

Dr. Ambedkar Institute of Technology
Department of Electrical and Electronics Engineering

The NAAC documents enclosed are verified and approved.

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COURSE OUTCOMES

I YEAR

18ELE13/18ELE23	BASIC ELECTRICAL ENGINEERING
CO1	Define the fundamental laws of electrical engineering.
CO2	Apply fundamental concepts to solve problems on electrical circuits.
CO3	Construct various electrical machines by applying fundamental laws of electromagnetic induction.
CO4	Analyze AC /DC machines by applying fundamental laws of electromagnetic induction. Solve problems of electrical machines.
CO5	Solve problems on machines and transformers.

18EEL17/18EEL27	BASIC ELECTRICAL ENGINEERING LAB
CO1	Determine the basic electrical parameters.
CO2	Demonstrate the use of protective devices.
CO3	Evaluate the performance of transformer.
CO4	Assess the magnetization characteristics of electrical machines
CO5	Interpret various electrical laws.

II YEAR

18EE31	ANALOG ELECTRONIC CIRCUITS
CO1	Recall the basic diode circuits and describe various wave shaping circuits.
CO2	Explain the working of transistor biasing circuits and locate quiescent point.
CO3	Analyze the models of transistor & FET amplifier circuits.
CO4	Design and develop various transistor amplifier circuits.
CO5	Construct and solve the transistor oscillator circuits.

18EE32	LOGIC DESIGN
CO1	To exemplify the concept of combinational systems using standard gates and minimization methods (Karnaugh Maps up to 5 variables)
CO2	To identify the limitations of K- map and use computerized simplification Techniques (Quine Mckluskey tabulation and MEV methods)
CO3	To analyze and design combinational systems composed of standard combinational modules, such as multiplexers, decoders, encoders, adders, subtractors and binary comparators.
CO4	To demonstrate knowledge of simple synchronous sequential systems (flip-flops and latches).
CO5	To analyze and design sequential systems composed of standard sequential modules, such as counters, registers, Mealy and Moore Models.

18 EE33	NETWORK ANALYSIS
CO1	Understand the concepts of nodal and mesh methods.
CO2	Express complex circuits in their simple form using different theorems.
CO3	Analyze the circuit using time and frequency domain.
CO4	Analyze and design resonant circuits.
CO5	Model the various electrical networks using two port circuits.

18EE33	TRANSFORMERS AND INDUCTION MACHINES
CO1	Explain operation of transformers and induction machines (1-phase and 3-phase).
CO2	Evaluate the performance of transformers and induction machines.
CO3	Understand the different connections for the three phase operations, advantages and applications.
CO4	Analyze induction motors with different rotors and as induction generator.
CO5	Understand the different starters and speed control techniques of three-phase induction motors.

18EE35	GENERATION, TRANSMISSION AND DISTRIBUTION
CO1	Explain the different methods of Power generation concepts using renewable and non – renewable sources and typical transmission scheme and voltage levels.
CO2	Describe the mechanical design calculations, different types of line insulators and the concept of Corona, formation, its influence on the operation of overhead transmission lines.
CO3	Apply the acquired knowledge of transmission and distribution systems, analyze the DC & AC distributors with different types of loads and analyze the working of underground Cables..
CO4	Apply the acquired knowledge to evaluate line parameters of 1- Φ and 3- Φ transmission and distribution systems.
CO5	Analyze the performance of power transmission lines by evaluating the line regulation and efficiency.

18 EEL36	ELECTRONIC CIRCUITS LAB
CO1	Explain the working of diode wave shaping circuits and to draw transfer characteristics.
CO2	Evaluate the characteristics of BJTs.
CO3	Test the resonant circuits resonating at required frequency
CO4	Design of amplifier circuit, draw frequency response and determine input and output impedances
CO5	Construct and test transistor circuits to oscillate at desired frequencies.

18EEL37	LOGIC DESIGN LAB
CO1	Apply the concept of various ICs, Logic gates and other components used in Digital logic circuit design.
CO2	Solve K-Maps and realize Boolean expressions.
CO3	Design and implement various code converters
CO4	Design and implement combinational circuits for various digital applications.
CO5	Design and implement sequential circuits

18EE41	ELECTRICAL AND ELECTRONIC MEASUREMENTS AND INSTRUMENTS
CO1	Define the different measuring network parameters and understand the measuring techniques in analog and digital systems.
CO2	Analyze the different methods of implementation in the working of measuring instruments and compare the end results.
CO3	Assess the performance of different measuring instruments.
CO4	Analysis of various generated waveforms using various instruments
CO5	Plan and design various measuring instruments for their innovation.

18 EE42	CONTROL SYSTEMS
CO1	Demonstrate an understanding of the fundamentals of control systems
CO2	Apply the concepts to develop mathematical modeling and transfer function of any system using various techniques.
CO3	Analyze the control system with respect to system stability in time and frequency domain.
CO4	Analysis of system stability using graphical methods
CO5	Design system using compensator for better performance.

18EE43	DC MACHINES AND SYNCHRONOUS MACHINES
CO1	Explain phenomena related to DC, synchronous machines and special machines
CO2	Explain the operation, characteristics and performance of DC, synchronous machines and special machines.
CO3	Solve problems related to speed control, losses and efficiency of DC machines.
CO4	Analyze the behavior of synchronous machines in parallel and on infinite busbars.
CO5	Evaluate voltage regulation of synchronous generators by various methods

18EE44	POWER ELECTRONICS
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CO1	Identify and selection of power electronic devices and to study control circuit for SCR/Thyristor.
CO2	To understand and analyze different AC-DC converters for power conversion system applications.
CO3	To understand and analyze different AC-AC and AC-DC-AC converters for power conversion system applications.
CO4	To Understand the control of DC drives.
CO5	To understand the control of AC drives.

18EE45	LINEAR ICS AND APPLICATIONS
CO1	Recall the basics of op-amp
CO2	Understand the behavior of op-amp linear and non- linear circuits
CO3	Understand the operation of op-amp in signal processing and oscillator circuits.
CO4	Analyze the application of op-amp in nonlinear circuits.
CO5	Design a circuit or system using integrated circuits.

18EEL47	TRANSFORMERS AND INDUCTION MACHINES LAB
CO1	Conduct various tests on single-phase transformer and evaluate their performance
CO2	Conduct various tests on Poly-phase induction machines and single-phase induction motor to evaluate their performance.
CO3	Operate two dissimilar transformers in parallel for different load sharing.
CO4	Experiment the various methods of speed control of Induction motor.
CO5	Connect and evaluate the performance of single phase transformers for three phase operation and phase conversion.

18EEL47	POWER ELECTRONICS LAB
CO1	An ability to understand basic operation of various power semiconductor devices and passive components.
CO2	An ability to understand the basic principle of switching circuits.
CO3	An ability to analyze and design an AC/DC rectifier circuit.
CO4	An ability to analyze and design DC/DC converter circuits.
CO5	An ability to analyze DC/AC inverter circuit.

III YEAR

18EE51	Signals and Systems
CO1	Characterize and analyse the properties of CT and DT signals and systems

CO2	Analyse LTI CT and DT systems in time domain using convolution & differential equation
CO3	Represent CT and DT signals in the Frequency domain using Fourier analysis tools.
CO4	Analyse Fourier transform for differential & difference equation applications.
CO5	Use Z-transform and properties of Z transform for the analysis of discrete time systems.

18EE52	Field Theory
CO1	Able to define and state the behaviour of static electric fields in standard configurations.
CO2	Able to explain concepts of Energy and Potential to solve numerical problems.
CO3	Able to solve problems on Poissons and Laplace's equations, Biot-savarts law and Circuital laws.
CO4	Able to distinguish the behaviour of Electrostatic and electromagnetic fields between two dielectrics/conductor-dielectric boundaries
CO5	Able to apply Maxwell's equations for real time problems

18EE53	MICROCONTROLLER
CO1	Explain the architecture & difference between Microprocessor & Microcontrollers.
CO2	Use the arithmetic and logical instructions.
CO3	Use the instructions for writing assembly language and C program.
CO4	Use timers in Assembly Language and C program.
CO5	Use interrupts for serial and external peripherals interface.

18EE54	Electrical Machine Design
CO1	Apply the basic principles of design, and to select the best materials used in electrical machines
CO2	Explain design concepts of static electrical machines.
CO3	Analyse the design concepts of rotating electrical machines for the optimized performance.
CO4	To solve the design problems of static electrical machines.
CO5	To design the rotating electrical machines for the optimized performance.

18EEL56	Control System Lab
CO1	Understand and analyze the time and frequency domain specifications for a second order system.
CO2	Analyze the performance of servomotors.

CO3	Evaluating system performance using P,I,D controllers.
CO4	Design the control system with compensators.
CO5	Use MATLAB for simulation and validation of results obtained by analytical calculations.

18EEL57	DC MACHINES & SYNCHRONOUS MACHINES LAB
CO1	Choose proper testing method to determine losses and efficiency of a DC machine and to determine voltage regulation of synchronous generator.
CO2	Explain the characteristics of DC machines and synchronous machines by conducting suitable tests.
CO3	Apply the basic concept for experimental determination of voltage regulation of synchronous generator.
CO4	Analyze the performance of DC machines on load and synchronous machines on infinite bus bars.
CO5	Evaluate the losses and efficiency of DC machines and performance of synchronous machines connected to infinite bus bars.

18EE551	PROGRAMMABLE LOGIC CONTROLLERS
CO1	Need of automation and its various control strategies with its auxiliary devices.
CO2	Programs for various functional block consisting of multiple inputs and outputs and to control
CO3	Programming issues with subroutines and debugged
CO4	The use of auxiliary units of a controller with hardware exposure.
CO5	The data handling with simple hardware.

18EE552	VLSI Circuit Design
CO1	Impart knowledge of MOS transistor theory and CMOS technologies
CO2	Understand different properties of MOS and BICMOS circuits.
CO3	Analyze the design process of MOS and BICMOS circuits along with scaling of MOS circuits..
CO4	Understand and analyse subsystem design and layout.
CO5	To understand the process of subsystem design.

18EE553	MODERN CONTROL THEORY
CO1	Understand the fundamentals of state variables, linear and nonlinear systems.
CO2	Analyze SISO and MIMO systems and obtain the state models.
CO3	Application of Eigen values for derivation of transfer functions.
CO4	Perform analysis on Controllability and Observability.

CO5	Improve stability of a given system by state feedback pole placement techniques.
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18EE554	EMBEDDED SYSTEMS
CO1	Apply the knowledge of Microcontrollers to understand & explain the concepts of Embedded systems
CO2	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO3	Design and Develop domain specific Embedded system applications.
CO4	Demonstrate understanding the facts of issues in embedded system design.
CO5	Design real time embedded systems using the concepts of RTOS and Analyze various examples of embedded systems by using the interfacing method.

18EEE01	RENEWABLE ENERGY SOURCES
CO1	Understand and Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. Explain renewable energy sources, Solar, Wind, Biomass, Geothermal, Ocean and Tidal systems.
CO2	Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry.
CO3	Gain knowledge and Discuss energy from sun, energy reaching the Earth's surface and solar thermal energy, identify the applications and Discuss types of solar collectors, their configurations, solar cells and their characteristics
CO4	Apply engineering techniques and Gain knowledge, discuss various generation schemes of energy from hydrogen, Solar, wind, Biomass, Ocean thermal, Tidal and geothermal systems
CO5	Demonstrate self-learning capability to discuss production of energy from solar, Biomass and Biogas energy, Wind, Geothermal, Hydrogen, Tidal, Ocean thermal, world and Indian scenarios resources. Discuss production of energy from all the above.

18EE61	POWER SYSTEMS ANALYSIS - I
CO1	Able to, recall the equivalent circuits of power system components and to draw the single line & impedance diagrams of power system network.
CO2	Apply concept of symmetrical components to power system network.
CO3	Analyze the behaviour of power system under different fault conditions.
CO4	Evaluate the steady state and transient stability of the Power Systems.
CO5	Investigate the effect of unbalanced operation and single phasing on the performance of three phase induction machines.

18EE62	HIGH VOLTAGE ENGINEERING
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CO1	Explain the need for high voltages and currents
CO2	Explain the physics of break down mechanisms of insulating media
CO3	Compare the merits and demerits of generation of high voltage and currents.
CO4	Select suitable method for measurement of high voltages and currents.
CO5	Explain the method of conducting the high voltage tests on different electrical equipment.

18EE63	DIGITAL SIGNAL PROCESSING
CO1	Analyse and find DFT of signals.
CO2	Analyse and find DFT using FFT algorithms.
CO3	Realize structures for FIR & IIR systems.
CO4	Design IIR filters for the given specifications.
CO5	Design FIR filters for the given specifications.

18EEL65	DIGITAL SIGNAL PROCESSING LAB
CO1	Write & execute the program to find DFT, Circular Convolution & Linear convolution
CO2	Write & execute program to find Impulse response of LTI system.
CO3	Differentiate & Write program for FIR & IIR Filter Structures
CO4	Design & Write program for IIR filters.
CO5	Design & Write program for FIR filters.

18EEL66	MICROCONTROLLER LAB
CO1	Understand different instruction set and architecture of 8051 Microcontroller.
CO2	Write & Analyze assembly language programming.
CO3	Understand usage of directives, Code Memory & external memory.
CO4	Write assembly language program using bit instructions.
CO5	Build Interfacing Circuit using embedded C programming.

18EE641	OPERATING SYSTEMS
CO1	Analyze the structure of OS and basic architectural components involved in OS design.
CO2	Analyse the working of various processes, scheduling and the concept of multitasking.
CO3	Define and analyze the synchronization requirements and its importance during the operation and deadlocks effect.
CO4	Justify the allocation of the memory for various tasks and its memory management.

CO5	Understand & analyse: file system, its implementation and list out the importance of the need of secondary memory.
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18EE642	SPECIAL ELECTRICAL MACHINES
CO1	Able to describe the construction and operation of different special electrical machines
CO2	Compare merits, demerits of different special electrical machines and their applications.
CO3	Analyse different power converter topologies for operation of special electrical machines
CO4	Formulate the torque equation and analyze speed –torque characteristics of special electrical machines.
CO5	Develop digital control techniques for the operation and control of special electrical machines.

18EE643	ARTIFICIAL INTELLIGENCE TECHNIQUES FOR ELECTRICAL ENGINEERING
CO1	Understand feed forward neural networks, feedback neural networks and learning techniques.
CO2	Analyze fuzziness involved in various systems and fuzzy set theory.
CO3	Develop fuzzy logic control for applications in electrical engineering
CO4	Develop genetic algorithm for applications in electrical engineering
CO5	Apply AI to study and analyse power system problems.

18EE644	ELECTRIC VEHICLE TECHNOLOGY
CO1	Summarize the fundamental concepts of Electric Vehicles.
CO2	Understand principles of operation of hybrid and electric vehicles.
CO3	Analyze the Electric Vehicle dynamics with constant and variable parameters.
CO4	Apply Electric Vehicle dynamics for real time applications
CO5	Create dynamic model of Electrical vehicle using simulation tools

18EE645	SMART GRID TECHNOLOGY
CO1	Understand technologies for smart grid
CO2	Understand technologies for smart grid.
CO3	Realize the distribution generation and smart consumption.
CO4	Know the regulations and market models for smart grid.

18EE646	OOPS using C++
CO1	Explain the basics of Object Oriented Programming concepts.

CO2	Apply the object initialization and destroy concept using constructors and destructors.
CO3	Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs and to implement compile time polymorphism in programs by using overloading methods and operators..
CO4	Use the concept of inheritance to reduce the length of code and evaluate the usefulness..
CO5	Use I/O operations and file streams in programs.

18EEE02	ELECTRIC VEHICLE TECHNOLOGY
CO1	Summarize the fundamental concepts of Electric Vehicles
CO2	Understand principles of operation of hybrid and electric vehicles.
CO3	Analyze the Electric Vehicle dynamics with constant and variable parameters
CO4	Apply Electric Vehicle dynamics for real time applications
CO5	Create dynamic model of Electrical vehicle using simulation tools

IV YEAR

18 EE 71	POWER SYSTEMS ANALYSIS-2
CO1	Describe the graph theory applied to Power System and construct the fundamental matrices and built the Ybus and Zbus matrices.
CO2	Categorize the buses and formulate the power flow problems of power system network
CO3	Analyze and solve the power flow problems through different iterative techniques.
CO4	Evaluate the economic operation of power system under various operating conditions..
CO5	Estimate the transient stability of the power system through different numerical methods.

18EE72	MODERN POWER SYSTEM PROTECTION
CO1	Explain protection philosophies, various protection devices and protection schemes
CO2	Analyse the characteristics and applications of various protective devices and protection schemes.
CO3	Apply the basic concepts of protection systems to solve problems related to protection devices and systems.
CO4	Explain and analyse modern protection techniques and systems for application to power system protection.
CO5	Explain automation concepts and justify the use of various international standards related to protective relaying.

18EEL76	POWER SYSTEM SIMULATION LABORATORY
CO1	Develop skills and obtain Power system parameters to experiment with software packages (Matlab/Mi- Power/MAT POWER-open source software)
CO2	Develop programs and models using computer based tools for analyzing optimal generator scheduling and theoretically to verify the same.
CO3	Develop programs to study different types of faults for stability studies and theoretically to verify the same.
CO4	Analyse Load flow parameters using numerical methods and theoretically for verification.
CO5	Devise programs to analyse and solve real time problems.

18EEL77	PROTECTION AND HIGH VOLTAGE LABORATORY
CO1	Identify the characteristics of protection devices for applications in power system protection.
CO2	Distinguish between the flashover characteristics of air insulation subjected to HVAC and HVDC under uniform and non- uniform field configuration
CO3	Illustrate the generation of standard lightning impulse voltage wave and to evaluate front and tail times.
CO4	Asses the field strength in liquid insulation and field distribution in the dielectric medium through field plotting.
CO5	To measure the high AC and DC voltages using standard sphere gap model

18EEL78	COMPUTER AIDED ELECTRICAL DRAWING
CO1	Understand the winding pitches of armature windings of electrical machines.
CO2	Illustrate possible winding pattern for DC machines.
CO3	Demonstrate the possible windings to three phase AC machines.
CO4	Develop the winding pattern to reduce copper usage in the windings
CO5	Design suitable winding type to reduce or suppress some harmonics.

18EE731	SENSORS AND TRANSDUCERS
CO1	Understand the use of gauges and transducers to measure pressure, direction, position, motion and distance.
CO2	Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.
CO3	Understand the working of different temperature sensing devices.
CO4	Summarize the principles and applications of audio electrical sensors and transducers used for the measurement of sound
CO5	Predict the performance of sensors for the measurement of mass, volume and environmental quantities.

18EE732	INSULATION ENGINEERING
CO1	Demonstrate their knowledge on Electric field and analyze electric field problems related to dielectric.
CO2	Explain and analyse - insulation / insulation systems used in power system apparatus.
CO3	Explain dielectric phenomena in insulation and analyse influence of excitations on insulation.
CO4	Explain - breakdown phenomena in gaseous insulation, over voltages in power systems and insulation coordination in power system.
CO5	Demonstrate their knowledge on ageing of insulation and analyse failure of insulation due to ageing.

18EE733	FLEXIBLE A.C. TRANSMISSION SYSTEMS (FACTS)
CO1	To understand transmission network of a power system and its peripheral parameters of control.
CO2	To analyse power devices and its characteristics to aid the control of power system parameter.
CO3	To apply different FACTS controllers to control power system
CO4	To Implement concept of shunt compensation in power system
CO5	To Implement concept of series compensation to power system

18EE741	POWER SYSTEM OPERATION AND CONTROL
CO1	Illustrate Economic operation of power system and importance of SCADA
CO2	Analyze the functions of Automatic generation control, speed governors and load frequency control Techniques
CO3	Ability to analyze methods of voltage and reactive power control
CO4	Solve unit commitment problems
CO5	Evaluate security issues, contingency analysis, state estimation and related issues of power

18EE742	COMPUTER CONTROL OF ELECTRIC DRIVES
CO1	Understand Digital Data Acquisition System and all types of sensors in detail
CO2	Understand the concept of AC Machine Drives operation and characteristics.
CO3	Analyse different types of phase controlled converters.
CO4	Apply principle of vector control to AC drives.
CO5	Design methodology of drives using fuzzy logic control feedback system

18 EE 743	ENERGY AUDITING & DEMAND SIDE MANAGEMENT
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CO1	Understand the technology, economics and regulation associated with energy conservation and energy audit.
CO2	Analyse the Energy Economic analysis and develop cash flow models.
CO3	Understand the energy management and methods of energy auditing in energy sector.
CO4	Apply Power factor Correction methods, tariff and ABT for Electric Equipments.
CO5	Familiarize with Demand side management and energy conservation in energy sector.

18EE751	ENERGY AUDITING & DEMAND SIDE MANAGEMENT
CO1	Understand the technology, economics and regulation associated with energy conservation and energy audit
CO2	Analyse the Energy Economic analysis and develop cash flow models.
CO3	Understand the energy management and methods of energy auditing in energy sector
CO4	Apply Power factor Correction methods, tariff and ABT for Electric Equipment's
CO5	Familiarize with Demand side management and energy conservation in energy sector.