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| **COURSE OUTCOMES (COs)** |  |
| **BTECH Electrical Engineering** |  |
| FINAL YEAR |  |
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|  | At the end of the course, the student should be able to |  |
| **BTEEC701** | **Subject Name:-HIGH VOLTAGE ENGINEERING**  |  |
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| CO1: | Explain the fundamental concept of power system. |  |
| CO2: | Design the mathematical model of synchronous machine. |  |
| CO3: | Design the mathematical model Excitation system and speed governing system. |  |
| CO4: | Analyze the transient stability of power system using swing equation and equal area criteria. |  |
| CO5: | Analyze the economic operation of power system. |  |
| CO6: | Explain the methods of Voltage control. |  |
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| **BTEEC702** | **Subject Name:-POWER SYSTEM OPERATION AND CONTROL** |  |
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| CO1: | Illustrate the concept of electric field stresses, applications of insulating materials and methods for Non-destructive testing of equipment like transformers, insulators, isolators, bushings, lightning arrestors, cables, circuit breakers and surge diverters. |  |
| CO2: | Explain the breakdown process in solid, liquid, and gaseous materials. |  |
| CO3: | Analyze methods for generation and measurement of High Voltages and Currents (both ac and dc). |  |
| CO4: | Describe the phenomenon of over-voltage and choose appropriate insulation co- ordination levels based on IS & IEC Standards. |  |
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| **BTEEPE703**  | **Professional Elective (Group F)** |  |
| **BTEEPE703**  | **(A)    Energy Audit and Conservation** |  |
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|  | After learning this course the students will be able to:  |  |
| CO1. | Understand energy scenario and policy |  |
| CO2. | Understand the significance and procedure for energy conservation and audit. |  |
| CO3. | Understand causes and remedies for global energy issues. |  |
| CO4. | Analyze, calculate and improve the energy efficiency and performance of electrical utilities. |  |
| CO5. | Analyze, calculate and improve the energy efficiency and performance of mechanical utilities. |  |
| CO6. | Understand the applications of Internet of Things (IoT) in the energy sector. |  |
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| **BTEEPE703**  | **(B)    Electrical System Design for Building** |  |
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| CO1. | At the end of this course, learners will be able to |  |
| CO2. | Illustrate various electrical design calculations in sizing and selection of electrical equipment |  |
| CO3. | Formulate load estimation for given load curve or consumption |  |
| CO4. | Calculate the power regulation, necessary power factor correction and evaluate the harmonics |  |
| CO5. | Apply various codes, standards, regulations to be followed |  |
| CO6. | Restate the importance of coordination with other discipline |  |
| CO7. | Demonstrate short circuit analysis and perform relay coordination in ETAP software |  |
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| **BTEEPE703**  | **(C)    Applications of Power Electronics in Power System** |  |
|  |  |  |
| CO1: | Enhance Theoretical and practical knowledge on modern day semiconductor devices, and control. |  |
| CO2: | Design various AC voltage controllers. |  |
| CO3: | Design various single and three phase inverter. |  |
| CO4: | Understand the simulation model of grid integration of DFIG and PMSG. |  |
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| **BTEEPE703**  | **(D) Electrical Utilization** |  |
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| CO1. | Able to maintain electric drives used in an industries |  |
| CO2. | Able to identify a heating/ welding scheme for a given application |  |
| CO3. | Able to maintain/ Trouble shoot various lamps and fittings in use |  |
| CO4. | Able to figure-out the different schemes of traction schemes and its main components |  |
| CO5. | Able to design a suitable scheme of speed control for the traction systems |  |
| CO6. | Able to identify the job/higher education / research opportunities in Electric Utilization industry. |  |
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|  | **Open Elective (Group G)** |  |
| **BTEEPE703**  | **(A)    Process Control Instrumentation** |  |
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| CO1. | Determine dynamic elements and open loop characteristics of processes for design of feedback controller. |  |
| CO2. | Analyze process control loops to identify its significant elements. |  |
| CO3. | Evaluate closed loop control performance for PID algorithms (P, PI and PID). |  |
| CO4. | Illustrate Cascade, feed-forward, feed-back-feed-forward, Ratio, Selective, Split range and Inferential Control strategies conventional single-loop PID controllers |  |
| CO5. | Design of control system for two input two output process by selecting an appropriate multiloop control configuration from for enhanced process control beyond characterizing loop interactions. |  |
| CO6. | Design of PID controller by direct synthesis and internal model control methods of model based techniques. |  |
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| **BTEEPE703**  | **(B)    Biomedical Instrumentation**  |  |
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| CO1 | Understand the physiology of biomedical system |  |
| CO2 | Measure biomedical and physiological information |  |
| CO3 | Discuss the application of Electronics in diagnostics and therapeutic area |  |
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| **BTEEPE703**  | **(C)    Mechatronics**  |  |
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| CO1. | Understand characteristics and the components of mechatronics systems |  |
| CO2. | Discuss recent trends in Mechatronics |  |
| CO3. | Describe active & Passive electrical circuits |  |
| CO4. | Describe the techniques are of used to design a mechatronics process. |  |
| CO5. | Suggest possible design solutions |  |
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| **BTEEOE705**  | **Open Elective (Group H)** |  |
| **BTEEPE703**  | **(A)    Electric and Hybrid Electric Vehicles** |  |
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| CO1. | Understand the architecture and vehicle dynamics of electric and hybrid vehicles |  |
| CO2. | Analyze and model the power management systems for electric and hybrid vehicles |  |
| CO3. | Devise power electronics based control strategies for electric and hybrid vehicles |  |
| CO4. | Analyze and design various components of electric and hybrid vehicles with environment concern. |  |
| CO5. | Investigate and model the issues in mathematical domain related to grid interconnections of electric and hybrid vehicle. |  |
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| **BTEEPE703**  | **(B)    Internet of Things (IoT)** |  |
| CO1. | Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals. |  |
| CO2. | Analyze the use of different power electronics devices and electrical machines in hybrid electric vehicles. |  |
| CO3. | Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology |  |
| CO4. | Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs. |  |
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| **BTEEPE703**  | **(A)    Testing, Maintenance and Commissioning of Electrical Equipment** |  |
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| CO1. | After learning the course, the students will be able to undertake installation, commissioning and maintenance of electrical equipment. |  |
| CO2. |  Preparation of maintenance schedule of different equipment and machines |  |
| CO3. |  Trouble shooting chart for various electrical equipment, machines and domestic appliances |  |
| CO4. |  Procedure of different types of earthing for different types of electrical installations |  |

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| **COURSE OUTCOMES (COs)** |
| **BTECH Electrical Engineering** |
| Third Year |
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| **BTEEC501** | **Subject Name:-POWER SYSTEM ANALYSIS** |
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| CO1: | To study different parameters of power system operation and control To study load flow and Diff. methods of reactive power control. |
| CO2: | To understand diff. methods of fault analysis and stability study. |
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| **BTEEC502**  | **Microprocessor and Microcontroller** |
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| CO1: | To know the architecture of 8085 and 8051. |
| CO2: | To understand interfacing and interrupt features of 8085 and 8051. To develop program for basic applications. |
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| **BTEEC503**  | **Power Electronics** |
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| CO1: | To review principle of construction, operation and characteristics of basic semiconductor devices. |
| CO2: | To understand and analyze performance of controlled and uncontrolled converters. |
| CO3: | To understand and analyze performance of DC to DC converters. Dc to AC converters. To understand and analyze performance of AC voltage controllers. |
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| **BTEEPLE504**  |  **A)HVDC** |
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| CO1: | Demonstrate the implementation benefits of HVDC transmission over EHVAC transmission with respect to economics, performance and technological developments from LCC to VSC based systems. |
| CO2: | Illustrate the detailed performance analysis of LCC and VSC converter-valve operation with the study of relevant PWM techniques used in VSCs |
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| **BTEEPLE504**  | **B) Power Quality Issues** |
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| CO1: | To study various methods of power quality monitoring. |
| CO2: | To Study the production of voltages sags. |
| CO3: | To Study the interruptions types and its influence in various components. |
| CO4: | To Study the Effects of harmonics on various equipment’s. |
| CO5: | Understand power quality monitoring and classification techniques |
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| **BTEEPLE504**  | **C) Industrial Automation** |
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| CO1: | Knowledge will be gained on application and utility of Intelligent Industrial Automation used in various sectors and fields. |
| CO2: | Understand automation technologies and identify advantages, limitations and applications of the same. |
| CO3: | Develop ability to recognize, articulate and solve industrial problems using automation technologies. |
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| **BTEEOE505**  | **A) Embedded System** |
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| CO1:  | Able to explain embedded systems and its applications. |
| CO2:  | Able to explain architecture, data transfer and different addressing modes in microcontrollers. |
| CO3: | Able to use different components in embedded systems and their assembly. |
| CO4: | Able to test their designs using circuit emulators. |
| CO5: | Able to appraise circuit emulator results with hardware implementation and real time applications. |
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| **BTEEOE505**  | **B) Electrical Safety** |
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| CO1:  | Understand the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers. |
| CO2:  | Outline the electrical safety during installation, testing and commissioning procedure. |
| CO3: | Make use of specification of electrical plants and classification of safety equipment for various hazardous locations. |
| CO4: | Distinguish various fire extinguishers and their classification. |
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| **BTEEOE505**  | **C) Condition Monitoring of Electric Apparatus** |
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| CO1:  | Identify and understand the significance of role of condition monitoring. |
| CO2:  | Assess the condition of various electrical equipments. |
| CO3: | Identify amount of damage/deterioration in the electrical equipments. |
| CO4: | Check the mechanical integrity of the electrical equipments |
| CO5: | Implement condition monitoring plan for complete electrical system |
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| **BTEEC601** | **Switchgear and Protection** |
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| CO1: | To understand principles of protective relaying. |
| CO2: | To understand principle of construction, operation and selection of different type of circuit breaker used in power system. |
| CO3: | To understand different protection schemes used in power system operation. |
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| **BTEEC602**  | **Electrical Machine Design** |
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| CO1: | To understand principles of electric machine design. To design different components of electric machine. To design Transformer. |
| CO2: | To understand CAD and use it for transformer design. |
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| **Column1** | **Column2** |
| BTEEC603 | Control System Engineering |
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| CO1: | To understand the behavior of nonlinear control system. To design and analyze PID controller. |
| CO2: | To understand and analyze state variable technique. |
| CO3: | To design and analyze suitable control system for engineering application. |
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| **BTEEPE604**  | **A) Flexible AC Transmission System** |
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| CO1: | To understand importance, configuration and types of HVDC transmission |
| CO2: | To analyst the operation of HVDC converter, system control and protection. |
| CO3: | To understand the concept of FACTS, their role, type and functionality. |
| CO4: | To analyze the operation of static series and shunt compensator. |
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| **BTEEPE604**  | **B) Smart Grid Technology** |
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| CO1:  | Understand the features of Smart Grid.  |
| CO2:  | Assess the role of automation and digitization in the Transmission and Distribution  |
| CO3: | Analyze Smart grids and Distributed energy resources (DER) with evolutionaryalgorithms. |
| CO4: | Understand the operation and importance of data acquisition devices and their location in Voltage and Frequency control |
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| **BTEEPE604**  | **C) Modeling, Simulation and Control of Electric Drives** |
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| CO1:  | Understand the basics of electric drives and fundamentals of drive dynamics. |
| CO2:  | Learn and analyze DC drive. |
| CO3: | Learn and analyze different steady state speed control methods for Induction motors, and understand the closed loop block diagrams for different methods. |
| CO4: | Get introduced to modern synchronous motors and drives. |
| CO5: | An ability to use standard methods to determine accurate modeling/simulation parameters for various general‐purpose electrical machines and power electronics devices required for |
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| **BTEEOE605**  | **A) E-waste Management** |
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| CO1:  | Know about the environmental impacts of e-waste. |
| CO2:  | Apply various concept learned under e-waste management hierarchy |
| CO3: | Distinguished the role of various national and internal act and laws applicable for e-waste management and handling. |
| CO4: | Analyze the e – waste management measures proposed under national and global legislations. |
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| **BTEEOE605**  | **B) Power Plant Engineering** |
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| CO1:  | To review basic components of power system, energy sources. |
| CO2:  | To understand principle of construction and operation of different conventional power plants. |
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| **BTEEOE605**  | **C) Sensor Technology** |
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| CO1:  | Graduates will be engineering practitioners and leaders, who would help solve industry’s technological problems  |
| CO2:  | Graduates will be engineering professionals, innovators or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in industry |
| CO3: | Graduates will function in their profession with social awareness and responsibility |
| CO4: | Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country  |
| CO5: | Graduates will be successful in pursuing higher studies in engineering or management |
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| **BTEEOE605**  | **D) Lightning Interaction with Power System** |
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| CO1:  | Students are able tounderstand normal and abnormal switching transients and damping. Able to design the insulation coordination in high voltage systems |
| CO2:  | Able to know the concept of power system transients in dc and ac three phase circuits. |
| CO3: | Able to analyze the lighting phenomenon, fast switching surges in transmission lines. |
| CO4: | Able to design the insulation coordination in high voltage systems |

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| **BTECH Electrical Engineering** |
| SECOND YEAR |
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| BTBS301  | Engineering Mathematics III |
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| **CO 1:** | **Solve problems in engineering domain related to Linear Algebra using matrices.** |
| **CO 2:** | **Analyze and solve engineering problems using Laplace Series.** |
| **CO 3:** | **Analyze and solve engineering problems using Fourier Series.** |
| **CO 4:** | **Solve engineering problems using Complex Integration.** |
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| BTEEC302 | Electrical Machines-I |
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| **CO 1:** | **Explain construction, working principle and power flow in DC Machines - Generator, Motor and AC Machines-Transformer,3Phase Induction Motor** |
| **CO 2:** | **Classify various machines and understand - characteristics, performance parameters of DC motors, transformer, 3-Phase Induction Motor, equivalent circuit parameters** |
| **CO 3:** | **Analyze various performance parameters of above machines.** |
| **CO 4:** | **Utilize the know-how of testing work for development of final year project.** |
| **CO 5:** | **Solve complex problems in machines which is useful for competitive exams.** |
| **CO 6:** | **Use of software for analysis of electrical machines.** |
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| BTEEC303 | Electrical and Electronic Measurement |
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| **CO1:** | **To understand philosophy of measurement.** |
| **CO2:** | **To understand different methods analog and digital measurement.** |
| **CO3:** | **To study principle of construction and operation of different transducer and dismay methods.** |
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| BTHM 304 | Basic Human Rights |
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| **CO1:** | **Identify and evaluate the historical, philosophical, political and cultural developments establishing human rights as a set of global norms, agreements, and procedures.** |
| **CO2:** | **Explore global human rights institutions, law, and processes, and assess the impact of their interaction with national and local cultural practices and norms.** |
| **CO3:** | **Examine the impact of diverse geographic, cultural and theoretical contexts on the social acceptance and practical application of human rights norms.** |
| **CO4:** | **Synthesize interdisciplinary approaches and contributions to topics such as gender, race, poverty, violence and post-colonialism within a human rights framework.** |
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| BTES305 | 5. Reflectively evaluate the effectiveness of human rights practice on local, national or international humanitarian efforts. |
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| **CO1:** | **To study about crystal structure.** |
| **CO2:** | **To understand magnetic material structure.** |
| **CO3:** | **To study about conducting and superconducting materials To study dielectric and nano materials.** |
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| BTEEC401 | Network Theory |
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| **CO1:** | **Explain the concept of Laplace transform & can apply to solve D.E and integral equation.** |
| **CO2:** | **To understand principles of various network theorems and network principles.** |
| **CO3:** | **Evaluate Fourier series and Fourier transform of function in different interval.** |
| **CO4:** | **Solve P.D.E and apply it for initial value problems and boundary value problems** |
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| BTEEC402 | Power System |
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| **CO 1:** | **To Understand basic operation of power system, power system components and their characteristics.** |
| **CO 2:** | **Able to select proper methodologies of load flow studies for the power network** |
| **CO 3:** | **Able to develop programs for power system studies.** |
| **CO 4:** | **Able to develop mathematical models for analysis.** |
| **CO 5:** | **Able to apply concepts of Stability analysis** |
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| BTEEC402 | Electrical Machines-II |
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| **CO 1:** | **To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.** |
| **CO 2:** | **To impart knowledge on Principle of operation and performance of synchronous motor** |
| **CO 3:** | **To impart knowledge on Construction, principle of operation and performance of induction machines.** |
| **CO 4:** | **To impart knowledge on Starting and speed control of threephase induction motors** |
| **CO 5:** | **To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines** |
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| BTBS404 | Analog and Digital Electronics |
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| **CO1:** | **To review basic number system.** |
| **CO2:** | **To understand deign and characteristics of digital logic gates. To study different** |
| **CO3:** | **To design digital systems.** |
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| BTEEPE405 | (A) Electromagnetic Field Theory |
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| **CO1** | **Solve mathematical problems in Cartesian, cylindrical and spherical coordinate systems.** |
| **CO2** | **Apply basics of electrostatics in different coordinate systems and analyze behavior of electric field in conductor, dielectric and interfaces.** |
| **CO3** | **Solve magneto statics of circuits using basic relations to analyze effect of magnetic forces, materials and calculate its inductance.** |
| **CO4** | **Ability to solve electromagnetic problems using Maxwell’s equations in for time varying fields** |
| **CO5** | **Investigate behavior of EM waves in different medias and to calculate average power density radiated.** |
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| BTEEPE405 | (B) Signals and Systems |
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| **CO1** | **To Understand different types of signals-continuous and discrete, odd and even, periodic and aperiodic etc. Be able to classify systems based on their properties** |
| **CO2** | **To familiarize the concepts of transform based continuous time and discrete time analysis of signals and systems** |
| **CO3** | **Analyze continuous time signals and systems by using appropriate mathematical tools** |
| **CO4** | **Analyze sampling process and sampling of discrete time signals.** |
| **CO5** | **Analyze discrete time signals and systems by using appropriate mathematical tools** |
| **CO6** | **Determine Fourier transforms for continuous-time and discrete-time signals (or impulse-response functions), and understand how to interpret and plot Fourier transform magnitude and phase functions.** |
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| BTEEPE405 | (C) Advance Renewable Energy sources |
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| **CO1** | **Understand of renewable and non-renewable sources of energy** |
| **CO2** | **Gain knowledge about working principle of various solar energy systems** |
| **CO3** | **Understand the application of wind energy and wind energy conversion system** |
| **CO4** | **Develop capability to do basic design of bio gas plant.** |
| **CO5** | **Understand the applications of different renewable energy sources like ocean thermal, hydro, geothermal energy etc.** |
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| BTEEPE405 | (D) Electronic Devices and Circuits |
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| **CO1** | **Comply and verify parameters after exciting devices by any stated method** |
| **CO2** | **Implement circuit and test the performance** |
| **CO3** | **Analyze small signal model of FET and MOSFET.** |
| **CO4** | **Explain behavior of FET at low frequency** |
| **CO5** | **Design an adjustable voltage regulator circuits.** |
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