B. Tech. (Electrical and Instrumentation Engineering)

- **Programme Outcomes**: The graduate engineers typically work for industries equipped with automation with the goal of improving the productivity, reliability, safety, optimization and stability. After completion of the course the students are commonly responsible for integrating the sensors used for various physical quantities with the recorders, transmitters, or displays. Along with the measurement they will provide the control action of the measurements. They may design or specify installation, wiring and signal conditioning. They may be responsible for calibration, testing and maintenance of the system. The students will have the opportunity to work in electrical power stations for the purpose of generation, transmission and distribution of the electricity. The students will get the opportunity to work in the field of microelectronic devices through their knowledge of electronics engineering, and the basic knowledge of coding and programming. Following are the major outcomes of B. Tech. (Electrical and Instrumentation Engineering) programme.

    - PO1. Electrical Engineering knowledge: Apply the knowledge of mathematics, science, electrical and instrumentation engineering fundamentals, to the solution of complex engineering problems.
    - PO2. Problem analysis: Identify, formulate, research literature, and analyze complex electrical and instrumentation engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and electrical and instrumentation engineering.
    - PO3. Design/development of solutions: Design solutions for complex electrical and instrumentation engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
    - PO4. 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.
    - PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern electrical engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
    - PO6. The Electrical and Instrumentation engineer and society: Apply reasoning informed by the electrical and instrumentation engineering 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 electrical and instrumentation 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 electrical and instrumentation ethics and responsibilities and norms of the electrical and instrumentation engineering practice.

- PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10. 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.
- PO11. Project management and finance: Demonstrate knowledge and understanding of the electrical and instrumentation 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.
- 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.

(Prof. S. C. Bhatt) (Mr. Gambheer Singh Kathait)

(Prof. M. K. Panda) (Prof. N. S. Panwar)

B. Tech. (Electrical and Instrumentation Engineering)

- **Programme Specific Outcomes**: After completion of the programme the students will have the opportunity to work in the automation sector, oil and petroleum sector, power sector, and can handle the operation of control unit of any industrial plant. Few of the Programme Specific Outcomes are listed below.

  - PSO1. Understand the characteristics and basic concepts of electrical network and electronic devices.
  - PSO2. Analyze the relationship among various physical parameter and their measurement and control.
  - PSO3. Perform procedures as per laboratory standards in the areas Electrical and Instrumentation Engineering.
  - PSO4. Understand the applications of electrical and instrumentation engineering in industrial, energy sector, agriculture and biomedical field.

(Prof. S. C. Bhatt) (Mr. Gambheer Singh Kathait)

(Prof. M. K. Panda) (Prof. N. S. Panwar)

COURSE OUTCOME
B. Tech. (Electrical and Instrumentation Engineering)

Third Semester

SUBJECT NAME: **MATHEMATICS III**
SUBJECT CODE: **SET/SH/BT/C301**
COURSE OUTCOME: Students will be able:

CO1To understand the Basic concepts in Laplace Transforms.
CO2To understand the Applications of Laplace Transforms.
CO3To understand the Basic concepts in Fourier series.
CO4 To understand the Basic concepts in Fourier Transforms.
CO5To understand the Basic concepts in Z Transforms.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester

SUBJECT NAME: **ELECTRONIC DEVICES AND CIRCUITS**
SUBJECT CODE: **SET/EC/BT/C302**
COURSE OUTCOME: Students will be able:

CO1 Capable to develop skills in the basics of the Electronic devices.
CO2 Capable to develop skills in the basics of the Electronic Circuits.
CO3 Capable to identify the components and design the circuits.
CO4 Understands to incorporate the circuits with the software like PSPICE.
CO5 Understands the Interpretation the results of the program.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester

SUBJECT NAME: **DIGITAL ELECTRONICS**
SUBJECT CODE: **SET/EC/BT/C303**
COURSE OUTCOME: Students will be able to:

CO1The graduate can tell the history and development of digital electronics.
CO2 Students can describe and demonstrate the use digital test equipment and its operating characteristics.
CO3 Identify and describe flip-flop circuits.
CO4 Understand electrical principle and working of diode, BJT and MOSFET.
CO5 Understanding of different memory devices.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **ELECTRICAL MACHINES**
SUBJECT CODE: **SET/EI/BT/C304**
COURSE OUTCOME: Students will be able:

CO 1 Understand electrical principle, laws, and working of DC/AC machines and generators, DC/AC motors.
CO2 Analyze the construction, characteristics and applications of DC motors.
CO3 Analyze the starting & speed controlof Induction, Stepper and Synchronous Motors.
CO4 Understand the working principle, construction and equivalent circuit diagram of transformers, auto transformer and instrument transformer.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **SIGNALS AND SYSTEMS**
SUBJECT CODE: **SET/EI/BT/C305**
COURSE OUTCOME: Students will be able:

CO1 Classify systems based on their properties and determine the response of LSI systemusing convolution.
CO2 Examine system properties based on impulse response the Fourier analysis.
CO3 Use the fourier transform to analyse continuous and discrete time signal and system.
CO4 Understand the process of sampling and the effects of aliasing.
CO5 Apply the Z – transform to analyze the discrete – time signals and systems.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**
SUBJECT CODE: **SET/EI/BT/C306**
COURSE OUTCOME: Students will be able:

CO1 Get ability use, measure and analysis the instruments.
CO2 Calculate all the parameters related to measurements.
CO3To understand about different instruments that are used for measurement purpose.
CO4 Identify the appropriate instruments for measurement of different quantities.
CO5To analyze various transducer and sensor.
CO6To understand measurement of various parameters of frequency.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

Fourth Semester

SUBJECT NAME: **SENSORS AND TRANSDUCERS**
SUBJECT CODE: **SET/EI/BT/C401**
COURSE OUTCOME: Students will be able:

CO1The student understands the dynamics of the Sensor/ transducer.
CO2The student will be able to select a suitable transducer for a given application.
CO3The student can design a sensor/transducer as per the requirement.
CO4To analyze the operation, characteristics, and applications of various types of sensor / transducer.
CO5ToUnderstands the advantages and disadvantages of various types of transducers.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **ANALOG INTEGRATED CIRCUITS**
SUBJECT CODE: **SET/EC/BT/C402**
COURSE OUTCOME: Students will be able to:

CO1The students will be able to understand the fundamentals of integrated circuits and designingelectronic circuits using it.
CO2 Acquires knowledge on implementing various circuits using Op-Amps.
CO3 Students can understand & Design waveforms Generating circuits and Multivibrators.
CO4 Students can be able to design simple filter circuits for specific engineering application.
CO5The graduate will be able to Design combinational logic circuits using digital IC's.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **MICROPROCESSORS AND MICROCONTROLLERS**
SUBJECT CODE: **SET/EI/BT/C403**
COURSE OUTCOME: Students will be able to:

CO1 Learn internal organization of some popular microprocessor / microcontroller.
CO2 Acquire the knowledge on internal organization of some popular microprocessor and microcontroller.
CO3 Capable of understanding the hardware and software interaction and integration.
CO4To understand the design of microprocessor and microcontroller based system.
CO5 To understand the applications of microcontroller.
CO6 Impart the knowledge about the instruction set.
CO7To understand the basic idea about data transfer schemes and its applications.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **ANALYTICAL INSTRUMENTS**
SUBJECT CODE: **SET/EI/BT/C404**
COURSE OUTCOME: Students will be able to:

CO1 Propose the appropriate analytical technique to determine the environment pollutants.
CO2 Differentiate clinical flame photometer with analytical flame photometer and able to use them.
CO3 Explain working principle, construction, working and sources of interferences in Atomic Absorption
CO4Spectrophotometers, Colorimeters and Spectrophotometers, Mass Spectrometers, Nuclear Magnetic
CO5Resonance technique, XRD, chromatography and SEM instruments.
CO6Propose the appropriate radiation detector.
CO7Will be able to perform measurement on instruments like ICP-MS, XRD, SEM, PE-Loop tracer and UV-Vis Spectrometer.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester
1 Practical period of two hour per week over a semester

SUBJECT NAME: **ELECTROMAGNETIC FIELD THEORY**
SUBJECT CODE: **SET/EC/BT/C405**
COURSE OUTCOME: Students will be able:

CO1 Apply vector calculus in orthogonal coordinate system.
CO2To analyze behavior of static electric fields in standard configurations.
CO3To analyze behavior of dynamic electric fields in standard configurations.
CO4To analyze behavior of static magnetic fields in standard configurations
CO5To analyze behavior of dynamic magnetic fields in standard configurations
CO6 Describe and analyze electromagnetic wave propagation in free space

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester

SUBJECT NAME: **CIRCUIT THEORY**
SUBJECT CODE: **SET/EI/BT/C406**
COURSE OUTCOME: Students will be able:

CO1To analyze behavior of basic circuit elements and to apply concept of mesh and nodeanalysis in circuit theory. Apply various network theorems to determine the circuit response /behavior.
CO2To apply transformation of a network to analyze in time domain, s-domain.
CO3To study necessary conditions for driving point functions, transfer function for theirapplication to agiven network for analyzing circuit design.
CO4To analyze the RC, RL and RLC networks with the help of Positive real function, Foster form, and Causer form.

Credits 3 Theory period of one hour per week over a semester
1 Tutorial period of one hour per week over a semester

Fifth Semester

SUBJECT NAME: **POWER SYSTEMS**
SUBJECT CODE: **SET/EI/BT/C501**
COURSE OUTCOME: Students will be able:

CO1To learn the characteristics, design and operating criteria of modern power system.
CO2 To understand the model and design turbines/generators/exciters. Understand the transmission line parameters,configurations and their calculations.
CO3 Analyzing the control of frequency and voltage through regulators and compensators.
CO4To understand the load flow curve, HVDC, contingency analysis, emergency and restorativecontrol.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **CONTROL SYSTEMS**
SUBJECT CODE: **SET/EI/BT/C502**
COURSE OUTCOME: Students will be able:

CO1 To learn the basics of various types of control systems and automaticsystems.
CO2To build the mathematical model of system from differentialequation and vice versa and shall know the better effects of feedback due to parametervariations.
CO3To apply the basic knowledge to formulate the input output relationship of various component used in control system and their applications inbuilding control system.
CO4 To perform and study a time domain analysis of control system anddifferentperformance measures and finally know about behavior of the system.
CO5 To learn the concept of stability, poles and zeros, using RouthHurwitz criteria and relative stability by Bode plot, polar plot, Nyquist plot and be able todesign and analyze the given system in frequency domain.
CO6To build state space model of system in different forms.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **INDUSTRIAL INSTRUMENTATION**
SUBJECT CODE: **SET/EI/BT/C503**
COURSE OUTCOME: Students will be able:

CO1To understands the properties of Density, Viscosity, Humidity and Moisture content.
CO2To acquire extensive knowledge about pressure, temperature measurement techniques.
CO3To analyze about variable head type, variable area type, and mass flow meters.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **POWER ELECTRONICS**
SUBJECT CODE: **SET/EI/BT/C504**
COURSE OUTCOME: Students will be able:

CO1Tounderstand basic operation of silicon controlled rectifier (SCR), analyzecharacteristics & protection schemes of SCR.
CO2To analyze characteristics &explain working of MOSFET, GTO, IGBT, TRIAC & UJT.
CO3TO understandand analyze single phase & three phase fully controlled AC to DCconverter circuits, evaluate their performance.
CO4 To understand and analyze working of single phase & three phase halfcontrolled AC to DC converter
circuits.
CO5Toexamine the working principle of chopper and series resonant inverter.
CO6To analyze DC to AC inverter circuits; understand harmonic attenuationconcepts used for inverters andthe working of cyclo- converter.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **ELECTRICAL DRIVES**
SUBJECT CODE: **SET/EI/BT/E505 (i)**
COURSE OUTCOME: Students will be able:

CO1To understand definition, scope, objectives, and limitation ofelectric drives, power transistor and SCR.
CO2 To analyze the construction and characteristics and application of DCmotor.
CO3To analyze the construction and characteristics and application ofthree phase induction motor.
CO4To analyze the speed control methods of AC and DCmotor.
CO5To analyze the construction and characteristics and application ofsensor,transducer and switches.
Students will be able to analyze the industrial applications of electric drives.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME: **LINE COMMUTATED AND ACTIVE PWM RECTIFIERS**
SUBJECT CODE: **SET/EI/BT/E505 (ii)**
COURSE OUTCOME: Students will be able:

CO1To analyze controlled rectifier circuits.
CO2Tounderstand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
CO3Tounderstand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME: **ELECTRICAL MACHINE DESIGN**
SUBJECT CODE: **SET/EI/BT/E505 (iii)**
COURSE OUTCOME: Students will be able:

CO1To understand the construction and performance characteristics of electrical machines.
CO2To understand the various factors which influence the design: electrical, magnetic and thermal loading ofElectrical machines
CO3To understand the principles of electrical machine design and carry out a basic design of an AC machine.
CO4 Use software tools to do design calculations.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

Sixth Semester

SUBJECT NAME: **DIGITAL SIGNAL PROCESSING**
SUBJECT CODE: **SET/EC/BT/C601**
COURSE OUTCOME: Students will be able:

CO1Students understand about discrete time signals and system.
CO2To understand the properties of Z-transform and they able solve the Fourier series.
CO3 Students learn the overview of Fourier transform, FIR and IIR filters.
CO4 Capable to design IIR and FIR filters with Fourier series method.
CO5 Acquire knowledge about Architecture and features of various signal processing chips.
CO6 Represent discrete-time signals analytically and visualize them in the time domain.
CO7To understand the meaning and implications of the properties of systems and signals.
CO8To understand the Transform domain and its significance and problems related to computational complexity.
CO9 Specify and design any digital filters using MATLAB.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **PLC AND AUTOMATION**
SUBJECT CODE: **SET/EI/BT/C602**
COURSE OUTCOME: Students will be able:

CO1To understand the automation, importance, expectations from automation and applications in industry.
CO2To understand working of PLC, I/O modules of PLC, Programming languages of PLC, design PLC based application by proper selection and sizing criteria, developing GUI and ladder program.
CO3To understand the ladder logic with the help of timers, counters, and various data manipulation,program control, math instructions.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **PROCESS CONTROL**
SUBJECT CODE: **SET/EI/BT/C603**
COURSE OUTCOME: Students will be able to:

CO1 Learn the necessity of process control, the mathematical modeling of different processes.
CO2 Learn different control actions and controllers like ON-OFF, P,P+I+D and also abouttuning methods for setting optimum value and various multi-loop controlling methods.
CO3 Acquire the knowledge of final control elements.
CO3 Design of multi loop control and examples of distillation column and boiler system.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **HVDC TRANSMISSION SYSTEMS**
SUBJECT CODE: **SET/EI/BT/E604 (i)**
COURSE OUTCOME: Students will be able to:

CO1 Evaluate the power handling capacity of different transmission systems.
CO2Analyze electrostatic and electromagnetic fields and corona in EHVAC lines.
CO3Explain basic configuration of EHVAC & HVDC system.
CO4Utilize the voltage control and current control systems for power flowcontrol in HVDC systems.
CO5Design the AC filters as well as DC filters, Reactive power compensation.
CO6Describe different types of HVDC systems such as MTDC, protection
and substation layout of HVDC power plant.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME:**INDUSTRIAL ELECTRICAL SYSTEMS**
SUBJECT CODE: **SET/EI/BT/E604 (ii)**
COURSE OUTCOME: Students will be able to:

CO1Formulate equations for electric and magnetic circuits of electric machines.
CO2Familiar with the wiring systems.
CO3To understanding various terms, like LCD, LED etc.
CO4Familiar with power factor correction.
CO5Familiar with the different Industrial Electrical Systems.
CO6 Study of PLC, SCADA.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME:**INDUSTRIAL DRIVES AND CONTROLS**
SUBJECT CODE: **SET/EI/BT/E604 (iii)**
COURSE OUTCOME: Students will be able to:

CO1The students will be able to identify the need and choice of various drives.
CO2The students will be exposed to different speed control methods in D.C and A.C motors using thyristor based control schemes.
CO3To understand how to use Microprocessors in the Synchronous motor drives.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME:**ELECTRICAL DISTRIBUTION SYSTEM**
SUBJECT CODE: **SET/EI/BT/E604 (iv)**
COURSE OUTCOME: Students will be able to:

CO1 Differentiate the types of loads and their characteristics.
CO2 Design a radial and loop type distribution feeders.
CO3 Calculate the voltage drop and power loss in a distribution system.
CO4 Identify and design protection system.
CO5 Recognize the necessity of distribution system protection and devices availablefor discriminatingfaults.

CO6 Discuss the need of pf correction and voltage drop compensation.
CO7 Identify the best methods for pf improvement and voltage control.
CO8 Design a suitable capacitance for voltage control in a Distribution System.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME:**POWER PLANT ENGINEERING**
SUBJECT CODE: **SET/EI/BT/E605 (i)**
COURSE OUTCOME: Students will be able to:

CO1Familiar with the basics of different power plant and power generation systems.
CO2To understand with the design of Analyzers and control loops used in power plant.
CO3 Detailed study of the P&I diagram of various power plant.
CO4Students also get thorough knowledge of Instrumentation involve in power plants.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME:**OPTICAL INSTRUMENTATION**
SUBJECT CODE: **SET/EI/BT/E605 (ii)**
COURSE OUTCOME: Students will be able to:

CO1Familiar with the basics of different Optical materials.
CO2Analyze the Testing of optical components, like Foucault-Knife edge test, Newton's ring method etc.
CO3Detailed study ofHolography.
CO4Detailed study of Laser system.
CO5Detailed study of the optical fibers, optic sensors etc.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME:**ANALOG AND DIGITAL COMMUNICATION**
SUBJECT CODE: **SET/EI/BT/E605 (iii)**
COURSE OUTCOME: Students will be able to:

CO1Familiar with the Frequency domain representation.
CO2Familiar with the different types of modulation.
CO3To understandprobability, random process anddetection of signals in noise.
CO4To understandDetection Theory, digital modulation scheme etc.
CO5To understanddemodulation, Synchronization and Carrier Recovery for Digital modulation.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

Seventh Semester

SUBJECT NAME: **BIOMEDICAL INSTRUMENTATION**
SUBJECT CODE: **SET/EI/BT/C701**
COURSE OUTCOME: Students will be able to:

CO1 Appreciate the role of instrumentation in the field of medical diagnosis.
CO2 Explain the bioelectric potentials and how they can be picked up.
CO3To understand and explain the main biological organs of humans and their structure.
CO4 Explain the working and use of Various Instruments like ECG, EEG, EMG, X -Ray imaging and ultrasound imaging used in medical diagnosis.
CO5 Use the ECG, EEG, EMG, X -Ray imaging and ultrasound imaging by their own.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME: **VACUUM INSTRUMENTATION AND THIN FILM DEPOSITIONTECHNIQUES**
SUBJECT CODE: **SET/EI/BT/C702**
COURSE OUTCOME**:** Students will be able:

CO1To understand the general terminology used in the vacuum system, i.e., throughput, mean free path, out gassing, vapor pressure, gettering, etc.
CO2To understand the theory of gaseous flow (turbulent, viscous and molecular), and the effect of physical variable on the flow.
CO3To understand the working, construction, characteristics curve and applications of various vacuum pumps.
CO4 Measure the vacuum pressure with the help of different vacuum gauges.
CO5To understand the properties of materials used in the vacuum systems, and basic idea of designing the vacuum system.
CO6 Detect the leak in the vacuum systems.
CO7 Learn about the physical and chemical methods of thin film deposition, and the measurement of thickness of thin film.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.
1 Practical period of two hour per week over a semester.

SUBJECT NAME**: ELECTRICAL ENERGY CONSERVATION & AUDITING**
SUBJECT CODE**: SET/EI/BT/E703 (i)**
COURSE OUTCOME**:**Students will be able to:

CO1 Learn about the basic scenario of energy, i.e. primary energy sources, need and importance of energy, energy conservation and effect of energy on environment, and various forms of energy.
CO2To understand the concept of energy management with the help of energy performance, optimization of energy requirements, energy audit, and materials and energy balance.
CO3To understand the role of energy in electrical systems and techniques to save the energy using efficient electrical equipments.
CO4 Learn how to efficiently utilize the energy in industrial environment and electrical systems using technology like sensors, controllers, etc.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: POWER QUALITY AND FACTS**
SUBJECTCODE**: SET/EI/BT/E703 (ii)**
COURSE OUTCOME**:** Students will be able to:
CO1 Learn the basic concepts of transmission lines and series/shunt compensation
CO2 Learn the characteristics of thyristor-based FACTS devices, different thyristor control action as series capacitors, braking resistors.
CO3To understand and analyze the economic aspects of both conventional transmission and FACTS
CO4 Know about the voltage source converter based FACTS and applications of FACTS.
CO5 Know about the power quality problems in distribution system.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME: **CONTROL SYSTEMS-II**
SUBJECT CODE: **SET/EI/BT/E703 (iii)**
COURSE OUTCOME:Students will be able:

CO1To understand the concepts of state variables, controllability and observability.
CO2Analyze the stability of linear and no-linear systems.
CO3 Analyze mathematically sampling process and adaptive control.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT **NAME: EMBEDDED SYSTEMS**
SUBJECT **CODE: SET/EI/BT/E704 (i)**
COURSE OUTCOME**:**Students will be able to:

CO1 Explain the concept of real time embedded systems and their applications.
CO2Indentify and differentiate between microcontroller and microprocessor internal architecture.
CO3 Handle the task of designing an embedded system and their programming.
CO4 Explain how High end embedded system's operating system is designed.
CO5 Identify and apply the embedded systems to solve the different real life challenges.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: FUZZY LOGIC & NEURAL NETWORK**
SUBJECTCODE**: SET/EI/BT/E704 (ii)**
COURSE OUTCOME**:**Students will be able

CO1To understand neural network, maps and theories.
CO2To understand overview of control case study for neural network
CO3Know the detailed overview about fuzzy sets, fuzzy rules, fuzzy relation and fuzzy algorithm.
CO4To understand about the design of fuzzy logic controller.
CO5Analyze of fuzzy algorithm and case study.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECT NAME**: INTRODUCTION TO ROBOTICS**
SUBJECTCODE**: SET/EI/BT/E704 (iii)**
COURSE OUTCOME**:** Students will be able

CO1To understand the basic concepts and parts of robots.
CO2To understanding the working of robots and various types of robots.
CO3Familiarize with the various drive systems of robots, sensors and their applications in robots and programming of robots.
CO4 Know the various applications of robots, justification and implementation of robots.
CO5To understand the concept of the manipulators, activators and grippers and their design considerations.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: COMPUTER ARCHITECTURE**
SUBJECTCODE**: SET/EI/BT/E704 (iv)**
COURSE OUTCOME**:**Students will be able

CO1 Analyze and design internal components of a digital computer.
CO2To understand and implement different algorithms for binary arithmetic.
CO3 Specify a computer in register transfer language.
CO4 Analyze performance of computer and its dependence on various components.
CO5 Design and implement different digital circuits and computer using VHDL.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

Eighth Semester

SUBJECTNAME**: RENEWABLE ENERGY ENGINEERING**
SUBJECTCODE**: SET/EI/BT/E801 (i)**
COURSE OUTCOME**:**Students will be able to:

CO1 Explain the role and need of renewable energy sources, purpose of Energy Auditing.
CO2 How the different renewable energy sources can be used in energy generation.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: ELECTRICAL DISTRIBUTION SYSTEM**
SUBJECTCODE**: SET/EI/BT/E801 (ii)**
COURSE OUTCOME**:** Students will be able to

CO1 Know about the basic concepts of distribution system, various types of loads and their characteristics.
CO2 Learn about the designing aspects of different distribution feeders and substations.
CO3Analyze the system in terms of voltage and power loss and can derive the mathematical expression to understand the system.
CO4 Find the different types of faults in the distribution system and their protection.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: CONTROL SYSTEMS DESIGN**
SUBJECTCODE**: SET/EI/BT/E801 (iii)**
COURSE OUTCOME**:** Students will be able

CO1To understand the design problems of control system, time domain and frequency domain design specifications.
CO2 Design the P, PI and PID controllers in time and frequency domain in feedback andfeedforward configurations.
CO3 Design and analyze the control system in state space using concept of controllability and observability.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: SWITCHGEAR AND PROTECTION**
SUBJECTCODE**: SET/EI/BT/E801 (iv)**
COURSE OUTCOME**:** Students will be able to

CO1Describe basic terminology of Protective Relaying, different types of faults and components used in Power System protection.
CO2Describe and design the over current protection schemes used for medium Voltage Line
CO3Differentiate and describe various distance protection schemes used for high voltage line
CO4Explain differential protection as applicable to bus bars, transformers, alternators, motors and Employ suitable protection scheme for various abnormal and faulty conditions
CO5Describe and Differentiate Static Relays with Electromechanical Relays

CO6Discuss various methods of Arc interruption and Explain Principle of operation, working and applications of different types of Circuit Breakers

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

COURSE NAME: **DATA COMMUNICATION AND NETWORKING**
COURSE CODE: **SET/EI/BT/E802 (i)**
COURSE OUTCOME: Students will be able to:
CO1 Define and explain different networks for data communication and how the information is transferred.
CO2 Explain and understand the use of OSI modal its layers and use of the different layers.
CO3To understand and design the network used in industries.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: VIRTUAL INSTRUMENTATION**
SUBJECTCODE**: SET/EI/BT/E802 (ii)**
COURSE OUTCOME**:**Students will be able to
CO1 Distinguish between virtual instruments and simple instruments.
CO2 Construct programs in graphical programming environment i.e. LabView software.
CO3 Construct a data acquisition system by own.
CO4 Pass various level of National Instruments certification.
CO5 Propose and design a virtual instrument using LabView to solve the encountered problem.

SUBJECTNAME**: SMART GRID TECHNOLOGY**
SUBJECTCODE**: SET/EI/BT/E802 (iii)**
COURSE OUTCOME**:** Students will be able
CO1To understand the basic elements and concepts of electrical power system.
CO2 Explain the smart grid characteristics, architectures and communication.
CO3To understand the renewable energy based grid architectures.
CO4 Learn about the use of sensor networks in smart grid, and security challenges in smart grid.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

SUBJECTNAME**: MOBILE COMMUNICATION AND NETWORKS**
SUBJECTCODE**: SET/EI/BT/E802 (iv)**
COURSE OUTCOME**:** Students will be able to
CO1 Explain the basic physical and technical settings functioning of mobile communication systems.
CO2 Classify the various techniques used for increasing the cellular capacity.
CO3 Describe the development and implementation of mobile communication systems.
CO4To understand the basics of wireless data communication systems and universal mobile telecommunication system.

Credits 3 Theory period of one hour per week over a semester.
1 Tutorial period of one hour per week over a semester.

(Prof. S. C. Bhatt) (Mr. Gambheer Singh Kathait)

(Prof. M. K. Panda) (Prof. N. S. Panwar)