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S.No.	Category	Course Code	Course Title	BOS
1	ES	GR14A1018	Basic Electrical Engineering	EEE
2	ES	GR14A2004	Electrical Technology	EEE
3	ES	GR14A2026	Electrical and Electronics Technology	EEE
4	ES	GR14A2032	Electrical and Electronics Technology Lab	EEE
5	ES	GR14A2034	Electromagnetic Fields	EEE
6	ES	GR14A2035	Network Theory	EEE
7	ES	GR14A2036	DC Machines and Transformers	EEE
8	ES	GR14A2037	DC Machines Lab	EEE
9	ES	GR14A2038	Multism / Networks Lab	EEE
10	ES	GR14A2039	Lab View / Matlab Lab	EEE
11	ES	GR14A2040	Power Generation and Distribution	EEE
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16	ES	GR14A2046	Analog and Digital Electronics Lab	EEE
17	ES	GR14A2105	Principles of Digital Electronics	EEE
18	ES	GR14A3015	Op Amps	EEE
19	ES	GR14A3016	Power Transmission System	EEE
20	ES	GR14A3017	Electrical Measurements and Instrumentation	EEE
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23	ES	GR14A3020	Power Electronics Lab	EEE
24	ES	GR14A3021	Computer Methods in Power Systems	EEE
25	ES	GR14A3022	Switch Gear and Protection	EEE
26	ES	GR14A3023	Utilization of Electrical Energy	EEE
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28	ES	GR14A3025	Power Systems Lab	EEE
29	ES	GR14A4022	Power Semiconductor Drives	EEE
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36	ES	GR14A4029	Power Electronic Drives Lab	EEE
37	ES	GR14A4030	Programmable Logic Controllers	EEE
38	ES	GR14A4031	Power Systems Automation	EEE
39	ES	GR14A4032	FACTS	EEE
40	ES	GR14A4034	DSP Based Electro Mechanical Systems	EEE
41	ES	GR14A4035	EHV AC Transmission	EEE
42	ES	GR14A4036	Modern Power Electronics	EEE
43	ES	GR14A4037	Advanced Control Systems	EEE

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44	ES	GR14A4038	PLC-Lab		EEE

1. Basic Electrical Engineering
Course Code: GR14A1018
Course Outcomes: At the end of the course, the student will be able to

1. Comprehend the basics of Electrical Engineering and practical implementation of Electrical fundamentals.
2. Illustrate applications of commonly used electric machinery.
3. Identify the methods for numerical solutions to fundamental electrical engineering.
4. Apply the basic principles involved in electrical engineering concepts.
5. Analyze the practical methods of basic house wiring.
6. Identify methods to solve AC circuits.
7. Comprehend basics of electric machines like induction motors, generators, transformers etc. used in industries.

2. Electrical Technology
Course Code: GR14A2004
Course Outcomes:

1. Learn how to develop and employ circuit models for elementary electronic components.
2. Know the application of ohms law & Kirchhoff's laws.
3. Will be familiar with ac and dc circuits solving.
4. An ability to find role of electrical machinery in simple & complex applications.
5. To demonstrate the designing and conducting experiments, to analyze and interpret data, and also provides the ability to visualize and work on laboratory and multidisciplinary tasks.
6. The student will be able to measure the fundamental electrical quantities using oscilloscope.
7. Ability to know about fundamental principles of electrical machines.

3. Electrical and Electronics Technology
Course Code: GR14A2026
Course Outcomes:

1. Apply knowledge of DC generators and motors in various applications and able to

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know the uses of three point starter.
2. Calculate Transformer EMFs, Losses, Efficiency and regulation
3. Apply knowledge of alternators and induction motors in various applications.
4. Learn to use Semiconductors and pn Junction Diodes in daily life and know about their switching characteristics.
5. Apply knowledge of diodes for implementation of Half wave, Full wave and Bridge rectifiers.
6. Develop various applications by using special diodes.
7. Know how to use BJT as an amplifier and its stabilizing and biasing techniques

4. Electrical and Electronics Technology Lab
Course Code: GR14A2032
Course Outcomes:

1. Understand The Concept Of Theorems.
2. Solve AC And DC Circuits
3. Conduct Open And Short Circuit Test On Transformers.
4. Conduct Experiment On Alternator To Find The Characteristics.
5. Conduct Experiment On Induction Motor.
6. Perform Test On DC Motors.
7. Perform Test On DC Generators.

5. Electro magnetic fields
Course Code: GR14A2034
Course Outcomes:

1. Solve the problems in different EM fields
2. Design a programming to generate EM waves subjected to the conditions
3. Applications of EM Waves in different domains and to find the time average power density
4. Solve Electromagnetic Relation using Maxwell Formulae
5. Solve Electro Static and Magnetic to Static circuits using Basic relations
6. Analyze moving charges on Magnetic fields
7. Design circuits using Conductors and Dielectrics

6. Network Theory
Course Code: GR14A2035
Course Outcomes:

1. Measure Three phase voltages and currents, active, reactive powers.
2. Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and solve the circuits.
3. Solve Circuits using Cut set ,Tie Set Methods.
4. Find dc and ac transient analysis for given circuit.
5. Analyse LP, HP, BS and BP filters.

6. Apply dot convention and to find out self and mutual inductance for a given circuit.
7. Ability to know poles and zeros of a given transfer function.

7. DC Machines and Transformers
Course Code: GR14A2036
Course Outcomes:

1. Understand energy conversion principles in DC machines & Transformers.
2. Find role of electrical machinery in simple & complex applications.
3. Articulate importance of extensive research in electrical machines.
4. Design real time applications.
5. Model DC Machine for given specification.
6. Draw armature winding for DC Machines
7. Find voltages , currents, torque and speed of given machine.

8. DC Machines Lab
Course Code: GR14A2037
Course Outcomes:

1. Have knowledge of various parts of a electrical machine.
2. Develop knowledge helpful for application of dc machines.
3. Ability to conduct speed control of different types of DC Motors.
4. Ability to test for characteristics of various generators depending on their type of field excitation.
5. Ability to understand the concept of different types of windings viz lap and wave for armature.
6. Ability to Perform test on Motor-Generator Set.
7. To know the concept of commutation dc machines for conversion of Ac to Dc or Dc to Ac.

9. Electrical Networks Lab
Course Code: GR14A2038
Course Outcomes:

1. Demonstrate knowledge of mathematics, science and engineering.
2. Demonstrate the ability to identify, formulate and solve engineering problems.
3. Demonstrate the ability to analyze and design basic lumped circuits.
4. Participate and try to succeed in competitive examinations.
5. Demonstrate the ability to simulate network circuits in MULTISIM.
6. Use techniques, skills and modern engineering tools necessary for engineering practice.
7. Demonstrate the ability to connect hardware components practically on breadboard.

10. Electrical Systems Lab
Course Code: GR14A2039

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Course Outcomes:

1. Express programming and simulation for engineering programs.
2. Find importance of these software's for lab experimentation.
3. Articulate importance of software's in research by simulation work.
4. In-depth knowledge of providing virtual instruments on Lab VIEW Environment.
5. Simulate basic electrical circuit in Mat lab Simulink.
6. Solve and execute complex algorithms in real time.
7. Integrate hardware and their corresponding software

11. Power Generation and Distribution
Course Code: GR14A2040
Course Outcomes:

1. Articulate power system concepts required to engineering problems.
2. Design power system components for a specified system and application
3. Ability to discuss various power sources for generation of power merit/Demerits
4. Formulate A.C and D.C distribution networks for necessary variable calculation
5. Ability to calculate usage of electrical power
6. Ability to plot the power/energy demand in the form of graph
7. Ability to discuss functions of substations

12. AC Machines
Course Code: GR14A2041
Course Outcomes:

1. Find role of electrical machinery pertaining to Synchronous machines, Single phase motors in simple & complex applications.
2. Express importance of extensive research in electrical machines.
3. In-depth knowledge of applying the concepts on real time applications.
4. Articulate rotating magnetic generation
5. Calculate machine variables in direct and quadrature axis form
6. Express working of single and three phase AC Machines
7. Know the concept of harmonics created in supply systems, need for reduction and design of synchronous machines for reducing them.

13. Control Systems
Course Code: GR14A2042
Course Outcomes:

1. Express the basic elements and structures of feedback control systems.
2. Represent the mathematical model of a system.
3. Apply Routh-Hurwitz criterion, RootLocus, Bode Plot and Nyquist Plot to determine the domain of stability of linear time-invariant system.
4. Determine the steady-state response, errors of stable control systems and design compensators to achieve the desired performance.

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5. Analyse the stability of the system.
6. Design lead, lag, lead-lag compensators.
7. Express control system models on state space models, to express state transition matrix and calculation of variables.

14. AC Machines Lab
Course Code: GR14A2044
Course Outcomes:

1. Have knowledge of various parts of a electrical machine.
2. Calculate the parameters of equivalent circuit of single phase induction motor.
3. Conduct open circuit/ short circuit test on transformer.
4. Conduct experiments on Ac Machines to find the characteristics.
5. Draw the various characteristics of three phase induction motor.
6. Perform test on synchronous Machine to find Direct and quadrature axis reactance.
7. Conduct No Load and Full load tests on transformers/Induction Motor.

15. Control Systems Lab
Course Code: GR14A2045
Course Outcomes:

1. Have a strong knowledge of MATLAB software
2. Do various engineering projects.
3. Formulate transfer function for given control system problems.
4. Find time response of given control system model.
5. Plot Root Locus and Bode plots for given control system model
6. Design Lead, Lag, Lead-Lag systems in control systems
7. Design PID controllers for given control system model

16. Analog and Digital Electronics Lab
Course Code: GR14A2046
Course Outcomes:

1. Recall the working operation of Operational Amplifiers, 555 Timer and their applications
2. Compare the Digital and Analog IC's
3. Practice the amplifiers, waveform generators and oscillator circuits
4. Differentiate the integrators and differentiators working operation
5. Judge the different waveforms and their applications
6. Predict the circuit output waveform and its value.
7. Construct the Digital Logic Function and analog circuits.

17. Principles of Digital Electronics
Course Code: GR14A2105
Course Outcomes:

1. Identify the different types of number systems and their use.
2. Explain the principle concepts of Digital Logic Design.
3. Implement the logic circuits using Combinational Logic IC's.

4. Distinguish between the Sequential and Combinational Logic Circuits.
5. Reconstruct the Logic Circuits for real time applications with Combinational Circuits
6. Formulate the Digital Logic Circuit function.
7. Design the Logic Circuit using Combinational and Sequential Circuits

18. OPamps
Course Code: GR14A3015
Course Outcomes:

1. Recognize the Operational Amplifier and describe their working operation
2. Outline different types of applications designed with Operational Amplifiers, 555 timer, ADC and DAC
3. Identify the circuits used for different applications implemented with Operational Amplifiers.
4. Prioritize the sequence of steps required while designing a circuit
5. Analyze the working operation of PLL
6. Determine the components used in different applications using Operational Amplifiers, 555 timer, PLL, ADC and DAC
7. Develop the basic applications using the IC's.

19.   Power Transmission System
Course Code: GR14A3016
Course Outcomes:

1. Exposure on transmission system.
2. Find calculation of resistance, Inductance and Capacitance of Transmission Lines.
3. Do calculation of power system Transients.
4. Discuss various factors governing the performance of Transmission Line.
5. Discuss construction of Underground Cables.
6. Understand the sag and tension calculations of transmission line.
7. Know the different types of overhead line insulators.

20.   Electrical Measurements and Instrumentation
Course Code: GR14A3017
Course Outcomes:

1. Analyze the techniques and skills for electrical projects.
2. Design a system, component or process to meet desired needs in electrical engineering.
3. Show measurement of R,L,C ,Voltage, Current, Power factor , Power, Energy
4. Calculate unknown values in Bridges.
5. Indicate frequency, phase with Oscilloscope.
6. Know the usage of Digital voltmeters.
7. Formulate strain, displacement, Velocity, Angular Velocity, temperature, Pressure ,Vacuum, and Flow .

21.   Power Electronics
Course Code: GR14A3018
Course Outcomes:

1. Discuss the basics of power electronic devices.
2. Construct the design and control of rectifiers, inverters.

3. Discover of power electronic converters in power control applications.
4. Compare characteristics of SCR, BJT, MOSFET and IGBT.
5. Demonstrate communication methods.
6. Experiment the design of AC voltage controller and Cyclo Converter.
7. Construct the Chopper circuits.

22. Sensors/Measurements and Instrumentation Lab
Course Code: GR14A3019
Course Outcomes:

1. Measure common physical quantities using common sensors and differentiate between the types of transducers available
2. Measure the power ,power factor from the given circuits
3. Construct basic programs for computer controlled measurement and transfer of data across the sensor network.
4. Establish competence in laboratory reporting in addition to the proper instrumentation of test systems and appropriate capture and interpretation of experimental test data.
5. Apply the statistics and uncertainty analysis to measuring instruments and record measuring data
6. Define various types of bridges in measurements, analyze and process the obtained measures
7. Design and create novel products and solutions for real time applications

23. Power Electronics Lab
Course Code: GR14A3020
Course Outcomes:

1. Design and conduct simulation and experiments.
2. Use the techniques, skills and modern engineering tools necessary for engineering practice.
3. Identify, formulate & solve engineering problems with simulation.
4. Simulate characteristics of SCR, MOSFET, IGBT.
5. Simulate Rectifiers, Choppers, AC voltage controller, Inverter, Cyclo-converter circuits
6. Perform cyclo converter circuits on hardware kits.
7. Demonstrate working of AC voltage controller circuit on hardware kit.

24. Computer Methods in Power Systems
Course Code: GR14A3021
Course Outcomes:

1. Form different network matrices based on graph theory.
2. Develop different algorithms for power flow solutions.
3. Solve the non-linear power flow equations using numerical methods.
4. Calculate short circuit current and MVA capacity.
5. Solve unsymmetrical faults using symmetrical components.
6. Understand the concepts of steady state stability and its significance.
7. Analyze the transient stability of power system.

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25. Switch Gear and Protection
Course Code: GR14A3022
Course Outcomes:

1. Know different Protective Equipments in Power Systems
2. State the terms used for Switchgear and Protection.
3. Summarize different techniques for relays and circuit breakers in power systems
4. Analyze the types, characteristics and applications of Distance, OverCurrent and Differential relays.
5. Identify various protective schemes for Generators, Transformers, Transmission lines and Busbars.
6. Illustrate effects and types of Grounded and Ungrounded systems.
7. Generalize protection against over voltages for Power System equipment

26. Utilization of Electrical Energy
Course Code: GR14A3023
Course Outcomes:

1. Underlying concepts of electrical traction drives
2. Introduction to different types of drives used in traction
3. A good engineering breadth so as to analyze different Train movements and speed time curves
4. Categorization of different types of Electrical Heating and Electrical welding
5. Ability to discuss about street lighting and flood lighting
6. Assessment of Specific Energy Consumption of a train
7. Skill to explain about the different types of Illumination

27. Non Conventional Sources of Energy
Course Code: GR14A3024
Course Outcomes:

1. Define the advances in spectral distribution of energy.
2. Evaluate the design and Principles of MHD power generation.
3. Articulate MHD technology in power control applications.
4. Evaluate the Application of OTEC systems
5. Know the techniques for principles of EMF generation
6. Evaluate Global energy position and environmental effects.
7. Know the techniques for energy storage

28. Power Systems Lab
Course Code: GR14A3025
Course Outcomes:

1. Know the power systems hardware.
2. Analyse the characteristics of various relays.
3. Design and analyse the transmission line.
4. Analyse various types of faults and its protection.
5. Implement various power factor correction systems.
6. Perform load flows,short circuit analysis for power generation, transmission and distribution networks.
7. Integrate software for applications that provides intelligent power monitoring, energy management, system optimization, advanced automation, and real-time prediction.

29. Power Semiconductor Drives
Course Code: GR14A4022
Course Outcomes:

1. To apply solid foundation in controlling method of different electrical appliances
2. Interpret power electronics applications in control of speed, torque and other components
3. Develop control Dc motor by Single phase converters.
4. Construct control DC Motor by Three Phase Converters
5. Able to solve four quadrant operation of DC drives.
6. Able to build control DC motors by Choppers
7. Able to model the control of Induction motor through system voltage.

30. Power System Operation and Control
Course Code: GR14A4023
Course Outcomes:

1. Analyse the steady and dynamic response of LFC control.
2. Understand the Economic operation of power system
3. Discuss about thermal and hydro power plants operation in meeting the load demand optimally. (State and central wide installation).
4. Understand the unit commitment problems and methods to solve the problems.
5. Understand how to model turbine, generator and automatic controllers.
6. Express the importance of reactive power control through seminars.
7. Solve problems (numerical problems at present) by posing different problem models related to Economic Load Dispatch, Load Frequency Control and reactive power control.

31. High Voltage DC Transmission Systems
Course Code: GR14A4024
Course Outcomes:

1. Understand the importance of Transmission power through HVDC.
2. Analyse the HVDC Converter operation.
3. Discuss firing angle control of 6 pulse,12 pulse circuits.
4. Discuss harmonics in HVDC.
5. Identify the importance of filters for HVDC system.
6. Analyse the impact of AC system faults on DC system operation.

7. Identify the need for propoer grounding for HVDC operation.

32. Neural and Fuzzy Systems
Course Code: GR14A4025
Course Outcomes:

1. Define the advances in neural networks
2. Evaluate the design and control of fuzzy systems.
3. Articulate the applications of fuzzy control block sets.
4. Evaluate the design of various models in neural networks
5. analyze the techniques of various types of neural networks
6. Evaluate the design and control of associative memories
7. Design fuzzy logic system.

33. Electrical Distribution Systems
Course Code: GR14A4026
Course Outcomes:

1. Perform load modeling and analyse the characteristics of loads .
2. Articulate the design concepts of primary and secondary systems.
3. Understand substation bus schemes and know the difference between 4&6 feeder patterns.
4. Apply Knowledge of SCADA concepts for functioning of substations.
5. Understand the coordination procedure of various protective devices.
6. Determine the optimum capacitor location and can understand the applications of capacitors in distribution systems .
7. Understand the importance of voltage control and know the equipment used for it.

34. DSP Based Electrical Lab
Course Code: GR14A4027
Course Outcomes:

1. Execute programs in Code Composer Studio.
2. Understand TMS320F2812 EzDSP architecture.
3. Program and analyse the functions of ADC and Event manager.
4. Explain how Digital Signal Processors are used in engineering applications.
5. Program and generate PWMs of desired frequency
6. Develop DSP based applications on DSP processors.
7. Apply programing knowledge in developing projects related to Lab experiments.

35. Power Systems Simulation Lab

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Course Code: GR14A4028
Course Outcomes:

1. Understand power industry practices for design, operation, and planning.
2. Use mathematical tools that are essential for system analysis and design.
3. Use commercial software packages in designing solutions to problems.
4. Have group participation in design and problem solving.
5. Analyse the performance of synchronous machine
6. Apply knowledge of load flows for planning and future expansion of existing as well as non-existing power systems.
7. Do modelling of transmission lines.

36. Power Electronic Drives Lab
Course Code: GR14A4029
Course Outcomes:

1. To apply solid foundation in controlling method of different electrical appliances
2. Interpret power electronics applications in control of speed, torque and other components
3. Develop control Dc motor by Single phase converters.
4. Construct control DC Motor by Three Phase Converters
5. Able to slove four quadrant operation of DC drives.
6. Able to build control DC motors by Choppers
7. Able to model the control of Induction motor through system voltage.

37. Programmable Logic Controllers
Course Code: GR14A4030
Course Outcomes:

1. Perform different types of PLC programming schemes.
2. Implement ladder diagrams for process control.
3. Control the robots using PLC.
4. Tune the PLC for different applications.
5. Analyze the PLC internal architecture.
6. Extend knowledge of PLC in analogue operations, arithmetic, logic functions, PID etc.
7. Interface PLC with other technologies like SCADA, HMI, etc.

38. Power System Automation
Course Code: GR14A4031
Course Outcomes:

1. Understand the automation systems in power systems.
2. Explore the SCADA communication systems.
3. Get acquainted with the SCADA and smart grid protocols.
4. Understand new smart devices for substation automation.

5. Extend knowledge of substation automation functions and benefits of data warehousing .
6. Interpret the load forecasting and transmission operations and management in real time applications.
7. Integrate DMS framework and real time DMS applications.

39. FACTS
Course Code: GR14A4032
Course Outcomes:

1. Express different types of FACTS controllers and their role in improving power system performance.
2. Understand the operating principles of various FACTS devices.
3. Relate the performance and applications of VSI & CSI.
4. Know the importance of compensation methods in power system network.
5. Extend the knowledge of active & reactive power and voltage control with FACTS devices.
6. Analyse role of SVC&STATCOM in improving the power system dynamics.
7. Analyze the use of control schemes of TCSC,TSSC,GSC in improving the power quality.

40. DSP Based Electro Mechanical Systems
Course Code: GR14A4034
Course Outcomes:

1. Explain the architecture and the functioning of different peripherals of F2407.
2. Design different types of applications with DSP F2407.
3. Apply the sequence of steps required for designing the circuit.
4. Understand the various types of Interrupt control registers.
5. Analyse the function of various peripherals of DSP for motor control applications.
6. Implement the DSP based DC-DC buck-boost converters.
7. Design the speed control circuit of stepper motor using DSP F2407

41. EHV AC Transmission
Course Code: GR14A4035
Course Outcomes:

1. Understand the importance of estimating the line parameters of EHV AC transmission lines.
2. Do the calculation of electrostatic field of AC lines and able to understand their effect on voltage gradients.
3. Identify the impact of overvoltages on transmission lines.

4. Get the knowledge of energized & un-energized lines and able to understand the requirement of VAR compensation.
5. Emphasize on the effect of corona with respect to its characteristics, properties and losses.
6. Understand the information of radio noise generation in transmission lines.
7. Get the awareness of the design of EHV lines with respect to steady & transient limits.

42. Modern Power Electronics
Course Code: GR14A4036
Course Outcomes:

1. Define the advances in power electronic devices.
2. Articulate power electronic resonant converters in power control applications.
3. Techniques for analyzing and design of resonant inverters
4. Evaluate the design and control of multi level inverters.
5. Articulate DC power supplies in Power electronic applications
6. Evaluate the design and control of AC power supplies
7. Evaluate the design and control of uninterruptable power supplies.

43. Advanced Control Systems
Course Code: GR14A4037
Course Outcomes:

1. Construct the trajectory for the system with nonlinear element for any initial condition
2. Derive the describing Function for non-linearities.
3. Identify systems using various identification methods.
4. Analyze off-line and on-line identifications of plant dynamics
5. Design and implement controller to regulate and control various processes and systems.
6. Design pole-assignment controller and the specific design procedures
7. Design sliding mode controller for non-linear systems

44. PLC Lab
Course Code: GR14A4038
Course Outcomes:

1. Perform PLC programming in software
2. Implement ladder diagrams in hardware.
3. Control the robots using PLC.
4. Implement applications in different types of PLC (Millenium Crouzet , Siemens ,ABB).
5. Develop different applications of PLC in control systems.

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6. Extend knowledge of PLC in analogue operations, arithmetic, logic functions, PID etc.
7. Interface PLC with other technologies like SCADA, HMI, etc.