Subject: Mathematics-1
Year/Semester: 1st/1st
Course Name: C101

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Module 1:Applications of definite integrals to evaluate length of curves, areas of surfaces and volumes of surfaces of revolution ,Improper integral (Definition and Elementary Examples) Beta and Gamma functions and their properties.	**CO101.1**- Learn the technique of calculus	L5
	CO101.2 –Familiarize with gamma and beta function .	L2
Module 2; Mean value theorem (Statement and applications), First derivative test for local extreme values of functions. Power series, Taylor and Maclaurin series.	**CO101.3**- Apply of mean value theorem and power series	L3
Module 3: Partial derivatives. Jacobians, Hessian Matrix. Maxima, Minima and saddle points. Method of Lagrange multipliers.	**CO101.4** – Identify the application of partial derivatives .	L4
Module 4:Vector Space, Basis and dimension, Linear Systems of Equations, Gauss elimination, Linear Dependence and Independence, Rank of a Matrix.	**CO101.5**- Deal with linear system of equation and rank of a matrix .	L4
Module 5: Inverse of a matrix (Gauss-Jordan). Symmetric, skew-symmetric and orthogonal matrices. Eigen values and eigenvectors. Caley-Hamilton Theorem (Statement only)	**CO101.6**- Identify the specific properties of matrices .	L2

Subject: Physics
Year/Semester: 1st/1st
Course Name: C102

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Module1: Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, steady state motion of forced damped harmonic oscillator	**CO102.1**: Apply knowledge of harmonic oscillation in mechanical and electrical system.	L3
Module2: Concept of wave and Wave equation, Superposition of many harmonic waves, Concept of coherent sources (Division of wave front and division of amplitude) . Interference in thin parallel film, Newton's ring: Determination of wavelength of light, Refractive index of liquid).Concept of diffraction (Huygen's Principle), Types of Diffraction, Fraunhoffer diffraction due to single slit, diffraction grating (qualitatively).	**CO102.2:** Understand the basic concept of nature of light and the concept of coherent sources of waves.	L2
	CO102.3: Explain the thickness of the thin film , refractive index & resolving power of grating using principle of interference & diffraction of light	L2
Module3: Vector calculus: Gradient, Divergence, Curl (Mathematical concept), Gauss divergence theorem and Stoke's theorem (statement only), Derivation of Maxwell's electromagnetic equation in differential form and integral form, Electromagnetic wave equations for **E** and **B** in vacuum and conducting medium, transverse nature of EM waves.	**CO102.4:** Use Maxwell's equations & time varying electric field to show the nature of propagation of EM waves & its energy through free space, non-conducting and conducting media.	L4
Module4: Wave particle duality, concept of phase velocity group velocity, relation between them, Matter waves (de Broglie hypothesis), Wave functions, Observables as operators, Eigen function and Eigen values, Normalization, Expectation values, Schrodinger equation (Time dependent and time independent), Particle in a box.	**CO102.5:** Understand the Schrodinger wave equation to calculate the matter wave energy and momentum & particle in a box.	L2
Module5: Introduction to Laser, Characteristics of Lasers, Einstein's coefficients and relation between them, Lasing action, Population inversion, Three and four level pumping schemes, Ruby Laser, He-Laser.	**CO102.6:** Classify among different types of LASER and its transition probabilities.	L3

Subject: Basic Electrical Engineering
Year/Semester: 1st/1st
Subject Code: C103

CO	CO STATEMENTS After completion of the course the student will be able to	BTL
CO103.1	Implement principles of DC network, theorems& its application.	L2
CO103.2	Analyze the concept of Single phase and three phase AC circuits in different passive loads.	L3
CO103.3	Express the concept of magnetic circuit compression with electric ckt & control of hysteresis & eddy current loss & its prevention	L2
CO103.4	Apply basic principles of AC machines and their working.	L3
CO103.5	Apply basic principles of AC static & Dynamic machines and their working.	L3
CO103.6	Know different power plant and its detail domestic utilization.	L2

Subject: Programming C & Data Structure
Year/Semester: 1st/1st
Subject Code: C104

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Module 1: Fundamentals of C: Algorithms and Flow Chart. C as a Middle-level language, Structure of C Program, Character set Identifiers, Keywords, Data Types, Constant and Variables, Statements, Input and Output statements, Operators and Expressions, Precedence of operators, Control Structures	**CO104.1**: Understand the basic concept of programming language.	L2
	CO104.2: Understand fundamentals concept of C Programming & Implement simple algorithm to C program.	L3
Module 2: Function, Array, Structure and Union.	**CO104.3**:Test and Execute programs using Function, Array, Structure and Union	L3
Module 3: Pointer & Dynamic Memory Allocation. Call by value vs. Call by reference, Passing parameters, pointer to pointer, pointer to function, Pointer to Structure, Array and pointers, Static vs. Dynamic memory, Pointer variables, Dynamic memory allocation functions	**CO104.4:** Analyze the relation of memory and memory referencing with program execution.	L3
Module 4: Data Structures Introduction to Data Structure, Linear Linked List: Creation, Insertion, Deletion. Stack, Stack applications (Infix to postfix, postfix evaluation), Queue (linear & circular)	**CO104.5**: Apply different Data structure for Problem Solving.	L4
Module 5: Tree, Introduction to Sorting & Searching. Binary Tree, Binary Search Tree, Sorting, Searching (Linear Search, Binary Search)	**CO104.6**: Implement different Sorting and Searching Algorithm	L5

Subject: Basic Civil Engineering
Year/Semester: 1st/1st
Subject Code: C105

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Module-I: Introduction to Civil Engineering: Various disciplines of Civil engineering, Importance of Civil engineering in infrastructure development of the country, interdisciplinary nature of construction projects. Residential Buildings: NBC Classification, Basic Components of a building: Basic requirement. Planning and Design of buildings: fundamental requirements, selection of sites, Introduction to building design: functional and structural design. Foundations: Classification, Bearing Capacity of Soil and related terms (definition only)	**CO105.1** - Understand the basics of civil engineering and fundamental aspects of building.	L1,L2
	CO105.2 – Get an overview about classification of foundation and bearing capacity of soil	L1,L2
Module-II: Fundamental Properties of Construction Materials: Physical, mechanical and durability properties. Construction materials: stone, bricks, cement, aggregate, mortar, concrete, timber, steel, non-ferrous metals, paint, plastic, glass, adhesive, tiles, composites(Definition, classification and application)	**CO105.3 – G**et brief overview of general aspects of building material.	L1,L2
Module-III: Importance of Transportation, Transportation modes i.e. Highway, railway, airways, water, pipe and conveyor – Basic Characteristics, advantages and disadvantages. Indian road transport system: Types of roads, classification of highway, urban roads: basic requirements and classification. Basic Components of a Road, Rigid and Flexible pavement (comparison only)	**CO105.4** - Get brief idea about transportation modes and planning.	L1,L2
Module-IV: Quantity of water: Sources of water, Per capita demand, drinking water standards, Public Water Supply System: Necessity and Basic lay out. Conventional water treatment process: Screening, Plain. Sedimentation, Sedimentation aided with Coagulation, Filtration, and Disinfection (working principles only).	**CO105.5** - Get brief idea about drinking water standards and water treatment plant.	L1,L2
Module-V: Irrigation: Importance of Irrigation, Classification of Irrigation projects, Irrigation system: Types, Field water distribution, Multipurpose river valley projects, Dams: Purpose, types. Layout of canal Irrigation system: components and definitions.	**CO105.6** - Get brief idea about irrigation network system.	L1,L2

Subject: Universal Human Values
Year/Semester: 1st/1st
Subject Code: C106

MODULE	CO STATEMENT	BTL
MODULE I: FOUNDATIONS OF VALUE EDUCATION-Right understanding, Relationship and Physical Facility (Holistic development and the Role of Education), Understanding Value Education.	**CO106.1:** Develop a holistic perspective based on self-exploration through value education.	**L6**
-Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, The Basic Human Aspirations, Happiness and Prosperity- Current Scenario, Method to Fulfill the Basic Human Aspirations.	**CO106.2:** Develop an understanding of the Self, the basic human aspirations and methods of fulfilling them.	**L6**
MODULE II: HARMONY IN THE HUMANLIFE, RELATIONSHIPS AND SOCIETY. -Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the needs of the Self and the Body, Achieving Harmony:	**CO106.3:** Develop an understanding or gain clarity of the harmony in the human being as a co-existence of the Self and the Body.	**L2**
-Integrating Self and the Body, Harmony in the Family and Society, 'Trust' and 'Respect'-- as Foundational Values in Relationship, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society and Universal Human Order.	**CO106.4:** Develop an understanding of the relationship with Family, society and nature/existence. Expanding the feeling of harmony from within to the same with the rest of the world.	**L6**
MODULE III: HARMONY IN THE NATURE /EXISTENCE AND PROFESSIONAL ETHICS. -Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Natural Acceptance of Human Values, Humanistic Education, Humanistic Constitution and Universal Human Order.	**CO106.5:** Develop an understanding of the relationship of synthesis and mutual fulfillment with nature and the world order. An awareness of the eco-system, one's place in and responsibility towards the same.	**L2**
-Competence in Professional Ethics- Ethical Decision Making and Transition towards Value-based Life and Profession.	**CO106.6:** Adapt to the present-day work scenario with knowledge of professional ethics, decision making, progressive and sustainable living.	**L6**

Subject: Physics Laboratory
Year/Semester: 1st/1st
Subject Code: C107

CO No.	List of Experiments	Statement	BTL
C107.1	Determination of acceleration due to gravity by using Bar Pendulum	Analyze acceleration due to gravity by using Bar pendulum and resonance using sonometer	L3
	Study of resonance using sonometer for unknown frequency		
C107.2	Determination of wavelength of monochromatic light with the help of Newton's ring apparatus	Understand wavelength of monochromatic light by using Newton's ring apparatus and diffraction grating using spectrometer.	L2
	Determination of grating element of a diffraction grating using spectrometer		
C107.3	Study of RLC circuit	Analyze RLC circuit, characteristic of Bipolar Junction Transistor (BJT) and PN junction diode.	L3
	To draw the characteristics of a bipolar junction transistor		
	To draw the VI characteristics of a PN Junction diode		
C107.4	To determine the rigidity modulus of the material of a wire by using Barton's apparatus	Understand the rigidity modulus by using Barton's apparatus, Young's modulus by Searle's apparatus and surface tension of capillary rise method.	L2
	To determine the Young's modulus of a given material by Searle's apparatus		
	Determination of surface tension of water by capillary rise method		
C107.5	Magnetic field measurement from Helmholtz coil	Analyse the magnetic field of Helmholtz coil & e/m ratio.	L3
	To determine e/m ratio		

Subject: Basic Electrical Engineering Lab
Year/Semester: 1st/1st
Subject Code: C108

CO	**After completion of the course the student will be able to**	BTL
CO108.1	Express the safety rules as per ISS and symbols of different electrical components and the use of various electrical instruments in the laboratory.	L2
CO108.2	Demonstrate the working and operational characteristics of dc motor and dc generator.	L2
CO108.3	Evaluate the voltage, current, power and power factor of choke coil and study BH curve of a ferromagnetic core.	L2
CO108.4	Measure armature and field resistance of DC machines, earth resistance and insulation resistance and demonstrate the internal structure of different machines.	L2
CO108.5	Analyze the connection and calibration of single phase energy meter.	L3

Subject: Programming Lab
Year/Semester: 1st/1st
Subject Code: C109

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
1.Write a program to print your Bio-data. 2 Write a program in C to test the arithmetic operators. 3 Write a program to find out the simple interest and compound interest with the given input data. 4.Write a program to enter the marks of a student in 4 subjects. Then calculate the total, Aggregate %, and display the grades obtained by the student. 5. Write a program to print the following pyramid star pattern.	**CO109.1**- Develop C programs for simple applications making use of basic constructs.	**L6**
6. Write a program to check a given number is palindrome or not. 7.Write a program to enter a number from 1-7 and display the corresponding day of the week using switch case statement. 8.Write a program to generate prime numbers present between two given numbers.	**CO109.2**- Develop C programs involving Loops	**L6**
8.Write a program that will accept an array, and find the largest number, smallest number, sum of the elements and average of the elements present in the array. 9.Write program that will accept an array and sort the array in ascending order. Display both the unsorted and unsorted arrays. 10. Write a program that will insert an element at a desired position of an array. Show the array before insertion and after insertion of the new element (Array, element and position will provided by the user)	**CO109.3**- Design and implement applications in C using Arrays and Strings	**L6**
11.Write a program to swap the value of two inputted variable using function. Show the initial value and value after swapping. 12 Write a program to print the Fibonacci series using function. 13 Write a program that will accept two matrices using function and multiply them using function and show the result using function. 14. Write a program to find the GCD among two given number using recursion. 15. Check a inputted string is palindrome or not using pointer.	**CO109.4**- Dvelop C programs involving Functions, Recursion, and Pointers.	**L6**
16.Write a program to implement insertion and deletion of an element using linked list. 17.Write a program to implement Push and Pop operations in Stack. 18.Write a program to implement insert and delete operations in Queue.	**CO109.5**- Develop C programs involving Linked List, Stack and Queue	**L6**
19.Write a program to implement Quick Sort algorithm using C. 20. Write a program to search an element using Linear Search algorithm. 21.Write a program to search an element using Binary Search algorithm.	**CO109.6**- Develop C programs involving searching and sorting	**L6**

Subject: Engineering Graphics & Design Lab
Year/Semester: 1st/1st
Subject Code: C110

Expt. No.	Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1	**AUTO CAD:** layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP &LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**CO110.1** Study different coordinate system, commands of Auto CAD and creation of basic drawings.	**L1,L2,L3**
2	**Orthographic Projections:** Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only),True and apparent lengths, True and apparent inclinations to reference planes.	**CO110.2**Study orthographic projection of point, straight line and planes.	**L1,L2,L3**
3	**Orthographic Projections of Plane Surfaces (First Angle Projection Only):** Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only	**CO110.3** – Study projection of different solids in first angle concept.	L1,L2,L3
4	**Projections of Solids (First Angle Projection Only):** Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. 2-Sheets Sections and Development of Lateral Surfaces of Solids Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.		
5	**Isometric Projection (Using Isometric Scale Only):** 21 Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**CO110.4** – Understand isometric projection of different solid objects.	**L1,L2,L3**

Subject: Mathematics-II
Year/Semester: 1st/ 2nd
Subject Code: C111

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Exact ODEs. Integrating factors. Linear first order ODEs. Nonlinear first order ODE and Bernoulli's equations, Applications to Population growth, Newton's law of cooling, RL circuit.	**CO111.1**- Solve first order differential equation analytically using standard method .	L3
Second order linear differential equations with constant coefficients, Euler-Cauchy equations, method of undetermined coefficients, solution by variation of parameters. Power series solutions of ODE. Legendre's equations (explicit solution only).	**CO112.2** –Familiarize with higher order differential equation.	L4
Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field,	**CO112.3**- Illustrate the concept of vector differential calculus.	L3
Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane (Statement and applications)	**CO112.4** Illustrate the concept of line integral c.	L4
Limit, Continuity, Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and logarithm functions.	**CO112.5** Know about various complex functions.	L3
Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions, Laurent series, Residue theorem with simple problems.	**CO112.6** Familiarize with the complex integration.	L2

Subject: Chemistry
Year/Semester: 1st/ 2nd
Subject Code: C112

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Quantum Chemistry: Basic concepts and postulates of quantum mechanics. Introduction to Schrodinger Wave Equation (without derivation), Particle in a box: Energy levels, quantum numbers and selection rule	**CO112.1**- Demonstrate various periodic properties associated with different elements present in different groups and periods of modern periodic table	**L4**
Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, applications on quantitative analysis. Effect of conjugation on chromophores, Absorption by aromatic systems, introductory idea on rotational and vibrational Spectroscopy Principles and application to diatomic molecules.	**CO112.2**- Understand about free energy concept of the thermodynamics associated with chemical reaction and equilibrium	**L1**
The phase rule: Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of one component system – water and sulfur system, Condensed phase rule, Phase diagram of two component system – Eutectic Bi-Cd, Pb-Tin system & Isomorphous System.	**CO112.3**- Analyze the concept of rotational and vibrational spectroscopy techniques for identification of organic and inorganic compounds	**L4**
Fuels: Classification of fuels, calorific value. (Determination by Dulong's formula), G.C.V. and N.C.V., Solid fuels, Analysis of coal. Liquid fuels: Classification of petroleum, Refining of petroleum, Cracking, Knocking and anti-knocking, cetane and octane numbers. Unleaded petrol, synthetic petrol, power alcohol. Gaseous Fuel: Producer gas, Water gas, LPG, CNG, Kerosene gas, Combustion calculation	**CO112.4**- Understand the concepts of UV spectroscopy for identification of organic and inorganic compounds.	**L2**
Corrosion: Electrochemical theory of corrosion, galvanic series, Types of corrosion; Differential metal corrosion, Differential aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlement in boilers), Factors affecting, metal coatings – Galvanizing and Timing, Corrosion inhibitors, cathodic protection.	**CO112.5**- Analyze the concept of configuration and conformations of various organic compounds .	**L4**
New Materials: Introduction to nano materials, classification (0D, 1D, 2D) with examples, size dependent properties, Top-down and Bottom-up approaches of nanomaterial synthesis. Introductory idea on synthesis of nano materials via green synthetic	**CO112.6**- Understand the generation , reaction , and identification of intermediate reaction and there applications .	**L2**

Subject: Basic Electronics
Year/Semester: 1st/ 2nd
Subject Code: C113

MODULE	CO STATEMENT After completion of the course the student will be able to	BTL
Semiconductor Physics: Properties of semiconductor, current flow in semiconductors, voltage -current characteristic of a p-n junction, Rectifiers Bipolar junction Transistor (BJT): Device structure, types and modes of operation, static characteristic, BJT as a switch, BJT as an amplifier, concept of biasing of BJT	**CO113.1**: Know basics of semiconductor diode and Introduction to transistor with different biasing techniques.	**L2**
JFET: Physical structure, operation and static characteristics MOSFET: Physical structure, operation and characteristics of D- and E-type MOSFET Integrated Circuits: Introduction to CMOS technology in VLSI, Introduction to Integrated circuits, Fabrication of monolithic IC, Integration of circuit components, Limitations of VLSI	**CO113.2:** Understand different biasing techniques to operate FET, MOSFET and CMOS circuits in different circuit design.	**L2**
Feedback Amplifiers: General feedback structure, properties of negative feedback, four basic types of feedback topologies (Block diagram only) Operational Amplifier (OP-AMP): Ideal OP-AMP, inverting configuration, non-inverting configuration, OP-AMP Applications (Adder, Subtractor only)	**CO113.3**: Know operational amplifier in different modes and analyze the design of circuits using op-amp.	**L2**
Digital Electronics Fundamentals-Number system (Decimal, Binary, Octal and Hexadecimal), conversion among number systems, signed-binary numbers, binary addition, subtraction, multiplication and division, logic gates, laws of Boolean Algebra, simplification of expressions	**CO113.4**: Compare design, advantages, and limitations of basic feedback circuits. Compare design, advantages, disadvantages and limitations of basic digital electronics circuits.	**L3**
Electronic Instruments: Overview of CRO, DSO; principles of operation, waveform reconstruction	**CO113.5**: Know about CRO and basics of communication circuits.	**L2**
Comparison between CRO & DSO, applications of oscilloscope, Principles of Communication Systems: Fundamentals of AM & FM, (Waveforms and general expressions only)	**CO113.6**: Remember the fundamentals of different Digital arithmetic operations	**L2**

Subject: Engineering Mechanics
Year/Semester: 1st/ 2nd
Subject Code: C114

Module	CO Statement After completion of the course the student will be able to	BTL
Module-I: Concurrent forces on a plane: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment. General case of forces on a plane: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections.	**CO114.1 -** Ability to analyze objects in static equilibrium including the determination of reactions, forces and moments.	**L4**
Module-II: Friction: Fundamentals and Problems involving friction, Ladder, Wedges. Principle of virtual work.	**CO114.2 –** Enrich fundamental concept of friction and demonstrate the analytical skills to solve the problems involving friction.	**L5**
Module-III: Parallel forces on a plane: General case of parallel forces, center of parallel forces and center of gravity, Centroid of plane and composite figures, Theorems of Pappus and Guildins. Moment of inertia: Plane figure with respect to an axis in its plane and perpendicular to the plane, Polar moment of inertia, parallel axis theorem.	**CO114.3 –** To Understand the knowledge for determination of centroid and second moment of area of sections and their engineering applications.	**L2**
Module-IV: Rectilinear translation: Kinematics, Principle of dynamics, D Alembert‟s Principle, Principle of work and energy for a particle and a rigid body, Conservation of energy, Principle of impulse and momentum for a particle and a rigid body, Conservation of momentum, System of rigid bodies, Impact, direct and central impact, coefficient of restitution	**CO114.4 -To** Analyze the work done by forces, the energy transferred from one object to other and applies principle of work and energy conservation in realistic/practical engineering problems. **CO114.5 –** To Study the influence of impulse and conservation of momentum on rigid bodies.	**L4** L1
Module-V: Curvilinear translation: Kinematics, Equation of motion, Projectile, D Alembert‟s principle of curvilinear motion. Kinematics of rotation of rigid body.	**CO114.6 -** Identify the various parameters in projectile motion. Apply the principle of dynamics .	**L3**

Subject: Basic Mechanical Engineering
Year/Semester: 1st/ 2nd
Subject Code: C115

Module	CO Statement After completion of the course the student will be able to	BTL
Module-I: Thermodynamics: Systems, Properties, Process, State, Cycle, Internal energy, Enthalpy, Zeroth Law, First law, and Second Law of Thermodynamics, Basic Concept Entropy, Properties of ideal gas, Properties of pure Substances, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables. Related numerical.	**CO115.1:** Comprehending the Laws of Thermodynamics and properties of steam.	**L1**
Module-II: Application of Thermodynamics: Single stage air compressor, Steam Power Plant, I.C. Engines (Brief Description on working principles with Schematic diagrams only) Elements of Fluid Mechanics and Heat Transfer Properties used in Fluid Mechanics, Fluid Statics, Kinematics and Dynamics (Concepts only), Heat transfer and Classifications (Concepts only)	**CO115.2:** Being Aware of how crucial thermodynamics is upon IC engines, power plants, refrigerators, and Heat Pump. **CO115.3:** Being Aware of fluid mechanics and heat transfer concepts.	**L1** L1
Module-III: Introduction to Manufacturing: Classification of engineering materials, Material Properties, Manufacturing processes: Welding, Casting, Forming (Basics only)	**CO115.4:** Understanding of Engineering materials and its properties **CO115.5:** Have a fundamental understanding of welding, Casting, Forming techniques.	**L2** L2
Module-IV: Basic Power transmission devices: Belt, Gear drives, clutch, brakes. (Working principle only) Introduction to Robotics: Robot anatomy, Joints and links and common robot configurations.	**CO115.6:** Recognize fundamentals concern to power transfer mechanisms and robotics system.	**L2**

Subject: English For Technical Writing
Year/Semester: 1st/ 2nd
Subject Code: C116

Module	CO Statement After completion of the course the student will be able to	BTL
MODULE 1: FUNDAMENTALS OF TECHNICAL COMMUNICATION Process of communication, Types of Communication (verbal & non-verbal), Channels of Business Communication, Barriers to Communication, Bias Free Language, Cross-cultural Communication	**CO116.1**: Understand the concept f communication and the objective communication relevant for the s Engineers.	L2
MODULE II: COMMUNICATIVE GRAMMAR Time and Tense, Passive and Active Voice, The English Conditionals.	**CO116.2:** Use suitable vocabulary and grammar with confidence and express their ideas both in speech and writing.	L3
MODULE III: SOUNDS OF ENGLISH Consonant sounds of English, vowel sounds of English, Stress patterns: Syllable, stress and Intonation, Problem sounds for Indian speakers.	**CO116.3:** Evaluate their efficacy as fluent and efficient communicators by learning the voice dynamics.	L2
MODULEIV:PROFESSIONALCOMMUNICATION AT WORKPLACE Paragraph Writing (the seven Cs of good professional writing), Formal letter writing, Memo and Notice writing, Agenda and Minute writing, Report writing.	**CO116.4:** Understand, develop and demonstrate appropriate and competent professional writing skills to communicate information effectively in the organization setup.	L3
MODULEV:PROFESSIONAL COMMUNICATION AND EMPLOYMENT-CV Writing	**CO116.5**: Formulate a comprehensive holistic and job specific chronological or functional resume, to increase employability.	L4
-Interview Skills	**CO116.6:** Develop appropriate skills to face interviews with confidence and to develop desired corporate and social etiquettes.	L3

Subject: Chemistry Laboratory
Year/Semester: 1st/ 2nd
Subject Code: C117

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1. Determination of the alkalinity in the given water sample 2. Determination of the temporary and permanent hardness in the given water sample by complexometric titration using EDTA as standard solution.	**CO117.1**: Analyze the alkalinity and hardness value of the water sample for industrial application .	**L4**
3. Standardization of potassium permanganate using sodium oxalate 4. Determination of amount of ferrous iron present in Mohr's salt. 5. Estimation of calcium in Limestone	**CO117.2**: Analyze the concentration of present in the solution. To analyze the concentration of Iron .for industrial application.	**L1**
6. Determination of amount of available chlorine in bleaching powder. 7. Determination of dissolved oxygen in water sample.	**CO117.3**: Analyze the chlorine content and dissolve oxygen of water sample for industrial application.	**L4**
8. Synthesis of Aspirin/Paracetamol	**CO117.4**: Impact knowledge on preparation of drugs for industrial application.	**L2**
9. Determination of viscosity of lubricating oil by Redwood viscometer. 10. Determination of flash point of a given oil by Pensky-Martens flash point apparatus.	**CO117.5**: Analyze viscosity and flashpoint of lubricating oils. For industrial application.	**L4**

Subject: Basic Electronics Lab
Year/Semester: 1st/ 2nd
Subject Code: C118

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital Multimeter should be used.	CO118.1: Acquire basic knowledge on electronic devices and components	L2
2.Study and use of CRO to view waveforms and measure its Amplitude and Frequency.		
3.V-I Characteristics of a Semiconductor Diode	CO118.2: Design different electronics circuits using semiconductor diodes.	L2
4.V-I (Output) Characteristics of N-P-N/P-N-P Transistor in CE Configuration	CO118.3: Analyze and develop the characteristics of BJT and FET Circuits	L3
5.Measurement of pinch off voltage and plot transfer characteristics and drain characteristics of JFET.		
6.Transfer characteristics and drain characteristics of MOSFET.		
7.OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.	CO4: Implement Operational amplifier circuits.	L2
8.Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.		
9.Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)	CO118.5: Acquire knowledge on basic digital logic gates.	
10. Implementation of digital circuit using Universal gates.		

Subject: Communicative English & Report Writing Lab.
Year/Semester: 1st/ 2nd
Subject Code: C119

Module	CO Statement After completion of the course the student will be able to	BTL
MODULE I: -Self-Introduction, Reading Practice. -Listening Practice	**CO109.1:** Develop different listening & reading skills. Introduce oneself impact fully and effectively in a gathering.	L6
	CO109.2: Develop different listening skills.	L6
MODULE II: Professional and PowerPoint presentation, Review of a book, newspaper in editorial, movie.	**CO109.3:** Demonstrate effective oral presentations by interpreting and analyzing data.	L4
MODULE III: Situational conversation practice and role play.	**CO109.4:** Improve and practice spoken English in various hierarchical setups with varied goals.	L6
MODULE IV: Cover letter and CV writing.	**CO109.5:** Able to showcase strengths, achievements and experience as per the requirement of the job and improve employability.	L4
MODULE V: Group discussion and Mock Interview	**CO109.6:** Acquire strategic competence to use both spoken and written language in a range of wide communication strategies.	L6

Subject: Workshop & Digital Manufacturing Lab.
Year/Semester: 1st/ 2nd
Subject Code: C120

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
Preparation of job in fitting section/Study of lathe and turning operation. 6	**CO102.1** Learn different lathe operation and various types of fittings	**L1,L2,L6**
Preparation of job in black smith section/ Study of milling machine and milling operation.		
Preparation of job in carpentry section/milling operation on CNC milling machine	**CO102.2 P**repare jobs in black smith and to learn milling and turning operation in CNC lathe.	**L1,L2**
Study of CNC lathe machine and turning on CNC lathe		
Study of Robot (Pick and place and palletizing operation).	**CO102.3** Study basic concepts and movement of Robots.	**L1**
Study of additive manufacturing using 3D printer and product development.	**CO102.4-** Study manufacturing and product development in 3D printing	**L2**

Subject: Mathematics-III
Year/Semester: 2nd / 3rd
Subject Code: C201

Module	CO Statement After completion of the course the student will be able to	BTL
MODULE 1: CONCEPTS: Solution of Non-linear equation in one variable (Bisection, Secant, Newton Rapson Method, Fixed Point Iteration method). Numerical Solutions of system of Linear equations (Gauss-Seidel, Successive Over Relaxation, Doolittle method, Crouts method, Choleskys Method). Interpolation: Newton's forward and backward interpolation, Newton divided difference interpolation, Lagrange Interpolation.	**CO201.1**- Analyze typical approximate roots. **CO201.2**- Enrich Fundamental Concept to approximate Function.	L4 L2
MODULE 2: Numerical Differentiation, integration and Solution of Differential Equations: Numerical Differentiation, The trapezoidal rule, The Simpson's rule, Gauss Integration formulas. Solution of ordinary differential equation: Euler's method, Improvement of Euler's method, Runge-Kutta methods, multi step methods, Methods for system and higher order ordinary differential equations.	**CO201.3**- Understand various methods relating to numerical values of Differentiation and integration.	L2
MODULE 3: Sample Space, Probability, Conditional Probability, Independent Events, Bayes' Theorem, Random variables, Probability distributions, Expectations, Mean and variance, Moments.	**CO201.4**- Analyze the Probability of events.	L4
MODULE 4: Bemoulli Trials, Binomial, Poisson, Hyper Geometric Distribution, Uniform.. Exponential and Normal distribution, Bivariaie Distributions.	**CO201.5**- Assess different real valued function linked with Probability function.	L5
MODULE 5: Correlation and Regression Analysis, Rank Correlation, Maximum Likely hood estimate, Method of Moments, Confidence intervals mean and variance of a Normal Distribution, p-value. Testing of hypothesis: test for goodness of fit, Test for single mean and variance of a Normal Distribution	**CO201.6**- Analyze co-relation and regression values in details Manner.	L4

Subject: OOP Using JAVA
Year/Semester: 2nd / 3rd
Subject Code: C202

Module	CO Statement After completion of the course the student will be able to	BTL
Module 1: An introduction to Programming. Different types of programming languages, Description of Compiler and Interpreter. Features of OOP, JVM, Tokens, Operators, Array, Scanner class	CO202.1 - Understand the basics of object-oriented programming using C++and JAVA.	L2
Module 2: Classes, Methods, Data hiding ,encapsulation, Constructor, Inheritance, wrapper Class, Dynamic method dispatching	CO202.2- Apply the concept of classes, Java, JDK Components and develop Simple Java Programs	L3
Module 3: Data Abstraction, Interface, Package, Exception Handling, Multithreading	CO202.3- Develop Simple Java Programs using inheritance and Exception handling	L4
Module 4:IO Streams, Applet	CO202.4-Develop web applications and can be executed by browsers for many platforms.	L4
Module5:Swing,Jlabel,JButton,JTextfield,JTextarea	CO202.5-Develop GUI applications using Swing components and Event handling programs.	L4
Module 6: Java FX, Create animation and Media	CO202.6-Develop the animation and media	L4

Subject: Organizational Behaviour
Year/Semester: 2nd / 3rd
Subject Code: C203

Module	CO Statement After completion of the course the student will be able to	BTL
Module 1: Fundamentals Of OB Definition, scope and importance of OB, Relationship between OB and the individual Evolution of OB, Theoretical framework (cognitive), behaviorist and social cognitive) Limitations of OB.	**CO203.1**-Learn about the Evolution of Organizational Behaviour and understand the managerial implications of different theories of Organizational Behaviour.	L1,L2
Module 2 Attitude: Importance of attitude in an organization, Components of attitude Right Attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace Job attitude, Barriers to changing attitudes. **Personality and values**: Definition and importance of Personality for performance The Myers Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace Personality Tests and their practical applications. Perception: Meaning and concept of perception, Factors influencing perception Perceptual process, Selective perception Social perception, Attribution theory stereotyping and halo effect. Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory) The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories — Equity Theory of Work Motivation.	**CO203.2**- Understand the importance of developing the Right Personality, Attitude, Perception to help them sustain in the workplace. Learn Motivation Theories /Models to improve Organizational Performance.	L3,L4
Module 3: Meaning of group and group behaviour, Group dynamics, Types of groups, The five stage model of group development. Managing Teams: Why Work Teams, Work Teams in Organization Developing Work Teams Team Effectiveness & Team Building Leadership: Concept of Leadership Styles of Leadership, Trait Approach Contingency Leadership Approach Meaning and significance of contemporary leadership- theories Concept of transformations leadership.	**CO203.3**-Understand the role of Group Behavior, ways to develop Effective Teams, understand various Leadership style, (practical applications role of leaders in decision making process)	L3
Module 4: Organizational Culture : Meaning& Definition of Organizational Culture Types of Culture, Creating & Sustaining Organizational Culture, Creating Positive	**CO203.4**-Develop Learning Attitude in workplace. Learn to adopt to new organizational culture and develop effective communication skills to resolve	L6

Organizational Culture,. Concept of Workplace Spirituality.	workplace conflicts & stress.	
Module 5: Organizational Change Meaning, Definition, Nature, Importance , Types of Organizational Change, Implementing Organizational Change	CO203.5- Develop a life- long learning attitude to adopt to organizational change process and proactively implement the changes to sustain in the highly competitive business environment .	L6,L3
Module 6: Approaches to managing Organizational Change(Kurt Lewin's-Three step model, Seven Stage model of Change &Kotter's Eight-Step plan for Implementing Change) **Leading the Change Process,** Facilitating Change, Dealing with Individual &Group Resistance Intervention Strategies for Facilitating Organizational Change, Developing a Learning Organization.	CO203.6-Analyze the different Organizational Change Models and Change Intervention Methods to solve organizational problems.	L4,L3

Subject: Digital Logic Design
Year/Semester: 2nd / 3rd
Subject Code: C204

Module	CO Statement After completion of the course the student will be able to	BTL
Logic design, Transistor as switches, C-MOS gates, Sequential circuits, some examples. Digital systems- Representation of numbers, Binary codes, grey code, error detecting & error correcting codes, register, binary logics, basic logic gates Boolean Algebra- Boolean operations, Boolean functions, Algebraic manipulation, minterm & maxterms , sum of products and product of sum representation, two input logic gates, functional completeness	**CO204.1:** Study different Transistor switches, digital logic circuit, number system and different codes. **CO204.2:** Study different Boolean Functions and Boolean operations.	**L2** L2
Minimization of Boolean functions- K- map, don't care conditions, prime implicants, Quine Mc-Cluskey technique, logic gates, NAND/NOR Gates, Universal gates	**CO204.3:** Describe the minimization tool to minimize the logical functions	**L4**
Combinational circuits- Adder, subtractor, multiplier, comparator, decoder, encoder, multiplexer, demultiplexers, MUX realization of switching functions, parity bit generator, code converters, Hazard & Hazard free realizations	**CO204.4:** Understand the working mechanism and design of different combinational circuit.	L2
Synchronous sequential circuits- Finite state machines, latches & flip-flops(SR,D, JK,T), synthesis of clocked sequence circuits, Steps in synchronous sequential circuis design, Design of Modulo- N Ring & Shift counters, serial binary adders.	**CO204.5:** Analyze the working mechanism and design of different sequential circuits.	**L4**
Registers & counters- Registers and shift registers, Sequential adders, Binary &BCD Ripple Counters, Synchronous counters Algorithmic State Machines- Salient features of ASM chart simple examples system design using Data path & control sub systems control implementations examples of weighing machine & binary multiplier.	**CO204.6:** Understand the basic idea of different counters, shift registers and algorithm of state machine.	**L2**

Subject: Data Structure
Year/Semester: 2nd / 3rd
Subject Code: C205

Module	CO Statement After completion of the course the student will be able to	BTL
Module I: Basic terminologies: Elementary Data organizations, Data structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, and Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	**CO205.1:** Learn the basic types for data structure, implementation and application.	**L3**
Module II: Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis. Applications of Stacks: Expression Conversion and evaluation corresponding algorithms and complexity analysis, ADT queue. Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	**CO205.2**: Know the strength and weakness of different data structures.	**L2**
Module III: Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching. Insertion into, Deletion from linked list, Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists all operations their algorithms and the complexity analysis	**CO205.3:** Use the appropriate data structure in context of solution of given problem.	**L3**
Module IV: Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.	**CO205.4**: Develop programming skills which require solving given problem. **CO205.5**: Understand different tree and graph operation	**L6** **L2**
Module V: Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree. Binary L2Search Tree, AVL Tree: Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	**CO205.6**: Understand the complexity analysis of tree & Graph	**L2**

Subject: DIGITAL LOGIC DESIGN LAB.
Year/Semester: 2nd / 3rd
Subject Code: C207

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates, use of Universal NAND Gate	**CO207.1:** Acquire knowledge on basic digital logic gates.	**L2**
Gate-level minimization: Two level and multi level implementation of Boolean functions.	**CO207.2:** Gate level minimization using universal gate	**L2**
Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.		
Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment display	**CO207.3:** Design of combinational circuits and verify truth table	**L2**
Design with multiplexers an de-multiplexers.		
Flip-Flop: assemble, test and investigate operation of SR, D & J-K flip-flops.	**CO207.4:** Design of sequential circuits and verify truth table	**L2**
Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.		
Counters: Design, assemble and test various ripple and synchronous counters - decimal counter, Binary counter with parallel load.		
Memory Unit: Investigate the behaviour of RAM unit and its storage capacity – 16 X 4 RAM: testing, simulating and memory expansion.	**CO207.5:** Test and simulate the memory unit and clock pulse generator	**L2**
Clock-pulse generator: design, implement and test.		

Subject: Data Structure Lab.
Year/Semester: 2nd / 3rd
Subject Code: C208

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1.Write a C Program to create a stack using an array and perform - i) Push operation, ii) Pop operation (b) Write a C Program to create a queue and perform - i) Push, ii) Pop, iii) Traversal **2**.Write a C Progran1 that uses functions to perform the following operations on a single linked list : i)Creation, ii) Insertion, iii) Deletion, iv) Traversal (b) Write a C Program that uses functions to perform the following operations on a double linked list: i)Creation, ii) Insertion, iii) Deletion **3**.Write a C Program that uses functions to perform the following operations on a Binary Tree :i) Creation, ii) Insertion, iii) Deletion	**CO208.1:** Develop linear and non-linear data structure	**L6**
4 Write a C Program to construct an AVL-Tree and delete the selective nodes.	**CO208.2:** Express different operation on AVL tree	**L2**
5.Write a C Program that uses Stack Operations to perform the following:- i) Converting an infix expression into postfix expression ii) Evaluating the postfix expression	**CO208.3:** Evaluate infix to postfix expression	**L5**
6.C Programs on : i) Bubble sort, ii) Selection sort, iii) Insertion sort, iv) Quick sort, v) Radix sort vi) Heap sort, vii) 2 Way Merge Sort	**CO208.4**: Apply sorting algorithms in real life application	**L3**
7.C Programs on : i) Sequential Search, ii) Binary Search	**CO208.5**: Apply searching algorithms in real life application	**L3**

Subject: OOP Using Java Lab.
Year/Semester: 2nd / 3rd
Subject Code: C209

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1.Introduction ,Compiling, Executing a Java Program	**CO209.1-** Write programs for solving real world problems using java collection framework	**L2**
2.Classes and Objects, Data Abstraction & Data Hiding, Inheritance, Polymorphism	**CO209.2-** Write programs using abstract classes.,Classes having different forms	**L2**
3.Threads Program	**CO209.3-** Develop multiple flow of execution simultaneously	**L3**
4.Interfaces & Inner classes, Wrapper Classes	**CO209.4-** Write how can access through implementing various classes.	**L3**
5.Applet Programs	**CO209.5-** Write GUI programs using Applet	**L3**
6.Exception Handling Mechanism	**CO209.6-** Develop Exception handling mechanism.	**L5**

Subject: Evaluation of Internship-I
Year/Semester: 2nd / 3rd
Subject Code: C210

	CO Statement **After completion of the course the student will be able to**	**BTL**
CO210.1	It focus on what students intend to accomplish for the internship organization during their work term.	L2
CO210.2	It describes what students will add to their knowledge, skills and development in that area.	L3
CO210.3	It describes the students punctuality at the place of internship how they will perform their duties.	L2
CO210.4	The activity is the expected achievement, within the time frame expected completion with date and the evaluation is the stated method of measurement.	L2
CO210.5	It gives a chance to gain real-world experience beyond classrooms..	L5

Subject: Discrete Mathematics
Year/Semester: 2nd / 4th
Subject Code: C211

After completion of the course the student will be able

Moduls -1 Sets and propositions, Principle of indusion and exclusion. Mathematical induction, propositions, Logical commentives Conditional and Biconditionals, Logical equivalences, Predicate Calculus, Quantifiers, Theony of inference, Methods of Proof.	**Statement** Co1 - To conderstand various methods for proof of propositions.
Module-2 Relations and functions, Propertie's of binary relations, closure of nelations. Wans hall's algorithm Equivalence relations. Pantal ondering relations and lattices, chains and antschains, functions, composate funtions, Invertible functions, Recursive functions, Pigemhole principle.	**CO2-** To study and analyse different nelations, functions.
Module-3 Numeric functions and Generating functions, Discrete numenze functions, Recumeme Relations, Recursive Algorithms. Recurrence Relations, Linear with consent co-effrerents. Solution by method of gementa functions. Divide and conquer algorithm.	**Co3-** Emich funda- mental concept to Solve Recurrence Relatie
Module-4 Groups, Rings, subgroups, casets, Lagnoge's theonem, Codes and group Ennon detection, Comection using group cater. Somorphism, homo- monthiem, Normal subgroups. Roogl, Integnel domain, fields. Boolean algebra Latticer, Algebrace systems, Principle of duality, Distributive Complemented lattices. Bookeen function expersion, Simplification of lagze expression using Kannaugh Map. Design, Implementation of digital notwanks, switching C2ncuts.	**Co4-** TO canalyse different grofes and relations in groups.
Module-5- Graphs and Trees, Basic Terminology Diagraphs and subs nelations,Representation of shaphs Operation on graphs, paths, Ginute Graph traversals, shondect path 20 weighted graphs. Exterion path Concists Houndtonian path, Concurts, Traveling Salesmen problem. Plommer Maths, Graph Colouring, Thees, Rooted trees, Binary Search treer, spooming toners. Minimum spooning trees, Kruskal's Algorithm, Prom's Algortihm...	**Co5-** To analyse different rings and nelations in rong. **Co6-**To understand 4 the fundamental concept of graph theony problems cord solutions.

Subject: Design and Analysis of Algorithm
Year/Semester: 2nd / 4th
Subject Code: C212

Module	CO Statement After completion of the course the student will be able to	BTL
Module 1: Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.:	**CO212.1-** Analyze different types of algorithms using different methods to calculate the best and worst-case running times of algorithms based on asymptotic analysis analyze the performance and justify the correctness of algorithms.	**L4**
Module II: Fundamental Algorithmic Strategies: Brute-Force: : Linear search, selection sort, Greedy: Huffman coding, Fractional knapsack problem, Activity selection Problem, Dynamic Programming: matrix chain multiplication, Longest common subsequence, Travelling Salesman Problem, Branch- and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.	**CO21.2-** Describe the different paradigm and explain the algorithmic design situation, synthesize it and analyze it to determine the computational complexity.	**L5**
Module III: Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	**CO212.3-** Solve the problems using different algorithms written for Trees and Graphs.	**L3**
Module IV: Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems (Clique Decision, Node cover Decision and Chromatic Number Decision problem) and Reduction techniques.	**CO212.4-**Analyse and compute randomized algorithms and examine computational problems.	**L4**
Module V: Approximation algorithms: Node cover problem, Travelling sales man problem, Randomized algorithms: Quick sort, n-queen problem, Min cut, Class of problems beyond NP – P SPACE	**CO212.5-** Explain and Compute the approximation algorithm using different factors.	**L4**
	CO212.6-Explain and compute the Randomized algorithm using different factors	**L4**

Subject: Engineering Economics
Year/Semester: 2nd / 4th
Subject Code: C213

Module	CO Statement After completion of the course the student will be able to	BTL
MODULE 1: CONCEPTS : Concept of Engineering Economics, Origin of EE, Definitions , Scope. Framework of Engineering Economics, Basic problems of an economy, Principles and Nature of Engineering Economics. Basic problems of an economy, Micro Economics and Macro Economics. **Demand:** Meaning of demand, Nature of Demand, Types of Demand, Determinants of demand, Demand function, Demand Schedule and Demand Curve, Law of Demand, assumptions underlying the law of Demand and exceptions to the law of Demand. Elasticity of demand: concept of Elasticity of Demand, Types – Price (types and Simple numerical problems to be solved) Income, Cross, and advertising Elasticity of Demand (Simple numerical problems to be solved) Demand Forecasting – Meaning and techniques **Supply**: Meaning of supply, Nature, Determinants of Supply, Supply Function Law of supply and its exception Elasticity of supply: Meaning, Degrees of Elasticity, and factors of Elasticity of Supply. **Determination of market equilibrium** (Simple numerical problems to be solved).	**CO213.1**-Know about the Meaning and Relevance of Engineering Economics in Business Decision making – Concept of demand & supply, Elasticity of demand and equilibrium price determination	**L1,L2**
Module 2 : Production : Concept of Production and factors of Production, Production function Laws of returns: Law of variable proportion, Law of returns to scale **Cost and Revenue Concepts** : concept of Cost, Total Costs, Fixed cost, Variable cost **Revenue Concepts**: Total revenue, Average revenue and Marginal revenue **Cost-Output Relationships** in the Short Run and Long Run, Analysis of cost minimization	**CO213.2**-Know about the laws of Production ,Cost Minimization Methods and Cost Output Relations in long Run & Short Run to manufacture quality goods at the least cost combinations of Inputs	**L4,L3**
Module 3: Market : Basic understanding of different market structures Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), **Break Even Analysis**: linear approach (Simple numerical problems to be solved).	**CO213.3**-Understand different market structure and its impact on price determination of goods. Understand the concept of Break Even Analysis with its effect on profitability of firms using mathematical formulas.	**L4,L3**

Module 4: Time Value of Money: Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence **Evaluation of Engineering Projects**: Present worth method, Future worth method, Annual worth method Internal rate of return method, Cost benefit analysis for public projects **Depreciation**-: Depreciation of capital assert, Causes of depreciation **Methods of calculating depreciation** : Straight line method, Declining balance method, SOYD method, After tax comparison of project.	**CO213.4-** Know about Time value of Money, cash flow problems, evaluate various engineering projects using engineering formulas and calculating Depreciation of Fixed Assets.	**L5**
Module 5:Inflation: Meaning of inflation, types, causes, measures to control inflation **National Income**: Definition, Concepts of national income, Method of measuring national income.	**CO213.5**-Learn about concepts of National Income, GNP, GDP, Inflation, Fiscal Policy and Macro economic variables to understand the working of National Economy as a whole.	**L2**
Module 6: Banking : Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.	**CO213.6-** Develop Knowledge About Role of RBI, And Commercial Banks-(Monetary Policy)	**L2**

Subject: Computer Organization and Architecture
Year/Semester: 2nd / 4th
Subject Code: C214

Module	CO Statement After completion of the course the student will be able to	BTL
Module-I: Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.	**CO214.1**-Understand the basics of instructions sets and their impact on processor design	L2
Module-II: Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.	**CO214.2**-Demonstrate an understanding of the design of the functional units of a digital computer system.	L3
Module-III: Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers. Programs and processes	**CO214.3**-Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.	L4
Module-IV: Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, CPU Basics: Multiple CPUs, Cores, and Hyper-Threading, Introduction to Multiple-Processor Scheduling in Operating System.	**CO214.4**-construct a computer processor including memory.	L6
	CO214.5-Design a pipeline for consistent execution of instructions with minimum hazards	L6
Module-V: Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, and write policies.	**CO214.6**-Manipulate representations of numbers stored in digital computers	L4

Subject: Data Communication
Year/Semester: 2nd / 4th
Subject Code: C215

Module	CO Statement After completion of the course the student will be able to	BTL
Module I: INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING: Standards Organizations for Data Communications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and parallel Data Transmission, Data communications Networks, Alternate Protocol Suites. SIGNALS, NOISE, MODULATION, AND DEMODULATION: Signal Analysis, Electrical Noise and Signal-to-Noise Ratio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and M-ary Encoding, Digital Modulation.	**CO215.1**- Understand the data communication Network Architecture & concept of Signal Analysis, Modulation & Demodulation	**L2**
Module II: METALLIC CABLE TRANSMISSION MEDIA: Metallic Transmission Lines, Transverse Electromagnetic Waves, Characteristics of Electromagnetic Waves. OPTICAL FIBER TRANSMISSION MEDIA: Advantages of Optical Fiber cables, Disadvantages of Optical Fiber Cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications, Optical Fiber Comparison, Losses in Optical Fiber Cables, Light sources, Light Detectors, Lasers.	**CO215.2**- Understand the concept & technique of Cable & Fiber Transmission Media.	**L2**
Module III: DIGITAL TRANSMISSION: Pulse Modulation, Pulse code Modulation, Dynamic Range, Signal Voltage to- Quantization Noise Voltage Ratio, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM and Differential PCM. MULTIPLEXING AND T CARRIERS: Time- Division Multiplexing, T1 Digital Carrier System, Digital Line Encoding, T Carrier systems, Frequency- Division Multiplexing, Wavelength- Division Multiplexing, Synchronous Optical Network.	**CO215.3**- Understand the concept of different type of modulation in data communication . **CO215.4**- Understand Multiplexing & T1 Digital Carrier System	**L2**
Module IV: WIRELESS COMMUNICATIONS SYSTEMS: Electromagnetic Polarization, Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, Microwave Communications Systems, Satellite Communications Systems.	**CO215.5**- Understand the concept of wireless communications systems like Electromagnetic Polarization, Electromagnetic Radiation etc.	**L2**

Module V: DATA COMMUNICATIONS CODES, ERROR CONTROL, AND DATA FORMATS: Data Communications Character Codes, Bar Codes, Error Control, Error Detection and Correction, Character Synchronization. DATA COMMUNICATIONS EQUIPMENT: Digital Service Unit and Channel Service Unit, Voice- Band Data Communication Modems, Bell Systems-Compatible Voice- Band Modems, Voice- Band Modem Block Diagram, Voice- Band Modem Classifications, Asynchronous Voice-Band Modems, Synchronous Voice-Band Modems, Modem Synchronization, 56K Modems, Modem Control: The AT Command Set, Cable Modems.	**CO215.6**- Understand the concept of data communications codes & error control	**L2**

Subject: Microprocessor and Microcontroller
Year/Semester: 2nd / 4th
Subject Code: C216

Module	CO Statement After completion of the course the student will be able to	BTL
Module-1 Introduction to 8 bit and 16 bit Microprocessors-H/W architecture Introduction to microprocessor, computer and its organization, Programming system; Address bus, data bus and control bus, Tristate bus; clock generation; Connecting Microprocessor to I/O devices; Data transfer schemes; Architectural advancements of microprocessors. Introductory System design using microprocessors; 8086 – Hardware Architecture; External memory addressing; Bus cycles; some important Companion Chips; Maximum mode bus cycle; 8086 system configuration; Memory Interfacing; Minimum mode system configuration, Interrupt processing.	**CO216.1:** Understand the basic architecture of 8085 and 8086.	L3
Module 2-16-bit microprocessor instruction set and assembly language programming: Programmer's model of 8086; operand types, operand addressing; assembler directives, instruction Set-Data transfer group, Arithmetic group, Logical group.	**CO216.2:** Impart the knowledge about the instruction set of 8086 and programing.	L4
Module 3-Microprocessor peripheral interfacing: Introduction; Generation of I/O ports; Programmable Peripheral Interface (PPI)-Intel 8255; Sample-and-Hold Circuit and Multiplexer; Keyboard and Display Interface; Keyboard and Display Controller (8279).	**CO216.3:** Understand the basic idea about the peripheral interfacing like 8255, 8251, and 8279.	L2
Module 4-8-bit microcontroller- H/W architecture instruction set and programming: Introduction to 8051 Micro-Controllers, Architecture; Memory Organization; Special Function register; Port Operation; Memory Interfacing, I/O Interfacing; Programming 8051	**CO216.4:** Understand the basic architecture of for INTEL 8051 architecture instruction set.	L3
Module 5-Resources, interrupts; Programmer's model of 8051; Operand types, Operand addressing; Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions; Programming	**CO216.5:** Develop skill in simple program writing.	L2
Module 6-8086: Maximum mode system configuration, Direct memory access, Interfacing of D-to-A converter, A-to-D converter, CRT Terminal Interface, Printer Interface, Programming of 8051 timers, 8051 serial interface, Introduction to 80386 and 80486 Microprocessor family.	**CO216.6:** Understand the basic architecture of 80386 and 80486.	L3

Subject: Digital Signal Processing
Year/Semester: 2nd / 4th
Subject Code: C217

Module	CO Statement After completion of the course the student will be able to	BTL
1.Discrete Time System: Basic Discrete Time Signals and their classifications, Discrete times systems and their classifications, Stability of discrete time system, Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and Non-recursive discrete time system, impulse response of LTI system, Correlation of discrete time Signal.	**CO217.1:** Understand the characteristics of different digital systems like linear time-invariant systems and others	**L2**
2.Z-Transform and Its Application to the Analysis of LTI Systems: Z-Transform, Direct Z-Transform, properties of the Z- Transform, Inverse Z-Transform, Inversion Z-Transform by Power Series Expansion, Inversion of the Z-Transform by Partial-Fraction Expansion, Analysis of Linear Tim-Invariant Systems in the z-Domain.	**CO217.2:** Explain z-transform to analyze the operations on signals and acquire knowledge about Systems	**L3**
3.Discrete Fourier Transform: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, Discrete Fourier Transform, DFT as a Linear Transformation, Relationship of DFT to other Transforms, Properties of DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Use of DFT in Linear Filtering, Filtering of Long Data Sequences	**CO217.3:** Apply different signal Processing algorithms like DFT and FFT to the different signals.	**L3**
4.Structure and Implementation of FIR and IIR Filter: Structure for the Realization of Discrete-Time Systems, Structure of FIR Systems: Direct- Form Structure, Cascade-Form Structure, Frequency-Sampling Structure	**CO217.4:** Analyze the different structure of FIR and IIR filter.	**L4**
5.Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by Frequency-Sampling Method. Structure for IIR Systems: Direct-Form Structure, Signal Flow Graphs and Transposed Structure, Cascade-Form Structure, Parallel-Form Structure. Design of IIR Filters from	**CO217.5:** Design of different FIR filters	**L2**
6.Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Basic adaptive filter: Structure of Adaptive FIR filter, System Modeling and Inverse Modeling, Matlab realization of DFT, FFT, Z-transform, IIR, FIR and adaptive filter.	**CO217.6:** Design the IIR filter and to develop Matlab code for DFT, FFT, IIR, and FIR	**L2**

Subject: Constitution of India
Year/Semester: 2nd / 4th
Subject Code: C218

Module	CO Statement After completion of the course the student will be able to	BTL
MODULE 1: Meaning of Constitutional Law and Constitutionalism Historical Perspective of Constitution of India, Salient Features and Characteristics of Constitution of India	**CO1**: Know about the Concept of Constitution and Importance of Constitutional Laws in governing a country. Learn about the evolution of Constitution of India with special reference to Constituent Assembly. Learn about the Salient features of Constitution of India	**L2**
Scheme of the Fundamental Rights Scheme of the Fundamental Right to Equality Scheme of the Fundamental Right to Certain Freedom under Article 19 Scope of Right to Life and Personal Liberty under Article 21	**CO2**:Understand of the Fundamental Rights and its Importance in people lives	**L2**
The scheme of Fundamental Duties and its Legal Status The Directive Principles of State Policy – Its Importance and Implementation	**CO3**: Learn about the 11 fundamental Duties and its importance in ruling the people of India . Understand the concept and significance of Directive Principles of State Policy	L2
Federal Structure and Distribution of Legislative and Financial Powers between the Union and the States Parliamentary Form of Government in India – The Constitutional Powers and Status of President of India Local Self Government- Constitutional Scheme in India	**CO4**: Understand the features of Federal and Unitary Structure of Indian Government Machinery Knowledge about the features of Indian Parliamentary system and its functions and Powers. Knowledge about the roles and powers of President of India Learn about the Panchayati Raj System in India and Provincial Autonomy	
Amendment of the Constitutional Powers and Procedure The Historical Perspectives of the Constitutional Amendments in India	**CO5**: Learn about the Importance of Constitutional Amendments and the various Amendments made in Constitution over the years	**L2**
Emergency Provisions: National Emergency, President Rule, Financial Emergency	**CO6**: Know about the Emergency situation in India and the different types of Emergency along with its provisions and Special powers of Central Government during Emergency	**L2**

Subject: Problem Solving and Python Programming Lab.
Year/Semester: 2nd / 4th
Subject Code: C219

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1.Compute the GCD of two numbers.	**CO1**-Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	**L2**
2.Find the square root of a number (Newton's method) 3.Exponentiation (power of a number) 4.Find the maximum of a list of numbers	**CO2**-Implement Conditionals and Loops for Python Programs	**L3**
5.Linear search and Binary search 6.Selection sort, Insertion sort 7.Merge sort 8.First n prime numbers 9.Multiply matrices	**CO3-** Express proficiency in the handling of strings and functions	**L2**
10.Programs that take command line arguments (word count)	**CO4**-Use functions and represent Compound data using Lists, Tuples and Dictionaries	**L3**
11.Find the most frequent words in a text read from a file 12.Simulate elliptical orbits in Pygame 13.Simulate bouncing ball using Pygame	**CO-5** Read and write data from & to files in Python and develop Application using Pygame	**L3**

Subject: Design and Analysis of Algorithm Lab
Year/Semester: 2nd / 4th
Subject Code: C220

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1.Using a stack of characters, convert an infix string to postfix string. 2.Implement insertion, deletion, searching of a BST.	**CO1-**Implement different operation and function of BST using C	L3
3.Implement binary search and linear search in a program 4.Implement a heap sort using a max heap 5.Write a program on Quick sort algorithm. 6.Write a program on merge sort algorithm.	**CO2-**Implement different searching and sorting techniques using C	L3
7.Implement DFS/ BFS for a connected graph. 8.Implement Dijkstra's shortest path algorithm using BFS.	**CO3-**Implement different shortest path algorithm using C	L3
9.Write a program to implement Huffman's algorithm. 10.Implement MST using Kruskal /Prim algorithm	**CO4-**Construct minimum spanning tree using different techniques using C	L3
11.Using dynamic programming implement LCS	**CO5-**Implement dynamic programming problem using different techniques using C	L3
12.Find out the solution to the N-Queen problem. 13.Implement back tracking using game trees.	**CO6-**Implement N-queen problem using C	L3

Subject: Computer Organization & Architecture Lab
Year/Semester: 2nd / 4th
Subject Code: C221

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
Demonstrate the several functional units of a PC physically.	**CO1-** Understand the primary functional units of a PC and their respective roles.	**L2**
Assemble a PC, Dismantle a PC	**CO2-** Understand designing, assembling, and disassembling a PC involves selecting compatible components based on user needs and system requirements, carefully connecting and disconnecting parts	**L2**
Study of SMPS	**CO3-** Gain an understanding of efficient power conversion techniques, including the principles of regulating voltage, reducing energy loss, and enhancing the performance and reliability of electronic devices.	**L2**
Understand different byte addressing instruction using 8085 simulator	**CO-4** Understand different byte addressing instructions using an 8085 simulator, students gain practical knowledge of how to manipulate memory and data effectively, enhancing their skills in low-level programming and microprocessor operations.	**L2**
Design of multiplexer and demultiplexer using VHDL	**CO-5** Design multiplexers and demultiplexers, and gain a comprehensive understanding of data routing, signal selection, and distribution in digital circuits, which are fundamental concepts in digital electronics and communication systems.	**L2**
C++ implementation of Booth's algorithm	**CO6**-By implementing Booth's algorithm in C++, students learn efficient techniques for binary multiplication, enhancing their understanding of arithmetic operations, algorithm optimization, and practical applications in computer engineering	**L3**

Subject: Formal Language and Automata Theory
Year/Semester: 3rd / 5th
Subject Code: C301

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
Module I: Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata	**CO1**: Determine the practical problem to Language.	**L3**
	CO2: Design and determine the Automata	**L3**
Module II: Regular Expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA	**CO3**: Analyze the Regular Expressions using different Theorem	**L4**
Module III: Context Free Grammar (CFG) and Context Free Languages (CFL): Definition, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFL	**CO4**: Demonstrate an increased level of Mathematical sophistication	**L3**
Module IV: Push Down Automata (PDA): Description and definition, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA	**CO5**: Derive And Simplify Context free grammar and Context free Language	**L3**
Module V: Turing machines (TM): Basic model, Language acceptance by TM, Variants of Turing Machine, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem,	**CO6**: Apply Mathematical and Formal techniques for solving problems	**L4**

Introduction to Undesirability, Undecidable problems about TMs.PCP		

Subject: Data Base Management System
Year/Semester: 3rd / 5th
Subject Code: C302

Module	CO Statement After completion of the course the student will be able to	BTL
Module I: Introduction: Purpose of Database System -– Views of data – data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modelling - motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.	**CO1**-Analyze the different database design models for various practical data base applications	**L4**
Module II: Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, relational+ algebra operators, SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviours. Querying in SQL, notion of	**CO2**-Develop SQL queries according to the various needs of the users and to optimize it for a specific application.	**L6**
Module III: Database Design: Dependencies and Normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, normalization, 4NF, and 5NF	**CO3**-Design and develop the database with optimal query processing and normalization and decomposition techniques	**L6**
Module IV: Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging	**CO4**-Apply concurrency control & recovery mechanism for practical problems in database design	**L3**
Module V: Implementation Techniques: Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees.	**CO5**-Identify the different advanced database techniques and apply it	**L3**
	CO6- Secure their database with the help of various security mechanisms	**L3**

Subject: Operating System

Year/Semester: 3rd / 5th

Subject Code: C303

Module	CO Statement After completion of the course the student will be able to	BTL
Module I: Operating Systems –Definition, Types, Functions , Abstract view of OS. System Structures –System Calls, Virtual Machines, Process Concepts –Threads , Multithreading.	**CO1-** Understand the basic concepts and functions of operating systems.	L2
Module II: Process Scheduling- Process Co-ordination –Synchronization ,Semaphores , Monitors Hardware Synchronization , Deadlocks –Methods for Handling Deadlocks	**CO2-** Understand the concept of Processes Scheduling,	L3
	CO3- Analyze the Threads and Deadlocks Handling Mechanism.	L3
Module III: Memory Management Strategies – Contiguous and Non-Contiguous allocation , Virtual memory Management –Demand Paging, Page Placement and Replacement Policies	**CO4-** Analyze memory management schemes and Demand Paging, Page Placement and Replacement Policies.	L3
Module IV: File System –Basic concepts , File System design and Implementation ,Case Study: Linux File Systems , Mass Storage Structure – Disk Scheduling , Disk Management –I/O Systems, System Protection and Security.	**CO5-** Understand I/O management and File systems and basics of Linux system and Mobile OS like iOS and Android.	L4
Module V: Distributed Systems –Distributed operating systems , Distributed file systems, Distributed Synchronization	**CO6-** Analyze the concept of Distributed operating systems, Distributed file systems and synchronization mechanism in distributed operating system.	L3

Subject: Artificial Intelligence & Machine Learning
Year/Semester: 3rd / 5th
Subject Code: C304

Module	CO Statement After completion of the course the student will be able to	BTL
Module 1: INTRODUCTION –The Foundations of Artificial Intelligence; - INTELLIGENT AGENTS – Agents and Environments, Good Behaviour: The Concept of Rationality, the Nature of Environments, the Structure of Agents,	**CO1-** Explain fundamental concepts and challenges in AI to acquaint students with the meaning, purpose, scope, applications, and effects of AI	**L2**
Module 1: SOLVING PROBLEMS BY SEARCH – Problem-Solving Agents, Formulating problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, Searching with Partial Information, Informed (Heuristic) Search Strategies, Greedy best-first search, A* Search, CSP, Means-End-Analysis.	**CO2-** Apply search methods that agents can employ for problem solving.	**L3**
Module 2 : ADVERSARIAL SEARCH – Games, The Mini-Max algorithm, optimal decisions in multiplayer games, Alpha-Beta Pruning, Evaluation functions, Cutting off search, ,		
Module 2: Knowledge-Based agents, Propositional Logic, Reasoning Patterns in Propositional Logic, Resolution, Forward and Backward chaining - FIRST ORDER LOGIC – Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic - INFERENCE IN FIRST ORDER LOGIC – Propositional vs. First-Order Inference, Unification and Lifting, Resolution	**CO3-** Interpret the knowledge using logic concepts.	**L5**
Module 3: UNCERTAINTY – Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use, PROBABILISTIC REASONING – Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distribution, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks	**CO4-** Create representations of the domain of interest and reason with these representations and infer solutions using probabilistic methods	**L3**

Module 4: LEARNING METHODS – Statistical Learning, Learning with Complete Data, Learning with Hidden Variables, Rote Learning, Learning by Taking Advice, Learning in Problem-solving, learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning.	**CO5-** Understand how machine learning algorithms works for real life problems	**L3**
Module 4: Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.	**CO6-** Comprehend AI & Expert System to analyze and map real world activities to digital world	**L4**

Subject: Computer Graphics
Year/Semester: 3rd / 5th
Subject Code: C305

Module	CO Statement After completion of the course the student will be able to	BTL
Module I: Basic of Computer Graphics: Applications of computer graphics, Display device	**CO1-** Understand the Application of Computer Graphics and to know the mechanism of its display devices.	L2
Module II: Graphics Primitives: Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributers.	**CO2-** Conceptualize various primitives algorithms and fill area primitives algorithm.	L3
Module III: 2D transformation and viewing: Transformations, matrix representation, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping, polygon clipping	**CO3-** Analyze various2D transformations, viewing and clipping techniques.	L4
Module IV: 3D concepts and object representation: 3D transformation and viewing: 3D scaling, rotation and translation, composite transformation.	**CO4-** Analyze the representation of different types of 3D transformation and viewing concepts	L4
Module V:Advance topics: visible surface detection concepts, back-face detection, depth buffer method, illumination, light sources, illumination methods, Color models: properties of light, XYZ, RGB, YIQ and CMY color models	**CO5** –Analyze the techniques of common visible surface detection methods.	L5
	CO6- Understand the concept regarding Illumination models and polygon surface rendering method	L4

Subject: Universal Human Values

Year/Semester: 3rd / 5th

Subject Code: C306

Module	CO Statement After completion of the course the student will be able to	BTL
MODULE I: FOUNDATIONS OF VALUE EDUCATION-Right understanding, Relationship and Physical Facility (Holistic development and the Role of Education), Understanding Value Education	**CO1:** Develop a holistic perspective based on self-exploration through value education.	**L6**
Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, The Basic Human Aspirations, Happiness and Prosperity- Current Scenario, Method to Fulfill the Basic Human Aspirations.	**CO2:** Develop an understanding of the Self, the basic human aspirations and methods of fulfilling them.	**L6**
MODULE II: HARMONY IN THE HUMAN LIFE, RELATIONSHIPS AND SOCIETY.-Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the needs of the Self and the Body, Achieving Harmony:	**CO3:** Develop an understanding or gain clarity of the harmony in the human being as a co-existence of the Self and the Body.	**L2**
-Integrating Self and the Body, Harmony in the Family and Society, 'Trust' and 'Respect'-- as Foundational Values in Relationship, Other Feelings, Justice in Human to Human Relationship, Understanding Harmony in the Society and Universal Human Order.	**CO4:** Develop an understanding of the relationship with Family, society and nature/existence. Expanding the feeling of harmony from within to the same with the rest of the world.	**L6**
MODULE III: HARMONY IN THE NATURE /EXISTENCE AND PROFESSIONAL ETHICS. -Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Natural Acceptance of Human Values, Humanistic Education, Humanistic Constitution and Universal Human Order.	**CO5:** Develop an understanding of the relationship of synthesis and mutual fulfillment with nature and the world order. An awareness of the eco-system, one's place in and responsibility towards the same.	**L2**

-Competence in Professional Ethics- Ethical Decision Making and Transition towards Value-based Life and Profession.	**CO6:** Adapt to the present-day work scenario with knowledge of professional ethics, decision making, progressive and sustainable living.	**L6**

Subject: Formal Language and Automata Theory Lab
Year/Semester: 3rd / 5th
Subject Code: C307

Module	CO Statement After completion of the course the student will be able to	BTL
Implement DFA for Regular language.	**CO1-** Gain a deep understanding of automata theory, formal language processing, and the foundations of computational theory, which are crucial for designing efficient algorithms and recognizing patterns in strings.	L3
Apply conversion techniques DFA and NFA	**CO2-** Gain insights into the equivalence of different computational models and enhance their skills in automata theory, formal language design, and the simplification of state machines.	L3
Able to do DFA minimization.	**CO3-** Able to optimize finite automata, improving their understanding of computational efficiency, formal language theory, and algorithmic design in the context of automata and language processing.	L4
Able to use PDA for context free language	**CO4-** Gain proficiency in parsing and recognizing syntactic structures, deepening their understanding of formal grammars, computational complexity.	L3
Able to design and develop CYK parsing algorithm for context free grammar able to design and develop Turing machine for some recursive language.	**CO5-** Gain advanced skills in computational theory and algorithmic design, enabling them to solve complex problems in language parsing, formal language theory, and theoretical computer science.	L3
	CO6- Gain a profound understanding of computability theory, algorithmic complexity, and the theoretical limits of computation, equipping them with advanced skills in problem-solving and theoretical computer science.	L4

Subject: Database Management System Lab
Year/Semester: 3rd / 5th
Subject Code: C308

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1.Use of SQL syntax: insertion, deletion, join, updation using SQL.	**CO1**- Use of SQL Syntax.	L4
2.Programs on join statements and SQL queries including where clause.	**CO2**- Able to use join statements in programs	L4
3.Programs on database triggers. 4. Programs on packages.	**CO3**-To be familiar and create program using database triggers and packages	L6
5. Programs on data recovery using check point technique	**CO4**-Able to use data recovery using check point technique	L4
6. Concurrency control problem using lock operations.	**CO5**-Able to design and develop Concurrency control problem using lock operation	L6
7.Programs on ODBC using either VB or VC++. 8. Programs on JDBC.	**CO6**-Able to design and develop ODBC,JDBC And embedded SQL using C/C++	L6

Subject: Operating System Lab
Year/Semester: 3rd / 5th
Subject Code: C309

Experiment Name	CO Statement After completion of the course the student will be able to	BTL
1.Basic UNIX Commands. Linux Administrative commands.	**CO 1**- Learn basic Unix commands and Linux Administrative commands.	L3
2.UNIX Shell Programming and Programs on UNIX System calls.	**CO 2** - Write shell program for process and file system management with system calls.	L3
3.Programs on process creation and synchronization, inter process communication including shared memory, pipes and messages. (Dinning Philosopher problem / Cigarette Smoker problem / Sleeping barber problem)	**CO 3** - Write Programs on process creation and synchronization, inter process communication including shared memory, pipes and messages .	L3
4.Simulation of CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing)	**CO 4**- Perform lab on CPU Scheduling Algorithms like FCFS, RR, SJF.	L4
5.Simulation of Banker's Algorithm for Deadlock Avoidance, Prevention.	**CO 5** - Perform lab on Banker's Algorithm for Deadlock Avoidance, Prevention.	L3
6.Program for FIFO, LRU, and OPTIMAL page replacement algorithm.	**CO 6 - W**rite Programs for FIFO, LRU, and OPTIMAL page replacement algorithm.	L4

Subject: Evaluation Of Summer Internship
Year/Semester: 3rd / 5th
Subject Code: C310

	CO Statement **After completion of the course the student will be able to**	**BTL**
CO 1	It focus on what students intend to accomplish for the internship organization during their work term.	L3
CO 2	It describes what students will add to their knowledge, skills and development in that area.	L3
CO 3	It describes the students punctuality at the place of internship how they will perform their duties.	L4
CO 4	The activity is the expected achievement, within the time frame expected completion with date and the evaluation is the stated method of measurement.	L4
CO 5	It gives a chance to gain real-world experience beyond classrooms.	L4

Subject: Software Engineering
Year/Semester: 3rd / 6th
Subject Code: C311

Module	CO Statement After completion of the course the student will be able to	BTL
Module I: Software Process Models: Software Product, Software crisis, Handling complexity through Abstraction and Decomposition, Overview of software development activities, Process Models, Classical waterfall model, iterative waterfall model, prototyping mode, evolutionary model, spiral model, RAD model, Agile models: Extreme Programming, and Scrum.	**CO1**- Know various software characteristics and analyze different software Development Models.	L2
Module II: Software Requirements Engineering: Requirement Gathering and Analysis, Functional and Non-functional requirements, Software Requirement Specification (SRS), IEEE 830 guidelines, Decision tables and trees. Structured Analysis & Design: Overview of design process, High-level and detailed design, Cohesion and coupling, Modularity and layering, Function–Oriented software design: Structured Analysis using DFD Structured Design using Structure Chart, Basic concepts of Object Oriented Analysis & Design. User interface design, Command language, menu and iconic interfaces.	**CO2**-. Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards. **CO3**- Develop, maintain and evaluate large-scale software systems	L3 L5
Module III: Coding and Software Testing Techniques: Coding, Code Review, documentation. Testing: - Unit testing, Black-box Testing, White-box testing, Cyclomatric complexity measure, coverage analysis, mutation testing, Debugging techniques, Integration testing, System testing, Regression testing. Software Reliability and Software	**CO4**- Formulate testing strategy for software systems using methods like functional testing, test driven development, and unit testing.	L5
Module IV: Maintenance: Basic concepts in software reliability, reliability measures, reliability growth modelling, Quality SEI CMM, Characteristics of software maintenance, software reverse engineering, software reengineering, software reuse. Emerging Topics: Client-Server Software Engineering, Service-oriented Architecture (SOA), and Software as a Service (SaaS)	**CO5**- Produce efficient, reliable, robust and cost-effective software solutions. **CO6**- Utilize and manage various software management tools for development, maintenance, and analysis while managing the software development process both individually and in teams.	L3 L4

Subject: Compiler Design
Year/Semester: 3rd / 6th
Subject Code: C312

Module	CO Statement After the successful completion of the course, students will be able to:	BTL
Module 1: Introduction: Overview and Phases of compilation. Lexical Analysis: Non-Deterministic and Deterministic Finite Automata (NFA & DFA), Regular grammar, Regular expressions and Regular languages,	**CO1 -** Visualize the different phases of compilation by applying knowledge of system programming and mathematics to solve problems related to language translation.	**L2**
Module 1: Design of a Lexical Analyzer as a DFA, Lexical Analyzer generator. Syntax Analysis: Role of a Parser, Context free grammars and Context free languages,	**CO2- D**evelop and understanding of their use for engineering practice for design of Lexical analyzers by using tools like LEX.	**L3**
Module 1 : Parse trees and derivations, Ambiguous grammar. Top Down Parsing: Recursive descent parsing, LL (1) grammars, Non-recursive Predictive Parsing, Error reporting and Recovery. Bottom Up Parsing: Handle pruning and shift reduces Parsing, SLR parsers and construction or SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, Parsing using Ambiguous grammars, Error reporting and Recovery, Parser generator	**CO3-** Formulate machine code by considering the system design components and functionalities involved in compilation by designing Parsers(LL, LR, CLR & LALR) using YACC tools as parser generator	**L5**
Module 2: Intermediate Code Generation: DAG for expressions, Three address codes - Quadruples and Triples, Types and declarations, Translation of Expressions, Array references, Type checking and Conversions, Translation of Boolean expressions and control flow statements, Back Patching, Intermediate Code Generation for Procedures.	**CO4-** Develop skills in generating syntax directed translation and different methods of intermediate code representation.	**L4**
Module 3: Code Generation: Factors involved, Registers allocation, Simple code generation using STACK Allocation, Basic blocks and flow graphs, Simple code generation using flow graphs. Code Optimization: Objective, Peephole Optimization, and Concepts of Elimination of local common sub-expressions, Redundant and un-reachable codes, Basics of flow of control optimization.	**CO5-** Build an environment for compilation and code generation.	**L2**
Module 4: Run Time Environment: Storage Organizations, Static and Dynamic Storage	**CO6-** Inspect runtime structure and analyze how to develop code & design a	**L4**

Allocations, STACK Allocation, Handlings of activation records for calling sequences. Syntax Directed Translation: Syntax Directed Definitions (SDD), Inherited and Synthesized Attributes, Dependency graphs, Evaluation orders for SDD, Semantic rules, Application of Syntax Directed Translation. Symbol Table: Structure and features of symbol tables, symbol attributes and scopes.	compiler for concise programming language.	

Subject: Optimization in Engineering
Year/Semester: 3rd / 6th
Subject Code: C313

Module	CO Statement After the successful completion of the course, students will be able to:	BTL
MODULE 1: Idea of Engineering optimization Problems Classification of optimization algorithms modeling of problems and principle of modeling .Linear Programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear Programming.	**CO1**- Understand various methods for salutation of LPP **CO2**- Study and analyze different cases of LPP	**L2** **L4**
MODULE 2: Transportation problems Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method Stepping stone method. Assignment problems: Hungarian method for solution of Assignment problems Integer Programming: Branch and Bound algorithm for solution of integer programming problems.	**CO3**- Enrich fundamental concept to solve assignment problem and T.P. problem	**L3**
MODULE 3: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method. Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint Lagrange multiplier, Projected gradient method. Constrained optimization with inequality constraint: Kuhn-Tucker condition Quadratic programming .	**CO4**- Analyze N.L.P.P. and salutation and Details.	**L4**
MODULE 4: Queuing models: General characteristics, Markovian queuing model, M/M/1model, Limited queue capacity, multiple server, Finite sources, Queue discipline. General characteristics, Markovian queuing model M/M/1model, Limited queue capacity, multiple server Finite sources Queue discipline.	**CO5**- Understand the fundamental concept of queue problem LPP and salutation. **CO6**- Assessment different NLPP linked with different method of salutation.	**L2** **L5**

Subject: Compiler Design
Year/Semester: 3rd / 6th
Subject Code: C314

Sl. No.	Module	After the successful completion of the course, students will be able to:	BTL
1	**Module 1:** Introduction: Overview and Phases of compilation. Lexical Analysis: Non-Deterministic and Deterministic Finite Automata (NFA & DFA), Regular grammar, Regular expressions and Regular languages,	**CO1 -** Visualize the different phases of compilation by applying knowledge of system programming and mathematics to solve problems related to language translation.	2
2	**Module 1:** Design of a Lexical Analyzer as a DFA, Lexical Analyzer generator. Syntax Analysis: Role of a Parser, Context free grammars and Context free languages,	**CO2-** Use of compiler phases to develop an understanding of their use for engineering practice for design of Lexical analyzers by using tools like LEX.	3
3	**Module 1 :** Parse trees and derivations, Ambiguous grammar. Top Down Parsing: Recursive descent parsing, LL (1) grammars, Non-recursive Predictive Parsing, Error reporting and Recovery. Bottom Up Parsing: Handle pruning and shift reduces Parsing, SLR parsers and construction or SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, Parsing using Ambiguous grammars, Error reporting and Recovery, Parser generator	**CO3-** Formulate machine code by considering the system design components and functionalities involved in compilation by designing Parsers(LL, LR, CLR & LALR) using YACC tools as parser generator	5
4	**Module 2:** Intermediate Code Generation: DAG for expressions, Three address codes - Quadruples and Triples, Types and declarations, Translation of Expressions, Array references, Type checking and Conversions, Translation of Boolean expressions and control flow statements, Back Patching, Intermediate Code Generation for Procedures.	**CO4-** Develop skills in generating syntax directed translation and different methods of intermediate code representation.	4
5	**Module 3:** Code Generation: Factors involved, Registers allocation, Simple code generation using STACK Allocation, Basic blocks and flow graphs, Simple code generation using flow graphs. Code Optimization: Objective, Peephole Optimization, and Concepts of Elimination of local common sub-expressions, Redundant and un-reachable codes, Basics of flow of control optimization.	**CO5-** Building an environment for compilation and code generation.	2
6	**Module 4:** Run Time Environment: Storage Organizations, Static and Dynamic Storage Allocations, STACK Allocation, Handlings of activation records for calling sequences. Syntax Directed Translation: Syntax Directed Definitions (SDD), Inherited and Synthesized Attributes, Dependency graphs, Evaluation orders for SDD, Semantic rules, Application of Syntax Directed Translation. Symbol Table: Structure and features of symbol tables, symbol attributes and scopes.	**CO6-** Inspect runtime structure and analyze how to develop code & design a compiler for concise programming language.	4

Subject: Real-Time System
Year/Semester: 3rd / 6th
Subject Code: C314

Module	CO Statement After the successful completion of the course, students will be able to:	BTL
Module-I: Introduction: What is real-time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations	**CO1**- Understand concepts of real-time system	L2
Module-II: Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization	**CO2**- Understand the different protocol in Real Time OS	L2
Module-III: Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real time operating system, POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.	**CO3**- Analyze the different real-time OS task	L4
	CO4- Understand the concepts of different types of commercial OS	L2
Module IV : Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.	**CO5**- Work out and apply real-time database	**L3**
	CO6- Understand and Analyze the concepts of Basic Real Time Communication Architecture	**L3**

Subject: Software Engineering Lab
Year/Semester: 3rd / 6th
Subject Code: C317

Experiment	CO Statement **After the successful completion of the course, students will be able to:**	BTL
1. Develop requirements specification for a given problem. (The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems,)	**CO1:** Prepare SRS document, design document, test cases and software configuration management and risk management related document	**L6**
2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem **3.** Develop structured design for the DFD model developed.	**CO2:** Create a DFD (Data Flow Diagram) model for a sample problem involves breaking down the system into its various processes and data flows	**L6**
4.Develop UML use case model for a problem(use of case tool like rational rose)	**CO3:**Develop function oriented and object oriented software design using tools like rational rose	**L6**
5.Develop sequence diagram**.** **6.**. Develop class diagram. **7.**Develop code for the developed class model using Java.	**CO4**: Develop the Class Diagram, Sequence Diagrams & Java code based on the class model.	**L6**
8.Use testing tool such as Junit.	**CO5**: Perform unit testing and integration testing	**L3**
9. Using configuration management tools. **10.**Use any one project management tool such as Microsoft project, Gantt project or project Libre.	**CO6:** Apply various white box and black box testing techniques	**L3**

Subject: Compiler Design Lab
Year/Semester: 3rd / 6th
Subject Code: C318

Course Outcome	Course Outcome Statements	BTL
CO318.1	How to create a DFA from a given regular expression & Read a regular expression in standard form and check the error.	L2
CO318.2	How to create a NFA from a given regular expression & Read a regular expression in standard form and check the error.	L2
CO318.3	To Use Lex and yacc to extract tokens from a given source code	L3
CO318.4	To know how to Write a suitable data structure to store a Context Free Grammar.	L2
CO318.5	To create LL(1) parse table & create SLR(1) parse table for a given grammar by Simulator.	L4

Subject: Future Ready Contributor Develop Model Lab
Year/Semester: 3rd / 6th
Subject Code: C319

Modules	CO Statement After the successful completion of the course, students will be able to:	BTL
MODULE I:DEVELOPING SELF-EFFICACY&BASIC INNER STRENGTH Who is Future-Ready contributor?, Self-esteem& Growth Identity, Become a creator of one's destiny	**CO1:** Understand &Apply the concepts related to self-efficacy, growth identity, and the shift from a victim mindset to a creator mindset.	**L2,L3**
MODULEII:BUILDINGABILITYTOMAKEMORE EFFECTIVE CAREER CHOICES -Achieving Sustainable Success -Career Development Pathways for a changing world, Make and impact in every part of one's life.	**CO2:** Innovate and create their own paths to long-term success by developing their own frame works for long-term career fulfillment and personal growth. **CO3: C**reate their "engine of success" and explore diverse career development pathways & to generate unique solutions tailored to their individual aspirations and circumstances. To achieve creativity and originality in their approach to achieving sustainable success.	**L4** L5
MODULE III: BUILDING ABILITY TO BECOME SOLUTION&VALUECREATINGINDIVIDUALSIN WORLDS -Think Solutions -Value Thinking, Engaging Deeply	**CO4: C**reate and develop a mindset focused on finding solutions rather than dwelling on problems, thereby being equipped to thrive in today's rapidly changing market landscape. **CO5: A**nalyze and create valuable contributions by identifying what matters to organizations and customers, as well as foster deep engagement with complex environments.	**L5**
MODULE IV: BUILDING ABILITY TO WORK COLLABORATIVELY&ASGOODCITIZENSOF ORGANIZATIONS & THE COUNTRY Enlightened self-interest & collaboration at work, Human-centered thinking & Empathy, Trust Conduct.	**CO6: A**pply practical skills and strategies for effectively collaborating in teams and contributing positively to organizations and society.	**L3**

Subject: Seminar-I
Year/Semester: 3rd / 6th
Subject Code: C320

CO Statement **After the successful completion of the course, students will be able to:**	**BTL**
CO1--Outline the topics on modern technology, Prepare implementation of the same as the presentation.	L2
CO2-Understanding the technologies used by extracting the new things to be implemented by reviewing the journals/research papers.	L3
CO3-Sketch the application of the technology for the use of the mankind.	L4
CO4- Analyze and correlate the new technology with the subject of interest for further study.	L4
CO5- Evaluate, plan and reframe the technology with the communication skills for a better explanation and presentation.	L3
CO6-Modify and design the concept into the realistic world.	L3

Subject: Entrepreneurship Development
Year/Semester: 4th / 7th
Subject Code: C401

Modules	**CO Statement** **After the successful completion of the course, students will be able to:**	**BTL**
Module 1: Concept of Entrepreneurship &Intrapreneurship, Nature, Process and importance of Entrepreneurship Types of Entrepreneurs, Entrepreneurial Traits and Skills, Entrepreneurial Personality Entrepreneurial Motivation and Achievement	**CO1**-Understand the Concept of Entrepreneurship, Startups & Incubation, Types of Entrepreneurs. Develop the entrepreneurial Skills and personality to be successful Entrepreneur.	L1,L2
Module – 2: Entrepreneurial Environment ,Identification of Opportunities ,Converting business opportunity into reality Setting up of a Small Enterprise, Issues relating to location Startups and business incubation	**CO2**-Analyze business environment to identify business opportunities, know the methods of conducting market survey and preparation of Preliminary & Detailed Project Report.	L5,L6
Module-3: Environmental problems and Environmental Pollution Act, Industrial Policies and Regulations Industrial Policy Resolution 1956.	**CO3**-Learn about the Environment Protection Acts, rules and regulations to start a new venture.	L3
Module-4: Need to know about accounting and Working Capital Management Marketing Management Human Resource Management and Labour Laws Organizational Support Services-Central & State Government Incentives and Subsidies	**CO4**-Develop Entrepreneurial Strategies(Marketing, Finance, Human Resource Management Accounting) to manage an enterprise and also know the various Government Schemes which support Entrepreneurs	L4,L3
Module-5: Sickness of Small Scale Industries, Causes and Symptoms of sickness	**CO5**- Identify the causes of industrial sickness and areas to implement remedial measures to revitalize and revive sick industries for sustainable growth of Indian Economy	L5,L3
Module-6: Cure of Sickness and Role of Banks and Government in reviving Industries	**CO6**-Learn to form associations and negotiate with Government and Banks to help these sick industries get adequate funds to revive their sick units.	L6

Subject: Embedded System
Year/Semester: 4th / 7th
Subject Code: C402

Modules	**CO Statement** **After the successful completion of the course, students will be able to:**	**BTL**
Module-1:Hardware Concepts Embedded System: Application and characteristics of embedded systems, Overview of Processors and hardware units in embedded system, embedded software in a system, Examples of Embedded system.	**CO1**: Study different embedded processors and system.	L2
Module -2:ARM:ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplication's instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions.	**CO2**: Emphasize knowledge about ARM pipeline and ISA architecture.	L3
Module-3:Devices and device drivers: I/O devices, Serial peripheral interfaces, IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA, PCI, PCI -X and advance busses, Device drivers.	**CO3**: Study different interfacing devices and drivers	L2
Module-4:Real Time Operating System (RTOS): Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA)	**CO4**: Acquire in-depth knowledge about real time operating system.	L3
Module-5: Modelling Techniques: Software and programming concept: Processor selection for an embedded system, State chart, SDL, Petri-Nets, Unified Modeling Language (UML). Hardware software design. Hardware and software partitioning: K-L partitioning, Partitioning using genetic algorithm,	**CO5** : Focus on model designing and programming of embedded system	L3
Module-6: Low power embedded system design: Dynamic power dissipation, Static power dissipation, Power reduction techniques, system level power management. Software design for low power devices.	**CO6**: study of low power embedded system.	L2

Subject: Software Project Management
Year/Semester: 4th / 7th
Subject Code: C403

Modules	CO Statement After the successful completion of the course, students will be able to:	BTL
Module I: Introduction to Software Project Management - Software Projects - ways of categorizing software projects – problems with software projects - Project Life Cycle – Management - Setting objectives – Stakeholders - Project Team – Step Wise: An overview of project planning - Project evaluation - Selection of appropriate project approach. S/W size estimation, estimation of effort & duration. COCOMO models, Putnam's work, Jensen's model, Halstead's software Science.	**CO1**-Describe the basic concept of software project management with its life cycle. **CO2**-Apply project estimation and evaluation techniques to real world problem	L3 L3
Module II: Activity planning - project schedules - sequencing and scheduling projects - Network planning models - AON and AOA - identifying critical activities - crashing and fast tracking, Risk management: Categories, Risk planning, management and control - Evaluating risks to the schedule, PERT. Resource allocation - identifying resource requirements - scheduling resources - creating critical paths - publishing schedule - cost schedules - sequence schedule. CPM, Gantt chart, staffing, organizing a software engineering project	**CO3-** Apply project management system techniques like PERT , Gantt chart , AON and AOA **CO4-** Identify project risk & monitor	L3 L2
Module III: Monitoring and control – Visualizing progress, Earned value analysis – Managing people and organizing teams – organizational structures - Planning for small projects. Case Studies, Agile Development.	**CO5**-.Work in team to evaluate the different mode of communication among people.	L5
Module IV: Software quality- quality engineering, defining quality requirements, quality standards, practices & conventions, ISO 9000, ISO 9001, Software quality matrices, managerial and organization issues, defect prevention, reviews & audits, SEI capability maturity model, PSP, six sigma.	**CO6**-Describe different techniques used in monitoring and improve the quality of project	L3

Subject: Green Technology
Year/Semester: 4th / 7th
Subject Code: C404

Modules	CO Statement After the successful completion of the course, students will be able to:	BTL
Module 1-Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact. Planning for the Future to reduce global warming Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere.	**CO1**- Understand the cause of production of greenhouse gases and it is effect on the environment.	**L2**
Module 2-The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigate Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.	**CO2**- Learn the basic actions to prevent global warming and climate change.	**L2**
Module 3-Opportunities in Control of Carbon Emissions and Accumulation:- Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India —More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India.	**CO3**- Understand the impact knowledge on the methods of reducing Co_2 level in atmosphere.	**L2**
Module 4-Green Technologies for Energy Production_:- Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.	**CO4**- Know the importance of alternative energy sources for energy production	**L2**
Module 5-Green Technologies for Personal and Citywide Application: - Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and Citywide Level, Carbon Emissions from Imports. Green Technologies for Specific Applications:- Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals,	**CO5**- Understand the principles of green building technology and energy conservation measures.	**L2**

Green Technologies for Transport, Green Roads, Ports and Harbors, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider Application to Town Planning and Area Re- Development Projects ,'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.		
Module 6- Some High-tech Measures for Reducing Carbon Emissions: - Use of Solar Power with Satellite-Based Systems, Use of Carbon Capture and Storage (Sequestration), Microorganisms, A Quick SWOT Analysis. Recommended Plan of Action: - India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, few case studies on Projects undertaken by Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change	**CO6**- Learn the measures used on modern technology to reduce the climate change.	**L2**

Subject: Cyber Law and Ethics
Year/Semester: 4th / 7th
Subject Code: C406

Modules	**CO Statement** **After the successful completion of the course, students will be able to:**	**BTL**
Module-I: Introduction to Cyber Law Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.	**CO1**- Know various aspect of cyber law, ethics & different cyber law approaches like Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction etc.	L1
Module-II: Information Technology Act Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.	**CO2**- Know the IT Act, 2000, Amendments and Limitations of IT Act. **CO3**- Focus on various aspects of digital transactions & cyber security	L3 L2
Module-III: Cyber Law and Related Legislation Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).	**CO4**- Know different type of Cyber Law and various legal aspects related to cyber-crime.	L2
Module-IV: Electronic Business and Legal Issues Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.	**CO5**- Understand the evolution and development of e-commerce to significantly transformed how business transactions are conducted	**L3**
Module-V: Cyber Ethics The Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.	**CO6**- Know the Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics.	**L1**

Subject: Digital VLSI Design
Year/Semester: 4th / 7th
Subject Code: C405

Modules	CO Statement After the successful completion of the course, students will be able to:	BTL
Module-1:Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer- Aided Design Technology.	**CO1** Understand the concepts of vlsi, design style, Fabrication of NMOS, PMOS and CMOS.	**L2**
Module-2:Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts, The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full Customs Mask Layout Design. MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.	**CO2** Explain the application fabrication of MOS Logic Circuits and circuit operation.	**L3**
Module-3:MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter. MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitic, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters. Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion NMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).	**CO3** Design Combinational Circuits using MOS logic circuits and performance analysis.	**L2**
Module-4:Sequential MOS Logic Circuits: Introduction, Behavior of Bi stable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge Triggered Flip Flop. Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.	**CO4** Design Sequential Circuits using MOS logic circuits and performance analysis.	**L2**
Module-5:Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring	**CO5** Understand and apply the VHDL programming of Digital Logic Circuits.	**L3**

IDDQ Test.		
Module-6:Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, Flash Memory.	**CO6** Summarize the Semiconductor memories-DRAM, SRAM, Flash Memory	**L2**

Subject: Minor Project
Year/Semester: 4th / 7th
Subject Code: C407

CO	CO Statements After completion of the course the student will be able to	BTL
CO1	Define problems and suggest a feasible, cost effective, ecofriendly solution for the benefit of the society.	L2
CO2	Understand relation of the project to the literature & Engineering knowledge.	L2
CO3	Demonstrate properly to complete the project within the scheduled time.	L2
CO4	Analyze project with proper methodology and team spirit.	L4
CO5	Evaluate and validate the project.	L5
CO6	Generate thesis/ project report as per standard norm.	L2

Subject: Seminar-II
Year/Semester: 4th / 7th
Subject Code: C408

CO	CO Statements After completion of the course the student will be able to	BTL
CO1	Find topics on modern technology, Prepare implementation of the same as the presentation.	L2
CO2	Understand the technologies used by extracting the new things to be implemented by reviewing the journals/research papers.	L2
CO3	Sketch the application of the technology for the use of the mankind.	L2
CO4	Analyze and correlate the new technology with the subject of interest for further study.	L4
CO5	Evaluate, plan and reframe the technology with the communication skills for a better explanation and presentation.	L2
CO6	Modify and design the concept into the realistic world.	L3

Subject: Major Project
Year/Semester: 4th / 8th
Subject Code: C410

After completion of the course the student will be able to

CO	CO Statements After completion of the course the student will be able to	BTL
CO1	Define problems and suggest a feasible, cost effective, ecofriendly solution for the benefit of the society.	L2
CO2	Understand relation of the project to the literature & Engineering knowledge.	L2
CO3	Demonstrate properly to complete the project within the scheduled time.	L2
CO4	Analyze project with proper methodology and team spirit.	L4
CO5	Evaluate and validate the project.	L5
CO6	Generate thesis/ project report as per standard norm.	L2