## Department of Computer Science and Engineering

**Program: B.Tech- Computer Science Engineering**

**Regulation: R20** **Course Outcomes** **No. of Courses: 89**

| I-I Sem | Course: Communicative English |
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| CO-1 | Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information |
| CO-2 | Ask and answer general questions on familiar topics and introduce oneself/others |
| CO-3 | Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information |
| CO-4 | Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs |
| CO-5 | Form sentences using proper grammatical structures and correct word forms |
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| **I-I Sem** | **Course: Mathematics - I (Calculus And Differential Equations)** |
| CO-1 | Utilize mean value theorems to real life problems (L3) |
| CO-2 | Solve the differential equations related to various engineering fields (L3) |
| CO-3 | Familiarize with functions of several variables which is useful in optimization (L3) |
| CO-4 | Apply double integration techniques in evaluating areas bounded by region (L3) |
| CO-5 | Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems(L5 ) |
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| **I-I Sem** | **Course: Applied Physics** |
| CO-1 | Explain the need of coherent sources and the conditions for sustained interference (L2). Identify the applications of interference in engineering (L3). Analyze the differences between interference and diffraction with applications (L4). Illustrate the concept of polarization of light and its applications (L2). Classify ordinary refracted light and extraordinary refracted rays by their states of polarization (L2) |
| CO-2 | Explain various types of emission of radiation (L2). Identify the role of laser in engineering applications (L3). Describe the construction and working principles of various types of lasers (L1). Explain the working principle of optical fibers (L2). Classify optical fibers based on refractive index profile and mode of propagation (L2). Identify the applications of optical fibers in medical, communication and other fields (L2). Apply the fiber optic concepts in various fields (L3). |
| CO-3 | Describe the dual nature of matter (L1). Explain the significance of wave function (L2). Identify the role of Schrodinger's time independent wave equation in studying particle in onedimensional infinite potential well (L3). Identify the role of classical and quantum free electron theory in the study of electrical conductivity (L3). Classify the energy bands of solids (L2). |

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| CO-4 | Explain the concept of dielectric constant and polarization in dielectric materials (L2). Summarize various types of polarization of dielectrics (L2). Interpret Lorentz field and Claussius-Mosotti relation in dielectrics (L2). Classify the magnetic materials based on susceptibility and their temperature dependence (L2). Explain the applications of dielectric and magnetic materials (L2). Apply the concept of magnetism to magnetic devices (L3) |
| CO-5 | Outline the properties of charge carriers in semiconductors (L2). Identify the type of semiconductor using Hall effect (L2). Identify applications of semiconductors in electronic devices (L2). Classify superconductors based on Meissner's effect (L2). Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2) |
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| **I-I Sem** | **Course: Programming for Problem Solving using C** |
| CO-1 | To write algorithms and to draw flowcharts for solving problems |
| CO-2 | To convert flowcharts/algorithms to C Programs, compile and debug programs |
| CO-3 | To use different operators, data types and write programs that use two-way/ multi-way selection |
| CO-4 | To select the best loop construct for a given problem |
| CO-5 | To design and implement programs to analyze the different pointer applications |
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| **I-I Sem** | **Course: Computer Engineering Workshop** |
| CO-1 | Assemble and disassemble components of a PC |
| CO-2 | Construct a fully functional virtual machine, Summarize various Linux operating system commands, |
| CO-3 | Recognize characters & extract text from scanned images, Create audio files and podcasts |
| CO-4 | Apply knowledge for computer assembling and software installation. |
| CO-5 | Troubleshoot hardware and software level problems. |
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| **I-I Sem** | **Course: English Communication Skills Laboratory** |
| CO-1 | Apply the concepts of English Language effectively in spoken and written forms. |
| CO-2 | Rephrase the texts and respond appropriately |
| CO-3 | Take part confidently in various formal and informal contexts. |
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| **I-I Sem** | **Course: Applied Physics Lab** |
| CO-1 | Verify the theoretical formulations/concept of Physics. |
| CO-2 | Know the art of recording the observations of an experiment scientifically |

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| CO-3 | Handle and operate the various elements/ parts of experiments. |
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| **I-I Sem** | **Course : Programming for Problem Solving using C Lab** |
| CO-1 | Gains Knowledge on various concepts of a C language |
| CO-2 | Able to draw flowcharts and write algorithms |
| CO-3 | Able design and development of C problem solving skills |
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| **I-II** | **Course: Mathematics – II (Linear Algebra And Numerical Methods)** |
| CO-1 | Develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6) |
| CO-2 | Solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3) |
| CO-3 | Evaluate the approximate roots of polynomial and transcendental equations by different algorithms (L5) |
| CO-4 | Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3) |
| CO-5 | Apply numerical integral techniques to different Engineering problems (L3) |
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| **I-II** | **Course: Applied Chemistry (BS)** |
| CO-1 | Analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers. |
| CO-2 | Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion. |
| CO-3 | Synthesize nanomaterials for modern advances of engineering technology. Summarize the preparation of semiconductors; analyze the applications of liquid crystals and superconductors. |
| CO-4 | Analyze the principles of different analytical instruments and their applications. Design models for energy by different natural sources. |
| CO-5 | Obtain the knowledge of computational chemistry and molecular machines |
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| **I-II** | **Course: Computer Organization (ES)** |
| CO-1 | Demonstrate and understanding of the design of the functional units of a digital computer system |
| CO-2 | Relate Postulates of Boolean algebra and minimize combinational functions |
| CO-3 | Recognize and manipulate representations of numbers stored in digital computers |
| CO-4 | Build the logic families and realization of logic gates. |

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| CO-5 | Design and analyze combinational and sequential circuits |
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| **I-II** | **Course: Python Programming (ES)** |
| CO-1 | Develop essential programming skills in computer programming concepts like data types, containers |
| CO-2 | Apply the basics of programming in the Python language |
| CO-3 | Solve coding tasks related conditional execution, loops |
| CO-4 | Solve coding tasks related to the fundamental notions and techniques used in object oriented programming |
| CO-5 | Use functions and represent Compound data using Lists, Tuples and Dictionaries |
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| **I-II** | **Course: Data Structures (ES)** |
| CO-1 | Summarize the properties, interfaces, and behaviors of basic abstract data types |
| CO-2 | Discuss the computational efficiency of the principal algorithms for sorting & searching |
| CO-3 | Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs |
| CO-4 | Demonstrate different methods for traversing trees |
| CO-5 | Implement ADTs such as lists, graphs, search trees in C++ to solve problems |
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| **I-II** | **Course: Applied Chemistry Lab (BS)** |
| CO-1 | The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills |
| CO-2 | Learn and apply basic techniques used in chemistry laboratory for volumetric analysis; redox titrations with different indicators; EDTA titrations |
| CO-3 | Expose to different methods of chemical analysis and use of some commonly employed instruments. |
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| **I-II** | **Course: Python Programming Lab (ES)** |
| CO-1 | Develop essential programming skills in computer programming concepts like data types, containers |
| CO-2 | Apply the basics of programming in the Python language |
| CO-3 | Solve coding tasks related conditional execution, loops |

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| **I-II** | **Course: Data Structures Lab (ES)** |
| CO-1 | Use basic data structures such as arrays and linked list. |
| CO-2 | Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths. |
| CO-3 | Use various searching and sorting algorithms. |
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| **I-II** | **Course: Environmental Science** |
| CO-1 | Analyze the interrelationship between living organism and environment. |
| CO-2 | Understand the importance of environment by assessing its impact on the human world |
| CO-3 | Enrich the knowledge on themes of biodiversity, natural resources, pollution control and waste management |
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| **II-I** | **Course: Mathematics III (BS)** |
| CO-1 | Interpret the physical meaning of different operators such as gradient, curl and divergence (L5) |
| CO-2 | Estimate the work done against a field, circulation and flux using vector calculus (L5) |
| CO-3 | Apply the Laplace transform for solving differential equations (L3) |
| CO-4 | Find or compute the Fourier series of periodic signals (L3) |
| CO-5 | Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3) |
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| **II-I** | **Course: Object Oriented Programming through C++ (CS)** |
| CO-1 | Classify object oriented programming and procedural programming |
| CO-2 | Apply C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling |
| CO-3 | Build C++ classes using appropriate encapsulation and design principles |
| CO-4 | Apply object oriented or non-object oriented techniques to solve bigger computing problems |
| CO-5 | Understand tokens, expressions, and control structures. |
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| **II-I** | **Course: Operating Systems (ES)** |
| CO-1 | Describe various generations of Operating System and functions of Operating System |
| CO-2 | Describe the concept of program, process and thread and analyze various CPU Scheduling Algorithms and compare their performance |

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| CO-3 | Solve Inter Process Communication problems using Mathematical Equations by various methods |
| CO-4 | Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques |
| CO-5 | Outline File Systems in Operating System like UNIX/Linux and Windows |
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| **II-I** | **Course: Software Engineering (CS)** |
| CO-1 | Ability to transform an Object-Oriented Design into high quality, executable code |
| CO-2 | Skills to design, implement, and execute test cases at the Unit and Integration level |
| CO-3 | Compare conventional and agile software methods |
| CO-4 | Students will be able to decompose the given project in various phases of a lifecycle |
| CO-5 | Students will be able to choose appropriate process model depending on the user requirements. |
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| **II-I** | **Course: Mathematical Foundations of Computer Science ( CS)** |
| CO-1 | Demonstrate skills in solving mathematical problems |
| CO-2 | Comprehend mathematical principles and logic |
| CO-3 | Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software |
| CO-4 | Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software |
| CO-5 | Communicate effectively mathematical ideas/results verbally or in writing |
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| **II-I** | **Course: Object Oriented Programming through C++ Lab (CS)** |
| CO-1 | Apply the various oops concepts with the help of programs. |
| CO-2 | Describe and use constructors and destructors. |
| CO-3 | Use functions and pointers in your C++ program. |
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| **II-I** | **Course:Operating Systems Lab (CS)** |
| CO-1 | To use Unix utilities and perform basic shell control of the utilities |
| CO-2 | To use the Unix file system and file access contro |
| CO-3 | To use of an operating system to develop software |
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| **II-I** | **Course: Software Engineering Lab (CS)** |

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| CO-1 | By the end of this lab the student is able to elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project |
| CO-2 | Prepare SRS document, design document, test cases and software configuration management and risk management related document. |
| CO-3 | Develop function oriented and object oriented software design using tools like rational rose. |
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| **II-I** | **Course: Skill oriented Course - I 1) Applications of Python-numpy 2) Web Application Development Using Full Stack -Frontend Development –Module -I (SO)** |
| CO-1 | Understand the workings of various numerical techniques |
| CO-2 | Understand how to apply some linear algebra operations to n-dimensional arrays |
| CO-3 | Use numpy perform common data wrangling and computational tasks in Python |
| CO-4 | Explain how data is collected, managed and stored for processing |
| CO-5 | Understand the workings of different descriptive measures of Statistics, correlation and regression to solve the engineering problems |
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| **II-I** | **Course: Skill oriented Course - I 2) Web Application Development Using Full Stack -Frontend Development –Module -I (SO)** |
| CO-1 | Analyze a web page and identify its elements and attributes |
| CO-2 | Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet |
| CO-3 | Implement MVC and responsive design to scale well across PC, tablet and Mobile Phone |
| CO-4 | Create web pages using HTML and Cascading Style Sheets |
| CO-5 | Create Cascading Style Sheets |
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| **II-I** | **Course: Constitution of India (MC)** |
| CO-1 | Understand historical background of the constitution making and its importance for building a democratic India. |
| CO-2 | Understand the functioning of three wings of the government ie., executive, legislative and judiciary |
| CO-3 | Understand the value of the fundamental rights and duties for becoming good citizen of India. |
| CO-4 | Analyze the decentralization of power between central, state and local selfgovernment |

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| CO-5 | Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.<br>1. Know the sources, features and principles of Indian Constitution.<br>2. Learn about Union Government, State government and its administration.<br>3. Get acquainted with Local administration and Panchayati Raj.<br>4. Be aware of basic concepts and developments of Human Rights.<br>5. Gain knowledge on roles and functioning of Election Commission |
| **II-II** | **Course: Probability and Statistics(BS)** |
| CO-1 | Classify the concepts of data science and its importance (L4) or (L2) |
| CO-2 | Interpret the association of characteristics and through correlation and regression tools (L4) |
| CO-3 | Make use of the concepts of probability and their applications (L3) |
| CO-4 | Apply discrete and continuous probability distributions (L3) |
| CO-5 | Design the components of a classical hypothesis test (L6) |
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| **II-II** | **Course: Database Management Systems (CS)** |
| CO-1 | Describe a relational database and object-oriented database |
| CO-2 | Create, maintain and manipulate a relational database using SQL |
| CO-3 | Describe ER model and normalization for database design |
| CO-4 | Examine issues in data storage and query processing and can formulate appropriate solutions |
| CO-5 | Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage |
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| **II-II** | **Course: Formal Languages and Automata Theory (CS)** |
| CO-1 | Classify machines by their power to recognize languages. |
| CO-2 | Summarize language classes & grammars relationship among them with the help of Chomsky hierarchy |
| CO-3 | Employ finite state machines to solve problems in computing |
| CO-4 | Illustrate deterministic and non-deterministic machines |
| CO-5 | Quote the hierarchy of problems arising in the computer science |
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| **II-II** | **Course: Java Programming (ES)** |
| CO-1 | Able to realize the concept of Object Oriented Programming & Java Programming Constructs |
| CO-2 | Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords |

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| CO-3 | Apply the concept of exception handling and Input/ Output operations |
| CO-4 | Able to design the applications of Java & Java applet |
| CO-5 | Able to Analyze & Design the concept of Event Handling and Abstract Window Toolkit |
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| **II-II** | **Course: Managerial Economics and Financial Accountancy (HS)** |
| CO-1 | The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product |
| CO-2 | The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs |
| CO-3 | The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units |
| CO-4 | The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis |
| CO-5 | The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making |
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| **II-II** | **Course: Database Management Systems Lab (CS)** |
| CO-1 | Utilize SQL to execute queries for creating database and performing data manipulation operations |
| CO-2 | Examine integrity constraints to build efficient databases |
| CO-3 | Apply Queries using Advanced Concepts of SQL |
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| **II-II** | **Course: Programming Lab (CS)** |
| CO-1 | Access online resources for R and import new function packages into the R workspace |
| CO-2 | Import, review, manipulate and summarize data-sets in R |
| CO-3 | Explore data-sets to create testable hypotheses and identify appropriate statistical tests |
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| **II-II** | **Course: Java Programming Lab (CS)** |
| CO-1 | Evaluate default value of all primitive data type, Operations, Expressions, Controlflow, Strings |
| CO-2 | Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism |
| CO-3 | Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism |
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| **II-II** | **Course: Skill Oriented Course – II: Applications of Python-Pandas** |

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| CO-1 | Use Pandas to create and manipulate data structures like Series and dataframes. |
| CO-2 | Work with arrays, queries, and dataframes |
| CO-3 | Query dataframe structures for cleaning and processing and manipulating files |
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| **II-II** | **Course: Skill Oriented Course - II2) Web Application Development Using Full Stack -Frontend Development –Module –II(SO)** |
| CO-1 | Develop of the major Web application tier- Client side development |
| CO-2 | Participate in the active development of cross-browser applications through javascript |
| CO-3 | Develop java script applications that transition between states |
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| **III-I** | **Course: Computer Networks** |
| CO-1 | Demonstrate different network models for networking links OSI, TCP/IP, B-ISDN, N-BISDN and get knowledge about various communication techniques, methods and protocol standards. |
| CO-2 | Discuss different transmission media and different switching networks. |
| CO-3 | Analyze data link layer services, functions and protocols like HDLC and PPP. |
| CO-4 | Compare and Classify medium access control protocols like ALOHA, CSMA, CSMA/CD, CSMA/CA, Polling, Token passing, FDMA, TDMA, CDMA protocols |
| CO-5 | Determine application layer services and client server protocols working with the client server paradigms like WWW, HTTP, FTP, e-mail and SNMP etc. |
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| **III-I** | **Course: Design And Analysis of Algorithms (R203105PC01)** |
| CO-1 | Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms |
| CO-2 | List and describe various algorithmic approaches and Solve problems using divide and conquer &greedy Method |
| CO-3 | Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations. |
| CO-4 | Organize important algorithmic design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches |
| CO-5 | Demonstrate NP- Completeness theory ,lower bound theory and String Matching |
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| **III-I** | **Course: Data Warehousing And Data Mining** |
| CO-1 | Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications |
| CO-2 | Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms |

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| CO-3 | Choose appropriate classification technique to perform classification, model building and evaluation. |
| CO-4 | Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation. |
| CO-5 | Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result |
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| **III-I** | **Course: Optimization In Operations Research** |
| CO-1 | State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem |
| CO-2 | Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution. |
| CO-3 | Apply and Solve transportation and assignment problem by using Linear programming Simplex method. |
| CO-4 | Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions |
| CO-5 | Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution. |
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| **III-I** | **Course: Artificial Intelligence (Professional Elective –I)** |
| CO-1 | Understand the fundamental concepts in Artificial Intelligence |
| CO-2 | Analyze the applications of search strategies and problem reductions |
| CO-3 | Apply the mathematical logic concepts. |
| CO-4 | Develop the Knowledge representations in Artificial Intelligence |
| CO-5 | Explain the Fuzzy logic systems. |
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| **III-I** | **Course: Software Project Management (Professional Elective –I** |
| CO-1 | Apply the process to be followed in the software development life-cycle models |
| CO-2 | Apply the concepts of project management & planning |
| CO-3 | Implement the project plans through managing people, communications and change |
| CO-4 | Conduct activities necessary to successfully complete and close the Software projects |
| CO-5 | Implement communication, modeling, and construction & deployment practices in software development |
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| **III-I** | **Course: Distributed Systems (Professional Elective –I)** |
| CO-1 | Elucidate the foundations and issues of distributed systems |

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| CO-2 | Illustrate the various synchronization issues and globalstate for distributed systems |
| CO-3 | Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems |
| CO-4 | Describe the agreement protocols and fault tolerance mechanisms in distributed systems |
| CO-5 | Describe the features of peer-to-peer and distributed shared memory systems |
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| **III-I** | **Course: Advanced Unix Programming (Professional Elective –I)** |
| CO-1 | Gain good knowledge on Unix commands and awareness of shell programming |
| CO-2 | Know about different system calls for files and directories |
| CO-3 | Ability to know the working of processes and signals |
| CO-4 | Application of client server program for IPC |
| CO-5 | Knowledge about socket programming |
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| **III-I** | **Course: Data Warehousing And Data Mining Lab** |
| CO-1 | Design a data mart or data warehouse for any organization |
| CO-2 | Extract knowledge using data mining techniques and enlist various algorithms used in information analysis of Data Mining Techniques |
| CO-3 | Demonstrate the working of algorithms for data mining tasks such as association rule mining, classification for realistic data |
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| **III-I** | **Course: Computer Networks Lab** |
| CO-1 | Know how reliable data communication is achieved through data link layer |
| CO-2 | Suggest appropriate routing algorithm for the network. |
| CO-3 | Provide internet connection to the system and its installation. |
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| **III-I** | **Course: Animation Course: Animation Design (Skill Oriented Course)** |
| CO-1 | learn various tools of digital 2-D animation |
| CO-2 | understand production pipeline to create 2-D animation |
| CO-3 | apply the tools to create 2D animation for films and videos |
| CO-4 | understand different styles and treatment of content in 3D model creation |
| CO-5 | apply tools to create effective 3D modelling texturing and lighting |
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| **III-I** | **Course:Continuous Integration And Continuous Delivery Using Devops (Skill Oriented Course)** |
| CO-1 | Understand the why, what and how of DevOps adoption |
| CO-2 | Attain literacy on Devops |
| CO-3 | Align capabilities required in the team |
| CO-4 | Create an automated CICD pipeline using a stack of tools |
| CO-5 | Enhanced Efficiency and Productivity |
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| **III-I** | **Course: Employability Skills-I** |
| CO-1 | Understand the corporate etiquette. |
| CO-2 | Make presentations effectively with appropriate body language |
| CO-3 | Be composed with positive attitude |
| CO-4 | Understand the core competencies to succeed in professional and personal life |
| CO-5 | To develop communication skills |
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| **III-I** | **Course: Database Management Systems** |
| CO-1 | Describe a relational database and object-oriented database |
| CO-2 | Create, maintain and manipulate a relational database using SQL |
| CO-3 | Describe ER model and normalization for database design |
| CO-4 | Examine issues in data storage and query processing and can formulate appropriate solutions |
| CO-5 | Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage |
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| **III-II** | **Course: Machine Learning** |
| CO-1 | Explain the fundamental usage of the concept Machine Learning system |
| CO-2 | Demonstrate on various regression Technique |
| CO-3 | Analyze the Ensemble Learning Methods |
| CO-4 | Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning |
| CO-5 | Discuss the Neural Network Models and Fundamentals concepts of Deep Learning |
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| **III-II** | **Course:Compiler Design** |

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| CO-1 | Demonstrate phases in the design of compiler |
| CO-2 | Organize Syntax Analysis, Top Down and LL(1) grammars |
| CO-3 | Design Bottom Up Parsing and Construction of LR parsers |
| CO-4 | Analyze synthesized, inherited attributes and syntax directed translation schemes |
| CO-5 | Determine algorithms to generate code for a target machine |
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| **III-II** | **Course: Cryptography & Network Security(R203205PC03)** |
| CO-1 | Explain different security threats and countermeasures and foundation course of cryptography mathematics |
| CO-2 | Classify the basic principles of symmetric key algorithms and operations of some symmetric key algorithms and asymmetric key cryptography |
| CO-3 | Revise the basic principles of Public key algorithms and Working operations of some Asymmetric key algorithms such as RSA, ECC and some more |
| CO-4 | Design applications of hash algorithms, digital signatures and key management techniques |
| CO-5 | Determine the knowledge of Application layer, Transport layer and Network layer security Protocols such as PGP, S/MIME, SSL,TSL, and IPsec . |
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| **III-II** | **Course : Mobile Computing (Professional Elective-II)** |
| CO-1 | Develop a strong grounding in the fundamentals of mobile Networks |
| CO-2 | Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network |
| CO-3 | Comprehend, design, and develop a lightweight network stack |
| CO-4 | Analyze the Mobile Network Layer system working |
| CO-5 | Explain about the WAP Model |
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| **III-II** | **Course: Big Data Analytics (Professional Elective II)** |
| CO-1 | Illustrate big data challenges in different domains including social media, transportation, finance and medicine |
| CO-2 | Use various techniques for mining data stream |
| CO-3 | Design and develop Hadoop |
| CO-4 | Identify the characteristics of datasets and compare the trivial data and big data for various applications |
| CO-5 | Explore the various search methods and visualization techniques |
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| **III-II** | **Course: Object Oriented Analysis And Design (Professional Elective II)** |

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| CO-1 | Analyze the nature of complex system and its solutions |
| CO-2 | Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships |
| CO-3 | Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications |
| CO-4 | Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams. |
| CO-5 | Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems. |
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| **III-II** | **Course: Network Programming (Professional Elective II)** |
| CO-1 | Identifying different models and sockets |
| CO-2 | Demonstrate different TCP Echo server functions and I/O models |
| CO-3 | Rationalize IPV4 and IPV6 Socket options |
| CO-4 | Identifying daemon processing and Advanced input and output functions |
| CO-5 | Analyze Broadcasting and multicasting |
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| **III-II** | **Course: Mean Stack Development (Job Oriented Course)** |
| CO-1 | Build static web pages using HTML 5 elements. |
| CO-2 | Apply JavaScript to embed programming interface for web pages and also to perform Client side validations. |
| CO-3 | Build a basic web server using Node.js, work with Node Package Manager (NPM) and recognize the need for Express.js. |
| CO-4 | Develop JavaScript applications using typescript and work with document database using MongoDB. |
| CO-5 | Utilize Angular JS to design dynamic and responsive web pages. |
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| **III-II** | **Course: Machine Learning Using Python Lab** |
| CO-1 | Implement procedures for the machine learning algorithms |
| CO-2 | Design and Develop Python programs for various Learning algorithms |
| CO-3 | Apply appropriate data sets to the Machine Learning algorithms |
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| **III-II** | **Course: Compiler Design Lab** |
| CO-1 | Design simple lexical analyzers |

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| CO-2 | Determine predictive parsing table for a CFG |
| CO-3 | Apply Lex and Yacc tools |
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| **III-II** | **Course: Cryptography Network Security Lab** |
| CO-1 | Apply the knowledge of symmetric cryptography to implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher |
| CO-2 | Demonstrate the different algorithms like DES, BlowFish, and Rijndael, encrypt the text "Hello world" using Blowfish Algorithm. |
| CO-3 | Analyze and implement public key algorithms like RSA, Diffie-Hellman Key Exchange mechanism, the message digest of a text using the SHA-1 algorithm |
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| **III-II** | **Course: Big Data: Spark (Skill Oriented Course)** |
| CO-1 | Develop Map Reduce Programs to analyze large dataset Using Hadoop and Spark |
| CO-2 | Write Hive queries to analyze large dataset Outline the Spark Ecosystem and its components |
| CO-3 | Perform the filter, count, distinct, map, flatMap RDD Operations in Spark. |
| CO-4 | Build Queries using Spark SQL |
| CO-5 | Apply Spark joins on Sample Data Sets |
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| **III-II** | **Course:Mean Stack Technologies-Module I (Html 5, Javascript, Express.Js, Node.Js And Typescript) (Skill Oriented Course)** |
| CO-1 | Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video and CSS Styles. |
| CO-2 | Utilize JavaScript for developing interactive HTML web pages and validate form data |
| CO-3 | Build a basic web server using Node.js and also working with Node Package Manager (NPM). |
| CO-4 | Build a web server using Express.js |
| CO-5 | Make use of Typescript to optimize JavaScript code by using the concept of strict type checking. |
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| **III-II** | **Course: Employability Skills-II** |
| CO-1 | Solve various Basic Mathematics problems by following different methods |
| CO-2 | Follow strategies in minimizing time consumption in problem solving Apply shortcut methods to solve problems |
| CO-3 | Confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life |

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| CO-4 | Analyze, summarize and present information in quantitative forms including table, graphs and formulas |
| CO-5 | Be prepared for the personal interview through mock interviews while being aware of the various kinds of interviews. |
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| **III-II** | **Course: Data Structures And Algorithms** |
| CO-1 | Use basic data structures such as arrays and linked list. |
| CO-2 | Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths. |
| CO-3 | Use various searching and sorting algorithms. |
| CO-4 | Ability to program data structures and use them in implementations of abstract data types |
| CO-5 | Understanding of basic algorithmic complexity. |
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| **IV-I** | **Course: Cloud Computing (Professional Elective-III)** |
| CO-1 | Illustrate the key dimensions of the challenge of Cloud Computing |
| CO-2 | Classify the Levels of Virtualization and mechanism of tools. |
| CO-3 | Analyze Cloud infrastructure including Google Cloud and Amazon Cloud. |
| CO-4 | Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud |
| CO-5 | Assess control storage systems and cloud security, the risks involved its impact and develop cloud application |
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| **IV-I** | **Course:Neural Networks And Soft Computing (Professional Elective-III)** |
| CO-1 | Understand the concepts of Artificial intelligence and soft computing techniques |
| CO-2 | Analyze the concepts of Neural Networks and select the Learning Networks in modeling real world systems. |
| CO-3 | Implement the concepts of Fuzzy reasoning and concepts of Genetic algorithm and its applications to soft computing |
| CO-4 | Classify Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization |
| CO-5 | Design hybrid system incorporating neural network, genetic algorithms, fuzzy systems. |
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| **IV-I** | **Course: AD-HOC And Sensor Networks (Professional Elective-III)** |
| CO-1 | Evaluate the principles and characteristics of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks |
| CO-2 | Determine the principles and characteristics of wireless sensor networks |

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| CO-3 | Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc sensor networks. |
| CO-4 | Illustrate the various sensor network Platforms, tools and applications. |
| CO-5 | Demonstrate the issues and challenges in security provisioning and also familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs |
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| **IV-I** | **Course: Cyber Security & Forensics (Professional Elective-III)** |
| CO-1 | Explain the Cybercrime Fundamentals |
| CO-2 | Describe the types of attacks on networks |
| CO-3 | Analyze various tools available for Cybercrime Investigation |
| CO-4 | Explain the Computer Forensics and Investigation Fundamentals and tools |
| CO-5 | Analyze the legal perspectives of Cybercrime |
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| **IV-I** | **Course: Deep Learning Techniques (Professional Elective-IV)** |
| CO-1 | Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning |
| CO-2 | Discuss the Neural Network training, various random models. |
| CO-3 | Explain the Techniques of Keras ,Tensor Flow, Theano and CNTK |
| CO-4 | Classify the Concepts of CNN and RNN |
| CO-5 | Implement Interactive Applications of Deep Learning. |
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| **IV-I** | **Course: Social Networks & Semantic Web (Professional Elective-IV)** |
| CO-1 | Demonstrate social network analysis and measures |
| CO-2 | Analyze random graph models and navigate social networks data |
| CO-3 | Apply the network topology and Visualization tools |
| CO-4 | Analyze the experiment with small world models and clustering models |
| CO-5 | Compare the application driven virtual communities from social network Structure. |
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| **IV-I** | **Course: Computer Vision (Professional Elective-IV)** |
| CO-1 | Identify basic concepts, terminology, theories, models and methods in the field of computer vision |
| CO-2 | Describe known principles of feature detection and matching, |

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| CO-3 | Describe basic methods of computer vision related to image stitching, photography like high dynamic range imaging and blur removal. |
| CO-4 | Suggest a design of a computer vision system for a 3D Reconstruction, Albedos, image based rendering views and depths. |
| CO-5 | learn different techniques employed for the enhancement of images. |
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| **IV-I** | **Course: Block-Chain Technologies (Professional Elective-V)** |
| CO-1 | Demonstrate the block chain basics, Crypto currency |
| CO-2 | To compare and contrast the use of different private vs. public block chain and use cases |
| CO-3 | Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins |
| CO-4 | Classify Permission Block chain and use cases – Hyper ledger, Corda |
| CO-5 | Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others |
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| **IV-I** | **Course: Wireless Network Security (Professional Elective-V)** |
| CO-1 | Explain the Threats in networks and provide Authentication to real time problems |
| CO-2 | Identify and investigate in-depth both early and contemporary threats to wireless networks security |
| CO-3 | Ability to analyze and determine for any organization the database security requirements and appropriate solutions |
| CO-4 | Determined IP Security Issues and solve real time problems |
| CO-5 | Build wireless Development Strategies in real time issues |
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| **IV-I** | **Course: Ethical Hacking (Professional Elective-V)** |
| CO-1 | Explain the concepts related to hacking, ports and protocols, pen testing and virtualization |
| CO-2 | Determine the applicable footprinting techniques and scanning methods |
| CO-3 | Explain the process of system hacking and Explain the concepts Trojans, backdoors, worms and virus and it's countermeasures |
| CO-4 | Demonstrate systematic understanding of the concepts of Sniffing and Social Engineering and it's attacks |
| CO-5 | Determine the applicable methods of cryptography, stegnography and Vulnerability Assessment |
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| **IV-I** | **Course: Api And Microservices (Job Oriented Course)** |
| CO-1 | Develop a Spring Data JPA application with Spring Boot |

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| CO-2 | Implement CRUD operations using Spring Data JPA |
| CO-3 | Implement pagination and sorting mechanism using Spring Data JPA |
| CO-4 | Implement query methods for querying the database using Spring Data JPA |
| CO-5 | Implement a custom repository to customize a querying mechanism using Spring Data JPA |
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| **IV-I** | **Course: Secure Coding Techniques (Job Oriented Course)** |
| CO-1 | Differentiate the objectives of information security |
| CO-2 | Understand the trend, reasons and impact of the recent Cyber attacks |
| CO-3 | Understand OWASP design principles while designing a web application |
| CO-4 | Understand Threat modelling |
| CO-5 | Importance of security in all phases of SDLC |
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| **IV-I** | **Course: Python: Deep Learning (Skill Oriented Course)** |
| CO-1 | Demonstrate the basic concepts fundamental learning techniques and layers |
| CO-2 | Discuss the Neural Network training, various random models |
| CO-3 | Apply various optimization algorithms to comprehend different activation |
| CO-4 | Functions to understand hyper parameter tuning |
| CO-5 | Build a convolutional neural network, and understand its application to build a recurrent neural network, and understand its usage to comprehend auto encoders to briefly explain transfer learning |
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| **IV-I** | **Course: Mean Stack Technologies-Module Ii- Angular Js, Mongodb (Skill Oriented Course)** |
| CO-1 | Build a component-based application using Angular components and enhance their functionality using directives. |
| CO-2 | Utilize data binding for developing Angular forms and bind them with model data. |
| CO-3 | Apply Angular built-in or custom pipes to format the rendered data. |
| CO-4 | Develop a single page applic |
| CO-5 | Make use of MongoDB queries to perform CRUD operations on document database. |
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| **IV-I** | **Course: Software Engineering** |
| CO-1 | Ability to transform an Object-Oriented Design into high quality, executable code |

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| CO-2 | Skills to design, implement, and execute test cases at the Unit and Integration level |
| CO-3 | Compare conventional and agile software methods |
| CO-4 | Prepare SRS document, design document, test cases and software configuration management and risk management related document. |
| CO-5 | Develop function oriented and object oriented software design using tools like rational rose |
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| **IV-I** | **Course: Computational Thinking** |
| CO-1 | Describe the skills that are involved in computational thinking |
| CO-2 | Demonstrate the concepts of Boolean Logic and Software Development. |
| CO-3 | Analyze the concepts of algorithmic thinking as modeling and abstraction as encapsulation. |
| CO-4 | Illustrate the distinctive nature of data organization, White box and Black box testing. |
| CO-5 | Student will be aware of a range of applications of computational thinking in different disciplines, Authentication and authorization. |
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| **IV-I** | **Course: Object Oriented Programming Through Java** |
| CO-1 | To identify Java language components and how they work together in applications |
| CO-2 | To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries |
| CO-3 | To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications |
| CO-4 | Practice programming in the Java |
| CO-5 | Gain knowledge of object-oriented paradigm in the Java programming language |
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| **IV-I** | **Course: Artificial Intelligence** |
| CO-1 | Understand the fundamental concepts in Artificial Intelligence |
| CO-2 | Analyze the applications of search strategies and problem reductions |
| CO-3 | Apply the mathematical logic concepts |
| CO-4 | Develop the Knowledge representations in Artificial Intelligence |
| CO-5 | Explain the Fuzzy logic systems. |
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| **IV-I** | **Course: Unix And Shell Programming** |
| CO-1 | Gain good knowledge on Unix commands and awareness of shell programming |

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| CO-2 | Know about different system calls for files and directories |
| CO-3 | Ability to know the working of processes and signals |
| CO-4 | Application of client server program for IPC |
| CO-5 | Knowledge about socket programming |
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| **IV-I** | **Course: Cloud Computing** |
| CO-1 | Illustrate the key dimensions of the challenge of Cloud Computing |
| CO-2 | Classify the Levels of Virtualization and mechanism of tools |
| CO-3 | Analyze Cloud infrastructure including Google Cloud and Amazon Cloud. |
| CO-4 | Create Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud |
| CO 5 | Assess control storage systems and cloud security, the risks involved its impact and develop cloud application |
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| **IV-II** | **Course: Project** |
| CO-1 | Formulate., and apply mathematical, science and engineering principles to solve real time engineering problems |
| CO-2 | Test the existing data, communicate and conduct research on complex problems using modern tools |
| CO-3 | Validate the obtained results on contemprory issues related to society and environment |
| CO-4 | Determine effectively the engineering principles used intheir project individually and as a team as per the norms of engineering practice |
| CO-5 | Structure future work to promote life long learning in the context of technological adaptation. |

Principal
PRINCIPAL
AVANTHI INSTITUTE OF ENGG. & TECH
Cherukupally (V), Near Tagarapuvalasa Bridge
Bhogapuram (M), Vizianagaram (D)-531162