| Unit No. | Topics covered |
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| **UNIT-I** | **Electrical machines and Drives** |
| | Single-phase transformer: equivalent circuit, phasor diagram, regulation and efficiency; Three-phase transformers: parallel operation; DC machines: types, characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, equivalent circuit, starting and speed control; single-phase induction motors; Synchronous machines: types, performance and characteristics, regulation and parallel operation of synchronous generator, starting of synchronous motors. |
| | DC motor characteristics, Chopper fed DC drive, Multi-quadrant DC drive, Closed-loop control of DC Drive, Induction motor characteristics, Scalar control or constant V/f control of induction motor, Control of slip ring induction motor |
| **UNIT-II** | **Power electronics** |
| | Simple diode circuits, Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications. Combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters, Boolean algebra, Sequential Logic, and Its Applications: Storage elements: latches & flip flops, Shift Registers, Ripple Counters, Synchronous Counters. Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Single and three-phase configuration of uncontrolled rectifiers; Voltage and Current commutated Thyristor based converters; Bidirectional ac to dc voltage source converters; Magnitude and Phase of line current harmonics for uncontrolled and thyristor based converters; Single-phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation. |
| **UNIT-III** | **Network Theory, Control systems and Microcontrollers** |
| | Network Theorems: KCL, KVL, Node and Mesh analysis, star-delta transformation; Superposition, Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations: Initial conditions – Classical method and Laplace transforms methods of solutions. Transient response of the above circuits for different inputs such as step, ramp, pulse and impulse by using Laplace transforms method, resonance, two port networks, balanced three phase circuits, complex power and power factor in ac circuits |
| | Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems. Introduction to 8051 Microcontrollers Architecture, Features, Pin layout, addressing modes, accessing memory using various addressing modes. Introduction to PIC Microcontroller, CPU registers, Pin |

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| | diagram, Instruction pipelining, CPU registers, Addressing modes. Application of PIC Microcontrollers. |
| **UNIT-IV** | **Measurement, Instrumentation and power system protection** |
| | Errors in Measurement & Measurement standards, Measurement of Resistance, Inductance and Capacitance, AC bridges for inductance and capacitance measurement. Electronic Measurements: Electronic instruments: Voltmeter, Multimeter, Wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Storage oscilloscope, Spectrum & Wave analyzer, Digital counter, frequency meter, and Digital Voltmeter. *Instrumentation*: Transducers & sensors, classification & selection of sensors, Measurement physical quantities, |
| | Requirement of a circuit breakers, difference between an isolator and circuit breaker, principle of operation of a circuit breaker, Various terms, DC circuit breaking, AC circuit breaking, current chopping, capacitance switching, resistance switching, Rating of Circuit breakers, SF6 breakers, vacuum circuit breakers, lightening arrestor. Non-directional and directional over current relays, IDMT and Directional characteristics, Differential relay, Buchholz relay, Merz price protection. Transformer protection scheme and Transmission line protection, protection of generators and transmission lines. |
| **UNIT-V** | **Power system analysis and power quality** |
| | Power generation by renewable & non-renewable energy sources. transmission, and distribution. Element of AC distribution, types, Transmission line parameters and their evaluations, types of overhead conductors with calculations of inductance and capacitance. Models of short, medium and long transmission lines, skin, proximity, and Ferranti effect. Classification of cables, insulation resistance, grading of cables. Per unit system, Reactance Diagram, Formation of Y-bus and Z-bus, Load flow problem, power flow equations, load flow solution using Gauss Seidal and Newton Raphson methods, Symmetrical fault, unbalanced faults (Single line to ground fault, Line to line and double line to ground), Concepts of types of stability limits, steady state stability analysis, transient stability analysis, Swing equation and its solution by point-by-point method, Equal area criterion, critical clearing angle and improvement of transient stability.<br>Power quality terms, Power Quality evaluation procedure, Importance of Power Quality, Symptoms of poor power quality, Power quality terms- its sources, effects and mitigation techniques, Power quality measuring devices, its selection, International standards related to power quality, power quality monitoring. |

| Text Books/References: | |
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| 1. | V K Mehta – "Principles of Electronics" S. Chand Publications |
| 2. | B L Theraja – "Electrical Technology", Vol I & III,S. Chand Publications |
| 3. | B.Ram "Fundamentals of Microprocessors and Microcomputers", edition 1995 Dhanapat Rai Publications |
| 4. | Ajay Deshmukh, 'Microcontrollers Theory and Applications', TATA McGraw Hill. |
| 5. | Sawhney A. K., *Electrical Machine Design*, Dhanpath Rai & Co. (P) Ltd Sixth Edition: 2006 |
| 6. | M.G. Say – Theory and Performance and Design of A.C. Machines, 3rd Edition, ELBS London. |
| 7. | M. H. Rashid – "Power Electronics" 2009 Edition, Pearson publication |

| 8. | Ned Mohan, Undeland, WP Robins - "Power Electronics" 3rd edition, John Wiley & Sons International Student edition |
|---|---|
| 9. | M. E. Van Valkenburg , "Network Analysis", PHI / Pearson Education,3rdEdition. Reprint 2002. |
| 10. | Roy Choudhury, "Networks and Systems", 2nd edition, 2006 re-print, New Age International Publications |
| 11 | Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill,2003. |
| 12 | Power Quality by C.Sankaran, CRC Publication,2005. |

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