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Vachana Pitamaha Dr. P.G. Halakatti College of Engineering & Technology, Vijayapur.

Program Outcomes

Department: Electrical & Electronics Engineering

List of Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.

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

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

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

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

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

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

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

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Program Specific Outcomes

Department: Electrical & Electronics Engineering

List of Program Specific Outcomes (PSO)

By the time of graduation, Electrical & Electronics Engineering students can

1. Demonstrate the knowledge and competence in the application of control system, circuit analysis, power electronics, analog & digital electronics and microcontroller in testing, protection and operation of power systems, electrical machines and electronic systems.

2. Explore the methodologies and new technologies in renewable energy engineering and use them to solve current and future energy problems globally for economic and efficient conservation of energy.

3. Use hardware and software skills for design, simulation and analysis of electrical and electronics systems.

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
III Semester			
1. TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES	18MAT31	C01	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
		CO2	Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
		CO3	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
		CO4	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
		CO5	Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
2. ELECTRIC CIRCUIT ANALYSIS	18EE32	C01	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.
		CO2	Solve complex electric circuits using network theorems.
		CO3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.
		CO4	Synthesize typical waveforms using Laplace transformation.
		CO5	Solve unbalanced three phase systems and also evaluate the performance of two port networks

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
3. TRANSFORMERS AND GENERATORS	18EE33	C01	Explain equivalent circuit, O.C & S.C test, voltage regulation and efficiency of single-phase transformer, explain different types of 3-Ph transformers and its connections.
		CO2	Illustrate different types of testing methods, losses in transformer, load sharing in 3-Ph transformer, autotransformers and tap changing transformers.
		CO3	Demonstrate the necessity of three-winding transformers, cooling of transformers. Explain armature reaction and commutation of dc generator, explain armature windings, winding factors, e.m.f equation, harmonics causes, reduction and elimination, armature reaction, synchronous reactance, equivalent circuit of synchronous generator.
		CO4	Analyze the behaviour of synchronous generator for various load conditions, voltage regulation by various methods. Describe the concept of O.C, S.C, S.C.R of synchronous generator.
		CO5	Discuss the effects of saliency, two-reaction theory, parallel operation of generators and load sharing, methods of synchronization, synchronizing power, slip test and performance of salient and non-salient pole synchronous generator. Describe capability curve for large turbo generators, hunting and damper windings.
4. ANALOG ELECTRONIC CIRCUITS	18EE34	C01	Obtain the output characteristics of clipper and clamper circuits.
		CO2	Design and compare biasing circuits for transistor amplifiers & explain the transistor switching.
		CO3	Explain the concept of feedback, its types and design of feedback circuits
		CO4	Design and analyze the power amplifier circuits and oscillators for different frequencies.

		CO5	Design and analysis of FET and MOSFET amplifiers

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
5. DIGITAL SYSTEM DESIGN	18EE35	C01	Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques.
		CO2	Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits.
		CO3	Design flip flops as sequential control circuits
		CO4	Design counters, shift registers as sequential control circuits
		CO5	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits Explain the functioning of Memories.
6. ELECTRICAL AND ELECTRONICMEASUREMENTS (Core Course)	18EE36	C01	Measure resistance, inductance and capacitance using bridges and determine earth resistance
		CO2	Explain the working of various meters used for measurement of Power, Energy & understand the adjustments, calibration & errors in energy meters.
		CO3	Understand methods of extending the range of instruments & instrument transformers.
		CO4	Explain the working of different electronic instruments.
		CO5	Explain the working of different display and recording devices
7.ELECTRICALMACHINES LABORATORY - 1	18EEL37	C01	Evaluate the performance of transformers from the test data obtained
		CO2	Analyze and operate two single phase transformers of different KVA rating in parallel
		CO3	Experiment with single phase transformers for three phase operation and phase conversion.
		CO4	Determine the voltage regulation of synchronous generator using the test data obtained in the laboratory.
		CO5	Estimate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus.

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
8. ELECTRONICS LABORATORY	18EEL38	C01	Design and test rectifier circuits with and without capacitor filters.
		CO2	Determine h-parameter models of transistor for all modes.
		CO3	Design and test BJT and FET amplifier and oscillator circuits.
		C04	Realize Boolean expressions, adders and subtractors using gates.
		CO5	Design and test Ring counter/Johnson counter, Sequence generator and 3 bit counters
9. ADDITIONAL MATHEMATICS – I	18MATDIP31	C01	Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
		CO2	Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
		CO3	Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
		CO4	Learn techniques of integration including the evaluation of double and triple integrals.
		CO5	Identify and solve first order ordinary differential equations.

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Subject	Code	Course Outcomes	Statement
IV Semester			
1. COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS	18MAT41	C01	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
		CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
		CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
		CO4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
		CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.
2. POWER GENERATION AND ECONOMICS	18EE42	C01	Describe the working of hydroelectric, steam power plants and state functions of major equipment of the power plants.
		CO2	Describe the working of diesel, gas, nuclear power plants and state functions of major equipment of the power plants
		CO3	Classify various substations and explain the importance of grounding.
		CO4	Understand the economic aspects of power system operation and its effects.
		CO5	Explain the importance of power factor improvement.

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
3. Transmission and Distribution	18EE43	C01	Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators.
		CO2	Analyze and compute the parameters of the transmission line for different configurations.
		CO3	Assess the performance of overhead lines.
		CO4	Interpret corona, explain the use of underground cables
		CO5	Classify different types of distribution systems; examine its quality & reliability
4. ELECTRIC MOTORS	18EE44	C01	Explain the construction, operation, classification, performance characteristics, applications and determine the losses and efficiency of DC Motor.
		C02	Describe the testing methods of DC machines and explain the construction and operation of 3-Φ induction motors.
		C03	Illustrate the Performance of Three-Phase Induction Motor.
		C04	Describe the Starting and Speed Control of 3-Φ induction motors, construction, operation, classification, performance characteristics, applications of 1-Φ induction motor.
		C05	Explain the construction, operation, classification, performance characteristics, applications of synchronous motors and Other motors.

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Subject	Code	Course Outcomes	Statement
5. ELECTROMAGNETIC FIELD THEORY	18EE45	C01	Use different coordinate systems , Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
		CO2	Calculate the energy and potential due to a system of charges & Explain the behavior of electric field across a boundary conditions.
		CO3	Explain the Poisson's, Laplace equations and behavior of steady magnetic fields.
		CO4	Explain the behavior of magnetic fields and magnetic materials.
		CO5	Asses time varying fields and propagation of waves in different media
6. OPERATIONAL AMPLIFIERS AND LINEAR ICs	18EE46	C01	Describe the characteristics of ideal and practical operational amplifier.
		C02	Design filters and signal generators using linear ICs.
		C03	Demonstrate the application of Linear ICs as comparators and rectifiers.
		C04	Analyze voltage regulators for given specification using op-amp and IC voltage regulators
		CO5	Summarize the basics of PLL and Timer

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Subject	Code	Course Outcomes	Statement
7.ELECTRICALMACHINES LABORATORY -2	18EEL47	C01	Evaluate testing of DC machines to determine their characteristics and also to control the speed of DC motor
		C02	Analyze and pre-determine the performance characteristics of DC machines by conducting suitable tests.
		C03	Experiment to perform load test on single phase and three phase induction motor to assess its performance.
		C04	Experiment to conduct test on induction motor to pre-determine the performance characteristics.
		C05	Estimate the performance of synchronous motor to draw the performance curves.
8. OP- AMP AND LINEAR ICS LABORATORY	18EEL48	C01	To conduct experiment to determine the characteristic parameters of OP-Amp
		CO2	To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator
		CO3	To design test the OP-Amp as oscillators and filters
		CO4	Design and study of Linear IC's as multivibrator power supplies.

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
V Semester			
1. MANAGEMENT AND ENTREPRENEURSHIP	18EE51	C01	Explain the field of management, task of the manager, planning and steps in decision making.
		CO2	Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.
		CO3	Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
		CO4	Show an understanding of role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises.
		CO5	Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques
2. MICROCONTROLLER	18EE52	C01	Outline the 8051 architecture, registers, internal memory organization, addressing modes.
		CO2	Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
		CO3	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
		CO4	Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
		CO5	Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
3. POWER ELECTRONICS	18EE53	C01	To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
		CO2	To explain the techniques for design and analysis of single phase diode rectifier circuits.
		CO3	To explain different power transistors, their steady state and switching characteristics and limitations.
		CO4	To explain different types of Thyristors, their gate characteristics and gate control requirements.
		CO5	To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers
4. SIGNALS AND SYSTEMS	18EE54	C01	Explain the generation of signals, behavior of system and the basic operations that can be performed on signals and properties of systems.
		CO2	Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.
		CO3	Solve the continuous time and discrete time systems by various methods and their representation by block diagram.
		CO4	Perform Fourier analysis for continuous and discrete time, linear time invariant systems.
		CO5	Apply Z-transform and properties of Z transform for the analysis of discrete time systems.

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Subject	Code	Course Outcomes	Statement
5. ELECTRICAL MACHINE DESIGN (Core Course)	18EE55	C01	Identify and list, limitations, modern trends in design, manufacturing of electrical machines and Properties of materials used in the electrical machines.
		CO2	Derive the output equation of DC machine, discuss selection of specific loadings and magnetic Circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine.
		CO3	Derive the output equations of transformer, discuss selection of specific loadings, estimate the number of cooling tubes, no load current and leakage reactance of core type transformer.
		CO4	Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor.
		CO5	Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications.
6. HIGH VOLTAGE ENGINEERING	18EE56	C01	Explain conduction and breakdown phenomenon in gases, liquid dielectrics and breakdown phenomenon in solid dielectrics.
		CO2	Summarize generation of high voltages and currents
		CO3	Outline measurement techniques for high voltages and currents.
		CO4	Discuss overvoltage phenomenon and insulation coordination in electric power systems.
		CO5	Explain non-destructive testing of materials and electric apparatus, high-voltage testing of electric apparatus

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
7. MICROCONTROLLER LABORATORY	18EEL57	C01	Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions and code conversions.
		CO2	Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
		CO3	Perform interfacing of stepper motor and dc motor for controlling the speed, elevator, LCD, external ADC and temperature control.
		CO4	Generate different waveforms using DAC interface.
		CO5	Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work
8. POWER ELECTRONICS LABORATORY	18EEL58	C01	Obtain static characteristics of semiconductor devices to discuss their performance
		C02	Trigger the SCR by different methods
		C03	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
		C04	Control the speed of a DC motor, universal motor and stepper motors.
		C05	Verify the performance of single phase full bridge inverter connected to resistive load.

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
VI Semester			
1. CONTROL SYSTEMS	18EE61	C01	Analyze and model electrical and mechanical system using analogous.
		C02	Formulate transfer functions using block diagram and signal flow graphs.
		C03	Analyze the stability of control system, ability to determine transient and steady state time response.
		C04	Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
		C05	Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification
2. POWER SYSTEM ANALYSIS -1	18EE62	C01	Show understanding of per unit system, its advantages and computation. Show the concept of one line diagram and its implementation in problems
		C02	Perform short circuit analysis on a synchronous machine and simple power system to select a circuit breaker for the system.
		C03	Evaluate symmetrical components of voltages and currents in un-balanced three phase circuits and Explain the concept of sequence impedance and sequence networks of power system components and power system.
		C04	Analyze three phase synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components.
		C05	Discuss the dynamics of synchronous machine, stability and types of stability and Discuss equal area criterion for the evaluation of stability of a simple system under different fault conditions.

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
3. DIGITAL SIGNAL PROCESSING	18EE63	C01	Apply DFT and IDFT to perform linear filtering techniques on given sequences to determine the output.
		C02	Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
		C03	Design and realize infinite impulse response Butterworth and Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
		C04	Develop a digital IIR filter by direct, cascade, parallel, ladder and FIR filter by direct, cascade and linear phase methods of realization
		C05	Design and realize FIR filters by use of window function and frequency sampling method.
4.COMPUTER AIDED ELECTRICAL DRAWING(Professional)	18EE643	C01	Develop armature winding diagram for DC and AC machines
		C02	Develop a Single Line Diagram of Generating Stations and substation using the standard symbols
		C03	Construct sectional views of core and shell types transformers using the design data
		C04	Construct sectional views of assembled DC and AC machine and their parts using the design data or the sketches

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Course Outcomes

Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
5. INTRODUCTION TO NUCLEAR POWER (PROFESSIONAL ELECTIVE)	18EE641	C01	Explain the fission process in nuclear materials, basic components of nuclear reactors, types of nuclear reactors and their working.
		CO2	List different types of coolants, their features, and cooling of reactors,
		CO3	Summarize loss of cooling accidents in different reactors.
		CO4	Discuss postulated severe accidents in reactors and cooling of reactor during removal of spent fuel.
		CO5	Discuss cooling and disposing the nuclear waste and prospect of fusion energy in the future
6. ELECTRICAL ENGINEERING MATERIALS (Professional Elective)	18EE642	C01	Discuss electrical and electronics materials, their importance, classification and operational requirement
		C02	Discuss conducting, dielectric, insulating and magnetic materials used in engineering, their properties and classification
		C03	Explain the phenomenon superconductivity, super conducting materials and their application in engineering.
		C04	Explain the plastic and its properties and application
7. EMBEDDED SYSTEMS (PROFESSIONAL ELECTIVE)	18EE644	CO1	Apply technological aspects to various interfacing with devices.
		CO2	Elaborate various design tradeoffs.
		CO3	Explain how to interface subsystems with external systems.
		CO4	Apply software aspects and programming concepts to the design of Embedded System.

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Subject	Code	Course Outcomes	Statement
8. OBJECT ORIENTED PROGRAMMING USING C++ (PROFESSIONAL ELECTIVE)	18EE64	C01	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 polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
		CO4	Utilize the concept of inheritance to reduce the length of code and evaluate the usefulness.
		CO5	Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs
		CO6	Utilize I/O operations and file streams in programs
9. CONTROL SYSTEM LABORATORY	18EEL66	C01	Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
		CO2	Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.
		CO3	Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.
		CO4	Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
		CO5	Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability of
10. DIGITAL SIGNAL	18EEL67	C01	Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
		CO2	Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications

PROCESSING LABORATORY		CO3	Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.
		CO4	Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
		CO5	Develop a script files to plot Root locus, Bode plot and Nyquist plot

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Subject	Code	Course Outcomes	Statement
			VII Semester
1. POWER SYSTEM ANALYSIS – 2	18EE71	C01	Formulate network matrices and models for solving load flow problems.
		CO2	Perform steady state power flow analysis of power systems using numerical iterative techniques.
		CO3	Solve issues of economic load dispatch and unit commitment problems.
		CO4	Analyze short circuit faults in power system networks using bus impedance matrix.
		CO5	Apply Point by Point method and Runge Kutta Method to solve Swing Equation.
2. POWER SYSTEM PROTECTION	18EE72	C01	Discuss performance of protective relays, components of protection scheme relay terminology and over current protection characteristics
		CO2	Explain the working of over current protection schemes, directional, distance relays, the effects of arc resistance, power swings and line length and source impedance on performance of distance relays.
		CO3	Evaluate the pilot protection, differential protection schemes, Protection of generators, motors, transformer and Bus Zone Protection.
		CO4	Analyze the principles of circuit interruption in different types of circuit breakers.
		CO5	Describe the construction and operating principle of different types of fuses and protection against over voltages and Gas Insulated Substation (GIS).

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Subject	Code	Course Outcomes	Statement
3. SOLAR AND WIND ENERGY (Professional Elective)	18EE731	C01	Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices.
		CO2	Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system.
		CO3	Describe the process of harnessing solar energy and its applications in heating and cooling.
		CO4	Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection.
		CO5	Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects.
4. SENSORS AND TRANSDUCERS (Professional Elective)	18EE732	C01	Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
		CO2	Explain the working of various transducers and sensors.
		CO3	Outline the recent trends in sensor technology and their selection.
		CO4	Analyze the signal conditioning and signal conditioning equipment.
		CO5	Illustrate different configuration of Data Acquisition System and data conversion.
		CO6	Show knowledge of data transmission and telemetry.
		CO7	Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity.

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Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
5. INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)	18EE733	C01	Explain energy generation by wind power and solar power.
		CO2	Discuss the variation in production capacity at different time scales,the size of individual units, and the flexibility in choosing locations with respect to wind and solar systems.
		CO3	Explain the performance of the system when distributed generation is integrated to the system.
		CO4	Discuss effects of the integration of DG: the increased risk of overload, increased losses, increased risk of overvoltages and increased levels of power quality disturbances.
		CO5	Discuss effects of the integration of DG: incorrect operation of the protection.
		CO6	Discuss the impact the integration of DG on power system stability and operation
6. ADVANCED CONTROL SYSTEMS (Professional Elective)	18EE734	C01	Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems.
		CO2	Develop of state models for linear continuous–time and discrete–time systems.
		CO3	Apply vector and matrix algebra to find the solution of state equations for linear continuous–time and discrete–time systems.
		CO4	Define controllability and observability of a system and test for controllability and observability of a given system.
		CO5	Design pole assignment and state observer using state feedback.
		CO6	Develop the describing function for the nonlinearity present to assess the stability of the system.
		CO7	Develop Lyapunov function for the stability analysis of nonlinear systems.

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
7. REACTIVE POWER CONTROL IN ELECTRIC POWER SYSTEMS (Professional Elective)	18EE735	C01	Distinguish the importance of load compensation in symmetrical as well as unsymmetrical loads
		CO2	Observe various compensation methods in transmission lines.
		CO3	Distinguish demand side reactive power management & user side reactive power management.
		CO4	Construct model for reactive power coordination and effects of harmonics on electrical equipments.
		CO5	Discuss the Reactive Power Planning for the electricity boards.
8. INDUSTRIAL DRIVES AND APPLICATIONS (Professional Elective)	18EE741	C01	Explain the advantages, choice and control of electric drive
		CO2	Explain the dynamics, generating and motoring modes of operation of electric drives
		CO3	Explain the selection of motor power rating to suit industry requirements
		CO4	Analyze the performance & control of DC motor drives using controlled rectifiers
		CO5	Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
9. UTILIZATION OF ELECTRICAL POWER(Professional Elective)	18EE742	C01	Discuss different methods of electric heating & welding.
		CO2	Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process.
		CO3	Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
		CO4	Analyze systems of electric traction, speed time curves and mechanics of train movement.
		CO5	Explain the motors used for electric traction, their control & braking and power supply system used for electric traction
10. PLC and SCADA(Professional Elective)	18EE743	C01	Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions.
		CO2	Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
		CO3	Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
		CO4	Convert relay schematics and narrative descriptions into PLC ladder logic programs.
		CO5	Analyse PLC timer and counter ladder logic programs.
		CO6	Understand about SCADA systems and its subsystems
11. SMART GRID (		C01	Explain the concept of Smart grid enables the ElectricNet and need of smart grid.
		CO2	Outline the benefits and drivers of DC Power delivery system.

Professional Elective)	18EE744	CO3	Summarize the Intelligrid Architecture for the smart grid.
		CO4	Explain the Efficient Electric End-use Technology Alternatives.
		CO5	Discuss Demand side planning and Evaluation

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
TIFICIAL NEURAL NETWORK WITH APPLICATIONS TO POWER SYSTEMS ssional Elective)	18EE745	C01	Develop Neural Network and apply elementary information processing tasks that neural network can solve.
		CO2	Develop Neural Network and apply powerful, useful learning techniques.
		CO3	Develop and Analyze multilayer feed forward network for mapping provided through the first network layer and error back propagation algorithm.
		CO4	Analyze and apply algorithmic type problems to tackle problems for which algorithms are not available.
		CO5	Develop and Analyze supervised/unsupervised, learning modes of Neural Network for different applications
13. POWER SYSTEM SIMULATION LABORATORY	18EEL76	C01	Develop a program in suitable package to assess the performance of medium and long transmission lines.
		CO2	Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator
		CO3	Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
		CO4	Develop programs in suitable package to formulate bus admittance and bus impedance matrices of interconnected power systems.
		CO5	Use suitable package to solve power flow problem for simple power systems.
		CO6	Use suitable package to study unsymmetrical faults at different locations in radial power systems

14. RELAY AND HIGH VOLTAGE LABORATORY	18EEL77	C01	Verify the characteristics of over current, over voltage, under voltage and negative seqence relay both electromagnetic and static type.
		CO2	Verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
		CO3	Show knowledge of protecting generator, motor and feeders.
		CO4	Analyze the spark over characteristics for both uniform and non-uniform configurations using High A and DC voltages.
		CO5	Measure high AC and DC voltages and breakdown strength of transformer oil and Draw electric field and measure the capacitance of different electrode configuration models.
		CO6	Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation
15. PROJECT PHASE – I	18EEP78	C01	Demonstrate a sound technical knowledge of their selected project topic.
		CO2	Undertake problem identification, formulation and solution.
		CO3	Design engineering solutions to complex problems utilizing a systems approach
		CO4	Communicate with engineers and the community at large in written an oral forms.

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Department: Electrical & Electronics Engineering Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
VIII Semester			
1. POWER SYSTEM OPERATION AND CONTROL(Core Course)	18EE81	C01	Describe various levels of controls in power systems, architecture and configuration of SCADA.
		CO2	Develop and analyze mathematical models of Automatic Load Frequency Control.
		CO3	Develop mathematical model of Automatic Generation Control in Interconnected Power system
		CO4	Discuss the Control of Voltage , Reactive Power and Voltage collapse
		CO5	Explain security, contingency analysis, state estimation of power systems.
2. FACTS AND HVDC TRANSMISSION (Professional Elective)	18EE821	C01	Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.
		CO2	Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology
		CO3	Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
		CO4	Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
		CO5	Explain advantages of HVDC power transmission, overview and organization of HVDC system.
		CO6	Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
		CO7	Explain converter control for HVDC systems, commutation failure, control

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Subject	Code	Course Outcomes	Statement
3. ELECTRICAL ESTMATION AND COSTING (Professional Elective)	18EE822	C01	Explain general principles of estimation and major applicable I.E. rules
		CO2	Discuss wiring methods, cables used, design of lighting points and sub-circuits, internal wiring, wiring accessories and fittings, fuses and types.
		CO3	Discuss estimation of service mains and power circuits.
		CO4	Discuss estimation of overhead transmission and distribution system its components.
		CO5	Discuss types of substation, main components and estimation of substation.
4. ELECTRIC VEHICLE TECHNOLOGIES (Professional Elective)	18EE823	C01	Explain the working of electric vehicles and recent trends.
		CO2	Analyze different power converter topology used for electric vehicle application.
		CO3	Develop the electric propulsion unit and its control for application of electric vehicles.
		CO4	Design converters for battery charging and explain transformer less topology
5. POWER SYSTES PLANNING (Professional Elective)	18EE824	C01	Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting.
		CO2	Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions
		CO3	Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.
		CO4	Discuss principles of distribution planning, supply rules, network development and the system studies
		C05	Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies

		CO6	Discuss planning and implementation of electric –utility activities, market principles and the norms framed

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
6. ELECTRICAL POWER QUALITY (Professional Elective)	18EE825	C01	Define Power quality; evaluate power quality procedures and standards.
		CO2	Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.
		CO3	Identify various sources of harmonics, explain effects of harmonic distortion.
		CO4	Evaluate harmonic distortion, control harmonic distortion.
		CO5	Estimate power quality in distribution planning. Identify power quality issues in utility system.
7. PROJECT WORK PHASE-2	18EEP83	C01	Describe the project and be able to defend it.
		CO2	Develop critical thinking and problem solving skills.
		CO3	Learn to use modern tools and techniques.
		CO4	Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
		C05	Develop skills to work in a team to achieve common goal.
		CO6	Develop skills of project management and finance.
		CO7	Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
		CO8	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
8. TECHNICAL SEMINAR	18EES84	C01	Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study
		CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology.
		CO3	Develop written and oral communication skills.
		C04	Explore concepts in larger diverse social and academic contexts.
		CO5	Apply principles of ethics and respect in interaction with others.
		CO6	Develop the skills to enable life-long learning.
9. INTERNSHIP /PROFESSIONAL PRACTICE	18EEI85	CO1	Gain practical experience within industry in which the internship is done.
		CO2	Acquire knowledge of the industry in which the internship is done.
		CO3	Apply knowledge and skills learned to classroom work.
		CO4	Develop a greater understanding about career options while more clearly defining personal career goals.
		CO5	Experience the activities and functions of professionals.

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Department: Electrical & Electronics Engineering Program: M.Tech in Microelectronics & Control Systems

Subject	Code	Course Outcomes	Statement
I Semester			
1. MATHEMATICAL METHODS IN CONTROL	18EEE11	C01	Understand the fundamentals of vector space and bases in reference to transformations.
		CO2	Solve system of linear equations using direct and iterative methods.
		CO3	Use the idea of Eigen values and Eigen vectors for the application of SVD.
		CO4	Describe the basic notions of discrete and continuous probability distributions.
		CO5	Find out responses of linear systems using statistical and probability tools
. ANALYSIS OF LINEAR SYSTEMS (Professional Core Course)	18EMS12	C01	Provide a state variable models for Continuous and discrete time systems.
		CO2	Solve the State equations to provide a solution and analyze them in both continuous and discrete time domains.
		CO3	Assess the controllability and observability of state space models developed.
		CO4	Apply the concepts of state feedback techniques in controlling the systems
3.VLSI DESIGN (Core Course) (Elective- 1)	18EMS13	C01	Explain in detail the basic processing details and the characteristics of MOS transistors.
		CO2	Optimize combinational circuits for lower delay, discuss alternate CMOS circuit families.
		CO3	Design both static and dynamic sequential circuits.
		CO4	Design and analyze CMOS power and differential amplifiers.
		CO5	Design and analyze the current mirrors as both bias elements and signal processing components and CMOS Op Amps

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Course Outcomes

Department: Electrical & Electronics Engineering Program: M.Tech in Microelectronics & Control Systems

Subject	Code	Course Outcomes	Statement
4. EMBEDDED SYSTEMS (Professional Core Course)	18EMS14	C01	Describe embedded system, recognize the classification of embedded systems and design process in embedded system.
		CO2	Describe processor architecture and memory organization.
		CO3	Communicate with processor using serial and parallel devices with the processor and explain interrupt services mechanism
5. INDUSTRIAL CONTROL TECHNOLOGY - 1 (Core Course)	18EMS15	C01	Differentiate between different types of industrial control systems; embedded control systems, real time control systems and distributed control systems.
		CO2	Explain three types of industrial control engineering; process control, motion control and production automation
		CO3	Explain the need of sensors and actuators used in industrial control systems.
		CO4	Explain the working of transducers and valves used in industrial control systems.
		CO5	Explain the need of microelectronic components in industrial control systems
		CO6	Explain the use of multi-core microprocessors in industrial control systems.
		CO7	Describe programmable peripheral I/O ports, programmable interrupt controllers, programmable timers, and CMOS and DMA controllers, the application specific integrated circuits used in industrial control systems

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Subject	Code	Course Outcomes	Statement
 6.MICROELECTRONICS AND CONTROL LABORATORY - 1	18EMSL16	C01	Use MATLAB/Scilab to simulate a second order system to study the output and perform state estimation by pole placement method.
		CO2	Analyze the stability of the systems in time and frequency domains
		CO3	Design and verify the frequency response of different compensators.
		CO4	Evaluate the performance of different controllers in enhancing the system performance
		CO5	Verify the sampling theorem, design and analyze the FIR filter

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Subject	Code	Course Outcomes	Statement
II Semester			
1. OPTIMAL CONTROL THEORY (Professional Core Course)	18EMS21	C01	Develop mathematical models for systems using state variables.
		CO2	Formulate an optimal control problem with constraints.
		CO3	Discuss performance of and performance measures used in control problems.
		CO4	Evaluate control function that minimizes the performance measure
		CO 5	Explain dynamic programming applicable to a class of control problems.
		CO6	Explain basic ideas of the calculus of variations.
		CO7	Explain application of variational method to optimal control problems.
2. HIGH SPEED VLSI DESIGN (Core Course)	18EMS22	C01	Discuss basic techniques and advanced concepts regarding wave propagation in an interconnection
		CO2	Discuss multilevel, multilayer, and multipath interconnections employed in VLSI applications.
		CO3	Discuss copper interconnections and their fabrication techniques.
		CO4	Explain numerical techniques that can be used to determine the interconnection resistances, capacitances, and inductances on a high-density VLSI chip.
		CO5	Calculate the propagation delays in the single and multilevel parallel and crossing interconnections using numerical algorithms.

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Course Outcomes

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Subject	Code	Course Outcomes	Statement
		CO6	Explain the crosstalk effects in the single and multilevel parallel and crossing interconnections and Develop a model of very high speed VLSI circuits for the crosstalk analysis
3.CAD TOOLS FOR VLSI DESIGN (Core Course)	18ems23	C01	Discuss design automation field including the VLSI design cycle, physical design cycle, design styles and packaging styles.
		CO2	Discuss the fabrication process for VLSI devices, process innovations, design rules and costs involved in fabrication process.
		CO3	Explain data structures for layout and algorithms involved in the physical design.
		CO4	Explain graphs used to model problems in VLSI design and algorithms for the graphs.
		CO5	Explain partitioning, partitioning algorithms, their classification and the factors that must be considered in partitioning the VLSI circuits.
		Co6	Discuss algorithms for floorplanning and pin assignment and techniques for placement.
		Co7	Discuss global routing, routing algorithms and routing of multi-terminal nets
4.NONLINEAR SYSTEMS (Elective Course)	18EMS241	C01	Identify the nonlinearity present in a system and explain the behavior of nonlinear system.
		CO2	Evaluate the describing function for the nonlinearity present in the system and assess the performance of the system using it.
		CO3	Analyze the nonlinear system using the Phase Plane Analysis.
		CO4	Define the stability of a system and assess the stability using Lyapunov Stability method.
		CO5	Assess the stability of nonlinear system using circle criterion and Popov's stability criterion and apply sliding mode control to the linear and nonlinear systems.

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Subject	Code	Course Outcomes	Statement
5.PROCESS CONTROL AND INSTRUMENTATION (Professional Elective Course)	18EMS242	C01	Explain the concepts of process control, the elements in the building blocks, the units for physical measurements, the use of basic electrical and analog electronic circuits.
		CO2	Explain the use of digital concepts to their applications, measurement of pressure and level in process control.
		CO3	Explain the use of instruments and sensors for measurement of flow of fluids, temperature and heat, position, force and light.
		CO4	Explain use of Humidity measuring devices, regulators, valves, motors and the use of PLC for sequential logic control and continuous control.
		CO5	Discuss various methods of analog and digital signal conditioning, process control, the terminology used, and the various methods of implementation of the controller functions and the documentation for alarm and trip systems
6. CONTROL SYSTEMS FOR HVAC (Professional Elective Course)	18EMS243	C01	Discuss the elements of a control system, the basic types of control action, and the energy sources used for controls and various types of control elements.
		CO2	Discuss formation of combinations control elements used for control of HVAC.
		CO3	Discuss formation and analysis of complete control system for specific application.
		CO4	Explain and solve the electrical problems inherent in the design of control diagrams, stability of and the digital control of HVAC control systems
		CO5	Use Psychrometric chart to control design, to study central plant pumping and distribution systems, existing HVAC systems and the tuning of HVAC control loops
7. ROBUST CONTROL THEORY (Professional Elective Course)	18EMS252	C01	Explain properties of linear time-invariant systems including controllability, observability, stability, stabilizability, and detectability.
		CO2	Synthesize linear time-invariant systems by pole placement and observer design.
		CO3	Discuss optimal control and the Kalman filter.
		CO4	Explain H_∞ and H_2 robust control design.
		CO5	Use optimal control approach to robust control design of linear and nonlinear systems

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Course Outcomes

Department: Electrical & Electronics Engineering Program: M.Tech in Microelectronics & Control Systems

Subject	Code	Course Outcomes	Statement
8. DIGITAL SYSTEM DESIGNWITH VHDL(Professional Elective Course)	18EMS253	C01	Discuss the design digital systems using VHDL, the technology of CMO integrated circuits programmable logic, engineering problems of noise margins and fan-out.
		CO2	Explain the principles of Boolean algebra, combinational logic design, timing, hazards and basic number systems.
		CO3	Model combinational logic and synchronous sequential logic systems in VHDL.
		CO4	Develop models for sequential logic blocks and complex sequential systems in VHDL.
		CO5	Describes idea of event-driven simulation and specific features of a VHDL simulator.
		CO6	Discuss synthesis tool for RTL synthesis, fault modeling and design-for-test principles.
		CO7	Design asynchronous sequential circuits.
9.MICROELECTRONICS ANDCONTROL LABORATORY - 2	18EMSL26	C01	Write Verilog code to verify the functionality of CMOS inverter and buffer.
		CO2	Write Verilog code to verify the functionality of Basic gates, transmission gates and universal shift register.
		CO3	Write Verilog codes for verifying the functionality of 3 input Boolean expression using 8:1 multiplexer.
		CO4	Determine critical input and output voltages of CMOS inverter and noise margins of CMOS inverter.
		CO5	Use Verilog code to design a 16 bit parallel adder, flip flops.
		CO6	Design MOD -16 synchronous counter using synchronous set AND Design MOD -16 asynchronous counter using T – flip flop
		CO6	Assess robust control of parametric systems using the Kharitonov theorem.

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Subject	Code	Course Outcomes	Statement
III Semester			
1. INDUSTRIAL CONTROL TECHNOLOGY - 2 (Professional Core Course)	18EMS31	C01	Explain the industrial intelligent controllers necessary for both industrial production control and industrial process control.
		CO2	Explain industrial process controllers, including PID controllers, batch process controllers and servo motion controllers.
		CO3	Explain industrial motherboards, industrial personal computers, computer peripherals and accessories.
		CO4	Discuss the layer model, architectures, components, functions.
		CO5	Discuss applications of several primary industrial control networks: CAN, SCADA, Ethernet, DeviceNet, LAN, and other enterprise networks.
		CO6	Explain networking devices, including networking hubs, switches, routers, bridges, gateways, repeaters and key techniques used in these networking devices.
2. INDUSTRIAL CONTROL - SOFTWARE AND ROUTINES (Professional Elective Course)	18EMS321	C01	Explain the Microprocessor boot code, one of the key component of Embedded software for control purpose.
		CO2	Explain in detail the real-time operating systems, which are the platforms needed for a control system to satisfy real-time criteria.
		CO3	Explain the distributed operating system, the necessary platform for distributed control systems.
		CO4	Explain industrial system operation routines, including the self-test routines at power-on and power-down, installation and configuration routines, diagnostic routines, and calibration routines.
		CO5	Discuss the identification principles and techniques for model-based control.
3. DIGITAL SYSTEM DESIGN WITH FPGA(Professional	18EMS322	C01	Discuss programmable logic devices that are available today, their architectures, their use within electronic system design and the terminology used.
		CO2	Discuss different programming languages that are used to develop digital designs for implementation in either a processor or in programmable logic.

Elective Course)		CO3	Explain designing of electronic systems, the types of solutions that can be developed, and the decisions that will need to be made in order to identify the right technology choice for the design implementation.
		CO4	Describe digital circuit and system designs in an ASCII text-based format using VHDL.
		CO5	Test the electronic systems for failure mechanisms in hardware and software.
		CO6	Interface programmable logic devices to the analogue world.
		CO7	Explain with a case study the necessity to develop programmable logic–based designs at a high level of abstraction using behavioral descriptions of the system functionality

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Subject	Code	Course Outcomes	Statement
4. REAL TIME APPROACH TO PROCESS CONTROL (Elective Course)	18EMS323	C01	Discuss process control and the instruments used in the process control
		CO2	Explain basics of single input – single output systems, Feedback control, elements of control loops, system dynamics including capacitance and dead time, and system modeling.
		CO3	Discuss various PID control modes.
		CO4	Understand control-loop design and tuning.
		CO5	Explain advanced control configurations including feed-forward, cascade, and override control.
		CO6	Explain thumb rules for designing and tuning the more common control loops found in industry and Control distillation columns.
5.MICROELECTRONIC FABRICATION (Professional Elective Course)	18EMS331	C01	Explain the basic processes of fabrication of monolithic integrated –circuit and basic steps in lithographic process.
		CO2	Discuss the theory of oxide growth, oxide growth processes, factors affecting the growth rate, impurity redistribution during oxidation.
		CO3	Explain techniques for selective oxidation of silicon, methods to determine the thickness of oxide film and process simulation.
		CO4	Explain theoretical and practical aspects of diffusion process and diffusion systems, the characterization of diffused layer sheet resistance and determination of junction depth.
		CO5	Discuss ion implementation technology, mathematical modelling of the impurity distributions, and the removal of crystal damage due to implantation process.
		Co6	Explain deposition processes and interconnections.
		Co7	Discuss packaging and associated processes with integrated circuits and MOS process integration.

6.LOW POWER VLSI DESIGN (Professional Elective Course)	18EMS332	C01	Explain the needs for low power VLSI, the charging and discharging capacitances, short circuit and leakage currents in CMOS circuits.
		CO2	Explain basic principles of low power design.
		CO3	Simulate VLSI chips using modelling techniques to estimate power dissipation.
		CO4	Perform probabilistic power analysis for VLSI circuits.
		CO5	Discuss the optimization and trade-off techniques that involve power dissipation for digital circuits.
		CO6	Explain gate reorganization, signal gating, logic encoding and low power techniques for reduction in power consumption in VLSI circuits.
		CO7	Explain power and performance management switching activity reduction and the architecture for reduction in the power consumption of VLSI circuits.
		Co8	Explain the advanced techniques in the design of VLSI circuits; adiabatic computation, pass transistor logic synthesis and asynchronous circuits.
7.NANOTECHNOLOGY FOR MICROELECTRONICS AND OPTOELECTRONICS (Professional Elective Course)	418EMS333	C01	Explain the present trends in microelectronic and optoelectronic devices, solid state and semiconductor physics and define nanostructures.
		CO2	Explain behavior of electrons in nanostructures and the transport and optical properties of nanostructures.
		CO3	Discuss the transport properties of electrons in magnetic field and integral and fractional quantum Hall effect.
		CO4	Discuss advanced semiconductor devices based on nanostructures and advanced optoelectronic and photonic devices based on quantum heterostructures

8. PROJECT WORK PHASE – 1	18EMS34	C01	Demonstrate a sound technical knowledge of their selected project topic.
		CO2	Undertake problem identification, formulation and solution
		CO3	Design engineering solutions to complex problems utilising a systems approach.
		CO4	Communicate with engineers and the community at large in written an oral forms.
		CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer
9. INTERNSHIP / PROFESSIONAL PRACTICE	418EMSI35	C01	Gain practical experience within industry in which the internship is done.
		CO2	Acquire knowledge of the industry in which the internship is done.
		CO3	Apply knowledge and skills learned to classroom work.
		CO4	Develop a greater understanding about career options while more clearly defining personal career goals.
		CO5	Experience the activities and functions of professionals.
		C06	Develop and refine oral and written communication skills.
		C07	Identify areas for future knowledge and skill development.
		CO8	Expand intellectual capacity, credibility, judgment, intuition. Acquire the knowledge of administration, marketing, finance and economics

Subject	Code	Course Outcomes	Statement
III Semester			
1. TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES	21MAT31	C01	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
		CO2	Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
		CO3	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
		CO4	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
		CO5	Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
2. Analog Electronic circuits and Op-Amps	21EE32	C01	Obtain the output characteristics of clipper and clamper circuits, and design and compare biasing circuits for transistor amplifiers & explain the transistor switching.
		CO2	Explain the concept of feedback, its types and design of feedback circuits
		CO3	Design and analyze the power amplifier circuits and oscillators for different frequencies.
		CO4	Design and analysis of FET and MOSFET amplifiers
		CO5	Demonstrate the application of Op-amps.

3. ELECTRIC CIRCUIT ANALYSIS	21EE33	C01	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 usingtransformations.
		CO2	Solve complex electric circuits using network theorems.
		CO3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and theirevaluation.
		CO4	Synthesize typical waveforms using Laplace transformation.
		CO5	Solve unbalanced three phase systems and also evaluate the performance of two port networks
4. Transformers and Generators	21EE34	C01	Understand the construction and operation of 1-phase, 3-Phase transformers and Autotransformer.
		CO2	Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation.
		CO3	Understand the construction and working of AC and DC Generators.
		CO4	Analyze the performance of the AC Generators on infinite bus and parallel operation.
		CO5	Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods
5. Electrical Machines Laboratory-1	21EEL35	C01	Evaluate the performance of transformers from the test data obtained.
		CO2	Connect and operate two single phase transformers of different KVA rating in parallel.
		CO3	Connect single phase transformers for three phase operation and phase conversion.
		CO4	Compute 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 and assess the performance of synchronous generator connected to infinite bus.

6.Social Connect and Responsibility	21UH36	C01	To appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity.
		CO2	To develop holistic vision of life by understanding human reality and rest of existence.
		CO3	Understanding the harmony in family and society
		CO4	Understanding the holistic perception of harmony in nature or existence.
		CO5	Analyze the implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with nature.

B.L.D.E.Association's

Vachana Pitamaha Dr. P.G. Halakatti College of Engineering & Technology, Vijayapur.

Course Outcomes

Department: Electrical & Electronics Engineering (2021 Scheme) Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
IV Semester			
1. Complex analysis , probability and statical methods	21MAT41	C01	To solve ordinary differential equation using **Laplace** Transform
		CO2	Demonstrate Fourier series to study the behavior of periodic and their applications
		CO3	To use Fourier Transform to analyze problems solving continuous time signals and to apply Z-transform to solve difference equations
		CO4	To solve mathematical models represented by initial or boundary value problems solving partial differential equations
		CO5	Determine the extremes of functional using calculus of variations and solve problems arising in dynamics of rigid bodies
2. Digital System Design	21EE42	C01	Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques.
		CO2	Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digitalcombinational control circuits.
		CO3	Design flip flops as sequential control circuits
		CO4	Design counters, shift registers as sequential control circuits
		CO5	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits Explain the functioning of Memories.

3. Microcontrollers	21EE43	C01	Outline the 8051 architecture, registers, internal memory organization, addressing modes.
		CO2	Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
		CO3	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
		CO4	Summarize the basics of serial communication and interrupts, also develop 8051 programs for serialdata communication and interrupt programming.
		CO5	Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control
4. Electric Motors	21EE44	C01	Explain the construction, operation, classification, performance characteristics, applications and determine the losses and efficiency of DC Motor.
		CO2	Describe the testing methods of DC machines and explain the construction and operation of 3-Φ induction motors.
		CO3	Illustrate the Performance of Three-Phase Induction Motor.
		CO4	Describe the Starting and Speed Control of 3-Φ induction motors, construction, operation, classification, performance characteristics, applications of 1-Φ induction motor.
		CO5	Explain the construction, operation, classification, performance characteristics, applications of synchronous motors and Other motors.
5. Biology and Engineering	21BE45	C01	Apart from conventional lecture methods various types of innovative teaching techniques through videos, and animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills
		CO2	Environmental awareness program for the in house campus
		CO3	Encourage collaborative (Group Learning) Learning in the class
		CO4	Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

6.Universal Human Values-II:Undersatanding Harmony and ethical human conduct	21UHV49	C01	To appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity.
		CO2	To develop holistic vision of life by understanding human reality and rest of existence.
		CO3	Understanding the harmony in family and society
		CO4	Understanding the holistic perception of harmony in nature or existence.
		CO5	Analyze the implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with nature.
7. Electrical Machines-2 Lab.	22EEL46	C01	Evaluate testing of DC machines to determine their characteristics and also to control the speed of DC motor
		CO2	Analyze and pre-determine the performance characteristics of DC machines by conducting suitable tests.
		CO3	Experiment to perform load test on single phase and three phase induction motor to assess its performance.
		CO4	Experiment to conduct test on induction motor to pre-determine the performance characteristics.
		CO5	Estimate the performance of synchronous motor to draw the performance curves.

B.L.D.E.Association's

Vachana Pitamaha Dr. P.G. Halakatti College of Engineering & Technology, Vijayapur.

Course Outcomes

Department: Electrical & Electronics Engineering (2022 Scheme) Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
I/II Semester			
1. Renewable Energy Sources	BETCK105E/BETCKE105	C01	Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
		CO2	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.
		CO3	Understand the conversion principles of wind and tidal energy
		CO4	Understand the concept of biomass energy resources and green energy.
		CO5	Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy.
2. Introduction to Electrical Engineering	BESCK104B	C01	Understand the concepts of various energy sources and electric circuits.
		CO2	Apply the basic electrical laws to solve circuits
		CO3	Discuss the construction and operation of various electrical machines.
		CO4	Identify suitable electrical machine for practical implementation
		CO5	Explain the concepts of electric power transmission and distribution, electricity billing, circuit protective devices and personal safety measures

B.L.D.E.Association's

Vachana Pitamaha Dr. P.G. Halakatti College of Engineering & Technology, Vijayapur.

Course Outcomes

Department: Electrical & Electronics Engineering (2022 Scheme) Program: BE in Electrical & Electronics Engineering

Subject	Code	Course Outcomes	Statement
I/II Semester			
1. Introduction to C programming	BESCK104E/ 204E	C01	Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts.
		CO2	Apply the programming concepts of c language to solve the real world problem.
		CO3	Explore user defined data structures like arrays in implementing solutions to problems like searching and sorting.
		CO4	Explore user defined data structures like structures like unions and pointers in implementing solutions.
		CO5	Design and develop solutions to problems using modular programming constructs using functions.
2 Introduction to Python programming	BPLCK10 5B	C01	Demonstrate proficiency in handling loops and creation of functions.
		CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.
		CO3	Develop programs for string processing and file organization
		CO4	Explore the classes, objects, function and methods.
		CO5	Interpret the concepts of Object-Oriented Programming as used in Python.
3 .Elements of Electrical Engineering	BEEE103	C01	Understand the concepts of DC circuits and Electromagnetism.
		CO2	Understand the concepts of single phase and Three phase AC circuits.
		CO3	Apply the basic Electrical laws to solve circuits.
		CO4	Understand the concepts of measurements and measuring Instruments
		CO5	Explain the concepts of domestic wiring, electricity billing, circuit protective devices and personal safety measures.