CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)
FOR
BACHELOR OF TECHNOLOGY (B.Tech.)
(4 Year Undergraduate Degree Programme)
IN
COMPUTER SCIENCE& ENGINEERING [w. e. f. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
39, Rajiv Gandhi Education City,
Sonepat Haryana-131029

COMPUTER SCIENCE AND ENGINEERING(CORE)

(w.e.f. Session 2024-25 onwards)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING FACULTY OF ENGINEERING AND TECHNOLOGY

SRM UNIVERISTY DELHI-NCR, SONEPAT

FACULTY OF ENGINEERING AND TECHNOLOGY

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (FEPEOs)

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.

FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES (FEPLOs)

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.

MAPPING OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES

AND FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES	**FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES**
Advancement to a professional position by virtue of their knowledge, skills and attitude.	1. An ability to identify, formulate, and solve real time engineering and 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.
Recognition for solving engineering problems and developing design solutions that consider safety and sustainability	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
Work as successful professionals in diverse engineering disciplines	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;
Increasing responsibilities of technical and managerial leadership in their work organizations;	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;
Professional development through a commitment to career-long learning.	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.

MAPPING MATRIX OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES AND ENGINEERING PROGRAM LEARNING OUTCOMES

(TABULAR FORMAT)

MAPPING	FEPELO1	FEPLO2	FEPLO3	FEPLO4	FEPLO5	FEPLO6	FEPLO7
FEPEO1	√	√					
FEPEO2		√	√				
FEPEO3			√	√			
FEPEO4				√	√	√	
FEPEO5						√	√

B.TECH - COMPUTER SCIENCE AND ENGINEERING GRADUATES EMPLOYABILITY ATTRIBUTES

EA 1: Sound Knowledge & Skill of Domain Area: Ability to demonstrate problems related with mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program

EA 2: Problem solving skills: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

EA 3: Cognitive and Analytical skills: Cognitive& Analytical skills help engineering graduates interpret data, remember team goals. These skills help them recall previous information that may relate to their organization's goals and help them make important connections between old and new information so that they can work more effectively.

EA 4: Design Thinking: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, economic, environmental, cultural and societal considerations.

EA 5: **Transferrable Skills:** Transferable skills are skills and abilities that are relevant and helpful across different areas of life: socially & professionally.

- **Interpersonal skills to work in diverse group:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
- **Communication Skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such abilities include reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
- **Positive attitude and thinking:** An ability to have positive attitude and thinking in challenging situations.
- **Adaptability:** Adapts learning strategies to new conditions. Recognizes parallels, analogies or similarities of new situations to more familiar situations.

- **Learn to Learn:** Learn ⟶ Unlearn ⟶ Relearn: An ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.

EA6: Information technology skills: An ability to create, select, adapt, and extend appropriate techniques, resources, and modern ICT tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

EA7: Sustainable Consumption and Production: the demands for system upgrades (domestic and commercial) as well as the move to continuous provision of service (e.g. domestic devices that are always powered and available) needs to be balanced with the views of sustainable consumption and production. Server based solutions – such as Google Docs (Google Docs, 2009) 0– can be considered as one way of addressing such concerns where individuals need not upgrade their own machines as regularly and install local applications (with subsequent updates).

B.TECH - COMPUTER SCIENCE AND ENGINEERING PROGRAMME 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.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMME LEARNING OUTCOMES (PLOs)

PLO1-Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and IC design and technology concepts towards modelling and prototyping Integrated systems.

PLO2-Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PLO3-Design/development of solutions: Design methodology to offer hardware solutions to public health, safety and agriculture, consumer electronics along with cultural, societal, and environmental considerations.

PLO4-Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PLO5-Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PLO6-The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PLO7-Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PLO8-Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PLO9-Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PLO10-Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehended write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO11-Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply the set one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PLO12-Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

SEMESTER - I & SEMESTER - II

ENGINEERING MATHEMATICS-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS101	
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 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.

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS201	
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.

ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	
Course Code: 24AS102/202	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING PHYSICS LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)

Course Code: 24AS103/203	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

FUNDAMENTALS OF COMPUTER & C PROGRAMMING (COMMON TO ALL BRANCHES)	
Course Code:24CS101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

C PROGRAMMING LAB (COMMON TO ALL BRANCHES)	
Course Code: 24CS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EC101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code:23EE151/24EC151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

BASIC ELECTRICAL ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EE101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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

COMMUNICATIVE ENGLISH (COMMON TO ALL BRANCHES)	
Course Code: 24HS101/201	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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.

COMMUNICATIVE ENGLISH LAB (COMMON TO ALL BRANCHES)	
Course Code:21HS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

INDIAN CONSTITUTION & POLITY (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24HS102/202	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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 an bala2ces. **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.

YOGA & PHYSICALEDUCATION Practices (COMMON TO ALL BRANCHES EXCEPT)	
Course Code:21SE151	
Credits: 1	
L T P: 0 0 2	
Prerequisite: Nil	

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

BASIC MECHANICAL ENGINEERING (Common to all Branches)	
Course Code: 23ME101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC MECHANICAL ENGINEERING LAB (Common to all Branches)	
Course Code: 23ME151/23 CS151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

MECHANICAL WORKSHOP LAB (Common to all Branches)	
Course Code: 23ME152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

ENGINEERING GRAPHICS & DESIGN LAB (Common to all Branches)	
Course Code: 23ME153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

CLO1 Understand orthographic projections of point sand 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 sand draw its projections

SEMESTER - III

ENGINEERING MATHEMATICS – III	
Course Code: 23AS301	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- Solve different types of partial differential equations.
- Find solutions of boundary value problems including heat and wave equations.
- Apply and analyze Fourier transforms with different applications.
- Evaluate the problems using z-transforms.
- Understand linear algebra and its application to Engineering.

- The rudiments of Fourier series
- The theory and problems of PDE
- The applications of PDE to boundary value problems

DATA STRUCTURE	
Course Code: 24CS2001	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Define linear and non-linear data structures. 2. Implement linear and non–linear data structure operations. 3. Use appropriate linear/non–linear data structure operations for solving a given problem. 4. Apply appropriate graph algorithms for graph applications. 5. Analyze the various searching and sorting algorithms.

COMPUTER ARCHITECTURE & ORGANIZATION	
Course Code: 24CSPE2007	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode. 2. Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities. 3. Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations. 4. Understand the need for an interface and instruction cycle phases. Implement the hardwiredand microprogrammed control unit for analyse the performance. 5. 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.

DATABASE MANAGEMENT SYSTEMS	
Course Code: 23CS2005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems. 2. Design the database schema with the use of appropriate data types for storage of data in database 3. Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries. 4. 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. 5. Understand and apply the concept of transaction, concurrency control and recovery in database. 6. Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 21CS2111	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
1. To explain basic database concepts, applications, data models, schemas and instances. 2. To demonstrate the use of constraints and relational algebra operations. And describe the basics of SQL and construct queries using SQL. 3. To emphasize the importance of normalization in databases. 4. To facilitate students in Database design. 5. To familiarize issues of concurrency control and transaction management.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. 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. 2. Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database. 3. Formulate query, using SQL, solutions to a broad range of query and data update problems. 4. Design and implement database applications on their own. 5. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL. 6. Analyze and Select storage and recovery techniques of database system.

DATA STRUCTRUES LAB	
Course Code: 24CS2113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Implement Linear data structure algorithms.
2. Implement applications using Stacks and Linked lists
3. Implement Binary Search tree and AVL tree operations.
4. Implement graph algorithms.

5. Analyze the various searching and sorting algorithms.

PROGRAMMING IN PYTHON	
Course Code: 24CS2007	Continuous Evaluation: 40 Marks
Pre-Requisite : Basic Programming Fundamentals	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Describe basics of Python, syntax, data types, and control structures for programming skills.
2. Implement input/output operations, functions, and operators to solve real-world problems.
3. Develop object-oriented programs using classes, modules, and exception handling to solve computation problem.
4. Construct files, utilize packages, and apply regular expressions for robust data handling.
5. Interpreting data using Python libraries like NumPy, Pandas, and Matplotlib for visualization.

PYTHON PROGRAMMING LAB	
Course Code: 24CS2015	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:

1. Understand and comprehend the basics of python programming, and built-in data structures list, sets, tuples, and dictionary.
2. Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
3. Understand and use the concept of Exception Handling, Operators, Expressions, and Arrays.
4. Focuses on working with different file formats (text, CSV, JSON) and using libraries like NumPy for data analysis.
5. Apply programming knowledge to solve real-world problems involving data analysis and visualization.

DATA STRUCTURES LAB	
Course Code: 24CS2113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks

L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Implement Linear data structure algorithms.
2. Implement applications using Stacks and Linked lists
3. Implement Binary Search tree and AVL tree operations.
4. Implement graph algorithms.
5. Analyze the various searching and sorting algorithms.

SEMESTER - IV

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.

THEORY OF COMPUTATION	
Course Code: 23CS2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.
2. Student understands the basics of regular expression and its equivalence.
3. Disambiguate context-free grammars by mastering the concepts of context- free languages and push- down automata
4. Study the concepts of Push Down Automata and its applications.

5. Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

OPERATING SYSTEMS	
Course Code: 24CS2006	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode. 2. Understand the process management policies and scheduling of processes by CPU . 3. Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading. 4. Describe and analyze the memory management and its allocation policies. 5. Identify use and evaluate the storage management policies with respect to different storage management technologies.

JAVA PROGRAMMING	
Course Code: 24**CS2010**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Apply the concepts of classes and objects to solve simple problems 2. Develop programs using inheritance, packages and interfaces 3. Make use of exception handling mechanisms and multithreaded model to solve real world problems 4. Build Java applications with I/O packages, string classes, Collections and generics concepts 5. Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 24**CSPE2008**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to: 1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms. 2. 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. 3. 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. 4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms. 5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

L T P : 3 0 0	
Credits: 3	

DISCRETE STRUCTURES	
Course Code: 24CS2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus and has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Model logic statements arising in algorithm correctness and real-life situations and manipulate them using the formal methods of propositional and predicate logic.
2. Relate the ideas of mathematical induction to recursion and recursively defined structures.
3. Establish and solve recurrence relations that arise in counting problems including the problem of determining the time complexity of recursively defined algorithms
4. Deduce properties that establish particular graphs as Planar, Eulerian, and Hamiltonian.
5. Formalizes the sets with the binary operations.
6. Understand the application of number theory in cryptography.

OPERATING SYSTEMS LAB	
Course Code: 23CS2114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:

1. Demonstrate the various operations of file system.
2. Understand and Implement Memory management schemes, Thread and synchronization
3. Implement Deadlock algorithms and page replacement algorithms.
4. Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.
5. Implement Scheduling algorithms.

		L	T	P	C
24CSPE2008	**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

JAVA PROGRAMMING LAB	
Course Code: 23CS2116	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE
1. To familiarize with the Java Environment and to implement OOP concepts.
2. To understand the concepts of interface and how to create new packages.
3. To learn how to create an interactive application

COURSE LEARNING OUTCOME:
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Learn & practice the Object Oriented concepts like Inheritance, Overloading etc.
2. Learn & practice Interfaces and Packages.
3. Design and implement GUI Applications using AWT.
4. Provide Error handling and Detection facility to the application

ANALYSIS AND DESIGN OF ALGORITHMS LAB	
Course Code: 24CSPE2118	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

1. To understand and apply the algorithm analysis techniques on searching and sorting algorithms.
2. To critically analyze the efficiency of graph algorithms.
3. To understand different algorithm design techniques.
4. To solve programming problems using state space tree.
5. To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

COURSE LEARNING OUTCOMES (CLO's)

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. Analyze the efficiency of algorithms using various frameworks.
2. Apply graph algorithms to solve problems and analyze their efficiency.
3. Implement various techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.
4. Analyze & Use the state space tree method for solving problems.
5. Apply problems solving using approximation algorithms and randomized algorithms.

SEMESTER - V

COMPILER DESIGN	
Course Code: 24CS3001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVES
1. To introduce the major concept areas in compiler design and know the various phases of the compiler
2. To understand the various parsing algorithms and comparison of the same
3. To provide practical programming skills necessary for designing a compiler
4. To gain knowledge about the various code generation principles
5. To understand the necessity for code optimization.

COURSE LEARNING OUTCOMES (CLO)
The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Apply the knowledge of LEX & YACC tool to develop a scanner and parser
2. Design and develop software system for backend of the compiler
3. Suggest the necessity for appropriate code optimization techniques
4. Conclude the appropriate code generator algorithm for a given source language
5. Design a compiler for any programming language.

COMPUTER NETWORKS	
Course Code: 24CSPE3003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
After completion of course, students would be able to:
1. Describe the functions of each layer in OSI and TCP/IP model.
2. Describe the functions of data link layer and explain the protocols.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.

4. Describe the Session layer design issues and Transport layer services.
5. Explain the functions of Application layer and Presentation layer paradigms and Protocols.

COMPUTER GRAPHICS	
Course Code: 24CSPE3019	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Illustrate the fundamentals of computer graphics hardware and software concepts.
2. Design two dimensional and three dimensional graphics and apply three dimensional transformations.
3. Demonstrate and Apply clipping techniques to graphics.
4. Apply algorithms on different graphical models
5. Apply Illumination and color models and design animation sequences.

COMPILER DESIGN LAB	
Course Code: 24CS3117	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 0 0 2	
Continuous Evaluation: 60 Marks	
End Semester Examination: 40 Marks	

COURSE LEARNING OUTCOMES (CLOs):-

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.
2. Learn application of different compiler writing tools to implement the different Phases of compiler.
3. Work in the development phase of new computer languages in industry and designing symbol tables.
4. Design Top-down, Bottom-up parsing Techniques.
5. Learn the process of translating a modern high-level language to executable code

PROGRAMMING USING MATLAB	
Course Code: 24CS2115	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Understand the importance of matlab commands and basic operations.
2. Implement various types of relational operator, constructor and arithmetic calculation.
3. Analyze and differentiate the various conditional loop & branch operation to observe performance.
4. Solve the various mathematical functions and equations using MATLAB also, observe the result of through plot graph.

LIVE PROJECT-II & INDUSTRIAL VISIT	
Course Code: 23CS0303	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

DIGITAL IMAGE PROCESSING	
Course Code: 24CSPE3023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Comprehend the need and usage of concepts of image processing.
2. Explore different image processing tools and study its various features.
3. Enhance the visual quality of given grey/color image using well known transformations and filters.

4. Learn different causes for image degradation and overview of image restoration techniques.
5. Segment the regions of given image using various feature extraction algorithms in order to recognize object.
6. Demonstrate the use of MATLAB to create interactive image processing applications.

		L	T	P	C
23CS 3029	**OPERATIONS RESEARCH TECHNIQUES**	**3**	**0**	**0**	**3**

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.

SEMESTER - VI

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM	
Course Code: 24CS3002	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
Understands the definitions and historical evolution of Artificial Intelligence, recognizing key milestones and advancements that have shaped the field.
Develop proficiency in state-space representation and search algorithms and gain an understanding of game theory basics.
Learn techniques for handling uncertainty in AI systems and apply knowledge representation methods
Gain fundamental concepts and components of AI planning and Learning systems.
Learn about various NLP, Pattern recognition and Expert Systems to understand how these models are used in real-world scenario.

SOFTWARE ENGINEERING	
Course Code: 24**CS3004**	Continuous Evaluation: 40 Marks
Pre-Requisite : Concept of OOP and Methodology	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Analyze software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification. 2. Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model. 3. Apply testing principles on software project and understand the maintenance concepts. 4. Identify risks, manage the change to assure quality in software projects. 5. Think critically about ethical and social issues in software engineering for different applications

BIG DATA ANALYTICS	
Course Code: 24CS3012	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOME (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Explain the motivation for big data systems and identify the main sources of Big Data in the real world and driver analysis of big data.
2. Demonstrate an ability to use analytics efficiently store retrieve and process Big Data for inferential analysis that will help in solving real world problems.
3. Implement several tools such as IBM Cognos to understand visual perception in a better way.
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data using Knowledge discovery mechanism.
5. Design an ecosystem to monitor and maintain the large number of files using big data tools Apache Hadoop.

ARTIFICIAL INTELLIGENCE LAB	
Course Code: 24CS3114	Continuous Evaluation: 60 Marks
Pre-Requisite : Basics of any Programming Language	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

After the completion of this course students will be able to:

1. Understand the requirement of search strategies in AI.
2. Understand and implement the concepts for uncertainty, knowledge representation and learning.
3. Learn to design the application while deciding the level of requirement of each AI component (search, Planning, Learning, uncertainty).
4. Learn and understand the mapping and interaction among various AI components for an automated/ smart application.

SOFTWARE ENGINEERING LAB	
Course Code: **24CS3118**	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits:1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Prepare SRS document, design document, test cases and software configuration management and risk management related document.
2. Develop function oriented and object oriented software design using tools like rational rose.
3. Generate a high-level design of the system from the software requirements

Have experience and/or awareness of testing problems and will be able to develop a simple testing report

LIVE PROJECT-III & INDUSTRIAL VISIT	
Course Code: 23CS0304	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

- Gather a first-hand experience on sites.
- Apply the concepts learnt to design and create a application.

SEMESTER – VII

CLOUD COMPUTING	
Course Code: 24CS4003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the history and evolution of cloud computing and explain the essential characteristics and architecture of cloud computing. 2. Explain virtualization techniques and their importance in cloud computing. 3. Understand the principles of cloud-native application development and implement microservices architecture in cloud applications. 4. Identify the key challenges associated with cloud migration and discuss the legal issues related to cloud computing. 5. Utilize tools and technologies to secure data in both private and public cloud architectures.

WEB APPLICATION DEVELOPMENT	
Course Code: 24CS4005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Create a personal portfolio webpage and build a multimedia gallery with images, audio, and video. 2. Style the personal portfolio webpage and Create a responsive web page layout using Flexbox and CSS Grid. 3. Build a dynamic to-do list application using vanilla JavaScript and a simple React application with multiple components and routing. 4. Build a full-stack application with React frontend and Node.js backend. 5. Develop and deploy a full-stack web application.

CLOUD COMPUTING LAB

Course Code: 23CS4113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:

1. Explain the fundamental principles of cloud computing and its related Concepts
2. Analyze Prominent Cloud computing technologies available in the marketplace.
3. Discuss virtualization technologies along with the architectural models of cloud computing.
4. Leverage the prominent Cloud computing technologies available in the market place.
5. Demonstrate different features of cloud platforms used in Industry.
6. Understand how energy efficiency achieved in cloud computing using green computing and understand the mechanism needed to harness cloud computing in the respective endeavours.
7. Apply suitable applications to leverage the strength of cloud computing.
8. Develop the applications of cloud Computing that can harness the power of cloud computing.

LIVE PROJECT-III & INDUSTRIAL VISIT	
Course Code: 23CS4115	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

MINOR PROJECT	
Course Code: 23CS4117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 8	
Credits: 4	

COURSE OBJECTIVE

To simulate real life situations related to Computer Science and engineering and impact adequate training so that confidence to face and tackle any problem in the field is developed.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

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

MAJOR PROJECT	
Course Code: 23CS4114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 24	
Credits: 12	

COURSE 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.

SYLLABUS OF PROFESSIONAL ELECTIVE COURSES

COMPUTER ARCHITECTURE & ORGANIZATION	
Course Code: 24CSPE2007	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.
2. Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.
3. Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.
4. Understand the need for an interface and instruction cycle phases. Implement the hardwiredand microprogrammed control unit for analyse the performance.
5. 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.

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 24**CSPE2008**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

6. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
7. 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.
8. 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.
9. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
10. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

ANALYSIS AND DESIGN OF ALGORITHMS LAB	
Course Code: 24CSPE2118	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO's)

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:

6. Analyze the efficiency of algorithms using various frameworks.
7. Apply graph algorithms to solve problems and analyze their efficiency.
8. Implement various techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.
9. Analyze & Use the state space tree method for solving problems.
10. Apply problems solving using approximation algorithms and randomized algorithms.

COMPUTER NETWORKS LAB	
Course Code: 24CSPE3113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Understand and learn how to determine the network statistics of their machines.

2. Learn about the working of a packet sniffer that is Wireshark.
3. Understand the in-depth working and role of network protocols.
4. Design and understand the working of TCP three way handshaking protocol.
5. Design and understand UDP based applications.

OPTIMIZATION TECHNIQUES	
Course Code: 24CSPE3027	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the usage of linear programming and Simulation for Solving Business Problems. 2. Conduct and interpret the assignment and transportation problems. 3. Identify the optimal sequence and best age of replacement. 4. Explain the meaning of Inventory control, various forms and functional role of Inventory. 5. Able to explain the applications of queue models in real life.

DISTRIBUTED DATABASE	
Course Code: 24CSPE3035	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand distributed database systems architecture and design. 2. Apply methods and techniques for distributed quey processing and optimisation. 3. Understand the broad concepts of distributed transaction process. 4. Understand Transaction Management & Compare various approaches to concurrency control in Distributed database. 5. Study and identify various issues related to the development of distributed database system. 6. Understand the design aspects of object-oriented database system and related development.

Computer graphics	
Course Code: 24CSPE3019	Continuous Evaluation: 40 Marks

Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Illustrate the fundamentals of computer graphics hardware and software concepts. 2. Design two dimensional and three dimensional graphics and apply three dimensional transformations. 3. Demonstrate and Apply clipping techniques to graphics. 4. Apply algorithms on different graphical models 5. Apply Illumination and color models and design animation sequences.

SYSTEM MODELING AND SIMULATION	
Course Code: 24**CSPE3021**	Continuous Evaluation: 40 Marks
Pre-Requisite : Mathematics, Computer Networks, Java	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Remember and understand the concepts of system and environment. 2. Understand and apply the concepts of statistics in simulation. 3. Apply and analyze how random numbers can be used for simulation and modelling. 4. Evaluate the concepts of simulation and modelling on test data. 5. Create and explore the applications of simulation.

DIGITAL IMAGE PROCESSING	
Course Code: 24CSPE3023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Comprehend the need and usage of concepts of image processing.
2. Explore different image processing tools and study its various features.

3. Enhance the visual quality of given grey/color image using well known transformations and filters.
4. Learn different causes for image degradation and overview of image restoration techniques.
5. Segment the regions of given image using various feature extraction algorithms in order to recognize object.
6. Demonstrate the use of MATLAB to create interactive image processing applications.

VISUAL PROGRAMMING	
Course Code: 23CSPE3025	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understands the visual programming concepts and can explain basic concepts and definitions. 2. Create programs that use decisions and repetition and Write statements that use various mathematical operators. 3. Design the front end or Graphical User Interface for any application. 4. Link the front end with the back-end and create an interactive environment.

PRINCIPLES OF PROGRAMMING LANGUAGES	
Course Code: 24**CSPE3033**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Gain knowledge of the basic entities of computer programming languages. 2. Gain knowledge of different categories of programming languages. 3. Apply the knowledge for identifying the appropriate programming language for a particular development scenario. 4. Logically analyze the advantages and disadvantages of using different programming language for different computer problem.

THEORY OF APP DEVELOPMENT	
Course Code: 23CSPE3037	Continuous Evaluation: 40 Marks

Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.
5. Deploy applications to the Android marketplace for distribution.

BLOCK CHAIN	
Course Code: 23CSPE3039	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand and learn how bitcoin and other coins work in real world.
2. Understand how cryptography primitives drive blockchains and crypto-currency infrastructures.
3. Understand how cryptocurrency and blockchains will move for future directions (ex. Privacy, multiparty computation, anonymity).

DATA SCIENCE	
Course Code: 24CSPE3041	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the role of EDA and probability in Data Science.
2. Apply and analyze the role of statistical/hypothesis testing for Data Analysis.

3. Understand and apply Regression for Predictive Data Analysis.
4. Analyze and evaluate time series data.
5. Build and create the applications using the concepts of Data Science.

SOFT COMPUTING	
Course Code: 23CSPE3031	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the need of soft computing and its components.
2. Design and understand simple applications using Single and Multi-layer perceptron.
3. Understand the concepts of Fuzzy controllers and their design principles.
4. Familiarize with the single and multi-objective optimization methods through Genetic Algorithms.
5. Understand the design principles for hybrid systems.
6. Develop and design real time applications using Soft Computing Principles.

DISTRIBUTED OPERATING SYSTEM	
Course Code: 23CSPE3020	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Gain knowledge of distributed operating system architecture. 2. Implement distributed client server applications using remote method invocation. 3. Have knowledge of Synchronization and Deadlock. 4. Have sufficient knowledge about file access. 5. Understand Shared Memory Technique, security, and distributed file systems.

Software Project Management	
Course Code: 23CSPE3024	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling.
2. Apply basic concepts related to software project planning, scope and feasibility.
3. Analyse of various project management activities such as tracking, project procurement, configuration management, monitoring.
4. Acquire knowledge about quality assurance, quality control, and risk management.

GRID COMPUTING	
Course Code: 24CSPE3026	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the genesis & know the applications of grid computing. 2. Understand the technology and tool kits for facilitating grid computing. 3. Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids. 4. Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research. 5. Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.

OBJECT ORIENTED ANALYSIS & DESIGN	
Course Code: 23CSPE3028	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Demonstrate knowledge of structural and behavioral modeling techniques.
2. Demonstrate knowledge of a model-based software development methodology.
3. Create application of the methodology and the modeling techniques in a significant software design project.
4. Demonstrate knowledge of design patterns and their application in a software design project.
5. Demonstrate knowledge of Design and Testing Process Improvement Models.

NEURAL NETWORKS & FUZZY LOGIC	
Course Code: 23**CSPE3030**	Continuous Evaluation: 40 Marks
Pre-Requisite : Soft Computing Course	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the mathematics behind the design of perceptron.
2. Correlate the need of extension of MLP to CNN.
3. Design and analyse the importance of kernel functions, RNN and memories.
4. Differentiate between fuzzy sets and crisp sets.
5. Apply and analyse the applications of fuzzy to reasoning and clustering

CYBER SECURITY	
Course Code: 23CSPE3032	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
2. Underline the need of digital forensic and role of digital evidences.
3. Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.
4. 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.

5. Apply the knowledge of IDS to secure network and performing router and network analysis.

DESIGN THINKING	
Course Code: 23CSPE3034	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Understand and critically apply the concepts and methods of business processes.
2. Understand and apply IBM Blueworks live and process designer tool concepts.
3. Understand and analyzing design thinking history and its various concepts.
4. Understand, analyzing and create models with users collaboration to apply design thinking concepts.
5. 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.

PREDICTIVE ANALYTICS	
Course Code: 23CSPE3036	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand and critically apply the concepts and methods of Preditive analytics.
2. Understand and apply IBM SPSS Modeler in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.
3. Apply and analyse how to use functions, deal with missing values, use advanced field operations, handle sequence data and improve efficiency.
4. Evaluate the Model on the basis of different Predictive Methods.
5. Build and create advanced analytical model that leverage historical data to uncover real-time insights to predict future events.

BUSINESS INTELLIGENCE	
Course Code: 23CSPE3038	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of Business Intelligence from a global context.
2. Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.
3. Apply and analyse various prompt types and conditionally render objects in reports .
4. Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.
5. Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

INTERNET OF THINGS	
Course Code: 23CSPE3040	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of IoT and communication protocols from a global context.
2. Understand and apply IoT protocols.
3. Apply and analyze sensor networks and their components to IoT domain.
4. Design portable IoT using appropriate boards.
5. Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.
6. Build and create state of the art architecture in IoT.

NETWORK SECURITY AND CRYPTOGRAPHY	
Course Code: 23CSPE4019	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

SOFTWARE TESTING	
Course Code: 23CSPE4033	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Demonstrate the fundamentals of software testing using real world examples 2. Identify and apply relevant testing techniques suitable for a real world scenario 3. Investigate the different levels in testing 4. Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs. 5. Use practical knowledge to test software and understand the trade-offs between testing techniques 6. Implement Test Automation process and experiment with testing tools.

WIRELESS ADHOC AND SENSOR NETWORK	
Course Code: 23CSPE4023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. 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.
2. Familiarize with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.
3. Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).
4. Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.
5. 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.

ADVANCE JAVA PROGRAMMING	
Course Code: 23CSPE4035	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Learn the graphics and animation on the web pages, using Java Applets.
2. 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.
3. Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.
4. Learn and design the server side programming using Servlets and JSP
5. Use the invocation of the remote methods in an application using RMI.

NASSCOM ASSOCIATE ANALYTICS - II	
Course Code: 23**CSPE4037**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

DATAWAREHOUSING AND DATA MINING	
Course Code: 23**CSPE4025**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the functionality of the various data mining and data warehousing component. 2. Design data warehouse with dimensional modelling and apply OLAP operations. 3. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining. 4. Describe complex data types with respect to spatial and web mining. 5. Extract knowledge using data mining techniques. 6. Apply the Data Mining principles and techniques for real time applications.

MOBILE COMPUTING

Course Code: 23**CSPE4027**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Grasp the concepts and features of mobile computing technologies and applications. 2. Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support 3. 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

MACHINE LEARNING USING R	
Course Code:23CSPE4029	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Learn the fundamentals of R-programming and probability.
2. Understand the basics and need of Machine learning in global view.
3. Demonstrate in-depth knowledge of methods and theories in the field of machine learning.
4. Understand, apply and evaluate the supervised learning techniques.
5. Apply, analyze and evaluate the ensemble learning and unsupervised learning techniques
6. Understand the concepts of reinforcement learning and transfer learning.
7. To implement the machine learning techniques for building different applications.

OPEN SOURCE SOFTWARE	
Course Code: 23**CSPE4031**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the difference between open source software and commercial software.
2. Identify, install and run Linux operating system.

3. Install and manage applications.
4. Identify, install open source web technologies Apache, MySql, PHP.
5. Develop web applications using LAMP.
6. Write session control PHP code for a website.

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NASSOCOM ASSOCIATE ANALYTICS-III	
Course Code: 23**CSPE4039**	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE OBJECTIVE
• This course provides knowledge of the advanced concepts of tools, technologies & programming languages which is used in day to day business analytics cycle.
COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

ADVANCED INTERNET OF THINGS	
Course Code: 24CSPE4041	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLOs)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand advanced concepts and principles of IoT
2. Design and implement IoT sensor networks.
3. Identify and analyze various IoT security threats and vulnerabilities and Implement security protocols and techniques to protect IoT systems.
4. Identify advanced IoT applications in different industries and analyse the real-world case studies of IoT implementations.
5. Evaluate the impact of emerging IoT technologies on various industries and develop a project that should demonstrate proficiency in IoT architecture, sensor networks, data analytics, security, and application development.

ADVANCED BLOCKCHAIN	
Course Code: 23CSPE4047	Continuous Evaluation: 40 Marks

Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.
2. Understand how blockchain solutions are transforming the industry landscape.
3. Design and develop for a permissioned blockchain
4. Explore a variety of blockchain case studies, including food provenance, container tracking, payments, identity.
5. Acquire hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.

CURRICULUM & SYLLABUS



SRM
UNIVERSITY
DELHI-NCR, SONEPAT

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

BACHELOR OF TECHNOLOGY (B.Tech.)

(4 Year Undergraduate Degree Programme)

IN

COMPUTER SCIENCE AND ENGINEERING

In Cyber Security

(In Alignment with National Education Policy, 2020)
[w. e. f. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
39, Rajiv Gandhi Education City, Sonepat
Haryana-131029

SEMESTER – I & SEMESTER – II

ENGINEERING MATHEMATICS-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS101	
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 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.

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS201	
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.

ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	
Course Code: 24AS102/202	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING PHYSICS LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)

Course Code: 24AS103/203	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

FUNDAMENTALS OF COMPUTER & C PROGRAMMING (COMMON TO ALL BRANCHES)	
Course Code:24CS101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

C PROGRAMMING LAB (COMMON TO ALL BRANCHES)	
Course Code: 24CS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EC101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code:23EE151/24EC151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

BASIC ELECTRICAL ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EE101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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

COMMUNICATIVE ENGLISH (COMMON TO ALL BRANCHES)	
Course Code: 24HS101/201	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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.

COMMUNICATIVE ENGLISH LAB (COMMON TO ALL BRANCHES)	
Course Code:21HS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

INDIAN CONSTITUTION & POLITY (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24HS102/202	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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 an bala2ces. **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.

YOGA & PHYSICALEDUCATION Practices (COMMON TO ALL BRANCHES EXCEPT)	
Course Code:21SE151	
Credits: 1	
L T P: 0 0 2	
Prerequisite: Nil	

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

BASIC MECHANICAL ENGINEERING (Common to all Branches)	
Course Code: 23ME101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC MECHANICAL ENGINEERING LAB (Common to all Branches)	
Course Code: 23ME151/23 CS151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

MECHANICAL WORKSHOP LAB (Common to all Branches)	
Course Code: 23ME152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

ENGINEERING GRAPHICS & DESIGN LAB (Common to all Branches)	
Course Code: 23ME153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

CLO1 Understand orthographic projections of point sand 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 sand draw its projections

ENGINEERING MATHEMATICS – III	
Course Code: 23AS301	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Pre-Requisite : NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course,

students would be able to:

- Solve different types of partial differential equations.
- Find solutions of boundary value problems including heat and wave equations.
- Apply and analyze Fourier transforms with different applications.
- Evaluate the problems using z-transforms.
- Understand linear algebra and its application to Engineering.

CRYPTOGRAPHY FUNDAMENTALS	
Course Code: 23CCS2009	Continuous Evaluation (Internal): 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisites: NIL	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
1. Identify basic security attacks and services
2. Use symmetric and asymmetric key algorithms for cryptography
3. Design a security solution for a given application
4. Secure a web server and web application
5. Understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.

CRYPTOGRAPHY LAB	
Course Code: 23CCS2117	Continuous Evaluation (Internal): 40 Marks
Credits: 1	End Semester Examination: 60 Marks
L T P : 0 0 2	
Prerequisites: Cyber Security	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
1. Implement the cipher techniques.
2. Develop the various security algorithms
3. Use different open source tools for network security and analysis
4. Secure a web server and web application

5. Configure firewalls and IDS

DATA STRUCTURE	
Course Code: 24CS2001	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
6. Define linear and non-linear data structures. 7. Implement linear and non–linear data structure operations. 8. Use appropriate linear/non–linear data structure operations for solving a given problem. 9. Apply appropriate graph algorithms for graph applications. 10. Analyze the various searching and sorting algorithms.

DATABASE MANAGEMENT SYSTEMS	
Course Code: 23CS2005	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
7. Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems. 8. Design the database schema with the use of appropriate data types for storage of data in database 9. Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries. 10. 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. 11. Understand and apply the concept of transaction, concurrency control and recovery in database. 12. Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 21CS2111	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES
6. To explain basic database concepts, applications, data models, schemas and instances. 7. To demonstrate the use of constraints and relational algebra operations. And describe the basics of SQL and construct queries using SQL. 8. To emphasize the importance of normalization in databases. 9. To facilitate students in Database design. 10. To familiarize issues of concurrency control and transaction management.

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
7. 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. 8. Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database. 9. Formulate query, using SQL, solutions to a broad range of query and data update problems. 10. Design and implement database applications on their own. 11. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL. 12. Analyze and Select storage and recovery techniques of database system.

ESSENTIALS OF BLOCKCHAIN & IOT –LEVEL-I	
Course Code: 23CS0201	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
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.

SEMESTER – IV

DISCRETE STRUCTURES	
Course Code: 24CS2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus and has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Model logic statements arising in algorithm correctness and real-life situations and manipulate them using the formal methods of propositional and predicate logic.
2. Relate the ideas of mathematical induction to recursion and recursively defined structures.
3. Establish and solve recurrence relations that arise in counting problems including the problem of determining the time complexity of recursively defined algorithms
4. Deduce properties that establish particular graphs as Planar, Eulerian, and Hamiltonian.
5. Formalizes the sets with the binary operations.
6. Understand the application of number theory in cryptography.

DATABASE SECURITY	
Course Code: 23CCS2006	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: Database Management System	

Course Learning Outcomes:
1. To understand the anatomy of various vulnerabilities and threats in database system.
2. To understand the techniques of database information security threats and techniques for database security assessment.
3. To identify and remove the authentication vulnerabilities.
4. To understand the application of granular access control.
5. To know the techniques that provide security when there is communication across different database.
6. To understand the working of virtual private database.
7. To know the application of access control to secure databases.

THEORY OF COMPUTATION	
Course Code: 23CSPE2004	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The 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:
1. Comprehend regular languages and finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.
2. Understands the basics of regular expression and its equivalence.
3. Disambiguate context-free grammars by mastering the concepts of context- free languages and push- down automata
4. Apply the concepts of Push Down Automata and its applications.
5. Apply the concepts of recursive and recursively enumerable languages and design efficient Turing Machines.

OPERATING SYSTEMS	
Course Code: 24CS2006	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode. 2. Understand the process management policies and scheduling of processes by CPU . 3. Distinguish between concepts related to concurrency including synchronization primitives, race conditions, critical sections and multi-threading. 4. Describe and analyze the memory management and its allocation policies. 5. Identify use and evaluate the storage management policies with respect to different storage management technologies.

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 24CS2008	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. 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.
3. 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.
4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

OPERATING SYSTEMS LAB	
Course Code: 23CS2114	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate the various operations of file system.
2. Understand and Implement Memory management schemes, Thread and synchronization
3. Implement Deadlock algorithms and page replacement algorithms.
4. Apply the process synchronous concept using message queue, shared memory, semaphore for given situation.
5. Implement Scheduling algorithms.

ANALYSIS AND DESIGN OF ALGORITHMS LAB	
Course Code: 23CSPE2118	Continuous Evaluation: 60 Marks
Pre-Requisite : Data Structures	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

1. To study a variety of useful algorithms and analyse their complexity.
2. To gain insight into principles and data-structures useful in algorithm design.

COURSE LEARNING OUTCOMES (CLO)

After the completion of course students will be able to:

1. 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).

2. 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.
3. 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).

DATABASE SECURITY LAB	
Course Code: 23CCS2118	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P: 0 0 2	
Prerequisite: Databases	

Course Learning Outcomes (CLO)
1. To be able to create various files and databases.
2. To be able to configure proxy authentication.
3. To be able to work with the privileges and policy.
4. To be able to enhance the security of the databases.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II	
Course Code: 23CS0202	Continuous Evaluation: 70 Marks
Pre-Requisite : NIL	End Semester Examination:30 Marks
L T P : 0 0 2	
Credits: 1	

TRAINING LEARNING OUTCOMES (TLOS): - **After the completion of training, the students will be able to:**
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. Understands, apply and evaluate the supervised learning techniques.
4. Design and implement the different applications using the concepts of AI and ML

LIVE PROJECT-I & INDUSTRIAL VISIT	
Course Code: 23CS0204	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks

L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVES

To provide hands-on experience at site where Computer Science and engineering projects are executed.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

SEMESTER – V

NETWORK SECURITY	
Course Code: 23CCS3001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the theory of fundamental cryptography, encryption, decryption and symmetric and public key cryptographic algorithms..
2. Demonstrate the various authentication applications and its requirements.
3. Comprehend different mechanisms related to network security, IP, cloud, IOT security and application privacy.
4. Interpret and apply the functionalities of firewall

KALI LINUX	
Course Code: 23CCS3005	Continuous Evaluation: 40 Marks
Pre-Requisite : Networking	End Semester Examination: 60 Marks
L T P : 2 0 0	
Credits:2	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Identify problems that are amenable to solution by secure methods, and which secure methods may be suited to solving a given problem.
2. Solve problems like brute force attack.
3. Deduce through logic and reasoning algorithms.

4. Handle viruses.
5. Understand the role of security in automated control and smart applications.
6. Formalize a given problem in the framework of different network methods.
7. Design and carry out an empirical evaluation of different cryptographic algorithms on a problem formalization

COMPILER DESIGN	
Course Code: 24CS3001	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus adheres to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Apply the knowledge of LEX & YACC tool to develop a scanner and parser
2. Design and develop software system for backend of the compiler
3. Suggest the necessity for appropriate code optimization techniques
4. Conclude the appropriate code generator algorithm for a given source language
5. Design a compiler for any programming language.

COMPUTER NETWORKS	
Course Code: 24CS3003	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Describe the functions of each layer in OSI and TCP/IP model.
2. Describe the functions of data link layer and explain the protocols.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.
4. Describe the Session layer design issues and Transport layer services.
5. Explain the functions of Application layer and Presentation layer paradigms and Protocols.

NETWORK SECURITY LAB	
Course Code: 23CCS3115	Continuous Evaluation: 60 Marks

Pre-Requisite : Basics of computer Networking	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

After the completion of this course students will be able to:

1. Understand the requirement of network-based tools for network analysis.
2. Understand the use techniques for Network scanning.
3. Learn and identify network vulnerability.

KALI LINUX LAB	
Course Code: 22CCS3113	Continuous Evaluation: 60 Marks
Pre-Requisite : Linux Programming and Computer Networks	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

After the completion of this course students will be able to:

4. Understand the requirement of security testing.
5. Understand and implement the concepts computer networking.
6. Design the application while deciding the level of requirement of each Linux component.
7. Learn and understand the mapping and interaction among various Linux components for a secure application.

COMPUTER NETWORKS LAB	
Course Code: 24CS3113	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

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COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Understand and learn how to determine the network statistics of their machines.
2. Learn about the working of a packet sniffer that is Wireshark.
3. Understand the in-depth working and role of network protocols.
4. Design and understand the working of TCP three way handshaking protocol.
5. Design and understand UDP based applications.

LIVE PROJECT-II & INDUSRIAL VISIT	
Course Code: 23CS0303	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	

Credits: 1	

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

COMPILER DESIGN LAB	
Course Code: 24CS3117	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 0 0 2	
Continuous Evaluation: 60 Marks	
End Semester Examination: 40 Marks	

COURSE LEARNING OUTCOMES (CLOs):-

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Acquire the generic skills to design and implement a compiler along with analysis of practical aspects.
2. Learn application of different compiler writing tools to implement the different Phases of compiler.
3. Work in the development phase of new computer languages in industry and designing symbol tables.
4. Design Top-down, Bottom-up parsing Techniques.
5. Learn the process of translating a modern high-level language to executable code

DESIGN THINKING AND AUGMENTED VIRTUAL REALITY-LEVEL- II & III	
Course Code: 23CS0301	Continuous Evaluation: 70 Marks
Prerequisite: NIL	End Semester Examination:30 Marks
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. Understand and analyse design thinking history and its various concepts.

3. Understand, analyse 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. 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

PENETRATION TESTING	
Course Code: 23CCS3002	Continuous Evaluation: 40 Marks
Pre-Requisite : Python	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Identify problems that are amenable to solution by python.
2. Solve problems like different types of attacks using python.
3. Deduce through logic and reasoning algorithms.
4. Handle uncertainty.
5. Understand the role of planning and learning in secure applications using python.
6. Formalize a given problem in the language/framework of different security methods.
7. Design and carry out an empirical evaluation of different algorithms using Python.

ANDROID SECURITY	
Course Code: 23CCS3010	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand how to setup, run the tools, and to develop Android applications on the Android platform.
2. Identify the security relevant problem and to protect the applications.
3. Known to examine Android application component types for security risk in source code and inter-application context.
4. Understand the Secure Sockets Layer communications
5. Formalize to protect from memory corruption and race condition exploitation.
6. Understand how to use encryption and developing device administration policies.

SOFTWARE ENGINEERING	
Course Code: 24CSPE3004	Continuous Evaluation: 40 Marks

Pre-Requisite : Concept of OOP and Methodology	End Semester Examination: 60 Marks
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Analyze software development process models, including agile models and traditional models like waterfall. Acquire knowledge about the concepts of application of formal specification. 2. Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model. 3. Apply testing principles on software project and understand the maintenance concepts. 4. Identify risks, manage the change to assure quality in software projects. 5. Think critically about ethical and social issues in software engineering for different applications

Penetration Testing Lab	
Course Code: 23CCS3116	Continuous Evaluation: 60 Marks
Pre-Requisite : Python	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

After the completion of this course students will be able to:

1. Understand the requirement of python.
2. Understand and implement the concepts python networking.
3. Learn to design the application while deciding the level of requirement of each security component.
4. Learn and understand the mapping and interaction among various Python components for a secure application.

SOFTWARE ENGINEERING LAB	
Course Code: 23CS3118	Continuous Evaluation: 60 Marks
Pre-Requisite: NIL	End Semester Examination: 40 Marks
L T P: 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

1. Prepare SRS document, design document, test cases and software configuration management and risk management related document.
2. Develop function oriented and object oriented software design using tools like rational rose.
3. Generate a high-level design of the system from the software requirements
4. Have experience and/or awareness of testing problems and will be able to develop a simple testing report

NETWORK PROGRAMMING LAB	
Course Code: 23CCS3014	Continuous Evaluation: 60 Marks
Pre-Requisite: Basics of any Programming Language	End Semester Examination: 40 Marks
L T P: 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

After the completion of this course students will be able to:

1. Understand and apply the concepts of socket programming to design client-server based applications.
2. Understand and apply the concepts of concurrent socket programming to design client-server based applications.
3. Understand and learn to create event based network program.

BIG DATA ANALYTICS, TOOLS AND TECHNIQUES- LEVEL-III	
Course Code: 23CS0302	Continuous Evaluation: 70 Marks
Prerequisite: NIL	End Semester Examination:30 Marks
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.

LIVE PROJECT-III & INDUSTRIAL VISIT	
Course Code: 23CS0304	Continuous Evaluation: 60 Marks

Pre-Requisite: NIL	End Semester Examination: 40 Marks
L T P: 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create a application.

SEMESTER – VII

CLOUD SECURITY	
Course Code: 23CCS4003	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand core cloud computing concepts and fundamental principles, including standard delivery models
2. Understand the foundational security practices that are required to secure modern cloud computing infrastructures.
3. Understand the complexity of cloud threat actors and techniques used to attack a cloud computing infrastructure
4. Understand the regulatory requirements needed to secure data in the cloud and the difficulties in meeting those requirements
5. Understand how to protect data-at-rest, data-in-transit, and data-in-use within a cloud environment.

QUANTUM CRYPTOGRAPHY	
Course Code: 23CCS4005	Continuous Evaluation (Internal): 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisites: Cryptography Fundamentals	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
1. The basic principles of quantum computing.
2. The fundamental differences between conventional computing and quantum computing.
3. Several basic quantum computing algorithms.
4. The classes of problems that can be expected to be solved well by quantum computers.
5. Understand the Quantum security techniques on real applications.

CLOUD SECURITY LAB	
Course Code: 23CCS4007	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand core cloud computing concepts and fundamental principles, including standard delivery models.
2. Understand the foundational security practices that are required to secure modern cloud computing infrastructures.
3. Understand the complexity of cloud threat actors and techniques used to attack a cloud computing infrastructure.

QUANTUM CRYPTOGRAPHY LAB	
Course Code: 23CCS4009	Continuous Evaluation (Internal): 40 Marks
Credits: 1	End Semester Examination: 60 Marks
L T P : 0 0 2	
Prerequisites: Cryptography Fundamentals	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
1. The basic principles of quantum computing.
2. The fundamental differences between conventional computing and quantum computing.
3. Several basic quantum computing algorithms.
4. The classes of problems that can be expected to be solved well by quantum computers.
5. Understand the Quantum security techniques on real applications.

LIVE PROJECT-IV & INDUSTRIAL VISIT	
Course Code: 23CS4115	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 2	
Credits: 1	

COURSE OBJECTIVE

To provide hands-on experience at site where Computer Science and engineering projects are executed and help them to improve their skills.

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Gather a first-hand experience on sites.
2. Apply the concepts learnt to design and create an application which help them to enhance their resume.

MINOR PROJECT	
Course Code: 23CS4117	Continuous Evaluation: 60 Marks
Pre-Requisite : NIL	End Semester Examination: 40 Marks
L T P : 0 0 8	
Credits: 4	

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COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

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

MAJOR PROJECT	
Course Code: 23CS4114	Continuous Evaluation: 60 Marks
Pre-Requisite: NIL	End Semester Examination: 40 Marks
L T P: 0 0 24	

Credits: 12	

COURSE OBJECTIVE

The objective of the project semester is to make the students solve real world problems using automated solutions, while developing management and writing skills amongst them.

COURSE LEARNING OUTCOMES:

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.

   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: 23CSPE3020	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Gain knowledge of distributed operating system architecture. 2. Implement distributed client server applications using remote method invocation. 3. Have knowledge of Synchronization and Deadlock. 4. Have sufficient knowledge about file access. 5. Understand Shared Memory Technique, security, and distributed file systems.

SOFTWARE PROJECT MANAGEMENT	
Course Code: 23CSPE3024	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Gain knowledge and understanding of basic concepts related to software project phases, estimation and scheduling. 2. Apply basic concepts related to software project planning, scope and feasibility. 3. Analyse of various project management activities such as tracking, project procurement, configuration management, monitoring. 4. Acquire knowledge about quality assurance, quality control, and risk management.

GRID COMPUTING	
Course Code: 23CSPE3026	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the genesis & know the applications of grid computing. 2. Understand the technology and tool kits for facilitating grid computing. 3. Evaluate enabling technologies such as high-speed links and storage area networks for building computer grids. 4. Design a grid computing application in one of the key application areas e.g. Computer Animation, E-Research. 5. Implement a grid computing environment; develop communications skills and accept the code of professional conduct and security practice through short presentations and group work.

OBJECT ORIENTED ANALYSIS & DESIGN	
Course Code: 23CSPE3028	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Demonstrate knowledge of structural and behavioral modeling techniques.
2. Demonstrate knowledge of a model-based software development methodology.
3. Create application of the methodology and the modeling techniques in a significant software design project.
4. Demonstrate knowledge of design patterns and their application in a software design project.
5. Demonstrate knowledge of Design and Testing Process Improvement Models.

NEURAL NETWORKS & FUZZY LOGIC	
Course Code: 23CSPE3030	Continuous Evaluation: 40 Marks
Pre-Requisite : Soft Computing Course	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the mathematics behind the design of perceptron.
2. Correlate the need of extension of MLP to CNN.
3. Design and analyse the importance of kernel functions, RNN and memories.
4. Differentiate between fuzzy sets and crisp sets.
5. Apply and analyse the applications of fuzzy to reasoning and clustering

CYBER SECURITY	
Course Code: 23CSPE3032	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
2. Underline the need of digital forensic and role of digital evidences.
3. Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.
4. 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.
5. Apply the knowledge of IDS to secure network and performing router and network analysis.

DESIGN THINKING	
Course Code: 23CSPE3034	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students will be able to:
1. Understand and critically apply the concepts and methods of business processes.
2. Understand and apply IBM Blueworks live and process designer tool concepts.
3. Understand and analyzing design thinking history and its various concepts.
4. Understand, analyzing and create models with users collaboration to apply design thinking concepts.
5. 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.

BUSINESS INTELLIGENCE	
Course Code: 23CSPE3038	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of Business Intelligence from a global context.
2. Understand and apply IBM Cognos Analytics in Market perspective of Business Intelligence.
3. Apply and analyse various prompt types and conditionally render objects in reports.
4. Evaluate query models, connect them to the report layout and combine data containers based on relationships from different queries.
5. Build and create Active Report connection. Creating projects using dashboards, stories and exploration to find business insights.

INTERNET OF THINGS	
Course Code: 23CSPE3040	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the vision of IoT and communication protocols from a global context.
2. Understand and apply IoT protocols.
3. Apply and analyze sensor networks and their components to IoT domain.
4. Design portable IoT using appropriate boards.
5. Evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.
6. Build and create state of the art architecture in IoT.

NETWORK SECURITY & CRYPTOGRAPHY	
Course Code: 23CSPE4019	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Present the exploitation present in the security.
2. Discuss various types of attacks and their characteristics.
3. Illustrate the basic concept of encryption and decryption for secure data transmission.
4. Analyze various cryptography techniques and its applications.
5. Develop solutions for security problems.

SOFTWARE TESTING	
Course Code: 23CSPE4033	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Demonstrate the fundamentals of software testing using real world examples 2. Identify and apply relevant testing techniques suitable for a real world scenario 3. Investigate the different levels in testing 4. Investigate the reason for bugs and analyse the principles in software testing to prevent and remove bugs. 5. Use practical knowledge to test software and understand the trade-offs between testing techniques 6. Implement Test Automation process and experiment with testing tools.

WIRELESS ADHOC AND SENSOR NETWORK	
Course Code: 23CSPE4023	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. 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.
2. Familiarize with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.
3. Enhance the basic knowledge about the principles and characteristics of wireless sensor networks (WSNs).
4. Understand how proactive and reactive protocols function and their implications on data transmission delay and bandwidth consumption along with design issues in wireless communication.
5. 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.

ADVANCED JAVA PROGRAMMING	
Course Code: 23CSPE4035	Continuous Evaluation: 40 Marks
Pre-Requisite : Core Java Programming	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Learn the graphics and animation on the web pages, using Java Applets.
2. 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.
3. Learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.
4. Learn and design the server side programming using Servlets and JSP
5. Use the invocation of the remote methods in an application using RMI.

NASSCOM ASSOCIATE ANALYTICS - II	
Course Code: 23CSPE4037	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks

L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

DATA WAREHOUSING & DATA MINING	
Course Code: 23CSPE4025	Continuous Evaluation: 40 Marks
Pre-Requisite: NIL	End Semester Examination: 60 Marks
L T P: 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Understand the functionality of the various data mining and data warehousing component. 2. Design data warehouse with dimensional modelling and apply OLAP operations. 3. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining. 4. Describe complex data types with respect to spatial and web mining. 5. Extract knowledge using data mining techniques. 6. Apply the Data Mining principles and techniques for real time applications.

MOBILE COMPUTING	
Course Code: 23CSPE4027	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:
1. Grasp the concepts and features of mobile computing technologies and applications. 2. Understand the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support 3. 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

OPEN SOURCE SOFTWARE	
Course Code: 23CSPE4031	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks

L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the difference between open source software and commercial software.
2. Identify, install and run Linux operating system.
3. Install and manage applications.
4. Identify, install open source web technologies Apache, MySql, PHP.
5. Develop web applications using LAMP.
6. Write session control PHP code for a website.

NASSCOM ASSOCIATE ANALYTICS - III	
Course Code: 23CSPE4039	Continuous Evaluation: 40 Marks
Pre-Requisite : NIL	End Semester Examination: 60 Marks
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)
The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:
1. Understand the tools, technologies & programming languages which is used in day to day analytics cycle.
2. Analyze and use the best tools to make sense from available raw data.

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. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY

SRM UNIVERSITY DELHI-NCR, SONEPAT

39, Rajiv Gandhi Education City, Sonepat

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 XEBIA PROGRAMME 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

ENGINEERING MATHEMATICS-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS101	
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 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.

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS201	
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.

ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	
Course Code: 24AS102/202	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING PHYSICS LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)

Course Code: 24AS103/203	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

FUNDAMENTALS OF COMPUTER & C PROGRAMMING (COMMON TO ALL BRANCHES)	
Course Code:24CS101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

C PROGRAMMING LAB (COMMON TO ALL BRANCHES)	
Course Code: 24CS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EC101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code:23EE151/24EC151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

BASIC ELECTRICAL ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EE101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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

COMMUNICATIVE ENGLISH (COMMON TO ALL BRANCHES)	
Course Code: 24HS101/201	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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.

COMMUNICATIVE ENGLISH LAB (COMMON TO ALL BRANCHES)	
Course Code:21HS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

INDIAN CONSTITUTION & POLITY (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24HS102/202	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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 an bala2ces. **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.

YOGA & PHYSICALEDUCATION Practices (COMMON TO ALL BRANCHES EXCEPT)	
Course Code:21SE151	
Credits: 1	
L T P: 0 0 2	
Prerequisite: Nil	

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

BASIC MECHANICAL ENGINEERING (Common to all Branches)	
Course Code: 23ME101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC MECHANICAL ENGINEERING LAB (Common to all Branches)	
Course Code: 23ME151/23 CS151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

MECHANICAL WORKSHOP LAB (Common to all Branches)	
Course Code: 23ME152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

ENGINEERING GRAPHICS & DESIGN LAB (Common to all Branches)	
Course Code: 23ME153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

CLO1 Understand orthographic projections of point sand 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 sand draw its projections

SEMESTER - III

DATA STRUCTURES USING C	
Course Code: 24CS2001	
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 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: 23CS2005
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: 21**CS2007**	
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.

SOURCE CODE MANAGEMENT &DEVELOPMENT AUTOMATION	
Course Code: 23CD201	
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.

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 23CS2111	
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.

DATA STRUCTURES USING C LAB	
Course Code: 23CS2113	
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.

SOURCE CODE MANAGEMENT &DEVELOPMENT AUTOMATION LAB	
Course Code: 23CD215	
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.

EFFECTIVE COMMUNICATION SKILLS	
Course Code: 24SS351	
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: 23CS2004	
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 isambiguate 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: 24CS2006	
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.

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 24CSPE2008	
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.

BUILD and RELEASE MANAGEMENT	
Course Code: 23CD204	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

DESIGN THINKING AND AUGMENTED VIRTUAL REALITY	
Course Code:24CS0202A	
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.

TEAMWORK & INTERPERSONAL SKILLS	
Course Code: 23SS452	
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.

OPERATING SYSTEMS LAB	
Course Code: 23CS2114	
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.

ANALYSIS AND DESIGN OF ALGORITHMS LAB	
Course Code: 24CSPE2118	
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).

BUILD and RELEASE MANAGEMENT LAB	
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.

SEMESTER - V

COMPILER DESIGN	
Course Code: 24CSPE3001	
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.

COMPUTER NETWORKS	
Course Code: 24CSPE3003	
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.

CONTINUOUS INTEGRATION AND CONTINUOUS DEPLOYMENT	
Course Code: 23CD301	
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.

AGILE PRACTICES	
Course Code: 23CD303	
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.

PRESENTATION & SPEAKING SKILLS	
Course Code: 23SS553	
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.

COMPUTER NETWORKS LAB	
Course Code:	
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.

Live Project – I & Industrial Training	
Course Code: 23CS0303A	
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

COMPILER DESIGN LAB	
Course Code: 24CSPE3117	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

CONTINUOUS INTEGRATION AND CONTINUOUS DEPLOYMENT LAB	
Course Code: 23CD311	
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

SEMESTER - VI

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	
Course Code: 24CSPE3002	
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

TEST AUTOMATION	
Course Code: 23CD302	
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.

APPLICATION CONTAINERIZATION	
Course Code: 23CD304	
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.

Professional Skills	
Course Code: 23SS655	
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: 24CS3114	
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: 23CD312	
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.

APPLICATION CONTAINERIZATION LAB	
Course Code: 23CD314	
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.

DATA ANALYTICS, TOOLS	
Course Code:24CS0302D	
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.

Live Project – II & Industrial Visit	
Course Code: 23CS0304A	
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

SYSTEM PROVISIONING AND CONFIGURATION MANAGEMENT	
Course Code: 23CD401	
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.

CLOUD COMPUTING	
Course Code: 24CS4003	
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.
ar

CLOUD COMPUTING LAB	
Course Code: 23CS4113	
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.

Live Project – III & Industrial Training	
Course Code: 23CS4115A	
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

SYSTEM PROVISIONING AND CONFIGURATION MANAGEMENT LAB	
Course Code: 23CD411	
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.

MINOR PROJECT	
Course Code: 23CS4117A	
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 & System Monitoring	
Course Code: 24CD402	
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: 23CS4114	
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: 23CDPE321	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

CLO1 Able to Understand to set up Python environment.
CLO2 Understand the Programming fundamentals.
CLO3 To Understand the Pre-Processing steps with Python.
CLO4 Learn the statistical Modeling with Python.

BIG DATA OVERVIEW	
Course Code: 23CDPE323	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

CLO1 Understand the types of data generated.
CLO2 Learn the Data Lake Essentials.
CLO3 Understand the Scalability.
CLO4 Explore the Big Data Ecosystem.

SYLLABUS OF PROFESSIONAL ELECTIVE COURSES - II

SUPERVISED LEARNING	
Course Code: 23CDPE322	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

C**LO1** Able to Understand the Machine Learning Concepts.
CLO2 Understand the Regression Techniques.

CLO3 o Learn the different types of Supervised Algorithms.
CLO4 Applications of Supervised Learning.

DOMAIN-DRIVEN APPROACH TO DESIGN AND IMPLEMENT MICROSERVICES	
Course Code: 23CDPE324	
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

GRID COMPUTING	
Course Code: 23CSPE3026	
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.

NEURAL NETWORKS & FUZZY LOGIC	
Course Code: 21**CS3030**	
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

CYBER SECURITY	
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.

PREDICTIVE ANALYTICS

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.

BUSINESS INTELLIGENCE	
Course Code: 23CSPE3038	
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.

INTERNET OF THINGS	
Course Code: 23CSPE3040	
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

DIGITAL PRODUCT ENGINEERING and DESIGN THINKING	
Course Code: 23CDPE421	
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.

SOFTWARE CRAFTMANSHIP OVERVIEW	
Course Code: 23CDPE423	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: 23CS4019	
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: 23CS4023	
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.

ADVANCED JAVA PROGRAMMING	
Course Code: 23CS4035	
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.

DATA WAREHOUSING & DATA MINING	
Course Code: 23CS4025	
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.

MOBILE COMPUTING	
Course Code: 23CS4027	
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

OPEN SOURCE SOFTWARE	
Course Code: 23CS4031	
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.
C**LO3** 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.

ADVANCED INTERNET OF THINGS	
Course Code: 24CSPE4041	
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.

ADVANCED BLOCKCHAIN	
Course Code: 23CSPE4047	
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

MODERN ARCHITECTURE PATTERNS	
Course Code: 23CDPE422	
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.

MODERN WEB and MOBILE FRAMEWORKS	
Course Code: 23CDPE424	
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

GERMAN LANGUAGE PHASE I	
Course Code: 24FLGR301	
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 understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.

CLO4 Student will 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.

GERMAN LANGUAGE PHASE II	
Course Code: 24FLGR401	
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 able to use language creatively and spontaneously.

CLO4 Get awareness of cross-cultural and intercultural difference.

FRENCH LANGUAGE PHASE I	
Course Code: 24FLFR301	
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.

FRENCH LANGUAGE PHASE II	
Course Code: 24FLFR401	
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.

ENTERPRENEURSHIP & NEW VENTURE MANAGEMENT	
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.

SUSTAINABLE GROWTH & DEVELOPMENT	
Course Code: 24ESUG202	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

CLO1 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 Able to work in the area of sustainability for research and education.

CLO4 Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

WASTE MANAGEMENT	
Course Code: 24ESUG203	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

CLO1 Able to develop an awareness about solid waste and management practices

CLO2 Design feasible solutions for waste management

CLO3 Students will have understanding of waste management practices, law and regulation related to solid waste management.

MICROPROCESSORS AND INTERFACING	
Course Code: 24EC390	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

CLO1 Understand the architecture of microprocessors and micro controller

CLO2 Able to 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 Data Science and Artificial Intelligence
[w. e. f. 2024-2025]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
39, Rajiv Gandhi Education City, Sonepat
Haryana-131029

SEMESTER - I & SEMESTER – II

FUNDAMENTALS OF COMPUTER & C PROGRAMMING	
Course Code: 23CS201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

After the completion of course, students will be able to:

- Understand the fundamental concepts of computers, both hardware and software.
- Learn and understand the major system software's that help in developing of an application. · Apply and analyse the basic programming constructs in context of C programming language. · Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions
- Create and manipulate a database or data storage through files.
- Develop a methodological way of problem solving.
- Learn a programming approach to solve problems.

C PROGRAMMING LAB	
Course Code: 23CS151	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

:The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course, students will be able to:

- · Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.
- Introduction to C Programming using Control Statements and Repetition Statement
- Apply and practice logical formulations to solve some simple problems leading to specific applications.
- · Design effectively the required programming components that efficiently solve computing problems in real world.
- Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

ENGINEERING MATHEMATICS-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS101	
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.

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS201	
Credits: 4	
L T P : 3 1 0	
Prerequisite: Engineering Mathematics-I	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors required for matrix diagonalization process
2. Apply the knowledge of differentiation, partial differentiation, Maxima and minima of two variables for analyzing engineering problems.
3. Apply the multiple integrals in engineering applications.
4. Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stroke's theorems.
5. Solve different problems with help of Fourier series.

ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	
Course Code: 24AS102/202	
Credits: 4	
L T P : 3 1 0	

Prerequisite: NIL	

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.

ENGINEERING PHYSICS LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	
Course Code: 24AS103/203	
Credits: 4	
L T P : 3 1 0	
Prerequisite: NIL	

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.

ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)	
Course Code: 24AS153/253	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EC101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC ELECTRONICS ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code:24EC151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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

BASIC ELECTRICAL ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code: 24EE101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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

BASIC ELECTRICAL ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code: 24EE151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: Nil	

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

COMMUNICATIVE ENGLISH (COMMON TO ALL BRANCHES)	
Course Code: 24HS101/201	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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.

COMMUNICATIVE ENGLISH LAB (COMMON TO ALL BRANCHES)	
Course Code: 24HS151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

INDIAN CONSTITUTION & POLITY (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24HS102/202	
Credits: 2	
L T P : 2 0 0	
Prerequisite: NIL	

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 an 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.

to be skilful in executing democratic leadership, developing skill in programme development to be able for self-employment, (COMMON TO ALL BRANCHES EXCEPT)	
Course Code:24SE151	
Credits: 1	
L T P: 0 0 2	
Prerequisite: Nil	

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 an 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,

ENGINEERING GRAPHICS & DESIGN LAB (Common to all Branches)	
Course Code: 23ME153/253	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

Once the course is completed, the students will be able to

· Understand orthographic projections of points and lines in any position through AutoCAD. · Imagine and convert isometric view into orthographic projections and vice versa.

· Should be able to understand the simple machine components and draw its projections

YOGA & PHYSICAL EDUCATION Practices (COMMON TO ALL BRANCHES EXCEPT)	
Course Code:24SE151	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P: 0 0 2	
Prerequisite: Nil	

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

BASIC MECHANICAL ENGINEERING (Common to all Branches)	
Course Code: 24ME101/201	
Credits: 3	
L T P : 3 0 0	
Prerequisite: NIL	

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.

BASIC MECHANICAL ENGINEERING LAB (Common to all Branches)	
Course Code: 24ME151/251	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

MECHANICAL WORKSHOP LAB (Common to all Branches)

Course Code: 24ME152/252	
Credits: 1	
L T P : 0 0 2	
Prerequisite: NIL	

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.

SEMESTER - III

ENGINEERING MATHEMATICS - III	
Course Code: 24AS301	
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.

PYTHON PROGRAMMING	
Course Code: 23CAM2009	
Pre-Requisite : NIL	
L T P : 2 0 0	
Credits: 2	

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

· Understand the vision of Python from a global context

· Understand the content that how to write loops, decision statements, write functions and pass arguments in Python.

· Learn how to use lists, tuples, and dictionaries in Python programs and to learn how to identify Python object types.

· Learn how to read and write files in Python. Will learn how to create Pandas DataFrames, calculate aggregates, and merge multiple tables.

DATA STRUCTURES	
Course Code: 24CS2001	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO's)

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. Define linear and non-linear data structures.
2. Implement linear and non–linear data structure operations.
3. Use appropriate linear/non–linear data structure operations for solving a given problem.
4. Apply appropriate graph algorithms for graph applications.
5. Analyze the various searching and sorting algorithms.

DATABASE MANAGEMENT SYSTEMS	
Course Code: 23CS2005	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

COURSE LEARNING OUTCOMES (CLO)

After completion of course, students would be able to:

1. Understand the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.
2. Design the database schema with the use of appropriate data types for storage of data in database
3. Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries.
4. 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.
5. Understand and apply the concept of transaction, concurrency control and recovery in database.
6. Understand the some current advance trends including Object DBMS, Distributed Database, Mobile database, Data Warehousing and Data Mining.

COMPUTER ARCHITECTURE & ORGANIZATION	
Course Code: 24**CSPE2007**	
Pre-Requisite : NIL	
L T P : 3 1 0	
Credits: 4	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After the completion of course the students will be able to:

1. Analyse the basic operational concepts of Functional unit, Instruction format and addressing mode.
2. Differentiate the RISC and CISC architecture. Analyze the performance of machines with different capabilities.
3. Illustrate the binary format of numerical and characters. Validate efficient algorithm for arithmetic operations.
4. Understand the need for an interface and instruction cycle phases. Implement the hardwired and microprogrammed control unit for analyse the performance.
5. 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.

PYTHON PROGRAMMING LAB	
Course Code: 23CAM2115	
Pre-Requisite : NIL	
L T P : 0 0 2	
Credits: 1	

LEARNING OUTCOME:

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

Apply the knowledge of basic python concepts to analyse the data and to derive meaningful results from raw datasets.

DATABASE MANAGEMENT SYSTEMS LAB	
Course Code: 23CS2111	
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.

DATA STRUCTRUES LAB	
Course Code: 23CS2113	
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.

INDUSTRY SESSION: DATA SCIENCE LAB	
Course Code: 23CAM2117	
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.

EFFECTIVE COMMUNICATION SKILLS	
Course Code: 23SS351	
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

CLOUD APPLICATION	
Course Code: 23CAM2004	
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.

AGILE DEVELOPMENT METHODOLOGY	
Course Code: 23CAF2006	
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.

THEORY OF COMPUTATION	
Course Code: 23CSPE2004	
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.

OPERATING SYSTEMS	
Course Code: 23CS2006	
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.

ANALYSIS AND DESIGN OF ALGORITHMS	
Course Code: 23**CS2008**	
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.

TEAMWORK & INTERPERSONAL SKILLS	
Course Code: 23SS452	
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.

CLOUD APPLICATION LAB	
Course Code: 23CAM2120	
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.

AGILE DEVELOPMENT LAB	
Course Code: 23CAF2118	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.

OPERATING SYSTEMS LAB	
Course Code: 23CS2114	
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.

ANALYSIS AND DESIGN OF ALGORITHMS LAB	
Course Code: 23CS2118	
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).

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-LEVEL-II	
Course Code: 23CS0202	
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

SEMESTER - V

MACHINE LEARNING USING R	
Course Code: 23CAM3001	
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.

ESSENTIALS OF HADOOP	
Course Code: 23CAF3005	
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.

COMPILER DESIGN	
Course Code: 23CSPE3001	
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.

COMPUTER NETWORKS	
Course Code: 23CSPE3003	
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.

PRESENTATION SKILLS	
Course Code: 23SS553	
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.

MACHINE LEARNING USING R LAB	
Course Code: 23CAM3115	
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.

HADOOP LAB	
Course Code: 23CAF3113	
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

COMPUTER NETWORKS LAB	
Course Code: 23CSPE3113	
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.

Live Project-I & Industrial Training	
Course Code: 23CS0303A	
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.

COMPILER DESIGN LAB	
Course Code: 23CSPE3117	
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

SEMESTER - VI

ARTIFICIAL INTELLIGENCE	
Course Code: 23CAM3002	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 3	

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.

NOSQL and MongoDB	
Course Code: 24CAF3010	
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.

SOFTWARE ENGINEERING	
Course Code: 23**CS3004**	
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

MANAGEMENT AND ORGANISATIONAL BEHAVIOUR	
Course Code: 23BS301	
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.

PROFESSIONAL SKILLS	
Course Code: 23SS655	
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:

- TLO1. The student will understand the importance of professional writing required in workplace.
- TLO2. 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.

ARTIFICIAL INTELLIGENCE LAB	
Course Code: 23CAM3116	
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.

NOSQL AND MONGODB LAB	
Course Code: 24CAF3012	
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

SOFTWARE ENGINEERING LAB	
Course Code: 23CS3118	
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

INDUSTRY SESSION : DEEP LEARNING LAB	
Course Code: 24CAM3014	
Pre-Requisite: **linear algebra, probability, basics of machine learning.**	
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.

DATA ANALYTICS, TOOLS	
Course Code: 24CS0302D	
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.

LIVE PROJECT-II & INDUSTRIAL VISIT	
Course Code: 23CS0304A	
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

DATA SCIENCE (PREDICTIVE ANALYSIS)	
Course Code: 24CAF4005	
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.

QUANTUM COMPUTING	
Course Code: 24CAM4003	
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.

INTERPERSONAL SKILLS: STRATEGIES (COMMON TO ALL BRANCHES)	
Course Code: 23SS756	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.

QUANTUM COMPUTING LAB	
Course Code: 24CAM4007	
Pre-Requisite : Basic Quantum Mechanism	
L T P : 0 0 2	

CLO1 : Access and navigate IBM Q Experience.

CLO2 : Identify Superposition, Entanglement, and Noise.

CLO3 : Swap the gates of qubits.

CLO4 : Code an Algorithm with Aqua

CLO5 : Perform calls to Aqua

DATA SCIENCE LAB	
Course Code: 24CAF4009	
Pre-Requisite : Knowledge of Analytics and Visualization	
L T P : 0 0 2	
Credits: 1	

CLO1 : To provide an overview of Data Science using Python.

CLO2 : To introduce the students with the importance of Machine Learning using and importance of their

improvement.

CLO3 : To introduce the students with the importance of Data Visualization in Machine Learning using

Python programming.

CLO4 : To teach the students different tools and libraries of Python Programming so that they can cope up

with industry standard and requirements.

CLO5 : 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.

INDUSTRY SESSION: BLOCKCHAIN	
Course Code: 23CAM4011	
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.

LIVE PROJECT-IV & INDUSTRIAL TRAINING	
Course Code: 23CS4115A	
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.

MINOR PROJECT	
Course Code: 23CS4117A	
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

MAJOR PROJECT	
Course Code: 23CS4114	
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

DISTRIBUTED OPERATING SYSTEM	
Course Code: 23CSPE3020	
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: 23CSPE3024	
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: 23CSPE3026	
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.

OBJECT ORIENTED ANALYSIS & DESIGN	
Course Code: 23CSPE3028	
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.

NEURAL NETWORKS & FUZZY LOGIC	
Course Code:23CSPE3030	
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

CYBER SECURITY	
Course Code: 23CSPE3032	
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.

DESIGN THINKING	
Course Code: 23CSPE3034	
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.

BUSINESS INTELLIGENCE	
Course Code: 23CSPE3038	
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.

INTERNET OF THINGS	
Course Code: 23CSPE3040	
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.

NETWORK SECURITY & CRYPTOGRAPHY	
Course Code: 23CSPE4019	
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.

SOFTWARE TESTING	
Course Code: 23CSPE4033	
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.

WIRELESS ADHOC AND SENSOR NETWORK	
Course Code: 23CSPE4023	
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.

ADVANCED JAVA PROGRAMMING	
Course Code: 23CSPE4035	
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.

NASSCOM ASSOCIATE ANALYTICS - II	
Course Code: **23CSPE4037**	
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.

DATA WAREHOUSING & DATA MINING	
Course Code: 23CSPE4025	
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.

MOBILE COMPUTING	
Course Code: 23CSPE4027	
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

OPEN SOURCE SOFTWARE	
Course Code: 23CSPE4031	
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.

NASSCOM ASSOCIATE ANALYTICS - III	
Course Code: 23CSPE4039	
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

GERMAN LANGUAGE PHASE I	
Course Code: 24FLGR301	
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.

GERMAN LANGUAGE PHASE II	
Course Code: 24FLGR401	
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 Use language creatively and spontaneously.
CLO4 Get awareness about cross-cultural and intercultural difference.

FRENCH LANGUAGE PHASE I	
Course Code: 24FLFR301	
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 Use language creatively and spontaneously.
CLO4 Know the culture of the countries where the French language is spoken.

FRENCH LANGUAGE PHASE II	
Course Code: 24FLFR401	
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 Use language creatively and spontaneously.
CLO4 Know the culture of the countries where the French language is spoken.

ENTERPRENEURSHIP & NEW VENTURE MANAGEMENT	
Course Code: SEC-FT-01	
Pre-Requisite : NIL	
L T P : 3 0 0	
Credits: 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.

SUSTAINABLE GROWTH & DEVELOPMENT	
Course Code:24ESUG202	
Credits: 3	
L T P : 3 0 0	
Prerequisite: 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

WASTE MANAGEMENT	
Course Code:24ESUG203	
Credits: 3	
L T P C : 3 0 0	
Prerequisite: 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.