Sant Baba Bhag Singh

UNIVERSITY

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PO, PEO, PSO and CO

of

(Electrical Engineering)

Dr. Vijay Dhir

(Dean)

1. ABOUT THE DEPARTMENT

The department offers a vibrant environment for education in Electrical Engineering. Our mission is to provide a high-quality education and prepare students to design and develop products as well as practical solutions to problems in public and private sectors. Currently, the department of Electrical Engineering offers B. Tech. in Electrical Engineering.

Faculty members in the Electrical Engineering department hold B. Tech/ M. Tech/ PhD degrees from prestigious government institutions. Faculty members have specialization in diverse fields of Electrical Engineering such as Power systems, Electrical Machines, Electrical Drives, High Voltage Engineering, Control systems, Instrumentation, Biomedical Engineering, Signal Processing, and Data Mining.

The faculty members have published significant number of research and review articles in reputed International Journals as well as in the Proceedings of various International and National Seminars, Conferences, Symposia and Workshops. Members of the faculty have also contributed chapters to books published by well-known international publishers.

2. SALIET FEATURES OF THE DEPARTMENT

- The department's faculty is highly qualified and has extensive teaching experience.
- Excellent teaching methodology with a focus on interactive learning through the use of audio- visual aids.
- Well-equipped and upgraded labs to provide students with hands-on learning opportunities.
- IIT Delhi's Virtual Labs platform is being used to provide additional Virtual Lab classes.
- The curriculum is well-balanced, with a good mix of research and industry-oriented courses.
- Students attend regular workshops, seminars, and guest lectures to learn about the latest technology and industry practices.
- Mini-projects and in-plant trainings to provide students with hands-on experience.
- Industrial visits to various renowned companies to expose students to a variety of environments.

3. VISION OF THE DEPARTMENT

To impart knowledge, develop skills and prepare graduates in achieving global excellence in Electrical Engineering education, industry and research.

4. MISSION OF THE DEPARTMENT

- To prepare engineering graduates with deep understanding of fundamentals of Electrical Engineering.
- To prepare professionals with good technical abilities, a positive attitude and ethical values.
- To collaborate with industry, research organizations and academia to encourage creativity and innovation.
- To provide a platform for students to develop new products and systems that will enefit industry and society as a whole.

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5. PROGRAMME OUTCOMES (POs)

PO1: *Engineering knowledge:* Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

PO2: *Problem analysis*: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3: *Design/development of solutions*: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: *Conduct investigations of complex problems:* Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: *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.

PO6: *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.

PO7: *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.

PO8: *Ethics:* Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9*: Individual and teamwork*: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO10: *Communication*: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations and give and receive clear instructions.

PO11: *Project management and finance*: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO12: *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.

6. PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Graduates will demonstrate their knowledge in the effective implementation during their practice of profession of Electrical Engineering with due regard to environment and social concerns.

PSO2: Graduates will demonstrate their knowledge in analysis, design and laboratory experimentation regarding Electrical Engineering.

14	Electrical Machines Laboratory – II	EE226	4	1. Obtain equivalent circuit parameters of single-phase and three- phase Induction motor. 2. Control speed of Induction motors by different methods. 3. Draw open and short circuit characteristics of three-phase alternator and V and inverted V curves of synchronous motor. 4. Find out voltage regulation of an alternator by different tests. 5. Synchronize two or more 3-phase alternators.
15	Power Electronics Laboratory	EE228	4	1. Students will be able to verify the characteristics of SCR and UJT and triggering pulses for them. 2. They will be able to visualize and analyze the performance of various rectifier and converter circuits. 3. They will be able to control the speed of motors using thyristor.
16	Power System-I (Apparatus & Modelling)	EE319	5	1. Understand the concepts of power systems. 2. Understand the various power system components. 3. Evaluate fault currents for different types of faults. 4. Understand the generation of over-voltages and insulation coordination. 5. Understand basic protection schemes. 6. Understand concepts of HVDC power transmission and renewable energy generation.
17	Control Systems	EE321	5	1. Understand the modelling of linear-time-invariant systems using transfer function and state-space representations. Understand the concept of stability and its assessment for linear-time invariant systems. 2. 3. Design simple feedback controllers.
18	Microprocessors	EE323	5	1. Do assembly language programming. 2. Do interfacing design of peripherals like I/O, A/D, D/A, timer etc. 3. Develop microprocessor based systems.
19	Power Systems Laboratory – I	EE325	5	1. Analyze the performance of transmission lines. 2. Analyze the performance of different types of relays. 3. Analysis of the symmetrical and unsymmetrical faults in power system using simulation based experiments.
20	Control Systems Laboratory	EE327	5	1. Analyze the characteristics of error detectors, servo motors 2. Speed control of Servo Motor 3. Simulation of the differential equations and calculation of time response specifications 4. Design compensation networks and analyze the performance characteristics.
21	Microprocessors Laboratory	EE329	5	1. Do assembly language programming. 2. Do interfacing of peripherals like I/O, A/D, D/A, timer etc. 3. Develop microprocessor based systems.
22	Electrical Machine Design	EE331	5	1. Understand the construction and performance characteristics of electrical machines. 2. Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines. 3. Understand the principles of electrical machine design and carry out a basic design of an AC machine. 4. Use software tools to do design calculations.
23	Power Systems – II (Operation and Control)	EE330	6	1. Use numerical methods to analyze a power system in steady state. 2. Understand stability constraints in a synchronous grid. 3. Understand methods to control the voltage, frequency and power flow. 4. Understand the monitoring and control of a power system. 5. Understand the basics of power system economics.
24	Measurements and Instrumentation	EE332	6	1. Design and validate DC and AC bridges. 2. Analyze the dynamic response and the calibration of instruments. 3. Learn about various measurement devices, their characteristics, their operation and their limitations. 4. Understand statistical data analysis. 5. Understand computerized data acquisition.
25	Electronics Design	EE334	6	1. Understand the practical issues related to practical implementation of applications using electronic circuits. 2. Choose appropriate components, software and hardware platforms.
26	Power Systems Laboratory – II	EE336	6	1. Use numerical methods to analyze a power system in steady state. 2. Understand stability constraints in a synchronous grid. 3. Understand methods to control the voltage, frequency and power flow. 4. Understand the monitoring and control of a power system. 5. Understand the basics of power system economics.

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Course Outcomes (COs)

S.No	Course Name	Course Code	Semester	Course Outcomes
1	Basic Electrical Engineering	EE102	2	1. Get an exposure to common electrical components and their ratings. 2. Make electrical connections by wires of appropriate ratings. 3. Understand the usage of common electrical measuring instruments. 4. Understand the basic characteristics of transformers and electrical machines. 5. Get an exposure to the working of power electronic converters.
2	Basic Electrical Engineering Laboratory	EE104	2	1. Measurement of electrical quantities 2. Analysis of the response or behavior of different types of electrical Circuits. 3. Analysis of the behavior of single-phase and three-phase transformer in different conditions. 4. Identification of the different sections of various types of machines. 5. Analysis of the characteristics of various types of motors. 6. Identification of the type of converter and knowledge about their applications
3	Electrical Circuit Analysis	EE215	3	1. Apply network theorems for the analysis of electrical circuits. 2. Obtain the transient and steady-state response of electrical circuits. 3. Analyze circuits in the sinusoidal steady-state (single-phase and three phase). 4. Analyze two port circuit behavior
4	Analog Electronics Circuits	EE217	3	1. Understand the characteristics of transistors. 2. Design and analyze various rectifier and amplifier circuits. 3. Design sinusoidal and non-sinusoidal oscillators. 4. Understand the functioning of OP-AMP and design OP-AMP based circuits.
5	Electrical Machines-I	EE219	3	1. Understand the concepts of magnetic circuits. 2. Understand the operation of dc machines. 3. Analyze the differences in operation of different dc machine configurations. 4. Analyze single phase and three phase transformers circuits.
6	Electromagnetic Fields	EE221	3	1. Understand the basic laws of electromagnetism. 2. Obtain the electric and magnetic fields for simple configurations under static conditions. 3. Analyse time varying electric and magnetic fields. 4. Understand Maxwell's equation in different forms and different media. 5. To understand the propagation of EM waves.
7	Analog Electronics Circuits Laboratory	EE223	3	1. Study of the characteristics of diodes and transistors. 2. Design and analyze diode and transistor based circuits. 3. Understand the functioning of OP-AMP and design OP-AMP based circuits.
8	Electrical Machines Laboratory-I	EE225	3	1. Understand the operation of dc machines. 2. Analyze the operation of different dc machine configurations and measurement of its important parameters. 3. Analyze single phase and three phase transformer circuits in different conditions
9	Digital Electronics	EE216	4	1. Understand working of logic families and logic gates. 2. Design and implement Combinational and Sequential logic circuits. 3. Understand the process of Analog to Digital conversion and Digital to Analog conversion. 4. Be able to use PLDs to implement the given logical problem.
10	Electrical Machines-II	EE218	4	1. Understand the concepts of rotating magnetic fields. 2. Understand the operation of ac machines. 3. Analyze performance characteristics of ac machines.
11	Power Electronics	EE220	4	1. Understand the differences between signal level and power level devices. 2. Analyze controlled rectifier circuits. 3. Analyze the operation of DC-DC choppers. 4. Analyze the operation of voltage source inverters.
12	Signals and Systems	EE222	4	1. Understand the concepts of continuous time and discrete time systems. 2. Analyze systems in complex frequency domain. 3. Understand sampling theorem and its implications.
13	Digital Electronics Laboratory	EE224	4	1. Understand working of logic circuits. 2. Design and implement Combinational and Sequential logic circuits.

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27	Measurements and Instrumentation Laboratory	EE338	6	1. Design and validate DC and AC bridges. 2. Analyze the dynamic response and the calibration of few instruments. 3. Learn about various measurement devices, their characteristics, their operation and their limitations. 4. Understand statistical data analysis. 5. Understand computerized data acquisition
28	Electronics Design Laboratory	EE340	6	1. Design a Printed Circuit Board, get it made and populate/solder it with components. 2. Work as a team with other students to implement an application.
29	Control Systems Design	EE342	6	1. Understand various design specifications. 2. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators). 3. Design controllers using the state-space approach.
30	Power System Protection	EE344	6	1. Understand the different components of a protection system. 2. Evaluate fault current due to different types of fault in a network. 3. Understand the protection schemes for different power system components. 4. Understand the basic principles of digital protection. 5. Understand system protection schemes, and the use of wide-area measurements
31	Line Commutated and Active Rectifiers	EE346	6	1. Analyze controlled rectifier circuits. 2. Understand the operation of line-commutated rectifiers in pulse and multi-pulse configurations. 3. Understand the operation of PWM rectifiers in rectification and regeneration modes and lagging, leading and unity power factor mode.
32	Computer Architecture	EE348	6	1. Understand the concepts of microprocessors, their principles and practices. 2. Write efficient programs in assembly language of the 8086 family of microprocessors. 3. Organize a modern computer system and be able to relate it to real examples. 4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes. 5. Implement embedded applications using ATOM processor.
33	Computational Electromagnetics	EE350	6	1. Understand the basic concepts of electromagnetics. 2. Understand computational techniques for computing fields. 3. Apply the techniques to simple real-life problems.
34	Electromagnetic Waves	EE352	6	1. Analyse transmission lines and estimate voltage and current at any point on transmission line for different load conditions. 2. Provide solution to real life plane wave problems for various boundary conditions. 3. Analyse the field equations for the wave propagation in special cases such as lossy and low loss dielectric media. 4. Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide. 5. Understand and analyse radiation by antennas.
35	Wind and Solar Energy Systems	EE415	7	1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources. 2. Understand the basic physics of wind and solar power generation. 3. Understand the power electronic interfaces for wind and solar generation. 4. Understand the issues related to the grid-integration of solar and wind energy systems.
36	HVDC Transmission Systems	EE417	7	1. Understand the advantages of dc transmission over ac transmission. 2. Understand the operation of Line Commutated Converters and Voltage Source Converters. 3. Understand the control strategies used in the HVDC transmission system. 4. Understand the improvement of power system stability using an HVDC system.
37	Power Quality and FACTS	EE419	7	1. Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation. 2. Understand the working principles of FACTS devices and their operating characteristics. 3. Understand the basic concepts of power quality. 4. Understand the working principles of devices to improve power quality.
38	High Voltage Engineering	EE421	7	1. Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials. 2. Knowledge of generation and measurement of D. C., A.C., & Impulse voltages. 3. Knowledge of tests on H. V. equipment and on insulating materials, as per the standards. 4. Knowledge of how over-voltages arise in a power system, and protection against these over-voltages.

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39	Digital Control Systems	EE423	7	1. Obtain discrete representation of LTI systems. 2. Analyze stability of open loop and closed loop discrete-time systems. 3. Design and analyse digital controllers. 4. Design state feedback and output feedback controllers.
40	Electrical Energy Conservation and Auditing	EE425	7	1. Understand the current energy scenario and importance of energy conservation. 2. Understand the concepts of energy management. 3. Understand the methods of improving energy efficiency in different electrical systems. 4. Understand the concepts of different energy efficient devices.
41	Industrial Electrical Systems	EE427	7	1. Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD. 2. Understand various components of industrial electrical systems. 3. Analyze and select the proper size of various electrical system components.
42	Electrical Drives	EE429	7	1. Understand the characteristics of dc motors and induction motors. 2. Understand the principles of speed-control of dc motors and induction motors. 3. Understand the power electronic converters used for dc motor and induction motor speed control.
43	Digital Signal Processing	EE418	8	1. Represent signals mathematically in continuous and discrete-time, and in the frequency domain. 2. Analyse discrete-time systems using z-transform. 3. Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms. 4. Design digital filters for various applications. 5. Apply digital signal processing for the analysis of real-life signals.
44	Electrical and Hybrid Vehicles	EE420	8	1. Understand the models to describe hybrid vehicles and their performance. 2. Understand the different possible ways of energy storage. 3. Understand the different strategies related to energy storage systems.
45	Power System Dynamics and Control	EE422	8	1. Understand the problem of power system stability and its impact on the system. 2. Analyse linear dynamical systems and use of numerical integration methods. 3. Model different power system components for the study of stability. 4. Understand the methods to improve stability
46	Advanced Electric Drives	EE424	8	1. Understand the operation of power electronic converters and their control strategies. 2. Understand the vector control strategies for ac motor drives 3. Understand the implementation of the control strategies using digital signal processors.
47	Electrical Materials	EE343	OE	1. Understanding of the basic concepts of materials. 2. Use of simplified materials selection concepts for design purposes. 3. Understanding of the properties of Materials
48	Electric Power Utilization	EE345	OE	1. Illustrate working principle electric power utilization and their application in rel life. 2. Choose proper traction systems depending upon application considering economic and technology up-gradation. 3. Employ mathematical and graphical analysis considering different practical issues to design traction system; analyses the performance parameter of the traction system. 4. Examine various applications in indoor and outdoor application areas where use of light sources are essential. 5. Classify type of electric light sources based on nature of operation and their objectives, performance and reliability. 6. Select most suitable type of illumination source for efficient conversion and recognize different process of utilizing electric energy for heating and electrolytic process.
49	Wavelet Theory and Applications	EE364	OE	1. Understand wavelet basis and characterize continuous and discrete wavelet transforms 2. Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties 3. Implement discrete wavelet transforms with multi-rate digital filters 4. Understand about wavelet packets. 5. Understand the applications of wavelet transforms to different fields.
50	Industrial Automation	EE366	OE	1. Describe the benefits, functions of the components, characteristics and applications of given automation system. 2. Identify specified modules of the PLC ad their interfacing with the I/O devices. 3. Development of PLC programs for various applications. 4. Describe the SCADA architecture, Interfacing SCADA system with PLC and applications of SCADA.

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51	Electronic Devices	EE439	OE	1. Understand the principles of semiconductor Physics 2. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
52	Instrumentation in Power System	EE441	OE	1. Learn the measurement of electrical quantities using different electrical instruments. 2. Understand the working of data acquisition system. 3. Understand the working of telemetry techniques. 4. Understand the working of the instruments used in various types of power plants.
53	VLSI Design	EE443	OE	1. Understand the foundations and features of CMOS circuits. 2. Design and implement sequential and combinational digital circuits. 3. Describe the architectural decisions and performance tradeoffs associated in developing and implementing circuits. 4. Become familiar with the various FPGA architectures and the testability of VLSI circuits.
54	Computational Intelligence	EE445	OE	1. Gain a working knowledge of knowledge-based systems. 2. Apply intelligent systems technologies in a variety of engineering applications. 3. Implement typical computational intelligence algorithms in MATLAB.
55	Analog and Digital Communication	EE434	OE	1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth. 2. Analyze the behavior of a communication system in presence of noise 3. Investigate pulsed modulation system and analyze their system performance 4. Analyze different digital modulation schemes and can compute the bit error performance.
56	Biomedical Instrumentation	EE436	OE	1. An understanding of physiological parameters and their measurement. 2. An understanding of the bio-electric signals and their measurements. 3. An understanding of the various types of assistive devices. 4. An understanding of the biotelemetry and its working.
57	Power Plant Engineering	EE438	OE	1. Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation. 2. Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts. 3. Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.
58	Embedded Systems	EE440	OE	1. Understand the key concepts of embedded systems. 2. Interface PIC Micro controller with peripherals. 3. Design real time operating system

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PSO3: Graduates will be motivated for continuous self learning in engineering practice and pursue research in advanced areas of Electrical Engineering in order to offer engineering services to the society, ethically.

7. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To prepare Electrical Engineering students to work for government or private sector companies responsible for the development of the power sector and to demonstrate their abilities in electrical maintenance for the industry.

PEO2: To prepare Electrical Engineering students to contribute to the teaching profession, as well as research and development, by pursuing higher education.

PEO3: To prepare students so that they can work well in multicultural and multidisciplinary groups as part of their profession.