Department of Electronics and Communication Engineering

Program: B.Tech- Electronics and Communications Engineering

Regulation: R20 **Course Outcomes** **No. of Courses: 81**

I-I Sem	Course:Communicative English
CO-1	understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
CO-2	ask and answer general questions on familiar topics and introduce oneself/others
CO-3	employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
CO-4	recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
CO-5	form sentences using proper grammatical structures and correct word forms
I-I Sem	**Course:Mathematics-I**
CO-1	Utilize mean value theorems to real life problems (L3)
CO-2	Solve the differential equations related to various engineering fields (L3)
CO-3	Familiarize with functions of several variables which is useful in optimization (L3)
CO-4	Apply double integration techniques in evaluating areas bounded by region (L3)
CO-5	Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5
I-I Sem	**Course:Applied Chemistry**
CO-1	Analyze the different types of composite plastic materials and interpretthe mechanism of conduction in conducting polymers
CO-2	Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion.
CO-3	Synthesize nanomaterials for modern advances of engineering technology.
CO-4	Summarize the preparation of semiconductors; analyze the applications of liquid crystals and superconductors.
CO-5	Analyze the principles of different analytical instruments and their applications.
I-I Sem	**Course:Programming For Problem Solving Using C**
CO-1	To write algorithms and to draw flowcharts forsolvingproblems□
CO-2	To convert flowcharts/algorithms to C Programs, compile anddebugprograms□

CO-3	To use different operators, data types and write programs that use two-way/ multi-way selection□
CO-4	To select the best loop construct for agivenproblem□
CO-5	To design and implement programs to analyze the differentpointerapplications□
I-I Sem	**Course:Engineering Drawing**
CO-1	Drawing instruments and to draw polygons, Engg. Curves
CO-2	Orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes
CO-3	Draw the projections of the plane inclined toboth the planes.
CO-4	Draw the projections of the various types of solids in different positions inclined to one of the planes
CO-5	Represent and convert the isometric view to orthographic view and vice versa. Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.
I-I Sem	**Course:English Communication Skills Laboratory**
CO-1	Students can able to learn Vowels, Consonants, Pronunciation, Phonetic Transcription, Common Errors in Pronunciation,
CO-2	Students can able to learn Word stress-di-syllabic words, poly-syllabic words, weak and strong forms, contrastive stress
CO-3	Students can able to learn Stress in compound words,rhythm, intonation,accent neutralisation.
I-I Sem	**Course:Applied Chemistry Lab**
CO-1	The students entering into the professional course have practically very little exposure to lab classes.
CO-2	The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis
CO-3	Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.
I-I Sem	**Course:Programming For Problem Solving Using C Lab**
CO-1	To write algorithms and to draw flowcharts for solving problems
CO-2	To convert flowcharts/algorithms to C Programs, compile and debug programs
CO-3	To use different operators, data types and write programs that use two-way/ multi-way selection

I-II Sem	**Course: Mathematics-II**
CO-1	develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
CO-2	solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
CO-3	evaluate the approximate roots of polynomial and transcendental equations by different algorithms (L5)
CO-4	apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
CO-5	apply numerical integral techniques to different Engineering problems (L3)
I-II Sem	**Course: Applied Physics**
CO-1	Classify the energy bands of semiconductors(L2)
CO-2	Interpret the direct and indirect band gap semiconductors(L2)
CO-3	Identify the type of semiconductor using Hall effect(L2)
CO-4	Identify applications of semiconductors in electronic devices(L2)
CO-5	Classify superconductors based on Meissner's effect(L2)
I-II Sem	**Course: Object Oriented Programming Through Java**
CO-1	Students can able to learn Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.
CO-2	Students can able to learn Inheritance and Polymorphism
CO-3	Students can able to learn Event and GUI programming
CO-4	Students can able to learn I/O programming
CO-5	Students can able to learn Multithreading in java
I-II Sem	**Course:Network Analysis**
CO-1	Gain the knowledge on basic networkelements.
CO-2	Will analyze the RLC circuits behaviorindetailed.
CO-3	Analyze the performance of periodicwaveforms.
CO-4	Gain the knowledge in characteristics of two port network parameters (Z,Y, ABCD,h&g).
CO-5	Analyze the filter design concepts in realworldapplications.

I-II Sem	**Course:Basic Electrical Engineering**
CO-1	Able to explain the operation of DC generator and analyze the characteristics of DC generator.
CO-2	Able to explain the principle of operation of DC motor and analyze theircharacteristics. Acquire the skills to analyze the starting and speed control methods ofDCmotors.
CO-3	Ability to analyze the performance and speed – torque characteristics of a3- phase induction motor and understand starting methods of 3- phaseinductionmotor.
CO-4	Able to explain the operation ofSynchronousMachines
CO-5	Capability to understand the operation of variousspecialmachines.
I-II Sem	**Course:Electronic Workshop Lab**
CO-1	Able to explain the operation of Identification of components
CO-2	Able to explain the principle of operation of Laboratoryequipment
CO-3	Ability to analyze the PCBLayout ,Soldering practice, operation of CRO
I-II Sem	**Course:Basic Electrical Engineering Lab**
CO-1	Determine and predetermine the performance of DC machines and transformers.
CO-2	Control the DC shunt machines.
CO-3	Compute the performance of 1-phasetransformer.
I-II Sem	**Course:Applied Physics Laboratory**
CO-1	Construction and working details of instruments
CO-2	Interferometer, Diffract meter and Polari meter are learnt.
CO-3	Study EM-fields and semiconductors under the concepts of Quantum mechanics paves way for their optimal utility.
I-II Sem	**Course:Environmental Science**
CO-1	Students will be able to Analyze global environmental changes
CO-2	Students will be able to Analyze Natural Resources
CO-3	Students will be able to Analyze Biodiversity and its conservation
CO-4	Students will be able to Environmental Pollution AND Solid Waste Management

CO-5	Students will be able to Social Issues and the Environment and Environmental Management
II-I Sem	**Course:Electronic Devices And Circuits**
CO-1	Apply the basic concepts of semiconductor physics.
CO-2	Understand the formation of p-n junction and how it can be used as a p- n junction as diode in different modes of operation.
CO-3	Know the construction; working principle of rectifiers with andwith outfilters with relevant expressions andnecessarycomparisons.
CO-4	Understand the construction, principle of operation of transistors, BJT and FETwith their V-Icharacteristics in differentconfigurations.
CO-5	Know the need of transistor biasing, various biasing techniques for BJT and FETandstabilization concepts with necessaryexpressions.
II-I Sem	**Course:Switching Theory and Logic Design**
CO-1	Classify different number systems and apply to generate various codes.
CO-2	Use the concept of Boolean algebra in minimization of switching functions
CO-3	Design different types of combinational logic circuits.
CO-4	Apply knowledge of flip-flops in designing of Registers and counters
CO-5	The operation and design methodology for synchronous sequential circuits and algorithmic state machines.
II-I Sem	**Course:Signals And Systems**
CO-1	Differentiate the various classifications of signals and systems
CO-2	Analyze the frequency domain representation of signals using Fourier concepts
CO-3	Classify the systems based on their properties and determine the response ofLTISystems.
CO-4	Know the sampling process and various types of sampling techniques.
CO-5	Apply Laplace and z-transforms to analyze signals and Systems (continuous&discrete).
II-I Sem	**Course:Random Variables And Stochastic Processes**
CO-1	Apply Mathematical model theorem and phenomena and solve simple probabilistic problems.
CO-2	Analyze different types of random variables and compute statistical averages of the random variables.
CO-3	Apply the random processes in the time and frequency domains.

CO-4	Analyze the LTI systems with random inputs.
CO-5	Understand the important concepts of random variables and stochastic processes
II-I Sem	**Course:Mathematics-III**
CO-1	Interpret the physical meaning of different operators such as gradient, curland divergence (L5)
CO-2	Estimate the work done against a field, circulation and fluxusing vector calculus (L5)
CO-3	Apply the Laplace transform for solving differential equations (L3)
CO-4	Find or compute the Fourier series of periodic signals (L3)
CO-5	Knowandbeable to apply integral expressions for the forwards and inverse Fourier transform to arrange of non-periodic wave forms (L3)
II-I Sem	**Course:Oops Through Java Lab**
CO-1	Identify classes, objects, members of a class and the relationship amongthemneeded for aspecific problem
CO-2	Implement programstodistinguishdifferentformsofinheritance
CO-3	Createpackagesandtoreusethem
II-I Sem	**Course:Electronic Devices And Circuits Lab**
CO-1	Student Able to Know P-N Junction Diode Characteristics
CO-2	Student Able to Know Zener Diode Characteristics
CO-3	Student Able to Know Rectifiers (without and with c-filter)
II-I Sem	**Course:Switching Theory And Logic Design Lab**
CO-1	Know logic gates
CO-2	Know combinational circuits
CO-3	Know decoders and encoders
II-I Sem	**Course:Python Lab (Skill Oriented Course)**
CO-1	Know comprehensions, generators in python.
CO-2	Know exception handling in python
CO-3	Know file I/O

II-II Sem	**Course:Electronic Circuit Analysis**
CO-1	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
CO-2	Design and analysis of multistage amplifiers using BJT and FET and Differential amplifier using BJT.
CO-3	Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.
CO-4	Know the classification of the power and tuned amplifiers and their analysis with performance comparison
CO-5	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
II-II Sem	**Course:Digital Ic Design**
CO-1	Understand the structure of commercially available digital integrated circuit families.
CO-2	Learn the IEEE Standard 1076 Hardware Description Language (VHDL).
CO-3	Model complex digital systems at several levels of abstractions, behavioral, structural, and rapid system prototyping.
CO-4	Analyze and design basic digital circuits with combinatorial and sequential logic circuits using VHDL.
CO-5	Create and implement combinational and sequential digital logic circuits.
II-II Sem	**Course:Analog Communications**
CO-1	Differentiate various Analog modulation and demodulation schemes and their spectral characteristics
CO-2	Analyze noise characteristics of various analog modulation methods
CO-3	Analyze various functional blocks of radiotransmitters and receivers
CO-4	Design simple analog systems for various modulation techniques
CO-5	Apply basic techniques for generating and demodulating various pulse modulated signals
II-II Sem	**Course:Linear Control Systems**
CO-1	This course introduces the concepts of feedback and its advantages to various control systems
CO-2	The performance metrics to design the control system intime-domain and frequency domain are introduced.
CO-3	Control systems for various applications can be designed using time-domain and frequency domain analysis.

CO-4	In addition to the conventional approach, the state space approach for the analysis of control systems is also introduced.
CO-5	Understand the concepts of state variable analysis, design and also the concepts of controllability and observability.
II-II Sem	**Course:Management And Organizational Behavior**
CO-1	After completion of the Course the student will acquire the knowledge on management functions, global leadership and organizational structure.
CO-2	Will familiarize with the concepts of functional management that is HR Mand Marketing of new product developments.
CO-3	The learnerisable to think in strategically through contemporary management practices.
CO-4	The learner can develop positive attitude through personality development and can equip with motivational theories.
CO-5	The student can attain the group performance and grievance handling in managing the organizational culture
II-II Sem	**Course:Electronic Circuit Analysis Lab**
CO-1	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
CO-2	Design and analysis of multistage amplifiers using BJT and FET and Differential amplifier using BJT.
CO-3	Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.
II-II Sem	**Course: Analog Communications Lab**
CO-1	Differentiate various Analog modulation and demodulation schemes and their spectral characteristics
CO-2	Analyze noise characteristics of various analog modulation methods
CO-3	Analyze various functional blocks of radio transmitters and receivers
II-II Sem	**Course: Digital Ic Design Lab**
CO -1	Understand the structure of commercially available digital integrated circuit families.
CO -2	Learn the IEEE Standard 1076 Hardware Description Language (VHDL).
CO -3	Model complex digital systems at several levels of abstractions, behavioral, structural, simulation, synthesis and rapid system prototyping.
II-II Sem	**Course:Soft Skills (Skill Oriented Course)**
CO-1	Use language fluently, accurately and appropriately indebates and group discussions

CO-2	Use their skills of listening comprehension to communicate effectively incross-cultural contexts.
CO-3	Learn and use new vocabulary.
CO-4	Write resumes, project reports and reviews
CO-5	Exhibit interview skills and develop soft skills.
III-I Sem	**Course:Analog Ics And Applications**
CO-1	Describe the Op-Amp and internal Circuitry: 555 Timer, PLL
CO-2	Discuss the Applications of Operational amplifier: 555 Timer, PLL
CO-3	Design the Active filters using Operational Amplifier
CO-4	Understand timers and phase locked loops
CO-5	Use the Op-Amp in A to D & D to A Converters
III-I Sem	**Course:Electromagnetic Waves And Transmission Lines**
CO-1	Determine E and H using various laws and applications of electric & magnetic fields
CO-2	Apply the Maxwell equations to analyze the time varying behavior of EM waves
CO-3	Gain the knowledge in uniform plane wave concept and characteristics of uniform plane wave in various media
CO-4	Calculate Brewster angle, critical angle and total internal reflection
CO-5	Derive and Calculate the expressions for input impedance of transmission lines, reflection coefficient, VSWR etc. using smith chart
III-I Sem	**Course:Digital Communications**
CO-1	Analyze the performance of a Digital Communication System for probability of error and are able to design a digital communication system.
CO-2	Analyze various source coding techniques.
CO-3	Compute and analyze Block codes, cyclic codes and convolution codes.
CO-4	Design a coded communication system.
CO-5	Create a digital communication system.
III-I Sem	**Course:Antenna And Wave Propagation (PE1)**
CO-1	Identify basic antenna parameters.
CO-2	Design and analyze wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and micro-strip antennas

CO-3	Quantify the fields radiated by various types of antennas
CO-4	Design and analyze antenna arrays
CO-5	Analyze antenna measurements to assess antenna's performance
III-I Sem	**Course:Electronic Measurements And Instrumentation (PE1)**
CO-1	Select the instrument to be used based on the requirements.
CO-2	Understand and analyze different signal generators and analyzers.
CO-3	Understand the design of oscilloscopes for different applications.
CO-4	Design different transducers for measurement of different parameters.
CO-5	Understand the concept Transducers.
III-I Sem	**Course:Computer Architecture & Organization (PE1)**
CO-1	Students can understand the architecture of modern computer.
CO-2	They can analyze the Performance of a computer using performance equation
CO-3	Understanding of different instruction types.
CO-4	Students can calculate the effective address of an operand by addressing modes
CO-5	They can understand how computer stores positive and negative numbers.
III-I Sem	**Course: Analog ICS And Applications Lab**
CO-1	Student Able To Learn the characteristics of ideal and practical op-amp.
CO-2	Student Able To Learn different application of op-amp
CO-3	Student Able To Learn the characteristics of op-amp as active filter.
III-I Sem	**Course: Digital Communications Lab**
CO -1	Able to understand basic theories of Digital communication system in practical.
CO -2	Able to design and implement different modulation and demodulation techniques.
CO -3	Able to analyze digital modulation techniques by using MATLAB tools.
III-I Sem	**Course: Data Structures Using Java Lab**
CO-1	Rememberfunctions to implement linear data structure operations

CO-2	Rememberfunctions to implement non-linear data structure operations
CO-3	Evaluate the given problem
III-II Sem	**Course: Microprocessor And Microcontrollers**
CO-1	Understand the architecture of microprocessor/ microcontroller and their operation.
CO-2	Demonstrate programming skills in assembly language for processors and Controllers.
CO-3	Analyze various interfacing techniques and apply them for the design of processor / Controller based systems.
CO -4	Understand the knowledge on interfacing various peripherals, configure and develop programs to interface peripherals/sensors.
CO -5	Understand To develop programs efficiently on ARM Cortex processors and debug.
III-II Sem	**Course: Vlsi Design**
CO-1	Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
CO-2	Apply the design Rules and draw layout of a given logic circuit.
CO-3	Design basic building blocks in Analog IC design.
CO-4	Analyze the behavior of amplifier circuits with various loads.
CO-5	Design various CMOS logic circuits for design of Combinational logic circuits.
III-II Sem	**Course: Digital Signal Processing**
CO-1	Apply the difference equations concept in the analysis of Discrete time systems
CO-2	Use the FFT algorithm for solving the DFT of a given signal
CO-3	Design a Digital filter (FIR&IIR) from the given specifications
CO-4	Realize the FIR and IIR structures from the designed digital filter.
CO-5	Use the Multirate Processing concepts in various applications (eg: Design of phase shifters, Interfacing of digital systems
III-II Sem	**Course: Microwave Engineering (PE2)**
CO-1	Design different modes in waveguide structures
CO-2	Calculate S-matrix for various waveguide components and splitting the microwave energy in a desired direction
CO-3	Distinguish between Microwave tubes and Solid State Devices, calculation of efficiency of devices.

CO-4	Measure various microwave parameters using a Microwave test bench
CO-5	Study of different microwave devices and their parameters
III-II Sem	**Course: Mobile & Cellular Communication (PE2)**
CO-1	Analyzethe limitations of conventional mobile telephone systems
CO-2	Understand the frequency management, channel assignment strategies and antennas in cellular systems.
CO-3	Understand the concept of architectures of various cellular systems
CO-4	Understand the concepts of cellular systems.
CO-5	Analyze handoff strategies
III-II Sem	**Course: Embedded Systems (PE2)**
CO-1	Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.
CO-2	The hardware components required for an embedded system and the design approach of an embedded hardware.
CO-3	The various embedded firmware design approaches on embedded environment.
CO-4	Understand how to integrate hardware and firmware of an embedded system using real time operating system.
CO-5	Createan embedded system design approach to perform a specific function.
III-II Sem	**Course: CMOS Analog IC Design (PE2)**
CO-1	Design MOSFET based analog integrated circuits.
CO-2	Analyzeanalog circuits at least to the first order.
CO-3	Appreciate the trade-offs involved in analog integrated circuit design.
CO-4	Understand and appreciate the importance of noise and distortion in analog circuits.
CO-5	Analyze complex engineering problems critically in the domain of analog IC design for conducting research.
III-II Sem	**Course: Microprocessor And Microcontrollers Lab**
CO -1	Demonstrate ability to handle arithmetic operations using assembly language programming in TASM and training boards
CO -2	Demonstrate ability to handle logical operations using assembly language programming in TASM
CO -3	Demonstrate ability to handle string instructions using assembly language programming in TASM

III-II Sem	**Course: VLSI Design Lab**
CO -1	Create Verilog /VHDL Source code, perform simulation using relevant simulator
CO -2	Create the latest FPGA/CPLD Hardware in the Laboratory
CO-3	Analyze the obtained simulation results using necessary Synthesizer.
III-II Sem	**Course: Digital Signal Processing Lab**
CO -1	Create DT, DFT, ZERO PLOT, BODEPLOT, NYQUIST PLOT,FIR, IIR FILTERS USING MAT LAB AND CCS STUDIO.
CO-2	Understand the use of TI DSP Starter Kit
CO-3	Remember the use of Cypress FM4 Starter Kit
III-II Sem	**Course:ARM Based/ Aurdino Based Programming**
CO -1	Apply simple applications on 88-bit microcontroller (ATmega328)
CO-2	Analyze basics of SPI interface.
CO-3	Analyze Accelerometer interface techniques
IV-I Sem	**Course: Optical Communication**
CO-1	Choose necessary components required in modern optical communications systems .
CO-2	Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers.
CO-3	Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.
CO-4	Choose the optical cables for better communication with minimum losses
CO-5	Design, build, and demonstrate optical fiber experiments in the laboratory.
IV-I Sem	**Course: Digital Image Processing**
CO-1	Perform image manipulations and different digital image processing techniques
CO-2	Perform basic operations like – Enhancement, segmentation, compression, Image transforms and restoration techniques on image.
CO-3	Analyze pseudo and full color image processing techniques.
CO-4	Apply various morphological operators on images

CO-5	Create different digital image processing techniques
IV-I Sem	**Course:Low Power Vlsi Design**
CO-1	Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon Technologies.
CO-2	Students able to understand deep submicron CMOS technology and digital CMOS design styles.
CO-3	To design chips used for battery-powered systems and high performance circuits.
CO-4	Learn the design of various CMOS dynamic logic circuits.
CO-5	Learn the design techniques low voltage and low power CMOS circuits for various applications.
IV-I Sem	**Course: Satellite Communication**
CO-1	Understand the concepts, applications and subsystems of Satellite communications.
CO-2	Derive the expression for G/T ratio and to solve some analytical problems on satellite link design.
CO-3	Understand the various types of multiple access techniques and architecture of earth station design. 4. Understand the concepts of GPS and its architecture.
CO-4	Understand the concepts, applications and subsystems of Satellite communications.
CO-5	Understand the concepts of GPS and its architecture.
IV-I Sem	**Course: Soft Computing Techniques**
CO-1	Develop intelligent systems leveraging the paradigm of soft computing techniques.
CO-2	Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
CO-3	Recognize the feasibility of applying a soft computing methodology for a particular problem
CO-4	Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms and neural networks.
CO-5	Design hybrid system to revise the principles of soft computing in various application
IV-I Sem	**Course: Digital Ic Design Using Cmos**
CO-1	Understand the concepts of MOS Design.
CO-2	Design and analysis of Combinational and Sequential MOS Circuits.
CO-3	Extend the Digital IC Design to Different Applications.

CO-4	Understand the Concepts of Semiconductor Memories, Flash Memory, RAM array organization.
CO-5	Remember the use of semiconductors
IV-I Sem	**Course:Radar Engineering**
CO-1	Derive the radar range equation and to solve some analytical problems.
CO-2	Understand the different types of radars and its applications.
CO-3	Understand the concept of tracking and different tracking techniques.
CO-4	Understand the various components of radar receiver and its performance.
CO-5	Evaluate the noise in radar signals
IV-I Sem	**Course: Pattern Recognition & Machine Learning**
CO-1	Study the parametric and linear models for classification
CO-2	Design neural network and SVM for classification
CO-3	Develop machine independent and unsupervised learning techniques.
CO-4	Analyze the linear discriminate functions
CO-5	Apply algorithms for independent machine learning
IV-I Sem	**Course: Internet Of Things**
CO-1	Understand internet of Things and its hardware and software components.
CO-2	Interface I/O devices, sensors & communication modules.
CO-3	Remotely monitor data and control devices.
CO-4	Design real time IoT based applications
CO-5	Apply IOT case studies for various applications
IV-II Sem	**Course: Basics Of Signals And Systems (OE)**
CO-1	Understand linear time invariant systems.
CO-2	Apply the concepts of Fourier series representations to analyze continuous and discrete time periodic signals.
CO-3	Understand and apply the continuous time Fourier transform, discrete time Fourier transform
CO-4	Apply the concepts of Laplace transform, and z-Transform to the analysis and description of LTI continuous and discrete-time systems

CO-5	Apply the concepts of Laplace transform, and z-Transform to the analysis and description of LTI continuous and discrete-time systems
IV-II Sem	**Course: Electronic Measurements And Instrumentation(OE)**
CO-1	Select the instrument to be used based on the requirements.
CO-2	Understand and analyze different signal generators and analyzers.
CO-3	Understand the design of oscilloscopes for different applications.
CO-4	Design different transducers for measurement of different parameters.
CO-5	Understand the concept Transducers.
IV-II Sem	**Course: Principles Of Signal Processing(OE)**
CO-1	Use the FFT algorithm for solving the DFT of a given signal
CO-2	Design a Digital filter (FIR&IIR) from the given specifications
CO-3	Realize the FIR and IIR structures from the designed digital filter.
CO-4	Use the Multirate Processing concepts in various applications
CO-5	Apply the Adaptive signal processing concepts to various signal processing applications
IV-II Sem	**Course: Industrial Electronics(OE)**
CO-1	Understand the concept of DC amplifiers.
CO-2	Analyze and design different voltage regulators for real time applications
CO-3	Describe the basis of SCR and Thyristor
CO-4	Determine the performance of DIAC and TRIAC
CO-5	Develop real time application using electronics
IV-II Sem	**Course: Consumer Electronics(OE)**
CO-1	Understand the various type of microphones and loud speakers.
CO-2	To identify the various digital and analog signal.
CO-3	Describe the basis of television and composite video signal.
CO-4	Describe the various kind of colour TV standards and system.
CO-5	Compare the various types of digital TV system.

IV-II Sem	**Course:Fundamentals Of Microprocessors And Microcontrollers(OE)**
CO-1	Understand the architecture of microprocessor/microcontroller and their operation.
CO-2	Demonstrate programming skills in assembly language for processors and controllers.
CO-3	Analyze various interfacing techniques and apply them for the design of processor/Controller based systems.
CO-4	Understand the concept 8051 micro controller
CO-5	Analyze the concept Micro controller programming & applications
IV-II Sem	**Course:Transducers And Sensors(OE)**
CO-1	Use concepts in common methods for converting a physical parameter into an electrical quantity
CO-2	Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
CO-3	Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
CO-4	Predict correctly the expected performance of various sensors
CO-5	Locate different type of sensors used in real life applications and paraphrase their importance
IV-IISem	**Course:Iot And Applications(OE)**
CO-1	Understand internet of Things and its hardware and software components.
CO-2	Interface I/O devices, sensors & communication modules.
CO-3	Remotely monitor data and control devices.
CO-4	Design real time IoT based applications
CO-5	Apply IOT case studies for various applications
IV-II Sem	**Course: Soft Computing Techniques(OE)**
CO-1	Develop intelligent systems leveraging the paradigm of soft computing techniques.
CO-2	Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
CO-3	Recognize the feasibility of applying a soft computing methodology for a particular problem
CO-4	Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms and neural networks.
CO-5	Design hybrid system to revise the principles of soft computing in various application

IV-II Sem	**Course:IC Applications(OE)**
CO-1	Analyse the Differential Amplifier with Discrete components
CO-2	Describe the Op-Amp and internal Circuitry: 555 Timer, PLL
CO-3	Discuss the Applications of Operational amplifier: 555 Timer, PLL
CO-4	Design the digital application using digital ICs
CO-5	Use the Op-Amp in A to D & D to A Converters
IV-II Sem	**Course:Principles Of Communications(OE)**
CO-1	Analyze the performance of analog modulation schemes in time and frequency domains.
CO-2	Analyze the performance of angle modulated signals.
CO-3	Characterize analog signals in time domain as random processes and noise
CO-4	Characterize the influence of channel on analog modulated signals
CO-5	Determine the performance of analog communication systems in terms of SNR
IV-II Sem	**Course:Basic Electronics(OE)**
CO-1	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.
CO-2	Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
CO-3	Understand the construction, principle of operation of transistors,
CO-4	Analyze FETs
CO-5	Analyze Thyristors and other devices
IV-II Sem	**Course:Data Communications(OE)**
CO-1	Know the Categories and functions of various Data communication Networks
CO-2	Design and analyze various error detection techniques.
CO-3	Demonstrate the mechanism of routing the data in network layer
CO-4	Know the significance of various Flow control and Congestion control Mechanisms
CO-5	Understand the importance of application layer

IV-II Sem	Course:Digital Logic Design(OE)
CO-1	Classify different number systems and apply togenerate various codes.
CO-2	Use the concept of Boolean algebra in minimization of switching functions
CO-3	Design different types of combination allogic circuits.
CO-4	Apply knowledge offlip-flops in designing of Registers and counters
CO-5	The operation and design methodology for synchronous sequential circuits and algorithmic state machines
IV-II Sem	**Course:Remote Sensing And Gis (OE)**
CO-1	Retrieve the information content of remotely sensed data
CO-2	Analyze the energy interactions in the atmosphere and earth surface features
CO-3	Interpret the images for preparation of thematic maps
CO-4	Apply problem specific remote sensing data for engineering applications
CO-5	Analyze spatial and attribute data for solving spatial problems
IV-II Sem	**Course: Bio Medical Instrumentation (OE)**
CO-1	Apply principles and concepts of electronics to analyze input and output signals in medical electronics
CO-2	Apply principles and concepts of electronics to design filters for de-noising of medical measurements
CO-3	Recognize different types of transducers, ongoing progress in improving their design, and their application in medical measurements
CO-4	Apply principles and concepts of engineering to quantify and model measurements of biopotentials
CO-5	Apply principles and concepts of sensing and engineering to (i) design diagnostic devices for detection of markers in biofluids, and (ii) be able to evaluate quality of diagnostic devices
IV Sem -II	**Project**
CO-1	Formulate., and apply mathematical, science and engineering principles to solve real time engineering problems
CO-2	Test the existing data, communicate and conduct research on complex problems using modern tools
CO-3	Validate the obtained results on contemprory issues related to society and environment
CO-4	Determine effectively the engineering principles used intheir project individually and as a team as per the norms of engineering practice

CO-5	Structure future work to promote life long learning in the context of technological adaptation.

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

Department of Mechanical Engineering

Program: B.Tech- Mechanical Engineering

Regulation: R20 **Course Outcomes** **No. of Courses: 93**

I-I Sem	Course: Mathematics - I (Calculus And Differential Equations)(BS)
CO-1	Utilize mean value theorems to real life problems (L3)
CO-2	Solve the differential equations related to various engineering fields (L3)
CO-3	Familiarize with functions of several variables which is useful in optimization (L3)
CO-4	Apply double integration techniques in evaluating areas bounded by region (L3)
CO-5	Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems(L5)
I-I Sem	**Course: Engineering Physics**
CO-1	Explain the need of coherent sources and the conditions for sustained interference
CO-2	Understand the basic concepts of LASER light Sources
CO-3	Explain the concept of dual nature of matter
CO-4	Explain the concept of dielectric constant and polarization in dielectric materials
I-I Sem	**Course: Programming For Problem Solving Using C**
CO-1	To write algorithms and to draw flowcharts for solving problems
CO-2	To convert flowcharts/algorithms to C Programs, compile and debug programs
CO-3	To use different operators, data types and write programs that use two-way/ multi-way selection
CO-4	To select the best loop construct for a given problem
I-I Sem	**Course: Communicative English**
CO-1	understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
CO-2	ask and answer general questions on familiar topics and introduce oneself/others
CO-3	employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
CO-4	recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs

I-I SEM	Course: Engineering Drawing
CO1	Use drawing instruments to draw polygons and Engineering Curves.
CO2	Construct scales and draw Orthographic projections
CO3	draw projections of points
CO4	draw projections of planes
CO5	Describe and draw projections of solids
I-II Sem	**Course: Applied Physics Lab**
CO-1	Develop skills to impart practical knowledge in real time solution.
CO-2	Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
CO-3	Design new instruments with practical knowledge.
I-I Sem	**Course: Programming For Problem Solving Using C Lab**
CO-1	Gains Knowledge on various concepts of a C language.
CO-2	Draw flowcharts and write algorithms.
CO-3	Design and development of C problem solving skills
I-I Sem	**Course:English Communication Skills Laboratory (HS)**
CO-1	Apply the concepts of English Language effectively in spoken and written forms.
CO-2	Rephrase the texts and respond appropriately
CO-3	Take part confidently in various formal and informal contexts.
I-I Sem	**Course: Environmental Science**
CO-1	Understand of the natural resources.
CO-2	Understand of the ecosystem and its diversity.
CO-3	Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
CO-4	Understand of the environmental impact of developmental activities.
CO-5	Create awareness on the social issues, environmental legislation and global treaties.

I-II Sem	Course: Mathematics-II
CO-1	develop the use of matrix algebra techniques that is needed by engineers for practical applications
CO-2	solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel
CO-3	evaluate the approximate roots of polynomial and transcendental equations by different algorithms
CO-4	apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals
CO-5	apply numerical integral techniques to different Engineering problems
I-II	**Course:Engineering Chemistry**
CO-1	Analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers.
CO-2	Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion.
CO-3	Synthesize nanomaterials for modern advances of engineering technology. Summarize the preparation of semiconductors; analyze the applications of liquid crystals and superconductors.
CO-4	Analyze the principles of different analytical instruments and their applications. Design models for energy by different natural sources.
CO-5	Obtain the knowledge of computational chemistry and molecular machines
I-II SEM	**Course: Engineering Mechanics**
CO1	Identify the significance of centroid/ center of gravity and find centroids of composite figures and bodies.
CO2	Understand the moment of inertia and method of finding moment of inertia of areas and bodies
CO3	Identify the type of frame and analyze for the forces in the members of the truss (frame) by method of joints and method of sections.
CO4	Interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc.,
CO5	Understand the kinetics of the rigid bodies and solve simple problems using work-energy method.
I-II Sem	**Course:Basic Electrical Engineering**
CO-1	Able to explain the operation of DC generator and analyze the characteristics of DC generator.
CO-2	Able to explain the principle of operation of DC motor and analyze theircharacteristics. Acquire the skills to analyze the starting and speed control methods ofDCmotors.

CO-3	Ability to analyze the performance and speed – torque characteristics of a3- phase induction motor and understand starting methods of 3- phaseinductionmotor.
CO-4	Able to explain the operation ofSynchronousMachines
CO-5	Capability to understand the operation of variousspecialmachines.
I-II SEM	**Course: Thermodynamics**
CO1	Describe basic concepts of thermodynamics
CO2	Explain Laws of thermodynamics
CO3	discuss Concept of entropy
CO4	evaluate vapours and their depiction in tables and charts
CO5	Evaluate properties of perfect gas mixtures.
I-II SEM	**Course: Engineering Workshop Practice Lab**
CO1	Design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint.
CO2	Design and model various basic prototypes in the trade of fitting such as Straight fit, V- fit.
CO3	Design various basic prototypes in the trade of Tin smithy such as rectangular tray, and open Cylinder.
I-II	**Course:Engineering Chemistry Lab**
CO-1	The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills
CO-2	Learn and apply basic techniques used in chemistry laboratory for volumetric analysis; redox titrations with different indicators; EDTA titrations
CO-3	Expose to different methods of chemical analysis and use of some commonly employed instruments.
I-II Sem	**Course:Basic Electrical Engineering Lab**
CO-1	Determine and predetermine the performance of DC machines and transformers.
CO-2	Control the DC shunt machines.
CO-3	Compute the performance of 1-phasetransformer.

I-II Sem	Course: Constitution Of India
CO-1	Understand historical background of the constitution making and its importance for building a democratic India.
CO-2	Understand the functioning of three wings of the government i.e., executive, Legislative and judiciary.
CO-3	Understand the value of the fundamental rights and duties for becoming good citizen of India.
CO-4	Analyze the decentralization of power between central, state and local self government.
CO-5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
II-I SEM	**Course:Mechanics Of Solids**
CO1	Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.
CO2	apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment
CO3	Analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of suchstructural components.
CO4	Compare the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
CO5	Design and analysis of Industrial components like pressure vessels.
II-I SEM	**Course:Fluid Mechanics & Hydraulic Machines**
CO1	Explain basic concepts of fluid properties
CO2	discuss mechanics of fluids in static and dynamic conditions
CO3	Explain Boundary layer theory, flow separation and dimensional analysis.
CO4	Derive Hydrodynamic forces of jet on vanes in different position
CO5	Explain Working Principles and performance evaluation of hydraulic pump and turbines.
II-I SEM	**Course:Production Technology**
CO1	design the gating system for different metallic components
CO2	design the gating system for different metallic components
CO3	Compare different types of manufacturing processes
CO4	use forging, extrusion processes
CO5	Compare different types of welding processes used for special fabrication

II-I SEM	**Course: Kinematics Of Machinery**
CO1	Draw Contrive a mechanism for a given plane motion with single degree of freedom
CO2	analyse a mechanism for a given straight line motion and automobile steering motion
CO3	Analyse the motion (velocity and acceleration) of a plane mechanism
CO4	analyse mechanisms for a prescribed intermittent motion like opening and closing of IC engine valves etc.
CO5	Select a power transmission system for a given application and analyse motion of different transmission system
II-I SEM	**Course: Computer Aided Engineering Drawing Practice**
CO1	Explain working of sheet metal with help of development of surfaces
CO2	Explain how to know the hidden details of machine components with the help of sections and interpenetrations of solids.
CO3	Explain modelling commands for generating 2D and 3D objects using computer aided drafting tools which are useful to create machine elements for computer aided analysis.
II-I SEM	**Course: Fluid Mechanics & Hydraulic Machinery Lab**
CO1	Compute Impact of jets onVanes
CO2	Analyse Performance Test on PeltonWheel.
CO3	Analyse Performance Test on FrancisTurbine.
II-I SEM	**Course: Production Technology Lab**
CO1	use sheet metal operations
CO2	Practice deep drawing and extrusion operations
CO3	Explain Basic powder compaction and interring
II-I SEM	**Course: Drafting And Modeling Lab**
CO1	Explain the concept of Traditional knowledge and its importance
CO2	Discuss importance of protecting traditional knowledge
CO3	Explain various enactments related to the protection of traditional knowledge

II-II SEM	Course:Materials Science & Metallurgy
CO1	Discuss the crystalline structure of different metals and study the stability of phases in different alloy systems.
CO2	Explain the behavior of ferrous and non ferrous metals and alloys and their application in different domains
CO3	Discuss the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
CO4	Explain methods of making of metal powders and applications of powder metallurgy
CO5	Comprehend the properties and applications of ceramic, composites and other advanced methods
II-II SEM	**Course:Complex Variables And Statistical Methods**
CO1	apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic
CO2	find the differentiation and integration of complex functions used in engineering problems
CO3	make use of the Cauchy residue theorem to evaluate certain integrals
CO4	apply discrete and continuous probability distributions
CO5	design the components of a classical hypothesis test
II-II SEM	**Course: Dynamics of Machinery**
C01	compute the frictional losses and transmission in clutches, brakes and dynamometers
C02	determine the effect of gyroscopic couple in motor vehicles, ships and aeroplanes
C03	analyse the forces in four bar and slider crank mechanisms and design a flywheel
C04	determine the rotary unbalanced mass in reciprocating equipment
C05	determine the unbalanced forces and couples in reciprocating and radial engines
II-II SEM	**Course: Thermal Engineering – I**
C01	Derive the actual cycle from fuel-air cycle and air- standard cycle for all practical applications.
C02	Explain working principle and various components of IC engine
C03	Explain combustion phenomenon of CI and SI engines and their impact on engine variables.
C04	Analyse the performance of an IC engine based on the performance parameters.
C05	Explain the cycles and systems of a gas turbine and determine the efficiency of gas turbine

C06	Explain the applications and working principle of rockets and jet propulsion.
II-II SEM	**Course: Industrial Engineering And Management**
C01	Design and conduct experiments, analyse, interpret data and synthesize valid conclusions
C02	Design a system, component, or process, and synthesize solutions to achieve desired needs
C03	Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints
C04	Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management
II-II SEM	**Course:Mechanics Of Solids And Mettalurgy Lab**
C01	impart practical exposure on the microstructures of various materials and their hardness evaluation
C02	impart practical knowledge on the evaluation of material properties through various destructive testing procedures.
C03	teach the mechanics of solids lab
II-II SEM	**Course:Machine Drawing Practice**
C01	Draw and represent standard dimensions of different mechanical fasteners and joints and Couplings.
C02	Draw different types of bearings showing different components
C03	Assemble components of a machine part and draw the sectional assembly drawing showing the dimensions of all the components of the assembly as per bill of materials
C04	Select and represent fits and geometrical form of different mating parts in assembly drawings.
C05	prepare manufacturing drawings indicating fits, tolerances, surface finish and surface treatment requirements
II-II SEM	**Course:Theory Of Machines Lab**
C01	Determine whirling speed of shaft theoretically and experimentally.
C02	Determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
C03	analyse the motion of a motorized gyroscope when the couple is applied along its spin axis

II-II SEM	**Course:Python Programming Lab**
C01	Solve the different methods for linear, non-linear and differential equations
C02	Explain the PYTHON Programming language
C03	Explain the strings and matrices in PYTHON
III-I SEM	**Course:Thermal Engineering – II**
C01	Explain the basic concepts of thermal engineering and boilers
C02	Discuss the concepts of steam nozzles and steam turbines.
C03	Impart knowledge about the concepts of reaction turbine and steam condensers.
C04	Discuss the concepts of reciprocating and rotary type of compressors.
C05	impart knowledge about the centrifugal and axial flow compressors.
III-I SEM	**Course:Design Of Machine Members – II**
C01	Compare materials and their properties along with manufacturing considerations.
C02	impart knowledge about the strength of machine elements.
C03	Apply the knowledge in designing the riveted and welded joints, keys,cotters and knuckle joints
C04	Apply the knowledge in designing the shafts and shaft couplings.
C05	Apply the knowledge in designing the mechanical springs.
III-I SEM	**Course:Machining, Machine Tools & Metrology**
C01	Discuss the concepts of machining processes
C02	Apply the principles of lathe, shaping, slotting and planning machines.
C03	Apply the principles of drilling, milling and boring processes.
C04	Analyze the concepts of finishing processes and the system of limits and fits.
C05	Explain the concepts of surface roughness and optical measuring instruments
III-I SEM	**Course:Sustainable Energy Technologies (OE-1)**
C01	Explain the importance of solar energy collection and storage.
C02	Apply the principles of wind energy and biomass energy.
C03	Analyze knowledge on geothermal and ocean energy

C04	Justify the knowledge about energy efficient systems.
C05	Discuss the concepts of green manufacturing systems.
III-I SEM	**Course:Operations Research (OE-1)**
C01	Apply the basics of operations research and linear programming problems.
C02	Apply the knowledge in solving problems of transportation, assignment and sequencing
C03	Judge the replacement and game theories and apply the knowledge to solve problems
C04	Discuss the waiting line models and project management techniques.
C05	Apply the knowledge in solving problems of dynamic programming and simulation.
III-I SEM	**Course:Nano Technology (OE-1)**
C01	Explain about nano-structured materials and their applications.
C02	Apply knowledge about the nano crystalline materials, their properties and defects
C03	Justify various techniques of nanofabrication.
C04	Apply the tools to characterize nano materials.
C05	Analyze the applications of nano materials.
III-I SEM	**Course:Thermal Management Of Electronic Systems (OE-1)**
C01	Apply the basics of heat transfer and analyze heat transfer through fins
C02	Analyze the basics of convection and radiation modes of heat transfer.
C03	Analyze knowledge about the thermal analysis of printed circuit boards and their cooling.
C04	Explain the principles of two-phase cooling and heat pipes.
C05	Justify knowledge about the thermoelectric coolers
III-I SEM	**Course:Finite Element Methods (PE-1)**
C01	Apply basic principles of finite element methods
C02	Analyze about discretization principles and apply to analyse the trusses.
C03	Apply the finite element method to analyze and solve beam problems.
C04	Explain about two dimensional stress analysis.

C05	Apply steady state and dynamic analysis.
III-I SEM	**Course:Industrial Robotics (PE-1)**
C01	Perceive the concepts of robotics and its sytems.
C02	Apply knowledge about the motion analysis and manipulator kinematics.
C03	Analyze the differential transformations.
C04	Apply the basics about path description and generation.
C05	Discuss about the actuators, feedback components and robotic applications.
III-I SEM	**Course:: Advanced Materials (PE-1)**
C01	Discuss metals and alloys and their utility in different environments.
C02	Judge about polymers and ceramics and their applications.
C03	Analyze composite materials along with reinforcements and their applications
C04	Utilize shape memory alloys and functionally graded materials for different applications.
C05	Discuss about the nanomaterials and their applications
III-I SEM	**Course:Renewable Energy Sources (PE-1)**
C01	Explain the importance of, solar energy collection and storage.
C02	Discuss the wind energy principles
C03	Analyze about biomass energy concepts.
C04	Apply the principles of tidal energy
C05	Utilize the concepts of geothermal energy.
III-I SEM	**Course:Mechanics Of Composites (PE-1)**
C01	Discuss the composite materials and their classification.
C02	Apply the micro mechanical analysis of a lamina.
C03	Explain about two dimensional angle lamina
C04	Apply the macro mechanical analysis of a lamina.
C05	Utilize knowledge in designing the laminates.

III-I SEM	Course:Machine Tools Laboratory
C01	Demonstrate general purpose machine tools in the machine shop.
C02	Perform various operations on lathe machine
C03	Perform different operations on drilling machine.
III-I SEM	**Course:Thermal Engineering Lab**
C01	Experiment with two stroke and four stroke compression and spark ignition engines for various characteristics
C02	Perceive flash point, fire point, calorific value of different fuels using various apparatus
C03	Perform engine friction, heat balance test, volumetric efficiency, load test of petrol and diesel engines
III-I SEM	**Course:Advanced Communication Skills Lab**
C01	Use vocabulary and use it contextually
C02	Listen and speak effectively
C03	Develop proficiency in academic reading and writing
III-I SEM	**Course:Professional Ethics And Human Values**
C01	Explain the concepts of human values
C02	impart knowledge about the principles of engineering ethics.
C03	Interpret engineering as social experimentation
C04	Realize engineers' responsibility for safety and risk.
C05	Discuss the engineers' rights and responsibilities.
III-II SEM	**Course:Heat Transfer**
C01	Apply knowledge about mechanism and modes of heat transfer
C02	Invstigate the concepts of conduction and convective heat transfer.
C03	Access forced and free convection.
C04	Analyze the concepts of heat transfer with phase change and condensation along with heat exchangers.
C05	Impart the knowledge about radiation mode of heat transfer

III-II SEM	**Course:Design Of Machine Members-Ii**
C01	Apply knowledge about the design of bearings
C02	Explain the concepts in designing various engine parts.
C03	Design curved beams and power screws.
C04	Discuss power transmission systems and to design pulleys and gear drives
C05	Apply the concepts in designing various machine tool elements.
III-II SEM	**Course:Introduction To Artificial Intelligence & Machine Learning**
C01	Discuss basic concepts of artificial intelligence, neural networks and genetic algorithms
C02	Apply the principles of knowledge representation and reasoning.
C03	Explain about bayesian and computational learning and machine learning.
C04	Utilize various machine learning techniques.
C05	Apply the machine learning analytics and deep learning techniques
III-II SEM	**Course: Automobile Engineering (PE-2)**
C01	Discuss various components of four wheeler automobile
C02	Apply the knowledge of different parts of transmission system.
C03	Compare different steering and suspension systems.
C04	Compare different braking system and electrical system used in automobiles.
C05	Analyse the concepts about engine specifications and service, safety and electronic system used in automobiles
III-II SEM	**Course:Smart Manufacturing (PE-2)**
C01	Apply the basic concepts of smart manufacturing
C02	Analyze about smart machines and sensors.
C03	Utilize the principles of IoT connectivity to industry 4.0.
C04	Perceive about digital twin and its applications and machine learning and artificial intelligence in manufacturing
C05	Discuss the basic concepts of metaverse

III-II SEM	Course:Advanced Mechanics Of Solids (PE-2)
C01	Explain the principles of failure criteria.
C02	Determine the stresses and deflection in unsymmetrical bending of beams
C03	Apply the knowledge about curved beam theory.
C04	Interpret the concept of torsion.
C05	Analyze the contact stresses
III-II SEM	**Course:: Statistical Quality Control (PE-2)**
C01	Discuss the concepts of quality systems and quality engineering in design and processes
C02	Utilize knowledge about the statistical process control charts and sampling techniques.
C03	Analyze the loss function and quality function deployment.
C04	Explain the models of reliability engineering
C05	Apply knowledge about the concepts of complex system and reliability engineering techniques.
III-II SEM	**Course:Industrial Hydraulics And Pneumatics (PE-2)**
C01	Discuss the principles and laws of fluid power
C02	Discuss the hydraulic and pneumatic elements and their accessories
C03	design the hydraulic and pneumatic circuits.
C04	Apply the principles of hydraulic and pneumatic devices.
C05	Examine knowledge of installation, maintenance and trouble shooting of hydraulic and pneumatic systems
III-II SEM	**Course:Industrial Robotics (OE-2)**
C01	Explain the basic concepts and components of industrial robotics and automation
C02	Impart the knowledge about robot actuators and feedback components
C03	Analyze the motion of robot and manipulator kinematics.
C04	Analyze the general considerations of path description and generation.
C05	Utilize knowledge about the image processing, machine vision and robotic applications.
III-II SEM	**Course:Essentials Of Mechanical Engineering (OE-2)**

C01	Discuss the concepts about stresses and strains.
C02	Identify the components of transmission systems
C03	solve Problems related to project management techniques.
C04	Utilize knowledge about manufacturing processes and materials
C05	Explain the concepts of boilers, steam power plant, petrol and diesel engines.
III-II SEM	**Course:Advanced Materials (OE-2)**
C01	Explain the metals and alloys and their utility in different environments.
C02	Discuss polymers and ceramics and their applications.
C03	Compare composite materials along with reinforcements and their applications
C04	Use the basics of shape memory alloys and functionally graded materials.
C05	Analyse the knowledge about the nanomaterials and their applications
III-II SEM	**Course:Introduction To Automobile Engineering (OE-2)**
C01	Explain various components of a four wheeler automobile.
C02	Discuss the different parts of transmission system.
C03	apply the concepts of steering and suspension systems.
C04	Categorise the braking system and electrical system used in automobiles.
C05	Analyze the concepts about engine specifications and service, safety of automobiles.
III-II SEM	**Course:Heat Transfer Lab**
C01	Determine the heat transfer rate and coefficient.
C02	Determine the thermal conductivity, efficiency and effectiveness
C03	Determine the emissivity and Stefan-Boltzman constant
III-II SEM	**Course:CAE & CAM LAB**
C01	Experiment with trusses and beams to determine stress, deflection, natural frequencies, harmonic analysis, HT analysis and buckling analysis
C02	Create part programmes using FANUC controller
C03	Apply G-codes for automated tool path using CAM software

III-II SEM	**Course:Measurements & Metrology lab**
C01	Demonstrate the calibration experiments with different gauges, transducers, thermocouple and temperature detector
C02	Demonstrate the calibration experiments with rotameter, seismic apparatus.
C03	Demonstrate the calibration experiments with vernier calipers, micrometer, height and dial gauges.
III-II SEM	**Course:Artificial Intelligence and Machine Learning Lab**
C01	apply the knowledge of artificial intelligence
C02	Explain machine learning models along with image classifiers using various software tools
C03	Explain machine learning models along with automatic facial recognition using various software tools
III-II SEM	**Course:Research Methodology and IPR**
C01	Discuss objectives and characteristics of a research problem
C02	Analyze research related information and to follow research ethics.
C03	compare types of intellectual property rights.
C04	find the scope of IPR.
C05	Impart the knowledge of new developments in IPR.
IV-I SEM	**Course:Mechanical Vibrations (PE-3)**
C01	Explain the concepts of vibrational analysis
C02	Compare the concepts of free and forced multi degree freedom systems
C03	Summarize the concepts of torsional vibrations
C04	Solve the problems on critical speed of shafts
C05	Apply and Analyse the systems subjected to Laplace transformations response to different inputs
IV-I SEM	**Course:Operations Research (PE-3)**
C01	Draw Linear Programming models
C02	Interpret Transportation and sequencing problems
C03	Solve replacement problems and analyze queuing models.

C04	Analyse game theory and inventory problems
C05	Interpret dynamic programming and simulation
IV-I SEM	**Course:Unconventional Machining Processes (PE-3)**
C01	Discuss the concepts of modern machining processes
C02	explain the principles of ultrasonic machining.
C03	Apply the principles and procedure of electro chemical and chemical machining processes.
C04	Apply the principles and procedure of thermal metal removal processes
C05	Illustrate the principles and procedure of electron beam machining, laser beam machining and plasma machining
IV-I SEM	**Course:Computational Fluid Dynamics (PE-3)**
C01	Explain elementary details and numerical techniques for solving various engineering problems involving fluid flow
C02	Apply finite difference applications in heat conduction and convection
C03	Apply finite difference for flow modeling.
C04	Outline concepts of finite volume method
C05	Apply concepts of finite element method applied to heat transfer problems
IV-I SEM	**Course:Gas Dynamics And Jet Propulsion (PE-3)**
C01	Explain elementary details and numerical techniques for solving various engineering problems involving fluid flow.
C02	Examine finite difference applications in heat conduction and convection
C03	Apply finite difference for flow modeling
C04	Explain the concepts of finite volume method.
C05	Apply concepts of finite element method applied to heat transfer problem
IV-I SEM	**Course:Automation In Manufacturing (PE-4)**
C01	compare types and strategies and various components in Automated Systems
C02	Classify the types of automated flow lines and analyze automated flow lines
C03	Solve the line balancing problems in the various flow line systems with and without buffer storage
C04	Interpret different automated material handling systems, storage and retrieval

	systems and automated inspection systems.
C05	compare types of automated inspection techniques and their applications
IV-I SEM	**Course:Power Plant Engineering (PE-4)**
C01	Identify the different components of the steam power plant for power production.
C02	Illustrate the component used in the diesel and gas power plant for power production
C03	Explain how the power is produced by hydro-electric and nuclear power plants
C04	Interpret the power production by combined power plants and operating principles of different instruments used in power plants
C05	Analyze power plant economics and implementation of pollution standards and control of pollution caused by the power plants.
IV-I SEM	**Course:Big Data Analytics (PE-4)**
C01	describe characteristics of big data and concepts of Hadoop ecosystem
C02	Design programs for big data applications using Hadoop components
C03	Apply Map reduce programming model to process big data
C04	Analyze Spark and its uses for big data processing
C05	Apply the concepts of NOSQL databases
IV-I SEM	**Course:Production Planning And Control (PE-4)**
C01	compare different types of production systems and the internal organization of production planning and control
C02	estimate forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques
C03	Describe the importance and function of inventory and to be able to apply for its control and management
C04	apply routing procedures and differentiate schedule and loading and interpret scheduling policies and aggregate planning
C05	Apply computers in production planning and control
IV-I SEM	**Course:Condition Monitoring (PE-4)**
C01	List out basics of vibration
C02	Analyze vibration measurement and analysis using transducers and mounting methods
C03	Find fault diagnosis and interpret vibration measurements

C04	analyse oil and wear debris
C05	Interpret Ultrasonic monitoring and analysis
IV-I SEM	**Course:Advanced Manufacturing Processes (PE-5)**
C01	Describe the working principles of various surface coating methods.
C02	Discuss novel and promising techniques in the processing of ceramics and composites
C03	Select suitable fabrication methods for MEMS components.
C04	Explain the concepts and principles of nano manufacturing methods.
C05	Illustrate the working principles of RP and select appropriate RP process for the application.
IV-I SEM	**Course:Mechatronics (PE-5)**
C01	Discuss the use the various mechatronics systems, measurement systems, sensors and transducers
C02	Apply the concepts of solid state electronic devices
C03	Identify the components in the design of electro mechanical systems.
C04	Apply the concepts of digital electronics and applications of PLCs for control
C05	Explain system interfacing, data acquisition and design of mechatronics systems
IV-I SEM	**Course: Refrigeration & Air-Conditioning (PE)**
C01	Illustrate the operating cycles and different systems of refrigeration
C02	Analyse cooling capacity and coefficient of performance of vapour compression refrigeration systems and understand the fundamentals of cryogenics
C03	Calculate coefficient of performance by conducting test on vapour absorption and steam jet refrigeration systems and understand the properties of refrigerants.
C04	Solve cooling load for air conditioning systems and identify the requirements of comfort air conditioning.
C05	Demonstrate different components of refrigeration and air conditioning systems
IV-I SEM	**Course:Additive Manufacturing (PE-5)**
C01	Discuss the principles of prototyping, classification of RP processes and liquid-based RP systems
C02	apply different types of solid-based RP systems
C03	Apply powder-based RP systems

C04	Analyse and apply various rapid tooling techniques
C05	Compare different types of data formats and explore the applications of AM processes in various fields
IV-I SEM	**Course:Non Destructive Evaluation (PE-5)**
C01	Describe the concepts of various NDE techniques and the requirements of radiographytechniques and safety aspects
C02	Interpret the principles and procedure of ultrasonic testing (BL-2).
C03	Explain the principles and procedure of Liquid penetration and eddy current testing
C04	Illustrate the principles and procedure of Magnetic particle testing.
C05	Interpret the principles and procedure of infrared testing and thermal testing
IV-I SEM	**Course:Additive Manufacturing (OE-3)**
C01	Describe the principles of prototyping, classification of RP processes and liquid-based RP systems.
C02	Explain different types of solid-based RP systems
C03	discuss powder-based RP systems
C04	Discuss various rapid tooling techniques
C05	Compare different types of data formats and explore the applications of AM processes in various fields
IV-I SEM	**Course:Mechatronics (OE-3)**
C01	describe the various mechatronics systems, measurement systems, sensors and transducers
C02	Apply the concepts of solid state electronic devices
C03	Identify the components in the design of electro mechanical systems
C04	Explain the concepts of digital electronics and applications of PLCs for control.
C05	Discuss system interfacing, data acquisition and design of mechatronics systems
IV-I SEM	**Course:Finite Element Methods (OE-3)**
C01	Discuss basic principles of variational methods
C02	Explain the principles of Weighted residual methods
C03	Describe the basic procedure of finite element method
C04	Analyse finite element modeling of two dimensional analysis

C05	Describe finite modeling using high order and isoparametric elements
IV-I SEM	**Course: Introduction To Artificial Intelligence & Machine Learning (OE-3)**
C01	Discuss basic concepts of artificial intelligence, neural networks and genetic algorithms.
C02	Apply the principles of knowledge representation and reasoning
C03	Outline Bayesian and computational learning and machine learning
C04	Use various machine learning techniques.
C05	Apply the machine learning analytics and deep learning techniques
IV-I SEM	**Course: Optimization Techniques (OE-4)**
C01	Explain classification of optimization problem and apply classical optimization techniques
C02	examine unconstrained optimization techniques using various methods
C03	Describe the characteristics and approaches of constrained optimization techniques
C04	Identify optimized solutions using constrained and unconstrained geometric programming
C05	Discuss different integer programming methods
IV-I SEM	**Course: Smart Manufacturing (OE-4**
C01	discuss smart manufacturing systems' components and can handle it more effectively in context of Industry 4.0
C02	Describe the smart machines and smart sensors
C03	Apply IoT to Industry 4.0 and they are able to make a system tailor-made as per requirement of the industry
C04	Explain concepts of Digital Twin and able to apply Machine Learning and Artificial Intelligence concepts in Manufacturing
C05	Compare concepts of AR/VR and Metaverse platform
IV-I SEM	**Course:S afety Engineering (OE-4)**
C01	Describe the concepts of industrial safety and management
C02	Discuss the smart machines and smart sensors
C03	Apply IoT to Industry 4.0 and they are able to make a system tailor-made as per requirement of the industry
C04	Compare fire prevention and protection systems

C05	apply the fire safety principles in buildings
IV-I SEM	**Course: Operations Management (OE-4)**
C01	Apply appropriate forecasting techniques & Aggregate planning methods
C02	Compare Materials management analysis and scheduling policies
C03	Explain inventory control techniques, MRP and contemporary management techniques
C04	Apply quality management principles proposed by Taguachi, Juran & Demigs
C05	Apply optimization to LP model & transportation and assignment problems
IV-I SEM	**Course: Mechatronics Lab**
C01	Explain Characteristics of LVDT
C02	Find load, displacement and temperature using analogue and digital sensors
C03	Develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.
IV Sem -II	**Project**
CO-1	Formulate., and apply mathematical, science and engineering principles to solve real time engineering problems
CO-2	Test the existing data, communicate and conduct research on complex problems using modern tools
CO-3	Validate the obtained results on contemprory issues related to society and environment
CO-4	Determine effectively the engineering principles used intheir project individually and as a team as per the norms of engineering practice
CO-5	Structure future work to promote life long learning in the context of technological adaptation.

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

Department of Electrical and Electronics Engineering

Program: B.Tech- Electrical and Electronics Engineering

Regulation: R20 **Course Outcomes** **No. of Courses: 77**

I-I Sem	Course: Communicative English
CO-1	understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
CO-2	ask and answer general questions on familiar topics and introduce oneself/others
CO-3	employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
CO-4	recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
CO-5	form sentences using proper grammatical structures and correct word forms
I-I Sem	**Course: Mathematics-I**
CO-1	utilize mean value theorems to real life problems
CO-2	solve the differential equations related to various engineering fields
CO-3	familiarize with functions of several variables which is useful in optimization
CO-4	apply double integration techniques in evaluating areas bounded by region
CO-5	Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems
I-I Sem	**Course: Mathematics-II**
CO-1	develop the use of matrix algebra techniques that is needed by engineers for practical applications
CO-2	solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel
CO-3	evaluate the approximate roots of polynomial and transcendental equations by different algorithms
CO-4	apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals
CO-5	apply numerical integral techniques to different Engineering problems
I-I Sem	**Course: Programming For Problem Solving Using C**
CO-1	To write algorithms and to draw flowcharts for solving problems
CO-2	To convert flowcharts/algorithms to C Programs, compile and debug programs
CO-3	To use different operators, data types and write programs that use two-way/ multi-way selection

CO-4	To select the best loop construct for a given problem
CO-5	To design and implement programs to analyze the different pointer applications
I-I Sem	**Course: Electrical Engineering Workshop**
CO-1	Explain the limitations, tolerances, safety aspects of electrical systems and wiring.
CO-2	Select wires/cables and other accessories used in different types of wiring.
CO-3	Make simple lighting and power circuits.
I-I Sem	**Course: Programming For Problem Solving Using C Lab**
CO-1	Gains Knowledge on various concepts of a C language.
CO-2	Draw flowcharts and write algorithms.
CO-3	Design and development of C problem solving skills
I-II Sem	**Course: Mathematics-III**
CO-1	interpret the physical meaning of different operators such as gradient, curl and divergence
CO-2	estimate the work done against a field, circulation and flux using vector calculus
CO-3	apply the Laplace transform for solving differential equations
CO-4	find or compute the Fourier series of periodic signals
CO-5	know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms
I-II Sem	**Course: Applied Physics**
CO-1	Explain the need of coherent sources and the conditions for sustained interference
CO-2	Understand the basic concepts of LASER light Sources
CO-3	Explain the concept of dual nature of matter
CO-4	Explain the concept of dielectric constant and polarization in dielectric materials
CO-5	Classify the energy bands of semiconductors
I-II Sem	**Course: Data Structures Through C**
CO-1	Data structures concepts with arrays, stacks, queues.

CO-2	Linked lists for stacks, queues and for other applications.
CO-3	Traversal methods in the Trees.
CO-4	Various algorithms available for the graphs.
CO-5	Sorting and searching in the data ret retrieval applications.
I-II Sem	**Course: Electrical Ciruit Analysis – I**
CO-1	AnalyzeVarious electrical networks in presence of active and passive elements
CO-2	Calculate Electrical networks with network topology concepts.
CO-3	Calculate Any magnetic circuit with various dot conventions
CO-4	Calculate Any R, L, C network with sinusoidal excitation
CO-5	Calculate Any R, L, network with variation of any one of the parameters R, L, C. and f.
I-II Sem	**Course: Basic Civil And Mechanical Engineering**
CO-1	Apply Shear force diagram & Bending moment diagram principles for
CO-2	Cantilever and Simply supported beams.
CO-3	Apply concepts of Rosette analysis for strain measurements.
CO-4	Analyse the characteristics of common building materials.
CO-5	Compare the working characteristics of Internal Combustion engines.
I-II Sem	**Course: Basic Civil And Mechanical Engineering Lab**
CO-1	Solve to arrive at finding constant speed and variable speed on IC engines and interpret their performance.
CO-2	Estimate energy distribution by conducting heat balance test on IC
CO-3	Explain procedure for standardization of experiments
I-II Sem	**Course: Data Structures Through C Lab**
CO-1	Be able to design and analyze the time and space efficiency of the data structure.
CO-2	Be capable to identity the appropriate data structure for given problem.
CO-3	Have practical knowledge on the applications of data structures.

I-II Sem	Course: Constitution Of India
CO-1	Understand historical background of the constitution making and its importance for building a democratic India.
CO-2	Understand the functioning of three wings of the government i.e., executive, Legislative and judiciary.
CO-3	Understand the value of the fundamental rights and duties for becoming good citizen of India.
CO-4	Analyze the decentralization of power between central, state and local self government.
CO-5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
II-I Sem	**Course: Mathematics-IV**
CO-1	apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic
CO-2	find the differentiation and integration of complex functions used in engineering problems
CO-3	make use of the Cauchy residue theorem to evaluate certain integrals
CO-4	apply discrete and continuous probability distributions
CO-5	design the components of a classical hypothesis test
II-I Sem	**Course: Electronic Devices And Circuits**
CO-1	Understand the basic concepts of semiconductor physics.
CO-2	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.
CO-3	Know the construction, working principle of rectifiers with and without filters with Relevant expressions and necessary comparisons.
CO-4	Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
CO-5	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.
II-I Sem	**Course: Electrical Circuit Analysis - II**
CO-1	Understand the concepts of balanced and unbalanced three-phase circuits
CO-2	Know the transient behavior of electrical networks with DC excitations
CO-3	Learn the transient behavior of electrical networks with AC excitations
CO-4	Estimate various parameters of a two port network
CO-5	Understand the significance of filters in electrical networks

II-I Sem	**Course: DC Machines and Transformers**
	Assimilate the concepts of electromechanical energy conversion
CO-1	Mitigate the ill-effects of armature reaction and improve commutation in dc machines.
CO-2	Understand the torque production mechanism and control the speed of dc motors.
CO-3	Analyze the performance of single phase transformers.
CO-4	Predetermine regulation, losses and efficiency of single phase transformers
CO-5	Parallel transformers, control voltages with tap changing methods and achieve three-phase to two-phase transformation
II-I Sem	**Course: Electromagnetic Fields**
CO-1	Determine electric fields and potentialsusing guass's lawor solving Laplace's or Possion's equations, for various electric charge distributions.
CO-2	Calculate and design capacitance, energy stored in dielectrics.
CO-3	Calculate the magnetic field intensity due to current, the application of ampere's law and the Maxwell's second and third equations.
CO-4	Determine the magnetic forces and torque produced by currents in magnetic field
CO-5	Determine self and mutual inductances and the energy stored in the magnetic field.
II-I Sem	**Course: Electrical Circuits Lab**
CO-1	Apply various thermos, determination of self and mutual inductances, two port parameters of a given electric circuits.
CO-2	Draw locus diagrams. Waveforms and phasor diagram for lagging and leading networks.
CO-3	Two port parameters of a given electric circuits
II-I Sem	**Course: DC Machines and Transformers Lab**
CO-1	Determine and predetermine the performance of DC machines and Transformers.
CO-2	Control the speed of DC motor.□
CO-3	Obtain three phases to two phase transformation.□
II-I Sem	**Course: Electronic Devices And Circuits Lab**
CO-1	Analyze the characteristics of diodes, transistors and other devices□

CO-2	Design and implement the rectifier circuits, SCR and UJT in the hardware circuits
CO-3	Design the biasing and amplifiers of BJT and FET amplifiers□
II-I Sem	**Course: Skill Oriented Course - Design Of Electrical Circuits Using Engineering Software Tools**
CO-1	write the MATLAB programs to simulate the electrical circuit problems
CO-2	simulate various circuits for electrical parameters
CO-3	simulate various wave form for determination of wave form parameters
CO-4	□simulate RLC series and parallel resonance circuits for resonant parameters
CO-5	simulate magnetic circuits for determination of self and mutual inductances
II-I Sem	**Course: Professional Ethics & Human Values**
CO-1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
CO-2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO-3	Articulate what makes a particular course of action ethically defensible
CO-4	Assess their own ethical values and the social context of problems
CO-5	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of
II-II Sem	**Course: Induction and Synchronous Machines**
CO-1	Explain the operation and performance of three phase induction motor.
CO-2	Analyze the torque-speed relation, performance of induction motor and induction generator.
CO-3	Explain design procedure for transformers and three phase induction motors
CO-4	Implement the starting of single phase induction motors.
CO-5	Perform winding design and predetermine the regulation of synchronous Generators.
II-II Sem	**Course: Python Programming**
CO-1	Develop essential programming skills in computer programming concepts like data types, containers
CO-2	Apply the basics of programming in the Python language Solve coding tasks related
CO-3	Conditional execution, loops

CO-4	Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming
CO-5	Understand the concepts of inheritance and polymorphismfor code reusability and extensibility.
II-II Sem	**Course: Digital electronics**
CO-1	Classify different number systems and apply to generate various codes.
CO-2	Use the concept of Boolean algebra in minimization of switching functions
CO-3	Design different types of combinational logic circuits
CO-4	Apply knowledge of flip-flops in designing of Registers and counters
CO-5	The operation and design methodology for synchronous sequential circuits and Algorithmic state machines.
II-II Sem	**Course: Power Systems-I**
CO-1	Identify the different components of thermal power plants.
CO-2	Identify the different components of nuclear Power plants.
CO-3	Distinguish between AC/DC distribution systems and also estimate voltage drops of distribution systems.
CO-4	Identify the different components of air and gas insulated Substations.
CO-5	Identify single core and multi core cables with different insulating materials
II-II Sem	**Course: Managerial Economics and Financial Analysis**
CO-1	Equipped with the knowledge of estimating the Demand and demand Elasticities for a product.
CO-2	Knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
CO-3	Understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units
CO-4	Prepare Financial Statements and the usage of various Accounting tools for Analysis.
CO-5	Evaluate various investment project proposals with the help of capital budgeting techniques for decision making.
II-II Sem	**Course: Induction and Synchronous Machines Lab**
CO-1	Assess the performance of single phase and three phase induction motors
CO-2	Control the speed of three phase induction motor

CO-3	Predetermine the regulation of three–phase alternator by various methods
II-II Sem	**Course: Python Programming Lab**
CO-1	Write, Test and Debug Python Programs
CO-2	Use Conditionals and Loops for Python Programs
CO-3	Use functions and represent Compound data using Lists, Tuples and
II-II Sem	**Course: Digital electronics Lab**
CO-1	Learn the basics of gates, filp-flops and counters
CO-2	Construct basic combinational circuits and verify their functionalities
CO-3	Apply the design procedures to design basic sequential circuits
III-I Sem	**Course: Power Systems–II**
CO-1	Understand parameters of various types of transmission lines during different operating conditions.
CO-2	Understand the performance of short and medium transmission lines.
CO-3	Understand travelling waves on transmission lines.
CO-4	Understand various factors related to charged transmission lines.
CO-5	Understand sag/tension of transmission lines and performance of line insulators.
III-I Sem	**Course: Control Systems**
CO-1	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
CO-2	Determine time response specifications of second order systems and absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.
CO-3	Analyze the stability of LTI systems using frequency response methods
CO-4	Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode diagrams
CO-5	Represent physical systems as state models and determine the response. Understand the concepts of controllability and observability.
III-I Sem	**Course: Renewable Energy Sources**
CO-1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage.

CO-2	Illustrate the components of wind energy systems
CO-3	Illustrate the working of biomass, digesters and Geothermal plants.
CO-4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves
CO-5	Evaluate the concept and working of Fuel cells & MHD power generation
III-I Sem	**Course: Concepts of Optimization Techniques**
CO-1	State and formulate the optimization problem without and with constraints, also apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints and arrive at an optimal solution
CO-2	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
CO-3	Formulate a mathematical model and apply non-linear programming techniques for unconstrained and constrained case studies.
CO-4	Solve transportation and assignment problem by using Linear programming Simplex method
CO-5	Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.
III-I Sem	**Course: Power Electronics**
CO-1	Explain the characteristics of various power semiconductor devices and analyze the static and dynamic characteristics of SCR's.
CO-2	Design firing circuits for SCR.
CO-3	Explain the operation of single phase full–wave converters and analyze harmonics in the input current.
CO-4	Explain the operation of three phase full–wave converters.
CO-5	Analyze the operation of different types of DC-DC converters
III-I Sem	**Course: Concepts of Control Systems**
CO-1	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
CO-2	Determine time response specifications of second order systems and to determine error constants.
CO-3	Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.
CO-4	Analyze the stability of LTI systems using frequency response methods.
CO-5	Represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability

III-I Sem	**Course: Linear IC Applications**
CO-1	Describe the Op-Amp and internal Circuitry: 555 Timer, PLL
CO-2	Discuss the Applications of Operational amplifier: 555 Timer, PLL
CO-3	Design the Active filters using Operational Amplifier
CO-4	Use the Op-Amp in A to D & D to A Converters
CO-5	Comprehend & differentiate the working principle of various data converters.
III-I Sem	**Course: Utilization of Electrical energy**
CO-1	Identify various illumination methods produced by different illuminating sources
CO-2	Identify a suitable motor for electric drives and industrial applications
CO-3	Identify most appropriate heating and welding techniques for suitable applications.
CO-4	Distinguish various traction system and determine the tractive effort and specific energy consumption.
CO-5	Validate the necessity and usage of different energy storage schemes for different applications and comparisons.
III-I Sem	**Course: Computer Architecture and Organisation**
CO-1	Explain the instruction cycle of a computer
CO-2	Understand various micro operations and register transfer language.
CO-3	Describe parallel processing and pipelining
CO-4	Interface different peripherals with processors
CO-5	Know the advantages of cache and virtual memory.
III-I Sem	**Course: Optimization Techniques**
CO-1	State and formulate the optimization problem without and with constraints, also apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints and arrive at an optimal solution.
CO-2	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
CO-3	Formulate a mathematical model and apply non-linear programming techniques for unconstrained and constrained case studies.
CO-4	Solve transportation and assignment problem by using Linear programming Simplex method

CO-5	Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.
III-I Sem	**Course: Object oriented Programming Through JAVA**
CO-1	Discuss and understand java programming constructs, Control structures
CO-2	Illustrate and experiment Object Oriented Concepts like classes, objects
CO-3	Apply Object Oriented Constructs such as Inheritance, interfaces, and exception handling
CO-4	Construct applications using multithreading and I/O
CO-5	Develop Dynamic User Interfaces using applets and Event Handling in java
III-I Sem	**Course: Power Electronics Lab**
CO-1	Analyse characteristics of various power electronic devices and design firing circuits for SCR.
CO-2	Analyse the performance of single–phase dual, three–phase full–wave bridge converters and dual converter with both resistive and inductive loads.
CO-3	Examine the operation of Single-phase AC voltage regulator and Cycloconverter with resistive and inductive loads.
III-I Sem	**Course: Control Systems Lab**
CO-1	Analyze the performance and working Magnetic amplifier, D.C and A.C. servo motors and synchronous motors.
CO-2	Design P,PI,PD and PID controllers
CO-3	Design lag, lead and lag–lead compensators
III-II Sem	**Course:Microprocessors and Microcontrollers**
CO-1	Understand the microprocessor capability in general and explore the evaluation of microprocessors.
CO-2	Understand the addressing modes of microprocessors
CO-3	Understand the micro controller capability
CO-4	Program mp and mc
CO-5	Interface mp and mc with other electronic devices
III-II Sem	**Course:Electrical Measurements and Instrumentation**

CO-1	Know the construction and working of various types of analog instruments.
CO-2	Describe the construction and working of wattmeter and power factor meters
CO-3	Know the construction and working various bridges for the measurement resistance inductance and capacitance
CO-4	Know the operational concepts of various transducers
CO-5	Know the construction and operation digital meters
III-II Sem	**Course:Power System Analysis**
CO-1	Draw impedance diagram for a power system network and calculate per unit quantities
CO-2	Apply the load flow solution to a power system using different methods.
CO-3	Form Z bus for a power system networks and analyse the effect of symmetrical faults.
CO-4	Find the sequence components for power system Components and analyse its effects of unsymmetrical faults
CO-5	Analyse the stability concepts of a power system
III-II Sem	**Course: Signals and Systems**
CO-1	Apply the knowledge of various signals and operations
CO-2	Analyze the spectral characteristics of periodic signals using Fourier Analysis.
CO-3	Classify the systems based on their properties and determine the response of LSI system using convolution.
CO-4	Understand the process of sampling and the effects of under sampling
CO-5	Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).
III-II Sem	**Course: Electric Drives**
CO-1	Explain the fundamentals of electric drive and different electric braking methods
CO-2	Analyze the operation of three-phase converter fed dc motors and four quadrant operations of dc motors using dual converters.
CO-3	Describe the DC-DC converter fed control of dc motors in various quadrants of operation
CO-4	Know the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters and differentiate the stator side control and rotor side control
CO-5	Learn the concepts of speed control of synchronous motor with different methods

III-II Sem	**Course: Advanced Control Systems**
CO-1	Analyse different canonical forms - solution of State equation
CO-2	Design of control system using the pole placement technique is given after introducing the concept of controllability and observability
CO-3	Analyze nonlinear system using describing function technique and phase plane analysis.
CO-4	Examine the stability analysis using Lyapunov method.
CO-5	Illustrate the Minimization of functional using calculus of variation - state and quadratic regulator problems
III-II Sem	**Course: Switch Gear and Protection**
CO-1	Illustrate the principles of arc interruption for application to high voltage circuit breakers of air - oil - vacuum - SF6 gas type.
CO-2	Analyse the working principle and operation of different types of electromagnetic protective relays.
CO-3	Acquire knowledge of protective schemes for generator and transformers for different fault conditions.
CO-4	Classify various types of protective schemes used for feeders and bus bar protection and Types of static relays.
CO-5	Analyse the operation of different types of over voltages protective schemes required for insulation co–ordination and types of neutral grounding
III-II Sem	**Course: Big data Analytics**
CO-1	Understand how to leverage the insights from big data analytics
CO-2	Analyze data by utilizing various statistical and data mining approaches
CO-3	Perform analytics on real-time streaming data
CO-4	Understand the various NoSql alternative database models
CO-5	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics
III-II Sem	**Course: Battery Management Systems and charging Stations**
CO-1	Describe the construction and operation of different batteries for EV applications
CO-2	Describe charging algorithms of different batteries and balancing methods of battery packs
CO-3	Describe the different kinds of infrastructure needed in the charging stations
CO-4	Describe the requirements of battery management and their maintenance
CO-5	Obtain the modelling of batteries and develop their simulation models

III-II Sem	**Course: Fundamentals of Utilization of Electrical Energy**
CO-1	Know the concepts of illumination and various illumination methods
CO-2	Know about the resistance - induction and dielectric heating.
CO-3	Learn about the resistance and arc welding and welding equipment
CO-4	Know about the mechanisms - equipment and technology used in the electric traction.
CO-5	Differentiate the importance of various energy storage systems
III-II Sem	**Course: Electrical Measurements and Instrumentation Lab**
CO-1	Know about the phantom loading.
CO-2	Learn the calibration process
CO-3	Measure the electrical parameters voltage - current - power - energy and electrical characteristics of resistance - inductance and capacitance.
III-II Sem	**Course: Microprocessors and Microcontrollers Lab**
CO-1	Write assembly language program using 8086 micro based on arithmetic, logical, and shift operations
CO-2	Interface 8086 with I/O and other devices
CO-3	Parallel and serial communication using 8051 & PIC 18 micro controllers
III-II Sem	**Course: Power Systems and Simulation Lab**
CO-1	Estimate the sequence impedances of 3-phase Transformer and Alternators
CO-2	Evaluate the performance of transmission lines
CO-3	Analyse and simulate power flow methods in power systems
IV-I Sem	**Course: Digital signal Processing**
CO-1	Know the concepts of Digital signal processing - frequency domain representation &z transform.
CO-2	Compute discrete Fourier transform and fast Fourier transforms for different sequences.
CO-3	Design IIR filters through analog filter approximation and basic structure of IIR filters
CO-4	Design FIR filters with window techniques and basic structure of FIR filters
CO-5	Learn the concepts of Multirate Signal Processing.

IV-I Sem	**Course: Renewable and Distributed Energy Technologies**
CO-1	Illustrate basic concepts of renewable and distributed sources
CO-2	Demonstrate the components of wind energy conversion systems.
CO-3	Model PV systems and analyse MPPT Techniques
CO-4	Illustrate the concept of Energy Production from Hydro - Tidal and Geothermal
CO-5	Distinguish between standalone and grid connected DG systems and design hybrid renewable energy systems.
IV-I Sem	**Course: Flexible Alternating Current Transmission Systems**
CO-1	Know the concepts of facts controller and power flow control in transmission line
CO-2	Demonstrate operation and control of voltage source converter and know the concepts current source converter.
CO-3	Analyse compensation by using different compensators to improve stability and reduce power oscillations in the transmission lines.
CO-4	Know the concepts methods of compensations using series compensators
CO-5	Analyse operation of Unified Power Flow Controller (UPFC) and Interline power flow controller (IPFC).
IV-I Sem	**Course: Power system Deregulation**
CO-1	Know the essential and operation of deregulated electricity market systems
CO-2	Learn about the different structure model.
CO-3	Analyze various types of electricity market operational and control issues using new mathematical models.
CO-4	Analyse LMP's wheeling transactions and congestion management
CO-5	Analyze impact of ancillary services.
IV-I Sem	**Course: Database Management systems**
CO-1	Illustrate the concept of databases, database management systems, database languages, database structures and their work
CO-2	Apply ER modeling and Relational modeling for designing simple databases
CO-3	Summarize the concepts related to relational model and SQL and Write database queries using relational algebra and structured query language.
CO-4	Design and develop databases from the real world by applying the concepts of Normalization
CO-5	Outline the issues associated with Transaction Management and Recovery, Tree Structured Indexing

IV-I Sem	**Course: Hybrid Electric Vehicles**
CO-1	Know the concept of electric vehicles and hybrid electric vehicles
CO-2	Familiar with different configuration of hybrid electric vehicles
CO-3	Choose an effective motor for EV and HEV application
CO-4	Understand the power converters used in hybrid electric vehicles
CO-5	Know different batteries and other energy storage systems
IV-I Sem	**Course: High voltage Engineering**
CO-1	Recognise the dielectric properties of gaseous materials used in HV equipment
CO-2	Differentiate the break down phenomenon in liquid and solid dielectric materials.
CO-3	Acquaint with the techniques of generation of high AC and DC voltages
CO-4	Acquaint with the techniques of generation of high Impulse voltages and currents
CO-5	Getting the knowledge of measurement of high AC - DC - Impulse voltages and currents
IV-I Sem	**Course: Programmable Logic Controllers and Applications**
CO-1	Illustrate I/O modules of PLC systems and ladder diagrams
CO-2	Demonstrate various types registers and programming instructions.
CO-3	Examine various types of PLC functions and its applications
CO-4	Assess different data handling functions and its applications.
CO-5	Describe the analog operations and PID modules
IV-I Sem	**Course: Cloud computing with AWS**
CO-1	Understand and analyze the architecture of Cloud
CO-2	Identify and apply deployment and management options of AWS Cloud Architecture
CO-3	Design architectures to decouple infrastructure and reduce interdependencies
CO-4	Analyze various cloud programming models and apply them to solve problems on the cloud.
CO-5	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

IV-I Sem	**Course: Deep Learning Techniques**
CO-1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning
CO-2	Discuss the Neural Network training, various random models.
CO-3	Explain the Techniques of Keras, TensorFlow, Theano and CNTK
CO-4	Classify the Concepts of CNN and RNN
CO-5	Implement Interactive Applications of Deep Learning
IV-I Sem	**Course: Power System Operation and Control**
CO-1	Compute optimal load scheduling of Generators
CO-2	Formulate hydrothermal scheduling and unit commitment problem..
CO-3	Analyse effect of Load Frequency Control for single area systems
CO-4	Analyse effect of Load Frequency Control for two area systems
CO-5	Describe the effect of reactive power control for transmission lines
IV-I Sem	**Course: Switched Mode Power Conversion**
CO-1	Design and analyse the operation of non-isolated switch mode converters
CO-2	Analyze the operation of isolated switch mode converters.
CO-3	Illustrate the operation of resonant converters
CO-4	Analyse the control schemes of converters and design transformer and inductor.
CO-5	Model the converters and design controller for closed loop operation
IV-I Sem	**Course: AI Applications of Electrical engineering**
CO-1	Analyse different models of artificial neuron & Use learning methods of ANN.
CO-2	Evaluate different paradigms of ANN.
CO-3	Classify between classical and fuzzy sets
CO-4	Illustrate different modules of Fuzzy logic controller.
CO-5	Apply Neural Networks and fuzzy logic for real-time applications
IV-I Sem	**Course: Data Science**
CO-1	Acquire the knowledge and expertise to become a proficient data scientist

CO-2	Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
CO-3	Explain how data is collected, managed and stored for data science
CO-4	Interpret the key concepts in data science, including their real-world applications and the toolkit used by data scientists
CO-5	Illustrate data collection and management scripts using MongoDB
IV-II Sem	**Course: Fundamentals of Electric Vehicles**
CO-1	Illustrate different types of electric vehicles.
CO-2	Select suitable power converters for EV applications
CO-3	Design HEV configuration for a specific application
CO-4	Choose an effective method for EV and HEV applications
CO-5	Analyse a battery management system for EV and HEV.
IV-II Sem	**Course: Concepts of Internet of Things**
CO-1	Review Internet of Things (IoT).
CO-2	Demonstrate various business models relevant to IoT
CO-3	Construct designs for web connectivity
CO-4	Organize sources of data acquisition related to IoT, integrate to enterprise systems
CO-5	Describe IoT with Cloud technologies.
IV-II Sem	**Course: Cocepts of Power System Engineering**
CO-1	Know the concepts of power generation by various types of power plants.
CO-2	Learn about transmission line concepts and distribution systems schemes.
CO-3	Learn about protection equipments and grounding methods of power system
CO-4	Know the economic aspects of electrical energy and their importance.
CO-5	Know the importance of power factor improvement and voltage control in power systems.
IV-II Sem	**Course:Concepts of Smart Grid Technologies**
CO-1	Know the concepts of smart grids and analyse the smart grid policies and developments in smart grids.
CO-2	Develop concepts of smart grid technologies in hybrid electrical vehicles etc.

CO-3	Know the concepts of smart substations - feeder automation - Battery Energy storage systems etc
CO-4	Analyse micro grids and distributed generation systems
CO-5	Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.
IV Sem -II	**Project**
CO-1	Formulate., and apply mathematical, science and engineering principles to solve real time engineering problems
CO-2	Test the existing data, communicate and conduct research on complex problems using modern tools
CO-3	Validate the obtained results on contemprory issues related to society and environment
CO-4	Determine effectively the engineering principles used intheir project individually and as a team as per the norms of engineering practice
CO-5	Structure future work to promote life long learning in the context of technological adaptation.

Principal
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