CLO3:** Design of programs in AI language(s).

**CLO4:** Acquire knowledge about the architecture of an expert system and design new expert systems for real life applications.

<b>CDV 3004</b>	<b>TEST AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand testing in DevOps.

**CLO2** Learn its approaches to testing.

**CLO3** Understand to design test cases.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CDV 3006</b>	<b>APPLICATION CONTAINERIZATION</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
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**CLO1** Understand containers in DevOps.

**CLO2** Learn its containerization.

**CLO3** Understand orchestration tools.

<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to assess the overall knowledge level of Computer Science and engineering standards and guide them to take corrective measures where deficiencies are detected.

**CLO2:**Types of reading strategies to enhance improve reading skills

**CLO3:**Role of writing skills in effective communication

**CLO4:** Learn Advantages & Disadvantages of written communication

<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT - VI</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

<b>CS 3114</b>	<b>ARTIFICIAL INTELLIGENCE LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To implement Heuristic functions & Propositional Logic

**CLO2:** Design to implement A\* & AO\* algorithms

**CLO3:** Implement an Expert system for medical diagnosis

**CLO4:**To teach the fundamental techniques and principles in achieving the concepts of machine learning and AI.

**CLO5:** Enable students to have skills that will help them to solve complex real-world problems regarding Artificial Intelligence.

<b>CDV 3112</b>	<b>TEST AUTOMATION LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CL01** Understand testing in DevOps.

**CL02** Learn its approaches to testing.

**CL03** Understand to design test cases.

<b>CDV 3114</b>	<b>APPLICATION CONTAINERIZATION LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CL01** Understand containers in DevOps.

**CL02** Learn its containerization.

**CL03** Understand orchestration tools.

<b>CIB 3116</b>	<b>PROJECT PHASE - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CL01** Master the basic concepts and appreciate the applications of database systems.

**CL02** Master the basics of SQL and construct queries using SQL.

**CL03** Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.

**CL04** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.

**CL05** Master sound design principles for logical design of databases, including the E-R method and normalization approach.

**CL06** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.

**CL07** Master the basics of query evaluation techniques and query optimization.

**CL08** Be familiar with the basic issues of transaction processing and concurrency control.

**CL09** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

## **SEMESTER - VII**



<b>CDV 4001</b>	<b>System Provisioning and Configuration Management incl more focus on cloud/Puppet/chef/cloud agnostic(terraform)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand provisioning on Cloud.

**CLO2** Learn automation, preventing errors, tracking of changes.

**CLO3** Understand configuration management.

CS 4115	INDUSTRIAL TRAINING - II	L	T	P	C
		0	0	2	1
(Training to be undergone after VI Semester)					

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

<b>CS 4117</b>	<b>MINOR PROJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

**CLO1:** Identify, formulate and analyze existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

<b>CDV 4121</b>	<b>Sys. Provisioning and Confi. Management Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand provisioning on Cloud.

**CLO2** Learn automation, preventing errors, tracking of changes.

**CLO3** Understand configuration management.

### **SEMESTER - VIII**

<b>CDV 4002</b>	<b>SYSTEM MONITORING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	4

**CLO1** Understand tenets of system monitoring.

**CLO2** Learn core components of monitoring tools.

**CLO3** Understand monitoring strategies.

<b>CDV 4004</b>	<b>APPLIED DEVOPS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	2	2

**CLO1** Understand applied DevOps.

**CLO2** Learn real world applications of DevOps.

**CLO3** Understand its practical examples.

<b>CS 4114</b>	<b>PROJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	16	8

**CLO1** Identify, formulate and analyze existing problems in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contributes to an ethical and professional work culture and also to learn to work in diverse teams.

### **SYLLABUS OF DEPARTMENTAL ELECTIVES**

CS 3020	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Able to Knowledge and understanding

**CLO2** Outline the potential benefits of distributed systems

**CLO3** Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

**CLO4** Cognitive skills (thinking and analysis).

**CLO5** Apply standard design principles in the construction of these systems

**CLO6** Select appropriate approaches for building a range of distributed systems, including some that employ middleware

**CLO7** Communication skills (personal and academic).

**CLO8** Practical and subject specific skills (Transferable Skills).

CS 3022	<b>SYSTEM SOFTWARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** Understand the relationship between system software and machine architecture.

**CLO2:** Know the design and implementation of assemblers

**CLO3:** Learn the design and implementation of linkers and loaders.

**CLO4:** To have an understanding of macro processors.

**CLO5:** Analyse an understanding of system software tools.

CS 3024	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Able to Describe and apply basic concepts related to software project planning, scope and feasibility.

**CLO2** Analyze various project estimation techniques, especially size estimation (FP), effort estimation (COCOMO models), schedule estimation (GANTT charts), and cost estimation.

**CLO3** Illustrate the concept of team structure and project communication management.

**CLO4** Acquire knowledge about quality assurance, quality control, and risk management.

**CLO5** Describe various project management activities such as tracking, project procurement, configuration management, monitoring.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CS 3026</b>	<b>GRID COMPUTING</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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**CLO1** Understand the genesis of grid computing

**CLO2** To know the application of grid computing

**CLO3** Understand the technology and tool kits for facilitating grid computing

**CLO4** Enabling technologies such as high-speed links and storage area networks for building computer grids;

**CLO5** Utilize grid computing and clustering middleware, such as Parallel Virtual Machine (PVM), Message Passing Interface (MPI), HPC Portals, and Peer-to-Peer networks for implementing virtual super computing resources;

**CLO6** To design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research;

**CLO7** To install a grid computing environment; develop communications skills and accept the code of professional conduct and practice through short presentations and group work.

<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Understanding Object Basics, Classes and Objects, Inheritance

**CLO2** How software objects are altered to build software systems that are more robust  
Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project

**CLO3** Understanding the issues and options in reuse

**CLO4** Using UML, a common language for talking about requirements, designs, and component interfaces

<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Expose the students to the concepts of feed forward neural networks

**CLO2:** To provide adequate knowledge about feedback networks.

**CLO3:** Teach about the concept of fuzziness involved in various systems.

**CLO4:** Get adequate knowledge about fuzzy set theory.

**CLO5:** To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

**CLO6:** Know adequate knowledge of application of fuzzy logic control to real time systems.

<b>CS 3032</b>	<b>CYBER SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Able to Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications/devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis

**CLO6** List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools

<b>CS 4019</b>	<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Able to Comprehend and implement various cryptographic algorithms to protect the confidential data.

**CLO2** Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.

**CLO3** Apply security tools to locate and fix security leaks in a computer network/software.

**CLO4** Secure a web server and web application

**CLO5** Configure firewalls and IDS

CS 4021	BIG DATA & ANALYTICS	L	T	P	C
		3	1	0	4

**CLO1:** Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

**CLO2:** Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

**CLO3:** Implement several Data Intensive tasks using the Map Reduce Paradigm

**CLO4:** Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

**CLO5:** Design algorithms to analyze big data like streams, Web.

CS 4023	WIRELESS ADHOC AND SENSOR NETWORK	L	T	P	C
		3	1	0	4

**CLO1:** Understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

**CLO2:** Know the principles and characteristics of wireless sensor networks (WSNs).

**CLO3:** how proactive protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO4:** Student understands how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO5:** Understands how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO6:** Learn how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO7:** Students are familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO8:** Know acquired skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

CS 4025	DATA WAREHOUSING & DATA MINING	L	T	P	C
		3	1	0	4

**CLO1:** Data pre-processing and data quality.

**CLO2:** Modeling and design of data warehouses.

**CLO3:** Algorithms for data mining.

**CLO4:** Design data warehouse with dimensional modeling and apply OLAP operations.

<b>CS 4027</b>	<b>MOBILE COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Grasp the concepts and features of mobile computing technologies and applications

**CLO2** Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Identify the important issues of developing mobile computing systems and applications

**CLO4** Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

**CLO5** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

**CLO6** Organize and manage software built for deployment and demonstration.

<b>CS 4029</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.

**CLO2** Apply decision tree learning, bayesian learning and artificial neural network in real world problems.

**CLO3** Understand the use of genetic algorithms and genetic programming.

**CLO4** Apply inductive and analytical learning with perfect domain theories.

**CLO5** Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

<b>CS 4031</b>	<b>OPEN SOURCE SOFTWARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Understand concepts, strategies, and methodologies related to open source software development.

**CLO2** Understand the business, economy, societal and intellectual property issues of open source software.

**CLO3** Be familiar with open source software products and development tools currently available on the market.

**CLO4** Be able to utilize open source software for developing a variety of software applications, particularly Web applications.

<b>CS 4033</b>	<b>SOFTWARE TESTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO2** Implement various test processes for quality improvement

**CLO3** Design test planning.

**CLO4** Manage the test process

**CLO5** Apply the software testing techniques in commercial environment

**CLO6** Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques

<b>CS 4035</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** To Learn the Internet Programming, using Java Applets

**CLO2** To create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CLO3** Apply event handling on AWT and Swing components.

learn to access database through Java programs, using Java Data Base Connectivity (JDBC)

**CLO4** Create dynamic web pages, using Servlets and JSP.

**CLO5** Make a reusable software component, using Java Bean.

**CLO6** Invoke the remote methods in an application using Remote Method Invocation (RMI).

**CLO7** Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

**CLO8** Develop Stateful, Stateless and Entity Beans.

**CLO9** Use Struts frameworks, which gives the opportunity to reuse the codes for quick development.



**CLO10** Map Java classes and object associations to relational database tables with Hibernate mapping files

### SYLLABUS OF OPEN ELECTIVES

LE 0201	GERMAN LANGUAGE PHASE - I	L	T	P	C
		2	0	0	2

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

LE 0205	FRENCH LANGUAGE PHASE - I	L	T	P	C
		2	0	0	2

**CLO1:** Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

LE 0202	GERMAN LANGUAGE PHASE - II	L	T	P	C
		2	0	0	2

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>LE 0206</b>	<b>FRENCH LANGUAGE PHASE - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	0	2

**CLO1:** Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

<b>CS 2012</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Get familiar with numerical solution of equations

**CLO2** Exposed to finite differences and interpolation

**CLO3** To be thorough with the numerical Differentiation and integration

**CLO4** To find numerical solutions of ordinary differential equations

**CLO5** Had to be thorough with probability concepts and the corresponding distributions.

**CLO6** Get exposed to the testing of hypothesis using distributions.

<b>MB 2002</b>	<b>ENGINEERING ECONOMICS AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** To apply theoretical economic concepts to practical business situation and to take decisions in the Industrial Engineering Situation.

**CLO2:** An Engineer must demonstrate knowledge and understanding of the

engineering and management

**CLO3:** Principle and Apply these to Engineering work environment, as a member and leader in a team,

**CLO4:** To manage projects and in multidisciplinary environments.

<b>MB 2004</b>	<b>INDUSTRIAL MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** Students will be able to perform the Management Functions.

**CLO2:** They can be able to compare selected Theories of Management.

**CLO3:** To perform the functions in the Marketing Mix.

**CLO4:** Students will be able to use basic Business Application Software.

**CLO5:** To assess ethical issues in Business situations.

<b>MB 2006</b>	<b>RELIABILITY AND QUALITY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** Apply the Concept of SQC in Process Control for Reliable Component Production

**CLO2:** To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management

**CLO3:** Identify risks, manage the change to assure quality in projects.

**CLO4:** Extract and analyse software requirements specifications for different projects.

<b>ET 2002</b>	<b>PRODUCTION AND OPERATION MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Able to Apply problem-solving and critical-thinking skills as required in materials and operations management.

**CLO2:** Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.

**CLO3:** To meet the specified needs with appropriate consideration for the public health and safety,

**CLO4:** Learn management principles and apply these to Engineering work environment,

<b>ET 2004</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Gain Knowledge and Skills needed to run a Business Successfully.

**CLO2:** Understand the different support system for business development.

**CLO3:** Get knowledge and acquire skill for setting up an enterprise and learn how the management works.

**CLO4:** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

<b>ET 2006</b>	<b>NON-CONVENTIONAL ENERGY RESOURCES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Acquired knowledge about different energy resources.

**CLO2:** Ability to convert the energy from one form to another form.

**CLO3 :** Learn how to use these energy resources

**CLO4:** Develop new effective to utilize energy

<b>ET 2008</b>	<b>NANOTECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** The various opportunities in the emerging field of nano electronics and nano technologies

**CLO2:** To know advantages and disadvantages of nano particles

**CLO3:** Analyse new technologies emerges with nanotechnology

**CLO4:** To know new and faster kinds of computers, more efficient power sources and life-saving medical treatment

# **CURRICULUM & SYLLABUS**



**CHOICE BASED CREDIT SYSTEM (CBCS)**  
**FOR**  
**BACHELOR OF TECHNOLOGY (B.Tech)**  
**(4 Year Undergraduate Degree Programme)**  
**IN**  
**COMPUTER SCIENCE AND ENGINEERING**

**In IOT & Blockchain in association with IBM**  
**[w. e. f. 2019-2020]**

**SEMESTER - I**

LE 0101	TECHNICAL ENGLISH - I	L	T	P	C
		1	0	2	2

**CL01** Understand and appreciate the need of communication training.

**CL02** Use different strategies of effective communication.

**CL03** Select the most appropriate mode of communication for a given situation.

**CL04** Speak assertively and effectively.

**CL05** Correspond effectively through different modes of written communication.

**CL06** Write effective reports, proposals and papers.

**CL07** Present himself/ herself professionally through effective resumes and interviews.

<b>MA 0101</b>	<b>MATHEMATICS - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** To apply advanced matrix knowledge to Engineering problems

**CLO2:** How to improve their ability in solving geometrical applications of differential calculus problems

**CLO3:** Understand equip themselves familiar with the functions of several variables

**CLO4:** To familiarize with the applications of differential equations

**CLO5:** Try expose to the concept of three dimensional analytical geometry

**CLO6:** Expose the students to the concept of convergence and divergence

**CLO7:** Learn to develop the ability to judge and apply appropriate tests to various infinite series

<b>PH 0101</b>	<b>PHYSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** To apply the Physics concepts in solving engineering problems

**CLO2:** How to educate scientifically the new developments in engineering and technology

**CLO3:** Try to emphasize the significance of Green technology through Physics principles

**CLO4:** An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.

<b>CY 0101</b>	<b>CHEMISTRY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** The role of applied chemistry in the field of engineering.

**CLO2:** Get knowledge of water quality parameters and the treatment of water.

**CLO3:** Understand principles involves in corrosion and its inhibitions.

**CLO4:** Important analytical techniques, instrumentation and the applications.

**CLO5:** Knowledge with respect to the phase equilibria of different systems.

<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1:** To know about different materials and their properties

**CLO2:** Understand engineering aspects related to buildings

**CLO3:** Learn importance of surveying and the transportation systems

**CLO4:** Get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

<b>CIB 1001</b>	<b>S/W FOUNDATION DIGITAL WORKFORCE SKILLS.</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Understand Models in emerging technologies and using basic tools for application development

**CLO2** Describe Model of Open Standard

**CLO3** Describe importance of security and scope.

**CLO4** Analyse Role of SQL queries

<b>PD 0101</b>	<b>PERSONALITY DEVELOPMENT- I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

<b>PH 0103</b>	<b>PHYSICS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand scientific concepts in measurement of different physical variables

**CLO2** Develop the skill in arranging and handling different measuring instruments and

**CLO3** Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

<b>CY 0103</b>	<b>CHEMISTRY LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand the basic concepts involved in the analyses

**CLO2:** Learn the basic concepts of measurement techniques.

**CLO3:** The synthesis, dynamics, chemical transformation and their applications

**CLO4:** To understand the route involved in the synthesis of chemical compounds, dynamics and related chemical transformation.

<b>GE 0107</b>	<b>NCC / NSS / NSO / YOGA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice.

**CLO2:** Understand discipline, gratitude towards country

**CLO3:** Practise YOGA poses and know how it is important

**CLO4:** Develop patriotic feeling for country



<b>CIB 1111</b>	<b>SOFTWARE FOUNDATION LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Understand Models in emerging technologies and using basic tools for application development

**CLO2** Describe Model of Open Standard

**CLO3 To** Describe importance of security and scope.

**CLO4** Analyse Role of SQL queries

<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**CLO1:** The basics of tools and equipment's used in fitting, carpentry, sheet metal, welding and smithy.

**CLO2:** The production of simple models in the above trades.

**CLO3:** Be aware of the safety precautions while working in the workshop.

**CLO4:** Use different measuring, marking, cutting tools used in the workshop.

## SEMESTER - II

<b>LE 0102</b>	<b>TECHNICAL ENGLISH - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>

**CLO1:** To provide for the acquisition of basic communication skills in English in relation to the requirements of the students of Engineering and Technology.

**CLO2:** Analyse facilitate the holistic, integrated development of LSRW involved in language learning through a series of intensely practical tasks and activities.

**CLO3:** Get offer professionally sustainable language content by which to address the special needs of the target learners to ensure that they are adequately equipped with discorsal and grammatical competencies.

**CLO4:** Try to help acquire the use of language simultaneously through the electronic media such as the Internet so as to enable the learners to deal effectively with E-materials.

**CLO5:** Use to expose the learners to a wide range of lexical and grammatical skills needed for their special professional demands.

<b>GE 0108</b>	<b>VALUE EDUCATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**CLO1** Help individuals think about and reflect on different values.

**CLO2** Deep understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.

**CLO3** Inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them

<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	0	2

**CLO1:** To familiarize the students with the basic organization of organisms and subsequent building to a living being.

**CLO2:** With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.

**CLO3:** Analyse to provide knowledge about biological problems that requires engineering expertise to solve them.

<b>MA 0102</b>	<b>MATHEMATICS - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** Solve the differential equations of first and 2nd order and basic application problems described by these equations.

**CLO2:** Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.

**CLO3:** Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.

**CLO4:** Solve systems of linear equations by using elementary row operations.

**CLO5:** Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the Eigen values and eigenvectors.

<b>PH 0102</b>	<b>MATERIAL SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**CLO1:** Understand electrical properties of materials,

**CLO2:** Learn the properties and applications of semi conducting materials,

**CLO3:** Analyse general properties and applications of magnetic and dielectric materials,

**CLO4:** Know the behaviour of materials on exposure to light,

**CLO5:** Understand general properties and application of modern engineering and bio materials, and get familiarized with the concepts of Nano Science and Technology.

<b>GE 0106</b>	<b>BASIC ENGINEERING - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**CLO1:** Understand the basic concepts of magnetic circuits, AC & DC circuits.

**CLO2:** Explain the working principle, construction, applications of DC & AC machines and measuring instruments.

**CLO3:** Gain knowledge about the fundamentals of wiring and earthing

**CLO4:** Fundamentals of electronic components, devices, transducers, Principles of digital electronics, and

**CLO5:** Principles of various communication systems

<b>LE 0104</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1** The importance of environmental education, ecosystem and ethics.

**CLO2** Knowledge with respect to biodiversity and its conservation.

**CLO3** Create awareness on various environmental pollution aspects and issues.

**CLO4** Educate the ways and means to protect the environment.

**CLO5** Important environmental issues and protection

<b>CIB 1004</b>	<b>PROGRAMMING WITH JAVA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Understand the vision of Object Oriented Programming from industry context.

**CLO2:** Apply Object Oriented Programming using Java using java I.D.E.

**CLO3:** Analyze multithreading programming of Java Language to create more robust and fast applications.

**CLO4:** Evaluate the application of Web Server and Application Server and how to deploy Web Applications.

**CLO5:** Build and create Web Applications using front end as html, css and java script and backend using Java Servlets and J.S.P(Java Server Pages). Creating projects by establishing database connection with IBM DB2 or MySql.

<b>PD 0102</b>	<b>PERSONALITY DEVELOPMENT - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

<b>PH 0104</b>	<b>MATERIAL SCIENCE LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** The students are expected to familiarize with various characterization techniques of materials.

**CLO2:** They should have developed better understanding of the underlying science behind the properties of various materials.

**CLO3:** To learn an introductory idea about new materials.

**CLO4:** To learn various types of fuels and their properties

<b>CIB 1114</b>	<b>JAVA LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Knowledge of the structure and model of the Java programming language

**CLO2** Use the Java programming language for various programming technologies (understanding)

**CLO3** Develop software in the Java programming language, (application)

**CLO4** Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)

**CLO5** Able to Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

**CLO6** Able to Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>3</b>	<b>3</b>

(Only First Angle Projection is to be followed)

**CLO1:** The construction of geometrical figures

**CLO2:** Learn the projection of 1D, 2D & 3D elements

**CLO3:** Sectioning of solids and development of surfaces

**CLO4:** Preparation and interpretation of building drawing

**CLO5:** Draw dimensioned orthographic and isometric projections of simple engineering objects.

**CLO6:** Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism;

### SEMESTER - III

MA 0211	MATHEMATICS - III	L	T	P	C
		3	1	0	4

**CLO1:** The rudiments of Fourier series

**CLO2:** Know the theory and problems of PDE

**CLO3:** The applications of PDE to boundary value problems

**CLO4:** Fourier transforms and to their branches of engineering

CS 2001	DATA STRUCTURES USING C	L	T	P	C
		3	1	0	4

**CLO1:** Implement the basic data structures and solve problems using fundamental algorithms. 2. Implement various search and sorting techniques.

**CLO2:** Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.

**CLO3:** Evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

**CLO4:** Enable them to write algorithms for solving problems with the help of fundamental data structures.

CS 2003	DISCRETE STRUCTURES	L	T	P	C
		3	1	0	4

**CLO1** Perform operations on various discrete structures such as set, function and relation.

**CLO2** Apply basic concepts of asymptotic notation in analysis of algorithm.

**CLO3** Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real-world problems.

**CLO4** Comprehend formal logical arguments and translate statements from a natural language into its symbolic structures in logic.

**CLO5** Identify and prove various properties of rings, fields and group.

<b>CS 2005</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.

**CLO2** Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.

**CLO3** Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.

**CLO4** Apply and create Relational Database Design process with Normalization and Denormalization of data.

**CLO5** Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins.

<b>CS 2007</b>	<b>COMPUTER ARCHITECTURE &amp; ORGANIZATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.

**CLO2** Describe the design of basic computer with instruction formats & addressing modes.

**CLO3** Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.

**CLO4** Interpret the concepts of pipelining, multiprocessors, and inter processor communication.

<b>CIB 2003</b>	<b>PROGRAMMING WITH PYTHON</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	0	2

**CLO1** Understand the basic concepts of Python

**CLO2** Learn how to write functions and pass arguments in Python

**CLO3** Design object- oriented programs with Python classes.

**CLO4** Define the structure and components of a Python program.

<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT - III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

**CLO1:** Acquire the important soft skills for employment

**CLO2:** Take part in group discussions and job interviews confidently

**CLO3:** Appear for placement aptitude tests confidently

**CLO4:** Gain self-confidence to face the placement process

CS 2111	DBMS LAB	L	T	P	C
		0	0	2	1

**CLO1:** Designing a database

**CLO2:** Using DDL and DML commands can create database

**CLO3:** Backing up of files can be done

**CLO4:** Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.

**CLO5:** Formulate query, using SQL, solutions to a broad range of query and data update problems.

CS 2113	DATA STRUCTURES LAB	L	T	P	C
		0	0	2	1

**CLO1** Implementing Stack, Queue , Linked List , Binary tree

**CLO2** Sorting and Searching Techniques

**CLO3** Divide and Conquer, Dynamic Programming methods

**CLO4** Greedy method , Traversals and Backtracking

CIB 2115	PYTHON PROGRAMMING LAB	L	T	P	C
		0	0	2	1

**CLO1** Understand the basic concepts of Python

**CLO2** Learn how to write functions and pass arguments in Python

**CLO3** Design object- oriented programs with Python classes.

**CLO4** Define the structure and components of a Python program.

#### SEMESTER - IV

CIB 2002	ESSENTIALS OF S/W ENGG. (OOAD & SW LIFECYCLE)	L	T	P	C
		3	0	0	3

**CLO1** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CLO2** Explain the different views of software architecture

**CLO3** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CLO4** Use the UML to represent the design model

<b>CS 2006</b>	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**CLO1:** Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

**CLO2:** Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.

**CLO3:** Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.

**CLO4:** Examine and categories various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.

**CLO5:** Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

<b>CS 2008</b>	<b>ANALYSIS AND DESIGN OF ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Implement the different tree structures algorithm and analyze in context of asymptotic notation.

**CLO2** Identify basic properties of graphs and apply their algorithms to solve real life problems.

**CLO3** Demonstrate the usage of algorithms under several categories like string matching, randomized algorithms and genetic algorithms.

**CLO4** Implement various advanced data structures using C/Java/Python or related languages.

<b>CIB 2004</b>	<b>APPLICATION DEVELOPMENT FOR CLOUD PLATFORMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**CLO1** Earn basic knowledge of Cloud Technologies in use today

**CLO2** Strategic plan to move applications and services to the Cloud

**CLO3** Understand Cloud Segments and Cloud Deployment Models



**CLO4** Importance of security in cloud computing

PD 0202	PERSONALITY DEVELOPMENT - IV	L	T	P	C
		0	0	2	1

**CLO1:** Understand guide thought process.

**CLO2:** Try to groom students' attitude.

**CLO3:** To develop communication skill.

**CLO4:** Develop self confidence.

CS 2114	OPERATING SYSTEMS LAB	L	T	P	C
		0	0	2	1

**CLO1:** Scheduling algorithms

**CLO2:** Deadlock algorithms and page replacement algorithms

**CLO3:** Memory management schemes, Thread and synchronization

**CLO4:** To study the process management and scheduling.

**CLO5:** Understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.

CS 2118	ANALYSIS & DESIGN OF ALGORITHMS LAB	L	T	P	C
		0	0	2	1

**CLO1** Contribute to a rapidly changing field by acquiring a thorough grounding in the core principles and foundations of computer science (e.g., techniques of program design, creation, and testing; key aspects of computer hardware; algorithmic principles).

**CLO2** Acquire a deeper understanding on (elective) topics of more specialized interest, and be able to critically review, assess, and communicate current developments in the field.

**CLO3** Prepare for the next step in their careers, for example, by having done a research project (for those headed to graduate school), a programming project (for those going into the software industry), or some sort of business plan (for those going into startups).

CIB 2118	FCEAD USING IBM RATIONAL TOOL LAB	L	T	P	C
		0	0	2	1

**CLO1** Apply an iterative, use case-driven, architecture-centric process to the development of a robust design model

**CLO2** Explain the different views of software architecture

**CLO3** Analyse the key mechanisms that are defined in support of that architecture, and the effect of the architecture and mechanisms on the produced design.

**CLO4** Use the UML to represent the design model

<b>CIB 2120</b>	<b>APPLICATION DEVELOPMENT FOR CLOUD PLATFORMS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Earn basic knowledge of Cloud Technologies in use today

**CLO2** Strategic plan to move applications and services to the Cloud

**CLO3** Understand Cloud Segments and Cloud Deployment Models

**CLO4** Importance of security in cloud computing

### **SEMESTER - V**

<b>CS 3001</b>	<b>COMPILER DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Design and construction of compilers and knowledge of working of major phases of compilation.

**CLO2:** Construct parsers.

**CLO3:** Implement a simple compiler for a language chosen.

**CLO4:** Classify various parameters passing scheme, explain memory management of a programming languages and perform code optimization.

<b>CS 3003</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Conceptualize and explain the functionality of the different layers within a network architecture

**CLO2:** Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies, subnetting and routing mechanism.

**CLO3:** Demonstrate the operation of various routing protocols and their performance analysis.

**CLO4:** Illustrate design and implementation of datalink, transport and network layer protocols within a simulated/real networking environment.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CS 3005</b>	<b>THEORY OF COMPUTATION</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
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**CLO1:** Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

**CLO2:** Disambiguate context-free grammars by mastering the concepts of context-free languages and push down automata.

**CLO3:** Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

**CLO4:** Solve analytical problems in related areas of theory in computer science

<b>CBD 3007</b>	<b>ESSENTIALS OF HADOOP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2:** Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3:** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4:** To understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5:** Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6:** Ability to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

<b>CIB 3009</b>	<b>IOT APPLICATION DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Unpacking Internet of Things

**CLO2** Getting introduced to IoT

**CLO3** Business Use cases of IoT

**CLO4** Embed various sensors with iot platform and simulate them on virtual simulation software proteus

**CLO5** Creating account on iot cloud platform and setting up communication between Arduino and cloud platform.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>PD 0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
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**CLO1** Acquire the important soft skills for employment

**CLO2** Take part in group discussions and job interviews confidently.

**CLO3** Appear for placement aptitude tests confidently

**CLO4** Gain self-confidence to face the placement process

<b>CS 3113</b>	<b>COMPUTER NETWORK LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Understand the requirements of an enterprise and outline its major design areas

**CLO2:** Identify functional areas to construct high level modules for enterprise architecture and analyze them.

**CLO3:** Know about the networking devices, prepare a bill of materials and configure the devices as per the Core, Access and Distribution layers

**CLO4:** Design the Server Farm for an enterprise network and discuss up gradations if needed.

**CLO5:** Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.

**CLO6:** Test and monitor the enterprise network using a tool

<b>CS 3115</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

<b>CS 3117</b>	<b>COMPILER DESIGN LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Demonstrate a working understanding of the process of lexical analysis, parsing and other compiler design aspects.

**CLO2:** To gain basic knowledge of Compiler, Assembler, Linker, Loader and Macro.

**CLO3:** Analyse and understand the fundamentals of the design of Compilers by applying mathematics and engineering principles.

**CLO4:** Design a system for parsing the sentences in a compiler grammar and developing a symbol table.

<b>CBD 3113</b>	<b>HADOOP LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1:** Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

**CLO2:** Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

**CLO3:** Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

**CLO4:** Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

**CLO5:** To recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

**CLO6:** learn to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

<b>CIB 3115</b>	<b>IOT APPLICATION DEVELOPMENT LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Unpacking Internet of Things

**CLO2** Getting introduced to IoT

**CLO3** Business Use cases of IoT

**CLO4** Embed various sensors with iot platform and simulate them on virtual simulation software proteus

**CLO5** Creating account on iot cloud platform and setting up communication between Arduino and cloud platform.

#### **SEMESTER - VI**

<b>CIB 3002</b>	<b>Associate Analytics-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Learn the terminology, technology and its applications.

**CLO2** Analyze basic concept of Analytics for Business

**CLO3** Learn the tools, technologies & programming languages which is used in day to day analytics cycle.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>CIB 3006</b>	<b>ARTIFICIAL INTELLIGENCE ANALYST</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
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**CLO1** Describe what Artificial Intelligence.

**CLO2** Learn about Machine Learning and NLP Concepts.

**CLO3** Understand and Framing NLC.

**CLO4** Design BOTs.

<b>CBD 3010</b>	<b>ADVANCED RDBMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1:** Master the basic concepts and appreciate the applications of database systems.

**CLO2:** Understand the basics of SQL and construct queries using SQL.

**CLO3:** Describe commercial relational database system (Oracle) by writing SQL using the system.

**CLO4:** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.

**CLO5:** learn sound design principles for logical design of databases, including the E- R method and normalization approach.

**CLO6:** Understand basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing.

**CLO7:** Acquire the basics of query evaluation techniques and query optimization.

**CLO8:** Be familiar with the basic issues of transaction processing and concurrency control.

**CLO9:** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

<b>CS 3112</b>	<b>COMPREHENSION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Able to assess the overall knowledge level of Computer Science and engineering standards and guide them to take corrective measures where deficiencies are detected.

**CLO2:**Types of reading strategies to enhance improve reading skills

**CLO3:**Role of writing skills in effective communication

**CLO4:** Learn Advantages & Disadvantages of written communication

<b>PD 0302</b>	<b>PERSONALITY DEVELOPMENT - VI</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

- CLO1** Acquire the important soft skills for employment
- CLO2** Take part in group discussions and job interviews confidently
- CLO3** Appear for placement aptitude tests confidently
- CLO4** Gain self-confidence to face the placement process

<b>CS 3118</b>	<b>ASSOCIATE ANALYST LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

- CLO1** To implement SQL Using R.
- CLO2** Try to Implement Data Visualization.
- CLO3** To implement Correlation & Regression Analysis.

<b>CIB 3112</b>	<b>ARTIFICIAL INTELLIGENCE ANALYST LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

- CLO1** Describe what Artificial Intelligence.
- CLO2** Learn about Machine Learning and NLP Concepts.
- CLO3** Understand and Framing NLC.
- CLO4** Design BOTs.

<b>CIB 3116</b>	<b>PROJECT PHASE - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	2	1

- CLO1** Master the basic concepts and appreciate the applications of database systems.
- CLO2** Master the basics of SQL and construct queries using SQL.
- CLO3** Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
- CLO4** Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.
- CLO5** Master sound design principles for logical design of databases, including the E-R method and normalization approach.
- CLO6** Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
- CLO7** Master the basics of query evaluation techniques and query optimization.
- CLO8** Be familiar with the basic issues of transaction processing and concurrency control.
- CLO9** (optional) Master working successfully on a team by design and development of a database application system as part of a team.

## SEMESTER - VII

<b>CIB 4001</b>	<b>BLOCKCHAINS DEVELOPER</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** Able to Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3** Explain blockchain software and its component

<b>CIB 4003</b>	<b>DEVOPS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**CLO1** To illustrate the interaction of multi-faceted fields like data mining, statistics and mathematics in the development of Predictive Analytics

**CLO2** Acquaint the student with the concepts of Ordinary Least Squares & Generalized Least Squares

**CLO3** To make the student familiar with various data clustering and dimension reduction techniques

CS 4115	INDUSTRIAL TRAINING - II	L	T	P	C
		0	0	2	1
(Training to be undergone after VI Semester)					

**CLO1:** To enable the students to gather a first-hand experience on site.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

**CLO4:** Identify, formulate and analyse existing problem in the (non-automated) work flow for performing a specific task.

<b>CS 4117</b>	<b>MINOR PROJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>



**CLO1:** Identify, formulate and analyze existing problem in the (non-automated) work flow for performing a specific task.

**CLO2:** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3:** Write technical reports.

**CLO4:** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5:** Contribute to an ethical and professional work culture and also to learn to work in diverse teams.

<b>CBD 4121</b>	<b>BLOCKCHAIN DEVELOPER LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

<b>CIB 4123</b>	<b>DEVOPS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

<b>CIB 4125</b>	<b>PROJECT WORK PHASE - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners.

**CLO2** Understand Ethereum Blockchain and learn Solidity programming language to develop Smart Contracts

**CLO3** Deploy private Blockchain on the web where you can visually see your chains & send transactions between nodes.

## SEMESTER - VIII

<b>CIB 4002</b>	<b>SECURITY INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Concepts & Principles of Security

**CLO2** Understand and apply Digital Identity and Identity Management

**CLO3** Introduce about Application Security

**CLO4** explain Data security

**CLO5** To understand Infrastructure Security**CLO6** To Identify Governance and data integration

**CLO7** Understand the secret server alerting and SIEM integration

<b>CIB 4112</b>	<b>SECURITY INTELLIGENCE LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**CLO1** Concepts & Principles of Security

**CLO2** Understand and apply Digital Identity and Identity Management

**CLO3** Introduce about Application Security

**CLO4** Explain Data security

**CLO5** Understand Infrastructure Security

**CLO6** Identify Governance and data integration

**CLO7** Understand the secret server alerting and SIEM integration

<b>CS 4114</b>	<b>PROJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**CLO1** Identify, formulate and analyze existing problems in the (non-automated) work flow for performing a specific task.

**CLO2** Design and implement automated solutions for the assigned/identified real world problems.

**CLO3** Write technical reports.

**CLO4** Practice and develop skills in time management and reporting within an industrial or research laboratory setting.

**CLO5** Contributes to an ethical and professional work culture and also to learn to work in diverse teams.

## SYLLABUS OF DEPARTMENTAL ELECTIVES

<b>CS 3020</b>	<b>DISTRIBUTED OPERATING SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CL01** Knowledge and understanding

**CL02** Outline the potential benefits of distributed systems

**CL03** Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

**CL04** Cognitive skills (thinking and analysis).

**CL05** Apply standard design principles in the construction of these systems

**CL06** Select appropriate approaches for building a range of distributed systems, including some that employ middleware

**CL07** Communication skills (personal and academic).

**CL08** Practical and subject specific skills (Transferable Skills).

<b>CS 3022</b>	<b>SYSTEM SOFTWARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CL01:** Understand the relationship between system software and machine architecture.

**CL02:** Know the design and implementation of assemblers

**CL03:** Learn the design and implementation of linkers and loaders.

**CL04:** To have an understanding of macro processors.

**CL05:** Analyse an understanding of system software tools.

<b>CS 3024</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CL01** Describe and apply basic concepts related to software project planning, scope and feasibility.

**CL02** Analyze various project estimation techniques, especially size estimation (FP), effort estimation (COCOMO models), schedule estimation (GANTT charts), and cost estimation.

**CL03** Illustrate the concept of team structure and project communication management.

**CL04** Acquire knowledge about quality assurance, quality control, and risk management.

**CL05** Describe various project management activities such as tracking, project procurement, configuration management, monitoring.

<b>CS 3026</b>	<b>GRID COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CL01** understand the genesis of grid computing

**CL02** To know the application of grid computing

**CLO3** Understand the technology and tool kits for facilitating grid computing

**CLO4** Enabling technologies such as high-speed links and storage area networks for building computer grids;

**CLO5** Utilize grid computing and clustering middleware, such as Parallel Virtual Machine (PVM), Message Passing Interface (MPI), HPC Portals, and Peer-to-Peer networks for implementing virtual super computing resources;

**CLO6** To design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research;

**CLO7** To install a grid computing environment; develop communications skills and accept the code of professional conduct and practice through short presentations and group work.

<b>CS 3028</b>	<b>OBJECT ORIENTED ANALYSIS &amp; DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Understanding Object Basics, Classes and Objects, Inheritance

**CLO2** How software objects are altered to build software systems that are more robust  
Gaining enough competence in object-oriented analysis and design (OOAD) to tackle a complete object oriented project

**CLO3** Understanding the issues and options in reuse

**CLO4** Using UML, a common language for talking about requirements, designs, and component interfaces

<b>CS 3030</b>	<b>NEURAL NETWORKS &amp; FUZZY LOGIC</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** Expose the students to the concepts of feed forward neural networks

**CLO2:** To provide adequate knowledge about feedback networks.

**CLO3:** Teach about the concept of fuzziness involved in various systems.

**CLO4:** Get adequate knowledge about fuzzy set theory.

**CLO5:** To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

**CLO6:** Know adequate knowledge of application of fuzzy logic control to real time systems.

<b>CS 3032</b>	<b>CYBER SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.

**CLO2** Underline the need of digital forensic and role of digital evidences.

**CLO3** Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.

**CLO4** Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications/devices like Windows/Unix system.

**CLO5** Apply the knowledge of IDS to secure network and performing router and network analysis

**CLO6** List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools

<b>CS 4019</b>	<b>NETWORK SECURITY &amp; CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Able to Comprehend and implement various cryptographic algorithms to protect the confidential data.

**CLO2** Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.

**CLO3** Apply security tools to locate and fix security leaks in a computer network/software.

**CLO4** Secure a web server and web application

**CLO5** Configure firewalls and IDS

<b>CS 4021</b>	<b>BIG DATA &amp; ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1:** Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

**CLO2:** Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.

**CLO3:** Implement several Data Intensive tasks using the Map Reduce Paradigm

**CLO4:** Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

**CLO5:** Design algorithms to analyze big data like streams, Web.

CS 4023	WIRELESS ADHOC AND SENSOR NETWORK	L	T	P	C
		3	1	0	4

**CLO1:** Understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.

**CLO2:** Know the principles and characteristics of wireless sensor networks (WSNs).

**CLO3:** how proactive protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO4:** Student understands how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO5:** Understands how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO6:** Learn how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

**CLO7:** Students are familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.

**CLO8:** Know acquired skills to design and implement a basic mobile ad hoc or wireless sensor network via simulations or programming of PDAs.

CS 4025	DATA WAREHOUSING & DATA MINING	L	T	P	C
		3	1	0	4

**CLO1:** Data pre-processing and data quality.

**CLO2:** Modeling and design of data warehouses.

**CLO3:** Algorithms for data mining.

**CLO4:** Design data warehouse with dimensional modeling and apply OLAP operations.

CS 4027	MOBILE COMPUTING	L	T	P	C
		3	1	0	4

**CLO1** Able to Grasp the concepts and features of mobile computing technologies and applications

**CLO2** Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support

**CLO3** Identify the important issues of developing mobile computing systems and applications

**CLO4** Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities

**CLO5** Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools

**CLO6** Organize and manage software built for deployment and demonstration.

<b>CS 4029</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.

**CLO2** Apply decision tree learning, bayesian learning and artificial neural network in real world problems.

**CLO3** Understand the use of genetic algorithms and genetic programming.

**CLO4** Apply inductive and analytical learning with perfect domain theories.

**CLO5** Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

<b>CS 4031</b>	<b>OPEN SOURCE SOFTWARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Understand concepts, strategies, and methodologies related to open source software development.

**CLO2** Understand the business, economy, societal and intellectual property issues of open source software.

**CLO3** Be familiar with open source software products and development tools currently available on the market.

**CLO4** Be able to utilize open source software for developing a variety of software applications, particularly Web applications.

<b>CS 4033</b>	<b>SOFTWARE TESTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs.

**CLO2** Implement various test processes for quality improvement

**CLO3** Design test planning.

**CLO4** Manage the test process

**CLO5** Apply the software testing techniques in commercial environment

**CLO6** Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques

CS 4035	ADVANCED JAVA PROGRAMMING	L	T	P	C
		3	1	0	4

**CLO1** To Learn the Internet Programming, using Java Applets

**CLO2** To create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings

**CLO3** Apply event handling on AWT and Swing components.

learn to access database through Java programs, using Java Data Base Connectivity(JDBC)

**CLO4** Create dynamic web pages, using Servlets and JSP.

**CLO5** Make a reusable software component, using Java Bean.

**CLO6** Invoke the remote methods in an application using Remote Method Invocation (RMI).

**CLO7** Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

**CLO8** Develop Stateful, Stateless and Entity Beans.

**CLO9** Use Struts frameworks, which gives the opportunity to reuse the codes for quick development.

**CLO10** Map Java classes and object associations to relational database tables with Hibernate mapping files

CS 4037	ASSOCIATE ANALYTICS - II	L	T	P	C
		3	1	0	4

**CLO1** Understand the terminology, technology and its applications

**CLO2** Explain the concept of Analytics for Business

**CLO3** Understand the tools, technologies & programming languages which is used in day to day analytics cycle





		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CS 4039</b>	<b>ASSOCIATE ANALYTICS - III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**CLO1** To Understand the terminology, technology and its applications

**CLO2** Knowledge the concept of Analytics for Business

**CLO3** Understand the tools, technologies & programming languages which is used in day to day analytics cycle

### **SYLLABUS OF OPEN ELECTIVES**

<b>LE 0201</b>	<b>GERMAN LANGUAGE PHASE - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>LE 0205</b>	<b>FRENCH LANGUAGE PHASE - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

<b>LE 0202</b>	<b>GERMAN LANGUAGE PHASE - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**CLO1:** Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**CLO2:** Understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

**CLO3:** Know the culture of the countries where the German language is spoken.

**CLO4:** Learn pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

<b>LE 0206</b>	<b>FRENCH LANGUAGE PHASE - II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	0	2

**CLO1:** Characterized by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

**CLO2:** Have Fluency in reading and writing.

**CLO3:** Use language creatively and spontaneously.

**CLO4:** Know the culture of the countries where the French language is spoken.

<b>CS 2012</b>	<b>COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1** Get familiar with numerical solution of equations

**CLO2** Exposed to finite differences and interpolation

**CLO3** To be thorough with the numerical Differentiation and integration

**CLO4** To find numerical solutions of ordinary differential equations

**CLO5** Had to be thorough with probability concepts and the corresponding distributions.

**CLO6** Get exposed to the testing of hypothesis using distributions.

<b>MB 2002</b>	<b>ENGINEERING ECONOMICS AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

**CLO1:** To apply theoretical economic concepts to practical business situation and to take decisions in the Industrial Engineering Situation.

**CLO2:** An Engineer must demonstrate knowledge and understanding of the engineering and management

**CLO3:** Principle and Apply these to Engineering work environment, as a member and leader in a team,

**CLO4:** To manage projects and in multidisciplinary environments.

<b>MB 2004</b>	<b>INDUSTRIAL MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1** Students will be able to perform the Management Functions.
- CLO2** Students will be able to compare selected Theories of Management.
- CLO3** Students will be able to perform the functions in the Marketing Mix.
- CLO4** Students will be able to use basic Business Application Software.
- CLO5** Students will be able to assess ethical issues in Business situations.

<b>MB 2006</b>	<b>RELIABILITY AND QUALITY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1:** Apply the Concept of SQC in Process Control for Reliable Component Production
- CLO2:** To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management
- CLO3:** Identify risks, manage the change to assure quality in projects.
- CLO4:** Extract and analyse software requirements specifications for different projects.

<b>ET 2002</b>	<b>PRODUCTION AND OPERATION MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1:** Apply problem-solving and critical-thinking skills as required in materials and operations management.
- CLO2:** Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.
- CLO3:** To meet the specified needs with appropriate consideration for the public health and safety,
- CLO4:** Learn management principles and apply these to Engineering work environment,

<b>ET 2004</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1:** Gain Knowledge and Skills needed to run a Business Successfully.
- CLO2:** Understand the different support system for business development.
- CLO3:** Get knowledge and acquire skill for setting up an enterprise and learn how the management works.
- CLO4:** To learn about and get an insight of Entrepreneurs and Entrepreneurship development.

<b>ET 2006</b>	<b>NON-CONVENTIONAL ENERGY RESOURCES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	1	0	4

- CLO1:** Acquired knowledge about different energy resources.
- CLO2:** Ability to convert the energy from one form to another form.

**CL03 :** Learn how to use these energy resources

**CL04:** Develop new effective to utilize energy

ET 2008	NANOTECHNOLOGY	L	T	P	C
		3	1	0	4

**CL01:** The various opportunities in the emerging field of nano electronics and nano technologies

**CL02:** To know advantages and disadvantages of nano particles.

**CL03:** Analyse new technologies emerges with nanotechnology.

**CL04:** To know new and faster kinds of computers, more efficient power sources and life-saving medical treatment.