

Electrical Engineering Department

Semester - VIII

Teaching Scheme

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
EE 4006	Instrumentation and Measurement	3	0	3	5
EE 400x	Open Elective-II	3	0	0	4
EE 400x	Dept. Elective-III/Open Elective-III	3	0	0	4
EE 4502	B.Tech. Project II	3	0	0	4
HS 4002	Engineering Ethics	3	0	0	4
	Total	15	0	3	21

Open Elective II

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
EE 4007	Switchgear and Protection	3	0	0	4

Open Elective III

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
EE 4009	Deregulated Power System	3	0	0	4
EE 4010	Technology Innovation and Intellectual property	3	0	0	4
EE 4011	VLSI Design	3	0	0	4

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I	Course Code	EE 4006			
II	Course Title	Instrumentation and Measurement			
III	Credit Structure	L	T	P	C
		3	0	3	5
IV	Prerequisite (if any for the student)	Nil			
V	Course Content	<p>Accuracy and Precision, Sensitivity, Linearity, Resolution, Hysteresis, Loading Effect. , Measurement of voltage, current, power, energy and power factor, DC and AC Ammeter, DC Voltmeter- Chopper type and solid-state, AC voltmeter using Rectifier, Average, RMS, Peak Responding voltmeters, Multi-meter, Power meter, Bolometer and Calorimeter.</p> <p>Different parts of CRO, Block diagram, Electrostatic focusing, Electrostatic deflection, Post deflection acceleration, Screen for CRTs, Graticules, Vertical and Horizontal deflection system, Time base circuit, Oscilloscope Probes, Applications of CRO, Special purpose CROs- Multi input, Dual trace, Dual beam, Sampling, Storage (Analog and Digital), Oscilloscope.</p> <p>Maxwells bridge (Inductance and Inductance-Capacitance), Hays bridge, Schering bridge (High voltage and Relative permittivity), Wein bridge, Wagner earth detector, Impedance measurement by Q-meter. Non-Electrical Quantities (Transducer): Classification of Transducers, Strain gauge, Displacement Transducer- Linear Variable Differential Transformer (LVDT) and Rotary Variable Differential Transformer (RVDT), Temperature Transducer- Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezo-electric transducer, Optical Transducer- Photo emissive, Photo conductive, Photo voltaic, Photo-diode, Photo Transistor, Nuclear Radiation Detector.</p> <p>Signal and Function Generators, Sweep Frequency Generator, Pulse and Square Wave Generator, Beat Frequency Oscillator, Digital display system and indicators, Classification of Displays, Display devices, Light Emitting diodes (LED), Liquid Crystal Display (LCD).</p> <p>Advantages of Digital Instrument over Analog Instrument, Digital-to-analog conversion (DAC) - Variable resistive type, R-2R ladder Type, Binary ladder, Weighted converter using Op-amp and transistor, Practical DAC. Analog-to-digital Conversion (ADC) Ramp Technique, Dual Slope Integrating Type, Integrating Type (voltage to frequency), Successive Approximations, digital voltmeters and multi-meters, Resolution and sensitivity of digital meter, PLC structure, principle of operation, response time and application.</p>			
VI	Text/Reference Books	<ol style="list-style-type: none"> 1. H. S. Kalsi: Electronics Instrumentation, TMH. 2. K. Sawhney: Instrumentation and Measurements, Dhanpat Rai and Co. 3. Helfric and Cooper: Modern Electronic Instrumentation and Measurement Techniques; Pearson. 			

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I	Course Code	EE 4007			
II	Course Title	Switchgear and Protection			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Power Systems			
V	Course Content	<p>Introduction to Protection System: Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection. Relays: Electromagnetic, design of electromagnetic relay. Circuit Breaking: Properties of arc, circuit breaker ratings, classification, testing station and equipments. Relay Characteristics: Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay, directional relay, distance relays, differential relay. Protection of Transmission Line: Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto re-closing. Circuit Breaker: Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers. Apparatus Protection: Protection of Transformer, generator and motor.</p>			
VI	Text/Reference Books	<ol style="list-style-type: none"> 1. S. S. Rao, Switchgear and Protection, Khanna Publishers, (2008). 2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.,(2011). 3. B. Ram and D. N. Vishwakarma, Power System Protection and Switchgear, Tata Mc. Graw Hill, (2011). 4. Y. G. Paithankar and S R Bhide, Fundamentals of Power System Protection, Prentice Hall of India. (2013). 5. T.S.M Rao, Power System Protection: Static Relays with Microprocessor Applications Tata Macgraw Hill, (2011). 6. A.R. Van C. Warringtaon , Protective Relays- Their Theory and Practice, Vol. I & II Jhon Willey & Sons. 			

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I	Course Code	EE 5005			
II	Course Title	Deregulated Power System			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Power Systems			
V	Course Content	<p>Deregulation of Electricity Supply Industry (ESIs): Need of deregulation, Issues associated with the restructuring of ESIs, International experiences. Economic Operation of Power Systems: Economic load dispatch, Unit commitment (UC), optimal power flow, optimal power flow in system design and operation. Electricity Markets: Models of competition, role of the independent system operator in pool versus bilateral markets, Bilateral trading, Electricity pools, Spot market, Settlement process. Power System Controls: Load frequency control, Generator voltage control. System Security and Ancillary Services (AS) Management: Balancing issues, Network issues, System restoration, AS provision, Distributed energy resources (DERs) in AS provision, Co-optimization of AS and energy. Transmission Pricing and Congestion Management: Electric power wheeling, Transmission open access, generation scheduling in deregulation, transmission pricing paradigms, Congestion management techniques, DERs in congestion management.</p>			
VI	Text/Reference Books	<ol style="list-style-type: none"> 1. S. S. Rao, Switchgear and Protection, Khanna Publishers, (2008). 2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.,(2011). 3. B. Ram and D. N. Vishwakarma, Power System Protection and Switchgear, Tata Mc. Graw Hill, (2011). 4. Y. G. Paithankar and S R Bhide, Fundamentals of Power System Protection, Prentice Hall of India. (2013). 5. T.S.M Rao, Power System Protection: Static Relays with Microprocessor Applications Tata Macgraw Hill, (2011). 6. A.R. Van C. Warringtaon , Protective Relays- Their Theory and Practice, Vol. I & II Jhon Willey & Sons. 			

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I	Course Code	EE 4009			
II	Course Title	Technology, Innovation and Intellectual Property Rights OE II			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)				
V	Course Content	<p>Syllabus: Introduction to IP Invention and Creativity Importance Protection of IPR Basic types of Property (i) Movable Property (ii) Immovable Property and (iii) Intellectual Property Types of IPR Patents Copyrights and related rights Trade Marks Industrial Designs Geographical Indications Traditional Knowledge -Plant variety protection- Layout designs of Integrated Circuits; Introduction to Patents Patentability criteria - Novelty, Non-Obviousness and industrial applicability - The Patent Act, 1970 Inventions not patentable Patent Specifications: Provisional and complete - Types of patent applications compulsory licensing Patent application Forms and fees Types of Patent search Prior-art search Freedom to operate search Patent validity/Invalidity search state of art search - International Patent Classifications (IPC) European patent classification (ECLA) Cooperative patent classification (CPC) patent claim analysis IP landscaping; International convention relating to Intellectual Property - History of GATT & TRIPS Agreement - Berne convention-Madrid agreement-Hague agreement concerning the International Deposit of Industrial Designs -Patent Cooperation treaty (PCT)- Paris convention-Lisbon Agreement - Establishment of WIPO UPOV and WTO-Mission and activities History General Agreement on Trade and Tariff (GATT)- TRIPS Trade-Related Aspects of Intellectual Property Rights WCT and WPPT Budapest Treaty - International Convention for the Protection of New Varieties of Plants sui generis system; Protecting Trademark and Copyright in the Social media - Copyright Issues in the Digital Environment</p>			
VI	Text/Reference Books	Innovation and Intellectual Property Rights, Ove Granstrand, The Oxford Handbook of Innovation, Edited by Jan Fagerberg and David C. Mowery.			

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I	Course Code	EE 4502			
II	Course Title	B.Tech. Project II			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Nil			
V	Course Content	Students are required to carry out project under the supervision of faculty members for the defined objectives. The project includes the thesis submission and viva-voice.			
VI	Text/Reference Books				

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I	Course Code	EE 4011			
II	Course Title	VLSI Design			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Nil			
V	Course Content	<p>VLSI Fabrication Processes and Techniques</p> <p>Introduction to microelectronic fabrication, crystallography, crystal defects, Czochralski growth, float zone growth, wafer processing- RCA clean, photolithography, ion-implantation, diffusion, thermal oxidation, LOCOS, STI, etching, thermal treatments, CVD, PVD, sputtering, MBE, CMP, testing, die preparation, IC packaging, IC testing, VLSI design flow, methodologies and problems.</p> <p>Aspects of CMOS Design</p> <p>CMOS fabrication and layout, lambda rules, design rule check, CMOS circuits- CMOS inverter, concept of pull-up and pull-down, CMOS NAND and NOR gates, latch-up, parasitic capacitance, concept of delay, delay estimation, concept and limits of scaling (miniaturization).</p> <p>IC design Techniques</p> <p>Full Custom Design, Semi-Custom Design, Field Programmable Gate Arrays (FPGA), Application Specific Integrated Circuits (ASICs), Standard Cell based design, VLSI physical design- Placement, Routing, Floor-Planning, Parasitic extraction.</p> <p>VLSI Testing</p> <p>Design for testability, fault types and models, Controllability and Observability, Built-In Self Test, IDDQ testing, packaging, heat dissipation, design economics and parametric yield.</p>			
VI	Text/Reference Books	<ol style="list-style-type: none"> 1) The Science and Engineering of Microelectronic Fabrication by S. A. Campbell (Oxford University Press). 2) The VLSI Handbook by W.-K. Chen (CRC Press). 3) CMOS Circuit Design, Layout and Simulation by R. J. Baker (Wiley). 4) CMOS Digital Integrated Circuits by S. M. Kang and Y. Leblebici (Tata McGraw Hill). 5) CMOS VLSI Design by N. Weste and D. Harris (Pearson). 6) Digital Integrated Circuits by J. M. Rabaey (Pearson). 7) Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits by M. Bushnell and V. Agrawal (Springer). 			