ECE131:BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L:3 T:1 P:0 Credits:4

Course Outcomes: Through this course students should be able to

CO1 :: discuss DC circuits and conceive approaches in designing of DC circuits

CO2 :: discuss AC Circuits and conceive approaches in designing of AC circuits

CO3 :: discuss the significance of operation amplifiers and its applications as filters

CO4 :: discuss the significance of embedded system and its application in industry

CO5 :: analyze the characteristics and perceive working principles of transformers and motors

CO6 :: analyze the importance of laplace transforms and its applications in circuit analysis

Unit I

Fundamentals of D.C. circuits : use of scientific calculators, the circuit abstraction - power of abstraction, lumped circuit abstraction, lumped matter discipline, limitations of the lumped circuit abstraction, practical two-terminal elements, ideal two-terminal elements, resistive networks-current division rule, voltage division rule, star–delta transformation, Kirchhoff's laws, basic method of circuit analysis, intuitive method of circuit analysis- series and parallel simplification, ideal and non-ideal energy sources, dependent sources and the control concept, network theorems-node method, loop method, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem

Unit II

Fundamentals of A.C. circuits : alternating current and voltage, concept of notations (i, v, I, V), three-phase circuits- numbering and interconnection (delta or mesh connection) of three phases, relations in line and phase voltages and currents in star and delta, series and parallel connections, sinusoidal inputs, step inputs, impulse inputs, use of Laplace transform in circuit analysis, first-order transients in linear electrical networks - analysis of RC circuits, analysis of RL circuits, impedance and frequency response - series RL circuit, RC circuit, frequency response of capacitors, inductors and resistors, power and energy in impedance, pure resistance, pure reactance, frequency response for resonant systems, series RLC, reactive power and power calculations, methods of power factor correction

Unit III

Fundamentals of electrical machines : Fleming's left hand and right hand rule, mutual inductance and mutual coupling phenomena in transformer, transformer – working, concept of turns ratio and applications, transformer on DC, auto-transformer, instrument transformers, dc machines- working principles, classification, starting, speed control and applications of dc motors, working principle of single and three phase induction motors, applications of ac motors

Unit IV

Fundamentals of semiconductor devices : digital abstraction- voltage levels and the static discipline, boolean logic, combinational gates, fan-in and fan-out of gates, noise margin in details, diodes- semiconductor diode characteristics, analysis of diode circuits, clamping circuit, testing of diodes, basic operation and testing of BJT, MOSFET- representation and characteristics, handling of integrated circuits-ESD phenomena

Unit V

Fundamentals of filters and operational amplifier : filter examples- band-pass filter, low-pass filter, high-pass filter, operational amplifier abstraction- device properties of the operational amplifier, simple op amp circuits – virtual ground concept, inverting and non-inverting op-amp, op-amp as an adder and subtractor, op-amp RC circuits – op-amp integrator, op-amp differentiator, active filter, op-amp as a comparator and its application in anti-lock braking systems

Unit VI

Fundamentals of embedded system and its application in industrial processes : comparison of microprocessor and micro-controller, types of processors : SOC, ASIC, DSP and FPGA, introduction to embedded system, examples of real-time applications of embedded system : GPOS and RTOS, cyber physical world, role of IOT and cloud computing in condition monitoring of plant processes

Text Books:

1. FOUNDATIONS OF ANALOG AND DIGITAL ELECTRONIC CIRCUITS by ANANT AGARWAL AND JEFFREY H.LANG, MORGAN KAUFMANN

References:

1. INTRODUCTION TO ELECTRONICS by EARL GATES, DELMAR - CENGAGE LEARNING

2. BASIC ELECTRICAL ENGINEERING by D.C. KULSHRESTHA, MC GRAW HILL

3. INTRODUCTION TO EMBEDDED SYSTEMS by K. V. SHIBU, MC GRAW HILL