B.E: Electrical and Electronics Engineering
(2020-2021)
Batch: 2017-21

Curriculum Structure & Syllabus
(7th & 8th semesters)

Department of Electrical and Electronics Engineering
The National Institute of Engineering
Mysuru-570 008
## VII SEMESTER - B.E.

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**Total Contact Hrs./Week : 32**

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*Pre-requisite: Introduction to Nano- Science and Technology (ME0438)
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* Pre-requisite: Power System analysis and Stability (EE0418)

** Pre-requisite: Control Systems - I (EE0437), Control Systems- II - (EE0439)
Computer Applications to Power System Studies (4-0-0)

Sub Code : EE0419  
CIE : 50% Marks

Hrs/week : 4+0+0  
SEE : 50% Marks

SEE Hrs : 3  
Max marks : 100

Course Outcomes
On successful completion of the course, the students will be able to:

2. Apply numerical techniques to evaluate the power flows and stability of power systems.
3. Analyse stability aspects of power system.


06 Hours

SLE: Primitive networks – impedance form and admittance form.


07 Hours

SLE: Modification of bus impedance matrix.


12 Hours

SLE: Comparison of Load Flow Methods.


10 Hours

SLE: Concept of Dynamic Stability.

SLE: Factors affecting transient stability  


SLE: State of the art, future trends and challenges  

Text Books:  


Reference Books:  

Power Distribution Planning and Control (3-0-0)

Sub Code : EE0323
Hrs/week : 3+0+0
SEE Hrs : 3

CIE:50% Marks
SEE:50% Marks
Max. Marks: 100

Course Outcomes
On successful completion of the course, the students will be able to:

1. Discuss the distribution system planning and concept of automation
2. Analyze the Performance of substation, primary and secondary distribution systems.
3. Discuss the concept of reactive power compensation and voltage control techniques
4. Discuss the Distribution Automation Control Function

UNIT 1: Distribution System Planning & Automation: Introduction, Distribution system planning, factors affecting system planning, Present technique, Role of computers in distribution planning, concept of Distribution Automation, SCADA –architecture and functions, local energy control center, Typical control applications

SLE: Remote Terminal UNIT.

06 Hours

UNIT 2: Distribution Substation: Introduction; Load characteristics, substation location, Rating a distribution substation, substation services area with ‘n’ primary feeders, derivation of K constant, substation Application curves, present voltage drop formula.

SLE: Comparison of four and six feeder patterns.

08 Hours

UNIT 3: Primary and secondary distribution systems: Introduction, feeder types and voltage levels, feeder loading, rectangular type development, radial type development application of the A,B,C,D general circuit constants to radial feeders. feeder control equipment.

SLE: Secondary banking

06 Hours


SLE: Ferro-Resonance due to Capacitor Banks

07 Hours
UNIT 5: Distribution system voltage regulation: Quality of service and voltage standards, voltage control, feeder voltage regulators, Line drop compensation, short cut method to calculate voltage dip due to single and three phase motor start.  

SLE: Voltage fluctuations 

07 Hours

UNIT 6: Distribution Automation Control Function: Demand side management, Feeder Automation- Fault detection, reconfiguration and restoration functions. 

SLE: Trouble calls 

06 Hours

Text Books:


High Voltage Engineering (3-0-0)

Sub Code : EE0328
Hrs/week : 3+0+0
SEE Hrs : 3
CIE : 50% Marks
SEE : 50% Marks
Max marks : 100

Course Outcomes

On successful completion of the course students will be able to:

1. Discuss the HV insulating media and understand criterion for electrical breakdown of insulating media.
2. Describe the concept of generating HVAC, HVDC, High voltage lightning impulses
3. Discuss principles and constructional aspects of measuring various categories of high voltages, high currents and surges.
4. Describe testing techniques of HV insulation and apparatus.

UNIT 1: Introduction: Introduction to HV technology, advantages of transmitting electrical power at high voltages, need for generating high voltages in laboratory, Electrode configuration, Classification of HV insulating media.

Breakdown phenomena in Liquid dielectrics: Pure and commercial liquids, properties, Suspended particle theory, Cavity breakdown theory, Stressed oil volume theory.

06 Hours

SLE: Degree of Uniformity


08 Hours

SLE: Panchen’s law, Time lags of Breakdown.


06 Hours

SLE: Parallel resonant circuit, HVDC- voltage doubler circuit.

generator by three electrode gap arrangement and Trigatron gap. Generation of high impulse current.

08 Hours

SLE: Generation of switching impulse voltage.


07 Hours

SLE: Magnetic links.


06 Hours

SLE: Test on Cables.

Text Books:


Reference Books:


Electric Drives (3-0-0)

Sub Code : EE0348  
Hrs/week : 3+0+0  
SEE Hrs : 3  
CIE : 50% Marks  
SEE : 50% Marks  
Max. Marks : 100

Course Outcomes:
On successful completion of the course, the students will be able to:

1. Describe the dynamics of electric drive system.
2. Select and Size the motors and drives for different applications with different torque speed characteristics.
3. Analyse DC motor drives and AC motor drives.

UNIT 1: An introduction to Electrical drives & its dynamics: Electrical drives-advantages, parts and choice of electrical drives.

Dynamics of electrical drives: Fundamental torque equation, speed torque conventions and multiquadrant operation. Equivalent values of drive parameters, components, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization

8 Hours

SLE: Status and Advantages of AC and DC drives

UNIT 2: Selection of motor power rating: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating.

6 Hours

SLE: Frequency of operations of motors subjected to intermittent loads.


7 Hours

SLE: Chopper control of DC separately exited dc motors

UNIT 4: Induction motor drives: Operation with unbalanced source voltages and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, Starting, braking and transient analysis

7 Hours

SLE: Linear induction motor and its control

UNIT 5: Stator voltage control: Variable frequency control of an induction motor, VSI fed induction motor drives, closed loop speed control for VSI fed induction motor drives, rotor resistance control, slip power recovery.
SLE: Starting methods and types of single-phase induction motors


SLE: Types of synchronous motors.

Text Book:


Reference Books:


Management & Entrepreneurship (3-0-0)

Sub Code: EE0333          CIE: 50% Marks
Hrs/week: 3+0+0            SEE: 50% Marks
SEE Hrs: 3                   Max marks: 100

Course Outcomes
On successful completion of the course, the students will be able to:

1. Explain the characteristics and functions of management in the contemporary context
2. Discuss different behavioral patterns, various executive training programs and objectives.
3. Discuss various management functions, its relevance and the process of human resource management.
4. Explain the need for project planning, entrepreneurship and traits of an entrepreneur

UNIT 1: INTRODUCTION: Evolution of concept of scientific management, historical perspective, contribution of Taylor, Henry Fayal, Gilbreth and HL Gantt to scientific management: management as science/art: relevance of scientific management in Indian context.

   06 Hours

SLE: Relevance of various schools of management thought in the present scenario

UNIT 2: MANAGEMENT AND BEHAVIOURAL APPROACH: Introduction to behavioural school of management thought, understanding past behaviour, predicting future behaviour, directing, changing and controlling present behaviour: Maslow's theory of hierarchical needs and Herzberg's two factor theory, McGregor's Theory X and Theory Y: Integration of organizational goals and needs of employees.

   06 Hours

SLE: Relevance of different motivational theories in the present scenario

UNIT 3: MANAGEMENT FUNCTIONS: Planning, organizing, staffing, directing, controlling. Principles of management, managerial skills and skill mix required at different levels, leadership styles.

   06 Hours

SLE: Necessity of leadership and management aspects in industry

UNIT 4: HUMAN RESOURCE MANAGEMENT: Selection and recruitment, training of personnel, employer employee relationship, causes and settlement of industrial disputes.

   06 Hours

SLE: Necessity of personnel selection criteria
UNIT 5: ENTREPRENEURSHIP: Definition, evolution of entrepreneurship, Qualities of entrepreneur; barriers to entrepreneurship, economic liberalization and development of entrepreneurship.

SMALL SCALE INDUSTRIES: Definition and objectives of SSI. Government policy and support through different state and central agencies; impact of economic liberalization on SSIs. Ancillary industry and tiny industries.

08 Hours

SLE: Study of women entrepreneurship and its relevance in the Indian context

UNIT 6: PROJECT PLANNING AND CONTROLLING: Definition of project, identification of project, feasibility study from technical, marketing, financial and social angles; preparation of project report, planning commission guidelines; project appraisal-factors to be considered, scheduling

SLE: Study of planning and controlling aspects involved in the recovery from disasters

08 Hours

SLE: Study of planning and controlling aspects involved in the recovery from disasters

Text Books:


Reference Books:


Electrical Power Quality (3-0-0)

Sub Code : EE0330  CIE : 50% Marks
Hrs/week : 3+0+0  SEE : 50% Marks
SEE Hrs : 3  Max. Marks :100

Course Outcomes
On successful completion of the course, the students will be able to:

1. Discuss the various power quality phenomenon.
2. Interpret and evaluate the voltage sags, interruptions and Transient over voltages.
3. Discuss the fundamental, effects of harmonics and mitigation techniques.
4. Describe the power quality monitoring and benchmarking process.

UNIT-1: INTRODUCTION - Power quality concern, Categories and Characteristics of Power System Electromagnetic Phenomena, power quality evaluation procedures, definition and cause of various power quality disturbances.

   6 Hours

SLE: CBEMA and ITI Curves

UNIT-2: VOLTAGE SAGS AND INTERRUPTIONS: Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, Solutions at the End-User Level.

   6 Hours

SLE: Utility System Fault-Clearing Issues


   7 Hours

SLE: Computer Tools for Transients Analysis


   7 Hours

SLE: Harmonic sequence
UNIT-5: APPLIED HARMONICS: Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, modeling of harmonic source, devices for controlling harmonic distortion, harmonic filters.

7 Hours

SLE: Standards on harmonics

UNIT-6: POWER QUALITY MONITORING: Monitoring considerations, power quality measurement equipments, assessment of power quality measurement data. Power quality benchmark: Introduction, benchmark process, power quality contract, application of intelligent systems.

7 Hours

SLE: Application of intelligent systems.

TEXT BOOK:


REFERENCE BOOKS:

Reactive Power Compensation and Flexible AC Transmission Systems (3-0-0)

Sub Code : EE0345  CIE : 50% Marks
Hrs/week : 3 Hrs   SEE : 50% Marks
SEE Hrs : 3 Hrs   Max marks : 100

Course Outcomes
On successful completion of the course, the students will be able to:

1. Describe the concept of load compensation.
2. Analyse the performance of uncompensated and conventionally compensated transmission lines.
3. Evaluate the reactive power problems associated with distribution system.
4. Discuss the basic principle of working of series and shunt FACTS devices and analyze their performance.

Unit-1: Load Compensation: Objectives and specifications –reactive power characteristics –inductive and capacitive approximate biasing –Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads.

6 Hours

SLE: Load compensator as a voltage regulator


7 Hours

SLE: Compensation by sectioning


8 Hours

SLE: Meters on power system
Unit-4: User Side Reactive Power Management: KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations


7 Hours

SLE: KVAR based tariffs

Unit-5: Introduction To FACTS: Basic Types of FACTS Controllers, Brief Description and Definition of Shunt, Series and combined Controllers, Benefits from FACTS Technology.

Static Series Compensators: Objectives of series compensation-Variable impedance type series compensation (only TCSC).

6 Hours

SLE: Applications of TCSC

Unit-6: Static Shunt Compensators: Objectives of shunt compensation, Methods of controllable VAR generation, Variable impedance type Static Var Generator, Switching converter type Var Generators, basic operating principle.

6 Hours

SLE: Applications of STATCOM

TEXT BOOKS:

Electric Power Utilization (3-0-0)

Sub Code : EE0332
Hrs/week : 3+0+0
SEE Hrs : 3
CIE : 50% Marks
SEE : 50% Marks
Max. Marks : 100

Course Outcomes

On successful completion of the course, the students will be able to:

1. Discuss the utilization of electrical power for Heating, welding and illumination applications.
2. Explain the principle of electrolytic process.
3. Discuss the operation of Electrical traction and Electric Hybrid vehicles.


SLE: Infrared or radiant heating.


SLE: Welding of various metals


SLE: Power Supply for Electrolytic processes


SLE: Flood lighting.

UNIT 5: Electric Traction: Introduction, Requirements, Different types, Comparison, power supply, AC locomotive, Tramways, Trolley-bus, Diesel electric Traction, overhead equipment.

SLE: Power factor and harmonics.
UNIT 6: Introduction to Electric and Hybrid vehicles: Configuration, Performance and Energy consumption of electric vehicles, Concept and Architecture of Hybrid electric vehicles, economic aspects of EV.  

08 Hours

SLE: Tractive effort during normal driving of electrical vehicles.

Text Books:


Reference Books:

Course Outcomes

On successful completion of the course students will be able to:

1. Discuss the energy scenario and fundamentals of energy and financial management.
2. Apply energy efficiency measures to save power.
3. Analyse the energy efficiency of electric motor and lighting loads.
4. Describe the DSM techniques.

UNIT 1: Energy Scenario: Introduction, primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy, global primary energy resource, Indian energy scenario, long term energy scenario for India, energy conservation and its importance, energy and environment.

6 Hours

SLE: Indian Energy Scenario.

UNIT 2: Energy Management and Audit: energy audit definitions, need for energy audit, types of energy audit and approach, preliminary, detailed and post audit phases, benchmarking, plant energy performance, instruments and metering for energy audit.

Financial Management: Introduction, financial analysis techniques-payback period, return on investment (ROI), time value of money: net present valued method, internal rate of return method, electricity tariff and billing, numerical.

7 Hours

SLE: Responsibilities and Duties of energy manager.

UNIT 3: Energy Efficiency in Electrical Utilities: Introduction, electrical load management and maximum demand control, power factor improvement, Economics of power factor improvement, automatic power factor controllers, selection and location of capacitors, performance assessment of power factor capacitors, energy efficient transformers, standards and labeling programme for distribution transformer, distribution losses in industrial system, assessment of T&D losses in power systems, estimation of technical losses in distribution system, causes for technical losses in distribution system, measures to reduce technical losses, commercial losses, A T & C losses.

9 Hours

SLE: Measures to reduce commercial losses.

Selection of Motors, Energy efficient motor, factors affecting energy efficiency and minimizing motor losses in operation.

6 Hours

SLE: Rewinding effects on energy efficiency.

UNIT 5: Lighting System: Introduction, basic parameters and terms in lighting system, light source and types of lamps, recommended illumination levels for various tasks, activities locations. Methods of calculating illuminance - lighting design for interiors, energy saving opportunities, energy efficient lighting controls. DG set as a system, energy performance assessment of DG sets.

6 Hours

SLE: Energy saving measures for DG sets.

UNIT 6: Demand Side Management and Demand Response: Introduction to DSM, Concept of DSM and Demand Response, Classification of DSM programs, Objectives & importance of DSM, DSM techniques, Load shaping objectives, time of day pricing, Benefits from DSM. Promoting energy conservation: Scope and potential in India.

6 Hours

SLE: India’s efforts DSM applications.

TEXT BOOKS:

Nokia offered Elective
- Theory :26 Hrs
- Project session/discussion : 10 Hrs (approx.)

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VLSI circuits (3-0-0)

Sub code: EE0305 CIE: 50% Marks
Hrs/Week: 3+0+0 SEE: 50% Marks
SEE Hrs : 3 Max. Marks: 100

Course Outcomes

On successful completion of the course students will be able to:

1. Describe the fundamental process of IC fabrication, basic components, design flow, scaling trends and limitations.
2. Analyze the electrical characteristics of MOSFET and DC characteristics of CMOS logic gates.
3. Develop simple delay models to analyze the high-speed VLSI system performance
4. Analyze advanced design techniques of CMOS circuits.

UNIT1: An overview of VLSI and logic design with MOSFETs: Complexity and Design, Basic concepts, Ideal switches and Boolean operations, MOSFETs as switches, Basic logic gates in CMOS, Complex logic gates in CMOS, Transmission gate circuits.

SLE: Clocking and Dataflow control.


SLE: stick diagrams.

UNIT 3: Elements of Physical Design: Basic concepts, Layout of Basic structures, cell concepts, FET sizing and unit transistor, Physical design of logic gates, Design hierarchies. Electrical characteristics of MOSFETs: MOS physics, nFET I-V equations, FET RC model, pFET characteristics.

SLE: modelling of small MOSFETs.

UNIT 4: Electronic analysis of CMOS logic gates: DC characteristics of CMOS inverter, Inverter switching characteristics, Power dissipation, DC Characteristics and transient response of NAND and NOR gates, Analysis of complex logic gates, Gate design for transient performance, transmission.

SLE: gates and pass transistors.
UNIT 5: Designing high-speed CMOS logic networks: Introduction, Transient response, Gate delays, RC delay model, Driving large capacitive loads, Logical effort, Parasitic delay, BiCMOS drivers.  

SLE: Overview of interconnects.  

Unit 6: Advanced techniques in CMOS logic circuits: Mirror circuits, Pseudo nMOS, Tristate circuits, Clocked CMOS, Dynamic CMOS logic circuits.  

SLE: Dual-rail logic networks. 

Text Book: 

Reference Books: 
Fuzzy Logic and Soft Computing (3-0-0)

Course Outcomes
On successful completion of the course, the students will be able to:

1. Understand soft computing concepts technologies, and applications
2. Understand the underlying principle of artificial neural network and its learning techniques.
3. Understand the underlying principle of fuzzy logic and its applications
4. Understand the underlying principle of genetic algorithm and its applications

UNIT 1: Introduction: Difference between Soft and Hard computing, Brief descriptions of different components of soft computing and its application, Artificial neural networks Vs Biological neural networks, ANN architecture, Basic building block of an artificial neuron, Activation functions, Introduction to Early ANN architectures (basics only)-McCulloch & Pitts model, Perceptron, ADALINE, MADALINE

7 Hours

SLE: Application of soft computing techniques


7 Hours

SLE: Biological neuron signal transmission


7 Hours

SLE: Advantages of learning algorithms

UNIT 4: Fuzzy Logic: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, properties, fuzzy relations, cardinalities, membership functions,
Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods,

7 Hours

SLE: Computer based simulation of fuzzy logic


6 Hours

SLE: Advantages of Neuro-Fuzzy system

UNIT6: Genetic algorithms: Introduction, encoding, fitness function, reproduction - Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Convergence of GA, Applications of GA case studies. Introduction to genetic programming- basic concepts.

6 Hours

SLE: Limitations of Genetic Algorithm

Textbooks:


Reference Books:

Course Outcomes:

On successful completion of the course, the students will be able to:

1. Describe the architecture of PIC microcontroller
2. Explain the working of peripheral devices and Interfacing concepts
3. Explain microcontroller applications along with examples
4. Explain the Real time operating systems in embedded systems


SLE: Pipelining - Program Memory considerations


SLE: Key switches, Display of Constant and Variable strings.


SLE: Sensor Interfacing.

UNIT-4: PIC Microcontroller Application design and Hardware Interfacing: Requirements definition, PIC microcontroller resource allocation, Effective user interfacing, Project management, Power management, Reset

SLE: Interfacing to external devices
UNIT 5: Sensors, Actuators and Examples of Embedded Systems: Sensors, actuators, Mobile phones, Automotive electronics, RFID, Wireless sensor networks, Robotics, biomedical applications. 07 Hours

SLE: Brain machine interface

UNIT 6: RTOS: Real time tasks, Real time systems, Types of real time tasks, real time operating systems, Real time scheduling algorithms, Rate monotonic algorithm, The earliest deadline first algorithm. 06 Hours

SLE: Basic design using RTOS

Text Books:

Reference Books:
Advanced Nano-Science & Technology (2-0-2)

Sub Code: ME0325  
Hrs / Week: 04  
SEE Hrs: 3 Hrs  

CIE     : 50 % Marks  
SEE     : 50 % Marks  
Max. Marks: 100

Course Prerequisites: Introduction to Nano-Science and Technology (ME0438)

Course Outcomes:
After the successful completion of this course, the student will be able to:
1. Define the basics of miniaturization at nanoscale.
2. Classify the Semiconducting materials and devices at nanoscale
3. Summarize the basics of Nanoscale heat transfer and fluid dynamics
4. Experiments will provide broad prospect of advance research techniques involved in nanotechnology research field.

Unit 1: Introduction to Miniaturization: scaling laws and accuracy, scaling in mechanics, scaling in electricity and electromagnetism, scaling in optics, scaling in heat transfer, scaling in fluids.

Self Learning Exercise: accuracy of the scaling laws

4hours

Unit 2: Nano Electronics: tuning the band gap of nanoscale semiconductors, Quantum Confinement, The density of States for Solids, Single Electron transistor, Molecular Electronics, the colors and uses of quantum dots, lasers based on quantum confinement, Semiconductor nanowires- Fabrication strategies, quantum conductance effects in semiconductor nanowires, fabrication of porous Silicon, nanobelts and nanosprings.

5 hours

Unit 3: Nano Electronic devices: Single Electronic Transistor, Spintronic Transistor, Single Photonic Transistor, Tandem Solar cell, Spintronic LED Perovskites thin film Photovoltaic, Quantum Dot thin film Photovoltaic,

Self Learning Exercise: current research trends on thin film Photovoltaics

5 hours

Unit 4: Nanoscale heat transfer and Fluid dynamics
Introduction, All heat is Nanoscale Heat: Boltzman constant, The Thermal Conductivity of Nanoscale Structures, Convection, Radiation.

4 hours
Unit 5: Nanoscale fluid dynamics:
Introduction, Low Reynolds Numbers, Surface Charges and The Electrical Double Layer, Pressure-Driven Flow, Gravity-Driven Flow, Electro osmosis, Superposition Of Flows, Stokes Flow Around A Particle,  

4 hours

Self Learning Exercise: Applications of Nano fluidics

Unit 6: Nano Biotechnology: Introduction, The Machinery of the cell, Biomimetic Nanostructures, Molecular motors, Bio Sensors  

4 hours

Self Learning Exercise: Applications of Bio Technology

Lab Experiments: (26 hrs)

1. Thin film preparation by DC sputtering
2. Thin film preparation by Thermal Evaporation
3. Thin film preparation by Sol-Gel Method (Spin and Dip)
4. Characterization studies of thin films by AFM
5. Phase studies of thin films by XRD
6. Optical properties of thin films by UV-Visible

Text Book:

Reference Books:
Bio-Medical Instrumentation (3-0-0)

Sub Code : EE0351
Hrs/week : 3+0+0
SEE Hrs : 3

CIE : 50% Marks
SEE : 50% Marks
Max marks : 100

Course Outcomes

On successful completion of the course, the students will be able to:

1. Describe the physiology of the human body and origin of biomedical signals.
2. Explain the working of different diagnostic instruments, Clinical Lab Equipments and different imaging modalities
3. Emphasize the knowledge on Telemedicine and Patient safety

UNIT-1: Fundamentals of Medical Instrumentation: Anatomy, Physiology, Physiology systems of the body, sources of bio-medical signals, basics of medical instrumentation, Performance requirements, Origin of biomedical signals.

06 Hours

SLE: action potential, general constraints in design of medical instrumentation systems

UNIT-2: Diagnostics and Monitoring: General concepts, ECG, Measurement of pulse rate, blood pressure measurement, Cardiac output measurement, measurement of respiration rate, EEG, oxymeter

08 Hours

SLE : Capnography(CO₂ method of respiration rate)


07 Hours

SLE: Radiation hazard reduction and biological impact


Drug Delivery systems: Infusion pumps and components, Implantable infusion systems,

07 Hours

SLE: ESU
Unit-5: Clinical Lab Equipment: Equipments: Spectrophotometry, Spectrophotometer, Colorimeter, Blood gas analyzers – Acid-base balance, Ph, PCO2 pO2 measurement (Intra-arterial blood gas monitoring), Types of blood cell, Method of blood cell counting.

06 Hours

SLE: Automated biochemical analysis system

Unit-6 Telemedicine and patient safety: Shock hazard, leakage current, safety code for medical devices, safety analyzers, Radiation safety, Regulations of medical device, Telemedicine.

06 Hours

SLE: Testing of biomedical equipment.

Text Book:

1. R S Khandpur, “Handbook of Biomedical instrumentation”, 2nd Edn., TMH,

Reference Books:

2. AnandNatarajan, “Biomedical instrumentation and measurement”, 2nd Edn. PHI New Delhi,
Electric vehicles and Battery Management systems (3-0-0)

Sub Code: EEXXX
CIE: 50% Marks
Hrs/week: 3
SEE: 50% Marks
SEE Hrs: 3
Max marks :100

Course Outcomes

On successful completion of the course, students will be able to:

1. Efficiency comparison, Development of Vehicle model, Various characteristic parameters of vehicle load.
2. Fuel economy of drives and Architecture of hybrid electric drive train
3. Configuration and performance of Electric vehicles
4. Describe the basic functions, topology and requirements of a battery-management system
5. Analyze the Equivalent-Circuit Models of lithium-ion cells and its applications to simulate the response of a battery pack to an input stimulus
6. Discuss theory basis and implementation details of state of charge and state of health estimation algorithms.

UNIT 1: History of hybrid electric and electric vehicles, EV advantage, Efficiency comparison with conventional vehicles, Roadway fundamentals, Laws of motion and vehicle kinetics. Dynamic equations for the vehicle, Force velocity characteristics, maximum gradability, velocity and acceleration, Velocity profile, Energy required.

07 Hours

SLE: EV Market and Infrastructure and propulsion system design basics

UNIT 2: Fuel economy characteristics of internal combustion engine, Basic techniques to improve fuel economy, Braking performance, Hybrid electric vehicles-Concept, Architecture, Series hybrid electric drive train, parallel hybrid electric drive train

07 Hours

SLE: Torque-Coupling and Speed-Coupling Parallel Hybrid Electric Drive Trains


06 Hours

SLE: Tractive effort in normal driving and Energy consumption

UNIT 4: Overview of Battery and Its Management: Introduction -Application Requirements for Batteries and BMS, Development Background of the Battery, Principles and Classification of the Lithium-Ion Battery. Battery-pack topology, Battery Management System (BMS) - basic functions, topology and development process of the BMS. BMS design requirements.

7 Hours

SLE: Communication via Control Area Network bus

7 Hours

SLE: Laboratory equipment for cell-data collection

Units 6: Battery SOC and SOH Estimation: SOC estimation, classification, Model based SOC estimation, Battery SOC Estimation Based on AEKF Algorithm, SOC Estimation Based on HIF Algorithm, SOH Estimation, Classification of SOH Estimation Methods, Capacity Estimation Based on SOC Estimation, Available Capacity Estimation Method Based on Response Surface.

SLE: Advantages and disadvantages of various SOH estimation methods and their application scope

6 Hours

Text Books:

3. Rui Xiong “Battery Management Algorithm for Electric Vehicles”, Springer Publisher, 2020

Reference Books

Power System Simulation Lab (0-0-3)

Sub Code : EE0109
Hrs/Week : 0+0+3

CIE: 25 Marks
SET: 25 Marks

Course Outcomes

On successful completion of the course, the students will be able to:

1. Formulate Y-Bus and Z-Bus and determine bus currents and line currents
2. Determine the transmission line parameters and efficiency
3. Perform the transient stability analysis
4. Perform load flow studies using numerical methods
5. Perform short circuit analysis
6. Solve unit commitment problem

List of experiments:

1. ABCD parameters: Formation for symmetric Π and T-configuration. Verification of AD-BC=1, determination of efficiency and regulation.
2. Obtaining power angle characteristics for salient and non-salient pole synchronous machines and determination of reluctance power and voltage regulation.
3. Y-Bus formation and determination of bus currents, bus power and line flow for a system with a given bus voltage Profile.
   a) Y Bus formation by inspection method.
   b) Y-Bus formation by singular transformation method
   c) Determination of bus currents, bus power and line flows for a given system.
5. To obtain swing curve and critical clearing time for a single machine connected to infinite bus.
6. Formation of Jacobian for a system not exceeding 4 buses (with no PV buses) in polar coordinates.
7. Program to perform load flow using Gauss-Seidel method (only PQ bus).
8. To determine fault currents and voltages in a single transmission line systems with star-delta transformers at a specified location for SLGF, DLGF.
10. Optimal Generator Scheduling for Thermal power plants.
11. Determine the transmission losses and efficiency by using hardware simulator.
Relay and High Voltage Lab (0-0-3)

Sub Code : EE0110                        CIE:25 Marks
Hrs/Week : 0+0+3                        SET:25 Marks

Course Outcomes

On successful completion of the course, the students will be able to:

1. Demonstrate the performance characteristics of Relays and Fuse
2. Demonstrate the Spark over characteristics of air insulation with uniform and non-uniform field configurations
3. Construct Field mapping for coaxial cable /capacitor/ transmission conductor model by electrolytic tank method
4. Conduct and verify the method of High voltage measurement.

List of experiments:

1. DMT characteristics of over voltage or under voltage relay. (solid state or Electromechanical type )
2. Operation of negative sequence relay.
3. Current-time characteristics of fuse.
4. Operating characteristics of microprocessor based over-current relay.
5. Operating characteristics of microprocessor based over/under voltage relay
6. Operating Characteristics microprocessor based Distance Relay.
8. Spark over characteristics of air insulation subjected to high voltage DC with spark over voltage corrected to STP.
10. Breakdown strength of transformer oil using oil-testing unit.
11. Field mapping using electrolytic tank for co axial cable /capacitor/transmission Line conductors models.
12. Generation and measurement of Lightning Impulse Voltage.
Mini Project (2 credits)

Sub code: EE0204

Course Outcomes

On successful completion of the course, students will be able to:

1. Identify the topic of relevance within the discipline.
2. Formulate the problem, develop and implement solution methodology.
3. Analyze and interpret the results.
4. Inculcate ethical practices.
5. Document and present reports.

Evaluation

- Students in consultation with the guide identify the topic which will be approved by DPC (Department Program Committee).
- Evaluation shall be based on two presentations by appropriate rubrics.
VIII Semester
Course Outcomes

On successful completion of the course, students will be able to:

1. Explain and Discuss Characteristics of Engineering Profession, Professional responsibility, Reporting and Rules of Practice.
2. Discuss and analyze conflicts of interest, Confidentiality and certification aspects.
4. Analyze feasibility of projects, Coordinate and control execution of Projects.
5. Describe Concepts of Project Management and apply project management tools and techniques.

UNIT 1: Introduction, Characteristics of a Profession, The Engineering Profession, Licence. Professional Responsibility, The Engineer's Duty to Report. Rules of Practice; Use of the Professional Engineers Seal, Relations with Client or Employer, Due Diligence. 07 Hours

SLE: Professional Engineering Bodies in India

UNIT 2: Report Writing, Giving Options, Communications, Retaining Documents, Confidential Information, Volunteering, Data Gathering at the Beginning of a Project. Conflicts of Interest, Certificate of Authorization 07 Hours

SLE: Software available for report writing.

UNIT 3: Professional Standards, Practice Guidelines. Professional Misconduct, Code of Ethics for the Profession. 06 hours

SLE: Professional code set forth by The Institution of Engineers, India

UNIT 4: Concepts of Project Management: Concepts of a project, Categories of projects, Phases of project life cycle, Tools and techniques for project management. 06 Hours

SLE: Roles and responsibility of project leader

07 Hours

SLE: Objectives and goals of a project

UNIT 6: Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project Evaluation and Review Technique (PERT) & Critical Path Method (CPM).

07 Hours

SLE: Role of computers in project management

Text Books:


Reference Books & Materials

1. Professional Engineering Practice: Professional Engineers Ontario, 101-40 Sheppard Avenue West Toronto ON M2N 6K9
Course Outcomes

On successful completion of the course, the students will be able to:

1. Identify the need of smart grid and differentiate between smart grid and Intelligrid
2. Implement the knowledge of smart grid to power system.
3. Compare the use of AC and DC sources in Smart grid.
5. Acquire the knowledge of market implementation and demand side planning

Unit 1: Introduction: Introduction to smart grid, electricity network, local energy networks, electric transportation, low carbon central generation, attributes of the smart grid, alternate views of a smart grid.

SLE: Benefits of Smart Grid.


SLE: Technology Innovation in Electricity use and the Consumer Portal.

Unit 3: Smart Grid to Evolve a Perfect Power System: Introduction, overview of the perfect power system configurations, device level power system, building integrated power systems, distributed power systems.

SLE: Fully integrated power system.

Unit 4: DC Distribution and Smart Grid: AC Vs. DC sources, benefits of and drives of dc power delivery systems, powering equipment and appliances with DC, data centers and information technology loads, future neighbourhood.
SLE: Potential future work and research.

Unit 5: The Smart Grid –Enabling Demand Response The Dynamic Energy Systems Concept: Smart energy efficient end use devices, smart distributed energy resources, advanced whole building control systems, integrated communications architecture, energy management, role of technology in demand response, current limitations to dynamic energy management, distributed energy resources, overview of a dynamic energy management, key characteristics of smart devices.

SLE: Key characteristics of advanced whole building control systems


SLE: Type of Demand Side Activities.

TEXT BOOKS:

Power System Operation and Control (3-0-0)

Sub Code: EE0304  CIE : 50% Marks
Hrs/week : 3+0+0  SEE : 50% Marks
SEE Hrs : 3  Max. Marks : 100

Course Outcomes

On successful completion of the course, the students will be able to:

1. Describe various basic aspects of electrical power system operation and system control strategies
2. Discuss load frequency control techniques and the methods of voltage and reactive Power control.
3. Describe optimum operation of power system units and Solve power system security analysis problems
4. Explain the recent trends in handling the practical issues with respect to power system operation and control.

UNIT-1: INTRODUCTION : Basic concepts of operation and control of power system, Operational objectives of a power system, Major Threats to System Security, Hierarchy of controls in a power system, Load forecasting, Purpose of load forecasting, Classification of load forecasting, Forecasting procedure.

7 hours

SLE: Reliable operation of power system and forecasting accuracy


7 hours

SLE: Load frequency control and issues in AGC implementation

UNIT-3: CONTROL OF VOLTAGE AND REACTIVE POWER CONTROL
Introduction, generation and absorption of reactive power, methods of voltage control, dependence of voltage on reactive power, sensitivity of voltage to changes in P and Q, cost saving, methods of voltage control by reactive power injection, voltage control using transformers.

7 hours

SLE: Flexible AC transmission controllers - SVC, STATCOM and TCSC

6 hours

SLE: Alternative approaches to unit commitment.


6 hours

SLE: Concentric Relaxation and Bounding.

UNIT-6: SCADA AND WAMS: Introduction, components of SCADA system, standard SCADA configurations, functionality, users of power system SCADA, data for a supervisory power system, transducers for data acquisition, RTUs for power system SCADA, common communication channels for SCADA in power systems, power system operator’s requirements, introduction to wide area measurement systems, synchronized phasor measurement system, Functions and opportunities of application of WAMS systems.

7 hours

SLE: Constraints on the design and implementation of SCADA systems and security of power system SCADA.

Text Books:

1. Dr.K.Uma Rao , “Power System- Operation and Control”, Wiley India


Reference Books:


2. S. Sivaganaraju, “Power System Analysis, Operation and Control”.
Insulation of High Voltage Equipment (3-0-0)

Sub Code : EE0337  CIE : 50% Marks
Hrs/week : 3+0+0  SEE : 50% Marks
SEE Hrs : 3  Max. Marks : 100

Course Outcomes
On successful completion of the course, the students will be able to:
1. Explain the requirements of Insulation and Methods of Determining the Electric Strength
2. Discuss the Short- and Long-Term Electric Strength of Insulating Materials
3. Describe the methods for Increasing the Working Field Strength of Insulation and design of insulation.

UNIT-1: Insulating Materials and System Design Selection & Test Techniques:
Operational Conditions and Requirements on Insulation, Typical Design of Electrophysical Systems Insulation, Testing Electric Strength, Lifetime. 06 Hours

SLE: Treeing Tests

UNIT-2: Influence of Dielectric Properties, State, and Electrodes on Electric Strength:
Pressure, Density, and Mechanical Stresses, Temperature, Molecular and Super molecular Structure, Electrode Material. Influence of Contamination and Structural Defects: Solid Particles, Structural Defects and Impurities in Solid Dielectrics, Moisture 08 Hours

SLE: State of the Electrode Surface

UNIT-3: Dependence of Electric Strength on the Parameters of Applied Voltage:
Voltage Duration, Shape of a Voltage Pulse, Frequency and Periodicity, Influence of Insulation Gap Geometry on Electric Strength: Field Configuration in an Insulation Gap, Interelectrode Gap Length, Electrode Surface Area, Dielectric Volume in an Electric Field 07 Hours

SLE: Voltage Polarity

UNIT-4: Flashover Voltage at the Interface between Two Dielectric Media:
Orientation and Dimensions of an Insulator in an Electric Field, Geometry of the Electrodes and the Character of Their Contact with the Insulator, Properties and State of the Insulator Surface and Ambient Medium, Parameters of the Applied Voltage. Methods for Improving the Dielectric Properties of Electric Insulating Materials and Media: Mixing and Injection of Additives and Fillers, Conditioning of the Electrodes and Dielectric Medium 07 Hours

SLE: Radiation Modification

UNIT-5: Methods for Increasing the Working Field Strength of Insulation:
Electric Field Control, Combination Insulating Materials. Calculation of Insulation: Calculations of
Short-Term Electric Strength (Static and Voltage-Time Characteristics), Statistical Characteristics of the Electric Strength and Coordination of Insulation, Calculation of Insulation Reliability and Operating Lifetime, Choice of the Working Field Strength.  

**SLE**: Electrode Coating


**SLE**: Recovery of Electric Strength after Spark and Arc Discharge

**Text Books**:

HVDC Transmission (3-0-0)

Sub code : EE0313               CIE : 50% Marks
Hrs/Week : 3+0+0               SEE : 50% Marks
SEE Hrs : 3                    Max. Marks : 100

Course Outcomes

On successful completion of the course, the students will be able to:

1. Discuss the state-of-art technology in HVDC transmission

2. Analyse HVDC converter performance and describing the techniques of converter control.

3. Discuss the HVDC converter faults and protection schemes

4. Describe concept of Reactive power control and design of harmonic filters.

UNIT 1: DC POWER TRANSMISSION TECHNOLOGY: Introduction, Comparison of AC and DC transmission, Applications of Dc transmission, description of DC transmission system, Types of DC links, planning for HVDC transmission.

06 Hours

SLE: Modern trends in DC transmission.

UNIT 2: ANALYSIS OF HVDC CONVERTERS: Pulse Number, Choice of Converter configuration, Simplified analysis of Gratez circuit without and with overlap, Characteristics of Twelve Pulse Converter.

06 Hours

SLE: Converter Bridge Characteristics

UNIT 3: CONVERTER and HVDC SYSTEMS: Principles of DC link control, Converter control characteristics and its modifications, system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link, Power control,

08 Hours

SLE: Higher level controller.

UNIT 4 : SMOOTHNING REACTOR AND DC LINE: Introduction, smoothing reactor, DC line corona effects, DC line insulators, Transient over voltage in a DC line, Protection of DC line, DC breakers –basic concept of current interruption,

06 Hours

SLE: Monopolar operation
UNIT 5: CONVERTER FAULTS AND PROTECTION: Introduction, Converter Faults, Protection against over currents, over voltages in converter stations, protection against over voltages

06 Hours

SLE: Surge arresters

UNIT 6: REACTIVE POWER CONTROL AND FILTERS: Reactive power requirements in steady state, sources of reactive power, Static Var Systems, Types of filters, Design criteria for DC filters

08 Hours

SLE: Generation of harmonics

Text Book:


Reference Book:

Finite Element Analysis of Electrical Machines (3-0-0)

Sub Code   : EE0338
Hrs/week   : 3+0+0
SEE Hrs    : 3
Max marks  : 100

CIE : 50% Marks
SEE : 50% Marks

Course Outcomes
On successful completion of the course, the students will be able to:
1. Understand the basics of Finite element and nonlinear problems.
2. Model the permanent magnets and analyze the eddy current in a non-linear material.
3. Compute the losses, resistance inductance force and torque using machine model.
4. Analysis of synchronous machine and induction motors in steady state conditions
5. Modeling of induction machine in time domain.


06hours

SLE: Cubic Splines.


06hours

SLE: Modelling Consideration.


08hours

SLE: Convergence of Force.

08hours

SLE: Poynting Vector Method.

UNIT 5: THE INDUCTION MOTOR IN STEADY STATE: Introduction, Obtaining Reactance from the frequency response, Results, Using Frequency Domain Data with time domain solution.

06hours

SLE: Obtaining Steady State Parameters


06hours

Text Book:

AI Application to Power Systems (3-0-0)

Sub Code    : EE0342                                      CIE         : 50% Marks
Hrs/week    : 3 Hrs                                      SEE         : 50% Marks
SEE Hrs     : 3 Hrs                                      Max Marks   : 100

Course Outcomes

On successful completion of the course students will be able to:

1. Discuss the fundamental concepts of AI techniques.
2. Analyse the different AI framework.
3. Apply AI techniques to solve power system problems.

UNIT 1: Artificial Neural Networks:

7 Hours

SLE: Learning Tasks.

UNIT 2: ANN Paradigms:

7 Hours

SLE: Hopfield Network.

UNIT 3: Fuzzy Logic:

7 Hours

SLE: Defuzzification methods

UNIT 4: Genetic Algorithms:

5 Hours

SLE: convergence of Genetic Algorithm
UNIT 5: Genetic Algorithms:
Multi point cross over – Uniform cross over – Matrix cross over – Cross over Rate – Inversion & Deletion – Mutation operator – Mutation – Mutation Rate – Bit-wise operators.

SLE: Generational cycle

7 Hours

UNIT 6:
Applications of AI Techniques:

SLE: speed control of DC and AC Motors

7 Hours

Text Books

Course Outcomes
On successful completion of the course, the students will be able to:

1. Recall the time domain and frequency domain response specifications and the Stability concepts.
2. Design lead, lag and lag-lead compensators in time domain.
3. Design lead, lag and lag-lead compensators in frequency domain.
4. Describe the realization of PID controllers by passive and active elements.
5. Design proportional, integral and derivative controllers in time domain.
6. Discuss various tuning rules of PID controller.

UNIT 1: Review of time response analysis, Performance indices, Approximation of high-order systems by lower-order systems, Time domain and frequency domain specifications, Stability from Rootlocus and Bode plots.

SLE: Relationship between phase margin and damping ratio

UNIT 2: Approaches to design problem, Preliminary considerations of classical design, Design of lead, Lag, Lag-lead compensator using Rootlocus.

SLE: Design of compensators using MATLAB in time domain

UNIT 3: Cascade compensation in frequency domain, Design of Lead, Lag and Lag-Lead compensators using Bode diagrams, Realization of compensators by passive and active elements, Comparison of characteristics of phase lead and lag networks.

SLE: Design of compensators using MATLAB in frequency domain

UNIT 4: Design of P, PI and PD controllers using the Root-locus diagrams, Rate feedback compensator design, Minor loop feedback compensation.

SLE: Design of PID controllers using the Root-locus diagrams
UNIT 5: Design of P, PI, PD and PID controllers using the Bode diagrams  

07 Hours

SLE: Design of controllers using MATLAB in frequency domain

UNIT 6: Tuning rules for PID controllers, Ziegler-Nichols rules for tuning PID controllers—First method, second method, Design considerations for robust control.  

06 Hours

SLE: Modifications of PID control schemes

Text Books:


Reference Book:

Philips Elective on Machine Learning

1 Methods of classification and prediction
Exercise: Identify solved and unsolved repetitive problems

2 Intro to ML
Exercise: Cosine distance; Discover bias in embedding

3 Intro to python, numpy and pytorch
Exercise: Algo try-outs using pytorch

4 Getting used to pytorch
Exercise: Algo try-outs using pytorch

5 Learning principles, estimation
Exercise: Estimate travel time / real-estate prices

6 Linear methods - Part 1
Exercise: Work out binary and math with ML
(E.g., XOR)

7 Linear methods - Part 2
Exercise: Work out on a simple logistic regression

8 Non-linear methods
Exercise: A simple example in decision trees

9 Neural Networks
Exercise: A simple logistic regression implementation using NN

10 Introduction to NLP
Exercise: Sentiment analysis

11 Instance based learning, Unsupervised learning
Exercise: KNN on word embeddings

12 Intro to deep learning
Exercise: Explore limitations of YOLO implementations

13 Deployment aspects of ML
Exercise: Part-failure prediction
Major Project (6 credits)

Sub code : EE0602
Hrs/Week: 12
SEE Hr : 1.5 hrs

CIE:50 Marks
SEE : 100 Marks

Course Outcomes:
On successful completion of the course, students will be able to:

1. Identify the topic of relevance within the discipline and carry out literature survey.
2. Formulate the problem, develop and implement solution methodology.
3. Analyze and interpret the results.
4. Identify and execute economically feasible projects of social relevance.
5. Document and present reports.

Evaluation

- Students in consultation with the guide identify the topic which will be approved by DPC (Department Program Committee).
- Internal evaluation shall be based on two presentations by appropriate rubrics.
- External evaluation for 100 marks at the end of eighth semester by a panel of examiners consisting of internal and external members.