



SAPTHAGIRI COLLEGE OF ENGINEERING

(Affiliated to VTU, Belagavi & Approved by AICTE, New Delhi)

(An ISO 9001:2015 and 14001:2015 Certified Institution)

Department of Electrical & Electronics Engineering

Course Outcomes

2015 Scheme

II Year Electrical & Electronics Engineering

Course Code	Course Name	Course Outcomes-On completion of this course the students will be
15MAT31	Engineering Mathematics-III	<p>CO1: Find the Fourier series, half range Fourier series and Fourier coefficients of periodic functions.</p> <p>CO2: Find the Fourier and inverse Fourier transforms of periodic functions.</p> <p>CO3: Find Z-transforms and inverse Z-transform, and to solve the finite difference equations using Z-transforms.</p> <p>CO4: Apply the concept of statics for curve fitting, correlation and regression.</p> <p>CO5: Solve the algebraic/transcendental equation, interpolating polynomials, intermediate values and evaluation of integrals using appropriate numerical techniques.</p> <p>CO6: Evaluate the integrals using Green's, Stokes and Gauss divergence theorem and able to apply Euler's equation to find the maxima or minima of the functional.</p>
15EE32	Electrical circuit analysis	<p>CO1: Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations.</p> <p>CO2: Apply network theorems and analyse complex electric circuits</p> <p>CO3: Analyse the resonance in series and parallel circuits,</p> <p>CO4: Analyse the importance of initial conditions and their evaluation</p>

		<p>CO5: Analyse typical waveforms using Laplace transformation</p> <p>CO6: Solve unbalanced three phase systems, Evaluate the performance of two port networks</p>
15EE33	Transformers and generators	<p>CO1: Explain the construction and operation and performance of single phase and three phase transformers</p> <p>CO2: Explain the use of auto transformer, tap changing and tertiary winding transformer and need of operating transformers in parallel.</p> <p>CO3: Explain the armature reaction and commutation and their effects in a DC generators.</p> <p>CO4: Explain the construction, operation and performance of Synchronous machines.</p>
15EE34	Analog electronics circuits	<p>CO1: Understand the principle of operation of Diode Circuits like Clipping & Clamping. Also study. Transistor characteristics to analyze & design Biasing circuits for Amplifiers, Oscillators & Switching Circuits</p> <p>CO2: Understand the transistor analysis using H-Models to analyze & determine the various parameters like Input /Output Impedance, Voltage / current gains.</p> <p>CO3: Understand different types of Oscillators & Power Amplifiers using Transistor & also to analyze & design the same..</p> <p>CO4: Understand the basics of JFET/MOSFET together with characteristics to analyze & design amplifiers using JFET/MOSFET.</p> <p>CO5: Understand operation of multi stage amplifiers using transistor and determine the various performance parameters. Also understand effect of Negative feedback in various types of Amplifiers on its performance parameters like Input/output Impedance, Voltage / current gains.</p>
15EE35	Digital system design	<p>CO1: Able to simplify switching equations generated from truth tables.</p> <p>CO2: Able to design combinational logic circuits; adders, Subtractors, Multiplexers and comparators.</p> <p>CO3: Able to design synchronous sequential circuits; latches, flip-flops, binary counters and Mod – 6 counters.</p> <p>CO4: Able to design Mealy and Moore synchronous sequential circuit models and Construct state diagrams for sequential circuits</p>

		CO5: Able to Describe the structure of HDL module, operators, data types, Comparison between VHDL and Verilog and Understand the concept of data-flow description.
15EE36	Electrical and electronic measurements	CO1: Understand dimensional equations for electrical parameters & measurement of resistance, inductance and capacitance using bridges. CO2: Explain the construction and operation of power factor meter, frequency meter and phase sequence indicator. CO3: Explain measurement of magnetic parameters and the methods of extending the range of instruments and instrument transformers. CO4: Discuss electronic and digital instruments used in measurements. CO5: Discuss display and recording devices used in measurements.
15EEL37	Electrical Machines Lab-1	CO1: Evaluate the performance of transformers from the test data obtained. CO2: Connect, operate and analyze two single phase transformers of different KVA rating in parallel. CO3: Connect and demonstrate the single phase transformers for three phase operation and phase conversion CO4: Compute and analyze the voltage regulation of synchronous generator using the test data obtained in the laboratory. CO5: Evaluate the performance of synchronous generators from the test data.
15EEL38	Electronics Lab	CO1: To design and test half wave and full wave rectifier circuits CO2: To design and test different amplifier and oscillator circuits using BJT CO3: To study the simplification of Boolean expressions using logic gates. CO4: To realize different Adders and Subtractors circuits. CO5: To design and test counters and sequence generators.
15MAT41	Engineering Mathematics – III	CO1: Apply the numerical methods to solve the linear ordinary differential equations of first and second order. CO2: Derive Bessel's function, Legendre's polynomials and its properties. Also able to apply Rodrigues's formula to find the polynomials. CO3: Solve problems on analytic functions using Cauchy – Riemann equations and to solve the complex line integrals, conformal and bilinear transformations.

		<p>CO4: Analyze and solve the probability distribution problems.</p> <p>CO5: Define hypothesis, analyze and interpret the hypothesis for the given sampling distribution and to solve stochastic process problems.</p>
15EE42	Power generation and economics	<p>CO1: Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants</p> <p>CO2: Classify various substations and explain the importance of grounding.</p> <p>CO3: Understand the economic aspects of power system operation and its effects.</p> <p>CO4: Explain the importance of power factor improvement.</p>
15EE43	Transmission and Distribution	<p>CO1: Explain the concepts of generation, transmission and distribution, Materials used for conductors. Explain the importance of HVAC, EHVAC, UHVAC and HVDC transmission. Explain different type of Insulators.</p> <p>CO2: Explain the line parameters- resistance, inductance and capacitance in detail.</p> <p>CO3: Explain the performance of transmission lines, Corona-advantages and disadvantages.</p> <p>CO4: Calculate the parameters of the transmission line for different configurations and assess the performance of line.</p> <p>CO5: Explain the use of underground cables and evaluate different types of distribution systems.</p>
15EE44	Electric Motors	<p>CO1: Able to explain the constructional features of motors and select a suitable drive for specific application.</p> <p>CO2: Able to analyze and assess the performance characteristics of Dc motors by conducting suitable tests and control the speed by suitable method.</p> <p>CO3: Able to explain the constructional features of three phase and single induction motor and assess their performance.</p> <p>CO4: Able to Control the speed of induction motor by suitable method.</p> <p>CO5: Able to Explain the operation of Synchronous motor and special motors.</p>
15EE45	Electromagnetic field theory	<p>CO1: Use different coordinate systems to explain the concept of gradient, divergence and curl of a vector. Assess time varying fields and propagation of waves in different media.</p> <p>CO2: Use Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.</p> <p>CO3: Calculate the energy and potential due to a system of charges.</p> <p>CO4: Explain the behavior of electric field across a boundary between a conductor</p>

		<p>and dielectric and between two different dielectrics.</p> <p>CO5: Explain the behavior of magnetic fields and magnetic materials.</p> <p>CO6: Assess time varying fields and propagation of waves in different media.</p>
15EE46	Operational amplifiers and linear IC's	<p>CO1: Understand the basics of Op-Amp, characteristic features, open-loop / closed-loop operations, different configurations together with Linear applications (like AC Amplifier, summing etc) and also understand the design & operation of DC Voltage Regulators.</p> <p>CO2: Understand the design & Operation of Active Filters, Signal Generators using Op-Amps.</p> <p>CO3: Understand the design & Operation of Comparators & converters using op-amps.</p> <p>CO4: Understand the operation & designing of Signal Processing circuits (Half wave / full wave precision rectifier) and A/D and D/A converters.</p> <p>CO5: Understand operation of Phase Locked Loop(PLL) & Timer ICs(555Timer).</p>
15EEL47	Electrical Machines Lab-2	<p>CO1: Test dc machines to determine their characteristics and speed control of DC motor.</p> <p>CO2: Pre-determine the performance characteristics of dc machines by conducting suitable tests.</p> <p>CO3: Perform load test on single phase and three phase induction motor to assess its performance.</p> <p>CO4: Conduct test on induction motor to pre-determine the performance characteristics.</p> <p>CO5: Conduct test on synchronous motor to draw the performance curves.</p>
15EEL48	Op-Amp & Linear IC'S Lab	<p>CO1:To conduct experiment to determine the characteristic parameters of OP-Amp</p> <p>CO2:To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator</p> <p>CO3:To design test the OP-Amp as oscillators and filters</p> <p>CO4:Design linear IC'S like 555 timer as Multivibrator power supply and test its performance</p>

III Year Electrical & Electronics Engineering

Course Code	Course Name	Course Outcomes-On completion of this course the students will be
15EE51	Management and Entrepreneurship	<p>CO1: Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process.</p> <p>CO2: To explain the social responsibility of business and leadership.</p> <p>CO3: Explain the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development</p> <p>CO4: Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation</p> <p>CO5: Discuss the concepts of project management, capitol building process, project feasibility study, project appraisal and project financing. the state /central level institutions / agencies supporting business enterprises</p>
15EE52	Microcontroller	<p>CO1: Discuss the history of the 8051 and features of other 8051 family members and the internal architecture of the 8051 and 8051 addressing modes.</p> <p>CO2: Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions.</p> <p>CO3: Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization.</p> <p>CO4: Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051 to the RS232 and discuss in detail 8051 interrupts and writing interrupt handler programs.</p> <p>CO5: Interface 8051 with real-world devices such as LCDs and keyboards, ADC, DAC chips and sensors and interface 8031/51 with external memories, 8255 chip to add ports and relays, opt isolators and motors.</p>
15EE53	Power Electronics	<p>CO1: Able to explain the diode characteristics and their effects, applications.</p> <p>CO2: Able to understand the switching characteristics and gate control requirement of transistor.</p> <p>CO3: Able to discuss types of thyristor operation, gate characteristics and applications.</p>

		<p>CO4; Able to explain designing, analysis techniques and characteristics of thyristor controlled Rectifiers.</p> <p>CO5; Able to analyze the operation of single phase and 3 phase converter and controllers.</p>
15EE54	Signals & Systems	<p>CO1:Classify signals, relate between elementary signals and identifying the properties of system</p> <p>CO2:Perform convolution operation on continuous and discrete time signals and realize LTI System by differential and difference Equations and demonstrate them difference and as block diagram representation.</p> <p>CO3:Analyze the concept, applications and identify the properties of CT and DT Fourier Transform.</p> <p>CO4:Analyze the concept, applications and identify the properties of Z transform.</p>
15EE563	Renewable energy sources	<p>CO1: Analyze causes of energy scarcity and its solution, energy resources and availability of renewable energy. And would be able to analyze energy from sun, energy reaching the Earth's surface and solar thermal energy applications.</p> <p>CO2: Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.</p> <p>CO3: Analyze generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.</p> <p>CO4: Analyze production of energy from biomass, biogas.</p> <p>CO5: Analyze tidal energy resources, energy availability and power generation.</p> <p>CO6: Analyze power generation sea wave energy and ocean thermal energy.</p>
15EEL57	Microcontroller lab	<p>CO1: Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions and code conversions.</p> <p>CO2: Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.</p> <p>CO3: Perform interfacing of stepper motor and dc motor for controlling the speed.</p> <p>CO4: Generate different waveforms using DAC interface.</p>
15EEL58	Power electronics lab	<p>CO1: Obtain static characteristics of semiconductor devices to discuss their performance.</p> <p>CO2: Trigger the SCR by different methods.</p>

		<p>CO3: Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.</p> <p>CO4: Control the speed of dc motor, universal motor and stepper motors.</p>
15EE61	Control Systems	<p>CO1: Discuss the effect of feedback, types of feedback control systems and develop the mathematical model of physical system from which derive their transfer function.</p> <p>CO2: Employ various block diagram reduction techniques & signal flow graph method transfer function of control systems.</p> <p>CO3: Compare the time response of various system using standard test signals in terms of system parameters.</p> <p>CO4: Evaluate the stability of criterion of linear feedback system using Routh stability criterion.</p> <p>CO5: Explain & apply the root locus concepts to determine the stability of the system.</p> <p>CO6: Discuss the frequency response of second order system and examine the stability of the system by constructing bode & Nyquist plots</p> <p>CO7: Design various controller configuration to improve steady state performance for the given specifications of control systems.</p>
15EE62	Power System Analysis – 1	<p>CO1: Represent the power system using single line diagram in per unit system.</p> <p>CO2: Identify and analyze different types of faults in power system.</p> <p>CO3: Resolve unbalanced phasors into symmetrical components for fault analysis of power system.</p> <p>CO4: Understand the concept of power system stability and evaluate it using graphical method.</p>
15EE63	Digital signal processing	<p>CO1: Compute the DFT of various signals using its properties and different methods.</p> <p>CO2: Apply fast and efficient algorithms to compute DFT and IDFT of a given sequence.</p> <p>CO3: Design IIR and FIR filters using Impulse invariant technique and Bilinear transformation</p> <p>CO4: Realize the digital filters using different transformation technique</p> <p>CO5: Design FIR filters using different window technique and frequency sampling technique.</p>

15EE64	Electrical machine design	co1: Judge and select the engineering materials for the construction of electrical machines co2: Describe the output equation of dc machines and derive the relationship between various parameters and estimate the dimensions armature of dc machines. co3: Estimate the dimensions of field and commutator co4: Describe the output equation of transformer and derive the relationship between various parameters and estimate the main dimension of transformer co5: Describe the output equation of ac machines and derive the relationship between various parameters and estimate the dimensions armature of ac machines.(induction , synchronous) co6: Define scr, effect of scr and then estimate the air gap length and design the field of synchronous machines
15EE651	Computer aided electrical drawing	CO1: Use the commands of Auto CAD to draw the components of substation like CT,PT, SA, CB, Isolator etc.. CO2: Draw the different types of DC and AC machine windings using Auto CAD software. CO3: Draw the various parts and their different views of transformer using Auto CAD. CO4: Draw the various parts and their different views of DC machine using Auto CAD. CO5: Draw the various parts and their different views of AC machine using Auto CAD.
15EE662	Sensors and Transducer	CO1: Able to discuss need of transducers, their classification, advantages and disadvantages. CO2: Able to discuss working of different types of transducers and sensors.. To discuss recent trends in sensor technology and their selection. CO3: Able to discuss basics of signal conditioning and signal conditioning equipment. CO4: Able to discuss configuration of Data Acquisition System and data conversion. To discuss the basics of Data transmission and telemetry. CO5: Able to explain measurement of various non-electrical quantities
15EEL67	Control systems lab	CO1: Design and analyses Lead, Lag and Lag – Lead compensators for given

		<p>specifications.</p> <p>CO2: Determine the performance characteristics of AC and DC servomotors and synchro-transmitter receiver pair used in control systems.</p> <p>CO3: Use software package and discrete components to determine the time and frequency domain responses of a given second order system.</p> <p>CO4: Simulate a second order system and study the effect of P, PI, PD and PID controllers on the step response of the system.</p> <p>CO5: Write a script files to draw root locus plot, bode plot and Nyquist plots to study the stability of the system using a software package.</p>
15EEL68	Digital Signal Processing LAB	<p>CO1:Develop a program in MATLAB to give interpretation of sampling theorem in time domain</p> <p>CO2:Develop a program in MATLAB to evaluate and provide the solution of impulse response ,step response, steady response, steady state response and arbitrary i/p of a given difference equation</p> <p>CO3:Develop a program in MATLAB to perform convolution of a given sequence to evaluate the response of a system</p> <p>CO4: Develop programs in MATLAB to compute DFT &IDFT of a given sequence using basic definition and / or Fast methods.</p> <p>CO5:Develop programs in MATLAB to Design and implementation of IIR & FIR filters</p>

IV Year Electrical & Electronics Engineering

Course Code	Course Name	Course Outcomes-On completion of this course the students will be
15EE71	Power system analysis – 2	CO1: Formulate network matrices and models for solving load flow problems. CO2: Perform steady state power flow analysis of power systems using numerical iterative techniques and suggest a method to control voltage profile. CO3: Show knowledge of optimal operation of generators on a bus bar, optimal unit commitment, reliability considerations and optimal generation scheduling. CO4: Discuss optimal scheduling for hydro-thermal system, power system security and reliability. CO5: Analyze short circuit faults in power system networks using bus impedance matrix. CO6: Perform numerical solution of swing equation for multi-machine stability.
15EE72	Power system protection	CO1: Able to discuss the components of protection schemes, relay terminologies and classification and performance of protective relays. CO2: Able to explain about the characteristics, various schemes and different forms of overcurrent protection. CO3: Able to explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays. CO4: Able to discuss pilot protection and its types, construction, operating principles and performance of differential relays and protection of generators, transformers and bus zone. CO5: Able to explain the principle of circuit interruption in different types of circuit breakers. CO6: Able to discuss the construction and operating principle of different types of fuses, protection against overvoltage and Gas Insulated Substation (GIS).
15EE73	High voltage engineering	CO1: Explain conduction and breakdown phenomenon in gases, liquid dielectrics CO2: Explain breakdown phenomenon in solid dielectrics CO3: Explain generation of high voltages and currents CO4: Discuss measurement techniques for high voltages and currents CO5: Discuss overvoltage phenomenon and insulation coordination in electric power systems
15EE742	Utilization of electrical power	CO1: Able to identify a heating/ welding scheme for a given application and able to understand Fundamental principles, extraction, refining of metals and electroplating a given application

		<p>CO2:Able to maintain/ Trouble shoot various lamps and fittings in use</p> <p>CO3:Able to figure-out the different schemes of traction schemes and its main components and will be able to design a suitable scheme of speed control for the traction systems,</p> <p>CO4: Able To explain the various braking operation for different types of drives and discuss about the Tramways and Trolley.</p> <p>CO5: Able To analyze about the Performance, concept and architecture of different Electric Vehicles.</p>
15EE752	Testing and commissioning of power system apparatus	<p>CO1:Able to explain the Installation of transformers, Proper methods of installation to give long trouble- free service and different tools used for installation process.</p> <p>CO2:Able to discuss the Installation of Synchronous Machines and Demonstrate the routine tests for synchronous machine</p> <p>CO3: Able to will be able to analyze the Commissioning test and installation of Induction motor.</p> <p>CO4: Able to will be able to explain the Handling, Testing and installation of underground cables and its fault clearance.</p> <p>CO5: Able to understand the protection equipment 'switchgear', its proper maintenance for protection of electrical systems and domestic testing methods and rules.</p>
15EEL76	Power system simulation lab	<p>CO1: Develop a program in MATLAB to assess the performance of medium and long transmission lines.</p> <p>CO2: Develop a program in MATLAB to obtain the power angle characteristics of salient and non-salient pole alternator.</p> <p>CO3: Develop a program in MATLAB to assess the transient stability under three phase fault at different locations in a of radial power systems.</p> <p>CO4: Develop programs in MATLAB to formulate bus admittance and bus impedance matrices of interconnected power systems.</p> <p>CO5: Use Mi-Power package to solve power flow problem for simple power systems.</p> <p>CO6: Use Mi-Power package to study unsymmetrical faults at different locations in radial power systems</p> <p>CO7: Use of Mi-Power package to study optimal generation scheduling problems for thermal power plants.</p>
15EEL77	Relay and High Voltage Lab	<p>CO1: Experimentally verify the characteristics of over current, over voltage, under voltage and negative sequence relays both electromagnetic and static type.</p> <p>CO2: Experimentally verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.</p> <p>CO3: Analyze the spark over characteristics for both uniform and non-uniform configurations using</p>

		<p>High AC and DC voltages</p> <p>CO4: Measure high AC and DC voltages and breakdown strength of transformer oil</p> <p>CO5: Draw electric field and measure the capacitance of different electrode configuration models</p>
15EE81	Power system operation and control	<p>CO1: Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA.</p> <p>CO2: Solve Unit Commitment Problems.</p> <p>CO3: Explain the issues of hydrothermal scheduling and solutions to hydro thermal problems.</p> <p>CO4: Explain basic generator control loops, functions of Automatic Generation Control and speed governors.</p> <p>CO5: Develop and analyse mathematical models of Automatic Load Frequency Control.</p> <p>CO6: Explain Automatic Generation Control in an interconnected power system.</p> <p>CO7: Explain voltage and reactive power control in an interconnected power system.</p> <p>CO8: Explain reliability, security, contingency analysis, state estimation and its issues in power systems.</p>
15EE82	Industrial Drives and Applications	<p>CO1: Explain the advantages and choice of electric drive.</p> <p>CO2: Explain dynamics and different modes of operation of electric drives</p> <p>CO3: Suggest a motor for a drive and control of dc motor using controlled rectifiers</p> <p>CO4: Analyze the performance of induction motor drives under different conditions</p> <p>CO5: Control of induction motor, synchronous motor and stepper motor drives.</p> <p>CO6: Suggest a suitable electrical drive for specific application in the industry.</p>
15EE833	Integration of distributed generation	<p>CO1: Able to explain power generation by alternate energy source like wind power and solar power</p> <p>CO2: Able to explain the integration of distributed generation and its effect on the performance of the power system.</p> <p>CO3: Able to explain the impact of integration of distributed generation on Voltage Magnitude Variations.</p> <p>CO4: Able to explain the impact of integration of distributed generation on Power Quality Disturbances.</p>
15EE84	INTERNSHIP / PROFESSIONAL PRACTICE	<p>CO1 Gain practical experience within industry in which the internship is done.</p> <p>CO2 Apply knowledge and skills learned to classroom work.</p>

		CO3 Experience the activities and functions of professionals. CO4 Develop and refine the oral and written communication skills. CO5 Identify areas for future knowledge and skill development. CO6 Acquire the knowledge of administration, marketing, finance and economics.
15EEP85	PROJECT	CO1: Identify, formulate and analyze engineering problems for the need of society. CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data. CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commitment to professional ethics. CO4: Work individually and in team, Communicate effectively through reports and presentations. CO5: Apply engineering, management and ethical principles for Project management and finance.
15EES86	SEMINAR	CO1 To attain, use and develop knowledge in the field of electrical and electronics engineering and other disciplines through independent learning and collaborative study CO2 To identify, understand and discuss current, real-time issues CO3 To improve oral and written communication skills CO4 To explore an appreciation of the self in relation to its larger diverse social and academic contexts CO5 To apply principles of ethics and respect in interaction with others.