Department of Computer Science and Engineering

Program: B.Tech- Computer Science and Engineering

Regulation: R16 **Course Outcomes** **No. of Courses: 66**

I-I SEM	Course: English
CO-1	Using English languages, both written and spoken, competently and correctly.
CO-2	Improving comprehension and fluency of speech.
CO-3	Gaining confidence in using English in verbal situations.
CO-4	Choose a source of energy suitable for rural India.
CO-5	Create awareness in the reader as to the usefulness of animals for the human society.
CO-6	Acquisition of writing skills
I-I SEM	**Course: Mathematics - I**
CO-1	Solve linear differential equations of first, second and higher order.
CO-2	Determine Laplace transform and inverse Laplace transform of various functions and use Laplace transforms to determine general solution to linear ODE.
CO-3	Calculate total derivative, Jocobian and minima of functions of two variables.
CO-4	Evaluate double and triple integrals techniques over a region in two dimensional and three dimensional geometry
CO-5	Familiarize with special functions to evaluate some proper and improper integrals using beta and gamma functions
CO-6	Equip themselves familiar with the functions of several variables and mean value theorems
I-I SEM	**Course: Mathematics - II**
CO-1	Calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators.
CO-2	Compute interpolating polynomial for the given data.
CO-3	Solve ordinary differential equations numerically using Euler's and RK method.
CO-4	Find Fourier series and Fourier transforms for certain functions.
CO-5	Identify/classify and solve the different types of partial differential equations
CO-6	Solve partial differential equations of first order
I-I SEM	**Course: Applied Physics**
CO-1	Use physical reasoning to explain astronomical phenomena and solve problems pertaining to the solar system

CO-2	Synthesize how historical and modern astronomers arrive at their understanding of astronomical phenomena relevant to the solar system.
CO-3	Use celestial charts and models to be able to differentiate objects in the sky connected with solar system observations and beyond.
CO-4	Use modern planetary science data to evaluate current theories describing the processes and properties of select objects in the solar system.
CO-5	Communicate scientific ideas clearly and effectively, such as describing how to solve problems utilizing scientific reasoning, use of developmental quantitative methods, and acquired physical science knowledge and skills.
CO-6	Demonstrate their knowledge of the process of science by performing science practices.
I-I SEM	**Course: Computer Programming**
CO-1	Makes students gain a broad perspective about the uses of computers in engineering industry.
CO-2	Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO-3	Develops the ability to analyze a problem, develop an algorithm to solve it.
CO-4	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
CO-5	Introduces the more advanced features of the C language
CO-6	Introduces the Problems using Files
I-I SEM	**Course: Engineering Drawing**
CO-1	Use the drawing instruments effectively and able to dimension the given figures
CO-2	Appreciate the usage of engineering curves in tracing the paths of simple machine components
CO-3	Understand the concept of projection and acquire visualization skills, projection of points
CO-4	Draw the basic views related to projections of Lines, Planes
CO-5	Skills in Reading and Interpretation of Engineering Drawings.
CO-6	The course is aimed at developing Basic Graphic skills
I-I SEM	**Course: English - Communication Skills Lab - I**
CO-1	Better pronunciation and accent
CO-2	Ability to use functional English
CO-3	Competency in analytical skills and problem solving skills

I-I SEM	Course: Applied/Engineering Physics Lab
CO-1	Develop skills to impart practical knowledge in real time solution.
CO-2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO-3	Understand measurement technology, usage of new instruments and real time applications in engineering studies
I-I SEM	**Course: Computer Programming Lab**
CO-1	Know concepts in problem solving
CO-2	To do programming in C language
CO-3	To write diversified solutions using C language
I-II SEM	**Course: English -II**
CO-1	The lesson underscores that the ultimate aim of Education is to enhance wisdom.
CO-2	The lesson highlights Abdul Kalam's contributions to Indian science and the awards he received.
CO-3	The lesson enables the students to promote peaceful co-existence and universal harmony among people and society.
CO-4	The lesson imparts the students to manage different cultural shocks due to globalization
CO-5	The seminal contributions of Homi Jehangir Bhabha to Indian nuclear programme provide an aspiration to the readers to serve the nation and sterngthen it.
CO-6	The Scientific discoveries and inventions of Jagadish Chandra Bose provide inspiration to the readers to make their own contributions to science and technology, and strengthen the nation.
I-II SEM	**Course: Mathematics-III**
CO-1	Determine rank, Eigen values and Eigen vectors of a given matrix and solve simultaneous linear equations.
CO-2	Solve simultaneous linear equations numerically using various matrix methods.
CO-3	Determine double integral over a region and triple integral over a volume.
CO-4	Calculate gradient of a scalar function, divergence and curl of a vector function. Determine line, surface and volume integrals. Apply Green, Stokes and Gauss divergence theorems to calculate line, surface and volume integrals.
CO-5	Demonstrate basic knowledge of L.D.E.,P.D.E.,Vector & F.T.
CO-6	Show the understanding of impact of Engg.Mathematics on Mech.
I-II SEM	**Course: Applied Chemistry**

CO-1	To impart the understanding of fundamental principles, analytical methods and the technological aspects of modern chemistry
CO-2	To impart the understanding of fundamental principles, analytical methods and the technological aspects of modern chemistry.
CO-3	To emphasize on water chemistry and quality parameters of water.
CO-4	Appreciate the role and impact of chemistry in various engineering field
CO-5	Analyze engineering problems and also derive solution based on the knowledge of chemistry
CO-6	Select appropriate materials and processes for specific applications
I-II SEM	**Course: Object-Oriented Programming Through C++**
CO-1	Able to develop programs with reusability
CO-2	Develop programs for file handling.
CO-3	Handle exceptions in programming.
CO-4	Develop applications for a range of problems using object-oriented programming techniques.
CO-5	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
CO-6	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.
I-II SEM	**Course: Environmental Studies**
CO-1	Know the importance for the sustenance of the life and recognize the need to conserve the natural resources
CO-2	The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
CO-3	The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
CO-4	Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
CO-5	Understand the environmental legislations of India and the first global initiatives towards sustainable development.
CO-6	Self Sustaining Green Campus with Environment Friendly aspect of – Energy, Water and Wastewater reuse Plantation, Rain water Harvesting, Parking Curriculum
I-II SEM	**Course: Enigineering Mechanics**
CO-1	understand the concepts of engineering mechanics
CO-2	understand the vectorial representation of forces and moments

CO-3	Gain the knowledge regarding center of gravity and moment of inertia and apply them for practical problems.
CO-4	gain knowledge regarding various types of forces and reactions and tom draw free body diagram to quicker solutions for complicated problems.
CO-5	Gain knowledge in solving problems involving work and energy
CO-6	Gain knowledge on friction on equilibrium and its application.
I-II SEM	**Course: Applied / Engineering Chemistry Laboratory**
CO-1	Analyze the need, design and perform a set of experiments
CO-2	Learn and apply basic techniques used in chemistry laboratory for volumetric analysis; redox titrations with different indicators; EDTA titrations
CO-3	Enhance the thinking capabilities in the modern trends in Engineering & Technology
I-II SEM	**Course: English - Communication Skills Lab- II**
CO-1	Better pronunciation and accent
CO-2	Ability to use functional English
CO-3	Competency in analytical skills and problem solving skills
I-II SEM	**Course: Object-Oriented Programming Lab**
CO-1	Explain the organization of basic computer , its design and the design of control unit.
CO-2	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
CO-3	Understand dynamic memory management techniques
II-I SEM	**Course: Statistics With R Programming(1hs)**
CO-1	List motivation for learning a programming language.
CO-2	Access online resources for R and import new function packages into the R workspace.
CO-3	Import, review, manipulate and summarize data-sets in R.
CO-4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
CO-5	Perform appropriate statistical tests using R Create and edit visualizations.
CO-6	Demonstrate how to install and configure R Studio. Apply OOP concepts in R programming.

II-I SEM	Course: Mathematical Foundations Of Computer Science(2)
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	Manipulate and analyze data numerically and/or graphically using appropriate Software.
CO-5	Communicate effectively mathematical ideas/results verbally or in writing.
CO-6	Understand sets, relations, functions, and discrete structures. Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.
II-I SEM	**Course: Digital Logic Design(3)**
CO-1	Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.
CO-2	Understand the different switching algebra theorems and apply them for logic functions.
CO-3	Define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions.
CO-4	Define the other minimization methods for any number of variables Variable Entered Mapping (VEM) and Quine-mecluskey (QM) Techniques and perform an algorithmic reduction of logic functions.
CO-5	Design various combinational and sequential circuits such as encoders , decoders and counters using multiplexers, and flip – flops.
CO-6	Acquire knowledge about various logic gates and logic families and analyze basic circuits of these families.
II-I SEM	**Course: Python Programming(4)**
CO-1	Make Software easily right out of the box.
CO-2	Experience with an interpreted Language.
CO-3	Build software for real needs.
CO-4	Know prior Introduction to testing software.
CO-5	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
CO-6	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
II-I SEM	**Course: Data Structures Through C++ (5)**
CO-1	Distinguish between procedures and object oriented programming.

CO-2	Apply advanced data structure strategies for exploring complex data structures.
CO-3	Compare and contrast various data structures and design techniques in the area of Performance.
CO-4	Implement data structure algorithms through C++.
CO-5	Implement all data structures like stacks, queues, trees, lists and graphs and compare their Performance and trade offs.
CO-6	Incorporate data structures into the applications such as binary search trees, AVL and B Trees.
II-I SEM	**Course: Computer Graphics (6)**
CO-1	Describe the general software architecture of programs that use 3D computer graphics.
CO-2	Discuss hardware system architecture for computer graphics. This Includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co-processors
CO-3	Select among models for lighting/shading: Color, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourand, Phong).
CO-4	Extract scene with different clipping methods and its transformation to graphics display device.
CO-5	Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
CO-6	Render projected objects to naturalize the scene in 2D view and use of illumination models for this.
II-I SEM	**Course: Data Structures Through C++Lab(7)**
CO-1	Design and analyze the time and space efficiency of the data structure
CO-2	Identity the appropriate data structure for given problem
CO-3	Identify the appropriate data structures and algorithms for solving real world problems
II-I SEM	**Course: Python Programming Lab**
CO-1	Understand the basic concepts scripting and the contributions of scripting language
CO-2	Explore python especially the object oriented concepts, and the built in objects of Python.
CO-3	Create programming, Web applications, discrete event simulations
II-II SEM	**Course: Software Engineering(1)**
CO-1	Define and develop a software project from requirement gathering to implementation.
CO-2	Obtain knowledge about principles and practices of software engineering.

CO-3	Focus on the fundamentals of modeling a software project.
CO-4	Obtain knowledge about estimation and maintenance of software systems.
CO-5	Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
CO-6	Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
II-II SEM	**Course: Java Programming(2)**
CO-1	Understand Java programming concepts and utilize Java Graphical User Interface in Program writing.
CO-2	Write, compile, execute and troubleshoot Java programming for networking concepts
CO-3	Build Java Application for distributed environment.
CO-4	Design and Develop multi-tier applications.
CO-5	Identify and Analyze Enterprise applications.
CO-6	Design event driven GUI and web related applications which mimic the real word scenarios.
II-II SEM	**Course: Advanced Data Structures(3)**
CO-1	Understand and apply amortised analysis on data structures, including binary search trees, mergable heaps, and disjoint sets.
CO-2	Understand the implementation and complexity analysis of fundamental algorithms such as RSA, primality testing, max flow, discrete Fourier transform.
CO-3	Have an idea of applications of algorithms in a variety of areas, including linear programming and duality, string matching, game-theory
CO-4	Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quick sort.
CO-5	Implement the Stack ADT using both array based and linked-list based data structures.
CO-6	Summarize searching and sorting techniques and to describe stack,queue and linked list operation
II-II SEM	**Course: Computer Organization(4)**
CO-1	Understand the architecture of modern computer.
CO-2	Analyze the Performance of a computer using performance equation
CO-3	Understand the different instruction types.
CO-4	Calculate the effective address of an operand by addressing modes
CO-5	Understand how computer stores positive and negative numbers.

CO-6	Understand of how a computer performs arithmetic operation of positive and negative numbers.
II-II SEM	**Course: Formal Languages And Automata Theory(5)**
CO-1	Classify machines by their power to recognize languages,
CO-2	Employ finite state machines to solve problems in computing,
CO-3	Explain deterministic and non-deterministic machines,
CO-4	Comprehend the hierarchy of problems arising in the computer science
CO-5	Understand the basic properties of formal languages and grammars. Differentiate regular, context-free and recursively enumerable languages make grammars to produce strings from a specific language.
CO-6	Acquire concepts relating to the theory of computation and computational models including decidability and intractability.
II-II SEM	**Course: Principles Of Programming Languages(6)**
CO-1	Describe syntax and semantics of programming languages
CO-2	Explain data, data types, and basic statements of programming languages
CO-3	Design and implement subprogram constructs, Apply object - oriented, concurrency, and event handling programming constructs
CO-4	Develop programs in Scheme, ML, and Prolog
CO-5	Understand and adopt new programming languages
CO-6	Understand the programming paradigms of modern programming languages
II-II SEM	**Course: Advanced Data Structures Lab(7)**
CO-1	Implement heap and various tree structure like AVL, Red-black, B and Segment trees
CO-2	Solve the problems such as line segment intersection, convex shell and Voronoi diagram
CO-3	Develop programs for implementing trees and their traversal operations.
II-II SEM	**Course: Course: Java Programming Lab**
CO-1	Write programs for solving real world problems using java collection frame work
CO-2	Write programs using abstract classes and to write multithreaded programs.
CO-3	Write GUI programs using swing controls in Java.

III-I SEM	Course: Compiler Design(1)
CO-1	Acquire knowledge in different phases and passes of Compiler, and specifying different types of tokens by lexical analyzer, and also able to use the Compiler tools like LEX, YACC, etc.
CO-2	Apply the Parser and its types i.e. Top-down and Bottom-up parsers.
CO-3	Construction of LL, SLR, CLR and LALR parse table.
CO-4	Syntax directed translation, synthesized and inherited attributes
CO-5	Techniques for code optimization.
CO-6	Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.
III-I SEM	**Course: Unix Programming(2)**
CO-1	Do documentation that will demonstrate good organization and readability.
CO-2	File processing projects will require data organization, problem solving and research.
CO-3	Apply Scripts and programs will demonstrate simple effective user interfaces.
CO-4	Understand the basic concepts of UNIX Architecture and basic Commands.
CO-5	Understand different types of Files, File system and basic file system commands.
CO-6	Testing will demonstrate both black and glass box testing strategies.
III-I SEM	**Course: Object Oriented Analysis & Design Using Uml(3)**
CO-1	Find solutions to the complex problems using object oriented approach
CO-2	Represent classes, responsibilities and states using UML notation
CO-3	Identify classes and responsibilities of the problem domain
CO-4	Analyze information systems in real-world settings and to conduct methods such as interviews and observations
CO-5	Construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams implementation diagrams) using the appropriate notation.
CO-6	Identify techniques aimed to achieve the objective and expected results of a systems development process.
III-I SEM	**Course: Data Base Management Systems(4)**
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	Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage.
CO-6	Design and build database system for a given real world problem
III-I SEM	**Course: Operating Systems(5)**
CO-1	Design various Scheduling algorithms.
CO-2	Apply the principles of concurrency
CO-3	Design deadlock, prevention and avoidance algorithms.
CO-4	Compare and contrast various memory management schemes.
CO-5	Design and Implement a prototype file systems
CO-6	Perform administrative tasks on Linux Servers
III-I SEM	**Course: Unified Modeling Lab(6)**
CO-1	Understand the Case studies and design the Model.
CO-2	Understand how design patterns solve design problems
CO-3	Develop design solutions using creational patterns.
III-I SEM	**Course: Operating Sysems And Linux Programming Lab(7)**
CO-1	Know the usage ofunix utilities and perform basic shell control of the utilities
CO-2	Know Unix file system and file access control.
CO-3	Demonstrate the use of an operating system to develop software
III-I SEM	**Course: Data Base Management System Lab(8)**
CO-1	Understand, appreciate and effectively explain the underlying concepts of database technologies
CO-2	Design and implement a database schema for a given problem-domain
CO-3	Design and implement a database schema for a given problem-domain
III-I SEM	**Course: Professional Ethics And Human Values(9)**
CO-1	Understand a variety issues that are encountered by every professional in discharging professional duties.

CO-2	Provide the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.
CO-3	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
CO-4	Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.
CO-5	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
CO-6	Assess their own ethical values and the social context of problems
III-II SEM	**Course: Computer Networks(1)**
CO-1	Understand OSI and TCP/IP models
CO-2	Analyze MAC layer protocols and LAN technologies
CO-3	Design applications using internet protocols
CO-4	Understand routing and congestion control algorithms
CO-5	Understand how internet works
CO-6	Understand Network Layer, Routing Algorithms, Congestion control algorithms, Internetworking, and Internet Protocol (IP).
III-II SEM	**Course: Data Ware Housing And Data Mining(2)**
CO-1	Understand stages in building a Data Warehouse
CO-2	Understand the need and importance of preprocessing techniques
CO-3	Understand the need and importance of Similarity and dissimilarity techniques
CO-4	Analyze and evaluate performance of algorithms for Association Rules.
CO-5	Analyze Classification and Clustering algorithms
CO-6	Appreciate the strengths and limitations of various data mining and data warehousing models
III-II SEM	**Course: Design And Analysis Of Algorithms(3)**
CO-1	Analyze of algorithms using inductive proofs and invariants.
CO-2	Analyze worst-case running times of algorithms using asymptotic analysis.
CO-3	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-andconquer algorithms. Derive and solve recurrences describing the performance of divideand-conquer algorithms.

CO-4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm.
CO-5	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.
CO-6	Synthesize dynamic programming algorithms, and analyze them.
III-II SEM	**Course: Software Testing Methodologies(4)**
CO-1	Understand the basic testing procedures.
CO-2	Support in generating test cases and test suites
CO-3	Test the applications manually by applying different testing methods and automation tools.
CO-4	Apply tools to resolve the problems in Real time environment.
CO-5	Analyze requirements to determine appropriate testing strategies.
CO-6	Evaluate the limitations of a given testing process and provide a succinct summary of those limitations.
III-II SEM	**Course: Artificial Intelligence(Open Elective)**
CO-1	Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
CO-2	Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
CO-3	Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
CO-4	Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.
CO-5	Apply AI techniques to real-world problems to develop intelligent systems.
CO-6	Select appropriately from a range of techniques when implementing intelligent systems
III-II SEM	**Course: Internet Of Things(Open Elective)**
CO-1	Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things
CO-2	Identify vulnerabilities, including recent attacks, involving the Internet of Things
CO-3	Develop critical thinking skills
CO-4	Compare and contrast the threat environment based on industry and/or device type
CO-5	Implement interfacing of various sensors with Arduino/Raspberry pi.

CO-6	Demonstrate the ability to transmit data wirelessly between different devices.
III-II SEM	**Course: Cyber Security(Open Elective)**
CO-1	Understand Cyber Security architecture principles
CO-2	Identify System and application security threats and vulnerabilities
CO-3	Identify different classes of attacks
CO-4	Apply Cyber Security incidents to appropriate response
CO-5	Describe risk management processes and practices
CO-6	Evaluate decision making outcomes of Cyber Security scenarios
III-II SEM	**Course: Digital Signal Processing(Open Elective)**
CO-1	Apply knowledge of Mathematics, science, and engineering
CO-2	Design and conduct experiments and interpret data
CO-3	Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
CO-4	Apply function as part of a multi-disciplinary team
CO-5	Understand the LTI system characteristics and Multirate signal processing.
CO-6	Analyze the inter-relationship between DFT and various transforms.
III-II SEM	**Course: Embedded Systems(Open Elective)**
CO-1	Acquire a basic knowledge about fundamentals of microcontrollers.
CO-2	Design, implement and test an embedded system. Identify the unique characteristics of real-time systems
CO-3	Define the unique design problems and challenges of real-time systems
CO-4	Acquire knowledge about basic concepts of circuit emulators
CO-5	Develop programming skills in embedded systems for various applications.
CO-6	Acquire knowledge about devices and buses used in embedded systems.
III-II SEM	**Course: Software Testing Lab**
CO-1	Find practical solutions to the problems
CO-2	Solve specific problems alone or in teams
CO-3	Manage a project from beginning to end

III-II SEM	**Course: Data Ware Housing And Data Mining Lab**
CO-1	Know the process and important issues around data cleaning, pre-processing and integration
CO-2	Know the principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction..
CO-3	Understand the functionality of the various data mining and data warehousing component
III-II SEM	**Course: Intellectual Property Rights And Patents**
CO-1	Apply IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents.
CO-2	Acquire knowledge of insight on Copyrights, Patents and Software patents which are instrumental for further advancements
CO-3	Identify different types of Intellectual Properties (ips), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
CO-4	Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
CO-5	Analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.
CO-6	Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
IV SEM -I	**Course: Cryptography And Network Security(1)**
CO-1	Develop a familiarity with distributed file systems.
CO-2	Describe important characteristics of distributed systems and the salient architectural features of such systems.
CO-3	Describe the features and applications of important standard protocols which are used in distributed systems
CO-4	Gain practical experience of inter-process communication in a distributed environment
CO-5	Understand key management and distribution schemes and design User Authentication
CO-6	Design network application security schemes, such as PGP, S/ MIME, ipsec, SSL, TLS, HTTPS, SSH, etc.
IV SEM -I	**Course: Management Science**
CO- 1	Acquire the knowledge on management functions, global leadership and organizational behavior.
CO-2	Understand the concepts of functional management project management and strategic management.

CO-3	Know basic issues of management like decision making and planning.
CO-4	Organize theories and models which are the important infrastructures of the management field.
CO-5	Determine EOQ
CO-6	Know concepts of HRM in Recruitment, Selection, Training & Development . Able to develop PERT/CPM Charts for projects of an enterprise and estimate time & cost of project.
IV SEM -I	**Course: Machine Learning**
CO-1	Recognize the characteristics of machine learning that make it useful to real-world problem
CO-2	Characterize machine learning algorithms as supervised, semi-supervised, and Unsupervised.
CO-3	Apply few machine learning toolboxes
CO-4	Use support vector machines.
CO-5	Use regularized regression algorithms.
CO-6	Understand the concept behind neural networks for learning non-linear functions
IV SEM -I	**Course: Concurrent And Parallel Programming (Elective - 3)**
CO-1	Understand the improvement of CPP concepts presented
CO-2	Know the number of reinforcement–exercises assigned
CO-3	Learn the time required for the resolution of exercises
CO-4	Apply compliance level with the new model of theoretical teaching
CO-5	Know the difference between the shared memory model for threads and the distributed memory model for processes
CO-6	Apply parallelism to optimise performance of algorithms
IV SEM -I	**Course: Artificial Neural Networks (Elective-3)**
CO-1	Design the offer as a graduate-level/ final year undergraduate level elective subject to the students of any branch of engineering/ science, having basic foundations of matrix algebra, calculus and preferably (not essential) with a basic knowledge of optimization.
CO-2	Research desirous of working on pattern recognition and classification, regression and interpolation from sparse observations; control and optimization are expected to find this course useful.
CO-3	Start with some mathematical foundations and the structures of artificial neurons, which mimics biological neurons in a grossly scaled down version.
CO-4	Develop concepts of multilayer perceptrons with back propagation learning.

CO-5	Use artificial neural networks (ANN) for problems pertaining to classification (supervised/ unsupervised) and regression.
CO-6	Learn mechanisms through ANN.
IV SEM -I	**Course: Operation Research (Elective - 3)**
CO-1	Apply methodology of Operations Research
CO-2	Solve linear programming methods, duality, and sensitivity analysis.
CO-3	Learn Integer Programming
CO-4	Analyze Network flows.
CO-5	Learn Multi-criteria decision techniques.
CO-6	Make Decision under uncertainty and risk
IV SEM -II	**Course: Distributed Systems**
CO-1	Understand the design principles in distributed systems and the architectures for distributed systems.
CO-2	Apply various distributed algorithms related to clock synchronization, concurrency control..
CO-3	Apply various distributed algorithms related to deadlock detection, load balancing, voting etc
CO-4	Analyze fault tolerance and recovery in distributed systems and algorithms for the same.
CO-5	Analyze the design and functioning of existing distributed systems and file systems.
CO-6	Implement different distributed algorithms over current distributed platforms
IV SEM -II	**Course: Management Science**
CO-1	Apply the fundamental knowledge and exposure to concepts theories and practices in the field of Management.
CO-2	Understand the work techniques of Organizations to ensure success and timely completion of tasks
CO-3	Understand the importance of motivation in building a strong and competitive Business Organization.
CO-4	Understand the importance of Leaders and Leadership in the context of Business Organizations
CO-5	Understand the different Determinants of Individual Behavior and how these can be used for the benefit of the Organization
CO-6	Demonstrate critical thinking, modelling, and problem-solving skills in a variety of contexts.
IV SEM -II	**Course: Machine Learning**
CO-1	Appreciate the importance of visualization in the data analytics solution

CO-2	Apply structured thinking to unstructured problems
CO-3	Understand a very broad collection of machine learning algorithms and problems
CO-4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
CO-5	Develop an appreciation for what is involved in learning from data.
CO-6	Finally, How to construct a learning machine
IV SEM -II	**Course: Operation Research**
CO-1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
CO-2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods
CO-3	Find the initial basic feasible and optimal solution of the Transportation problems
CO-4	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
CO-5	Model competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
CO-6	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems
IV SEM -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.

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