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<th>Scheme of Teaching (hrs / week)</th>
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External examiner may be appointed from the same university or other university.

* Student will submit the report on In-plant training and deliver seminar

**List of Electives:**

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EE401: High Voltage Engineering

Teaching Scheme:

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Evaluation Scheme:

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<td>End–Semester Examination</td>
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Prerequisites:
EE 246-Generation Transmission and Distribution of electric Power
EE 353-Switchgear and Protection

Course Educational Objectives:
The objectives of the course are to
1. Develop an understanding of breakdown phenomenon in case of solid, liquid and gaseous insulating medium.
2. Develop familiarity with various methods of generation of high voltages.
3. Develop familiarity with various methods of measurement of high voltages.
4. Develop an understanding of over voltage phenomenon & concepts of insulation coordination.
5. Develop an understanding of importance of testing of power apparatus.
6. Develop an understanding of safety practices in laboratories.

Course Outcomes:
Students will be able to
1. Decide the suitability of various insulating materials for power system applications.
2. Understand the breakdown phenomenon in case of various insulating materials.
3. Understand the concepts of generation of high voltages & currents.
4. Understand the causes and protection from over-voltages and the concept of insulation Coordination.
5. Explain the direct and indirect testing methods.
6. Exhibit safe working practices in laboratories.


UNIT- 2  Generation of high voltage & currents, Generation of high DC voltages, High alternating voltages & impulse voltages, Generation of impulse currents.

UNIT- 3  Measurement of high voltages & currents, Measurement of high direct current voltages, High alternating voltages, & impulse voltages, Measurement of high direct currents, High alternating currents & high impulse currents, Dielectric loss & partial discharge measurements.
UNIT -4 Over voltage phenomenon & insulation co-ordination, Natural causes for over voltages, lightning phenomenon, over voltages due to switching surges, system faults & other abnormal conditions, principles of insulation co-ordination on high voltage & extra high voltage power systems

UNIT -5 High Voltage Testing of Power Apparatus.

TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. Assignments. 05 Marks
2. Surprise test. 10 Marks
3. Quiz. 05 Marks
Teaching Scheme:

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Prerequisites:
EE 345 - Control Systems-I

Course Educational Objectives:
The objectives of the course are to
1. Explain Control system design by frequency response.
2. Introduce Digital control system and estimate stability by using Jury criterion.
3. Explain design of non linear control system using describing function concepts and phase plane techniques.
4. Introduce optimal design concept, Intelligent Controllers like Fuzzy logic controller.

Course Outcomes:
Students will be able to
1. Find the controllability and observability for a given system.
2. Realize the desired performance by using pole placement and observer design.

UNIT -1 Control system design by frequency response:
Lag compensation, lead compensation, Lag-Lead compensation
State Variable Analysis and Design:
State space representation of continuous and discrete systems solving the time – invariance state equation, state transition matrix, Eigen values and Eigen vectors, Controllability and observability criteria for time invariant systems, Pole placement using state variable feedback ,Design of state observers.

UNIT -2 Digital Control Systems:
Introduction to discrete time systems, the Z transform and the inverse Z transform, Pulse transfer function, Time response of sampled data systems, Stability using Jury criterion, Bilinear transformation, Frequency response root locus.

UNIT -3 Non Linear Control Systems:
Characteristics of non linear systems, Linearizing techniques, Design of non linear control system using describing function concepts and phase plane techniques, Liapunov's stability criterion.

UNIT -4 Introduction to Optimal Control, Introduction to Process Control:
Feed forward, ratio, cascade, DDC, Supervisory.

UNIT -5 Industrial Controllers:
PID controllers, Tuning methods, Pneumatic and hydraulic controllers.
ISE, IATE Programmable Logic Controllers:
Introduction to PLC, Constructional features, Working principle and applications Intelligent Controllers: Fuzzy logic controller.
TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following

1. PPT presentation 05 Marks
2. Surprise test. 05 Marks
3. Quiz. 05 Marks
4. Assignment. 05 Marks
EE403: Energy Conservation and Management

Teaching Scheme:

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Evaluation Scheme:

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<td>End–Semester Examination</td>
<td>60 Marks</td>
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Prerequisites:

EE246 - Generation Transmission and Distribution of electric Power
EE353 - Switchgear and Protection
EE 341 -Synchronous Machine

Course Educational Objectives:
The objectives of the course are to

1. Explain the current energy scenario and need of energy conservation.
2. Demonstrate the advantages of demand side management.
3. Introduce various standards for illumination.
4. Introduction to captive power generation and co-generation.

Course Outcomes:
Students will be able to learn

1. Implement energy conservation techniques to its surrounding.
2. Understand various kinds of tariffs in DSM.
3. Explain HVAC system.

UNIT -1 Energy Scenario:

UNIT- 2 Energy Audit:

UNIT- 3 Demand Side Management:
UNIT- 4 Energy Efficiency in Electrical Utility:
Compressed Air Systems:
Types of air compressors, Compressor efficiency, Efficient compressor operation, Compressed air systems component, Capacity assessment, Leakage test, Factors effecting the performance and saving opportunities, HVAC and refrigeration systems, Vapour compression refrigeration cycle refrigerants, Coefficient of performance, Capacity factors affecting refrigeration and air conditioning systems performance and saving opportunities, Vapour absorption refrigeration systems, Principle types, Saving potential, Fan and Blower, Types, Performance evaluation.

UNIT- 5 Captive Power Generation:
Types of captive power plants, Financing of captive power plants, Captive power plants in India, Energy banking, Energy wheeling.
Co-generation:
Co-generation technologies, Industries suitable for cogeneration, Allocation of costs, Sale of electricity to utility, Impact of pricing of cogeneration, Electric power plant reject heat, Agricultural uses of waste heat, Use of power plant reject heat for west water treatment, Integrated energy system, Potential of cogeneration in India.

TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. Visit and data collection of industry. 05 Marks
2. Quiz. 05 Marks
3. Multiple Choice Question. 05 Marks
4. Numerical from Bureau of Energy Efficiency India. 05 Marks
EE404: Digital Signal Processing

Teaching Scheme:
- Lectures: 04 Hrs/week
- Total Credits: 04

Evaluation Scheme:
- Class Test: 20 Marks
- Assignment: 20 Marks
- End-Semester Examination: 60 Marks

Prerequisites:
EE 244 - Network Analysis
EE 345 - Control Systems I

Course Educational Objectives:
The objectives of the course are to
1. Introduce the basic concepts and techniques for processing signals on a computer.
2. Be familiar with the most important methods in DSP, including digital filter design, Transform-domain processing and importance of Signal Processors.
3. Emphasize intuitive understanding and practical implementations of the theoretical concepts.

Course Outcomes:
Students will be able to
1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Understand the meaning and implications of the properties of systems and signals.
3. Understand the Transform domain and its significance and problems related to computational complexity.
4. Specify and design any digital filters using MATLAB.

UNIT -1 Signals and Signal Processing:
Discrete-Time Signals and Systems in the Time-Domain:

UNIT-2 Transform-Domain Representations of Discrete-Time Signals:
LTI Discrete-Time Systems in the Transform-Domain:
UNIT-3  Digital Processing of Continuous-Time Signals:
Introduction, Sampling of Continuous-Time Signals, Sampling of Band pass Signals, Analog
Low pass Filter Design, Design of Analog High pass, Band pass, and Band stop Filters, Anti-
Aliasing Filter, Design of Sample-and-Hold Circuit, Analog-to-Digital Converter, Digital-to-

UNIT-4  Digital Filter Structures:
Block Diagram Representation, Equivalent Structures, Basic FIR Digital Filter Structures,
Basic IIR Filter Structures, Realization of Basic Structures using MATLAB, All pass Filters,
Tuneable IIR Digital Filters, IIR Tapped Cascaded Lattice Structures, FIR Cascaded Lattice
Structures, Parallel All pass Realization of IIR Transfer Functions, Digital Sine-Cosine
Generator.

UNIT-5  Digital Filter Design:
Preliminary Considerations, Bilinear Transform Method of IIR Filter Design, Design of Low
pass IIR Digital Filters, Design of High pass, Band pass, and Band stop IIR Digital Filters,
Spectral Transformations of IIR Filters, FIR Filter Design Based on Windowed Fourier
Series, Computer-Aided Design of Digital Filters, Design of FIR Filters with Least-Mean-
Square Error, Digital Filter Design Using MATLAB.
Applications of Digital Signal Processing:
Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non stationary Signals, Spectral
Analysis of Random Signals.

TEXT AND REFERENCE BOOKS:

   Publishing (India) Pvt. Ltd.
   Prentice-Hall.

Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Questions. 05 Marks
2. MATLAB based assignment. 10 Marks
3. PPT presentation. 05 Marks
EE 410: Lab High Voltage Engineering

**Teaching Scheme:**

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**Evaluation Scheme:**

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<tr>
<td>Practical/Oral</td>
<td>25 Marks</td>
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Term work shall consist of minimum six experiments from the following:

4. Impulse voltage test on insulator.
5. Power frequency test on insulator.
6. Tan δ measurement of insulator.
7. Study of Impulse Generator.
EE 411: Lab Control System II

Teaching Scheme:       Evaluation Scheme:
Practical             Term Work        25 Marks
          02 Hrs/ week       Practical/Oral    25 Marks
Total Credits         01

Term work will consist of minimum eight experiments from the following:

1. Lag Lead Compensation.
2. Relay control system.
3. Computer aided programme to find out Controllability, Linearization, and PID controller.
4. MATLAB program on Fuzzy Logic Controller.
5. Modelling of systems (any hydraulic, pneumatic etc).
6. Study of a process control system.
7. Study of PID controller.
8. DC position control system.
10. Study of DDC.
EE 412: Lab Digital Signal Processing

**Teaching Scheme:**

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<tr>
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<td>25 Marks</td>
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Term shall consist of minimum eight experiments from the following:

1. Architecture of DSP chips-TMS 320C 6713 DSP Processor.
2. Linear convolution.
3. Circular convolution.
4. FIR Filter (LP/HP) Using Windowing technique.
5. Rectangular window.
6. Triangular window.
8. IIR Filter (LP/HP) on DSP processors.
11. FFT of 1-D signal plot.
12. MATLAB program to generate sum of sinusoidal signals.
13. MATLAB program to find frequency response of Analog filters (LP/HP).
14. Simulation of Position and Speed Control of Stepper Motor.
15. Simulation of DC Motor Speed Control.
EE413: Project Phase 1

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Students will carry out literature review. Students will present seminar on identified problem. Students will present in-plant training seminar. Term work will be based on in plant training seminar and work carried out for project work.
SEMESTER II
EE 414: Power System Operation and Control

Prerequisites:
EE 349 - Power System Analysis
EE 344 – Estimation Testing and Maintenance

Course Educational Objectives:
The objectives of the course are to
1. Explain concepts of power system stability to students.
2. Describe transient stability and methods of analysis.
3. Enumerate excitation systems to students.
4. Introduce the concept of reactive power and voltage control.
5. Explain optimal operation of generating units & grid management.

Course Outcomes:
Students will be able to
1. Describe stability conditions of power systems.
2. Determine transient stability under various fault conditions.
3. Employ excitation methods.
4. List reactive power and voltage control methods.
5. Find the optimum unit commitment for a power system.

UNIT -1 Power System Stability:
Brief review of synchronous machine equations and parameters, Concept of steady state, Transient and dynamic stability , Modelling of synchronous machine, The stability problem, Power angle equation, Node elimination techniques ,Steady state stability limit, Methods to determine steady state stability limit- Clarke diagram etc, Methods of improvement.

UNIT-2 Transient Stability Analysis:
The swing equation, Point by point solution of the swing equation, One machine connected to infinite bus, Critical clearing angle and time, Equal area criterion for stability and its application to one machine infinite bus and two finite machines problems, Concept of multi-machine system, Effect of type of fault, Grounding, reclosing on transient stability limit , Methods of improvement.

UNIT- 3 Excitation Systems:
Excitation System requirements, Elements of an excitation system, Types of excitation systems. Improvement of Stability:
Transient stability enhancement, Small signal stability enhancement.

UNIT- 4 Control of voltage and reactive power:
Necessity, Various Methods.
Load Frequency Control:
Load frequency problem, Speed governing system, Automatic voltage control.
UNIT -5  Optimal System Operation:
System constraints, Economic load sharing of units in power stations and in interconnection, Incremental fuel cost method, Grid Management.

TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. PPT Presentation. 05 Marks
2. Multiple Choice Question based on GATE. 10 Marks
3. Quiz. 05 Marks
**EE415: Advanced Microprocessors and Microcontrollers**

**Prerequisites:**
EE357 - Microprocessor & Interfacing Techniques

**Course Educational Objectives:**
The objectives of the course are to
1. Study the concepts and basic architecture of 8086, 8051 and other micro-controllers.
2. Know the design aspects of basic microprocessor.
3. Write assembly language programs in microprocessor and microcontrollers for various applications.

**Course Outcomes:**
Students will be able to
1. Understand the architecture of 8086 and 8051.
2. Write assembly language program in 8086 and 8051 for various applications.
3. Design memory for microprocessor.
4. Interface peripheral devices with techniques using 8086 and 8051.

**UNIT- 1** Advanced Microprocessors:
Architecture Of Typical 16 Bit Microprocessor(Intel 8086), Memory Address Space And Data Organization, Segment Registers And Memory Organization, Addressing Modes, 8086 Configurations, Minimum Mode, Maximum Mode, Comparison Of 8086 And 8088, Bus Interface, Interrupts And Interrupt Priority Management.

**UNIT- 2** Programming 8086:
Instruction Set, Assembly Language Programming, Input/ Output Operations, Interfacing Of Peripheral Devices Like 8255, 8259, LED etc.

**UNIT- 3** Multiprocessor System:
Queue Status and Lock Facility Of 8086 Based Multiprocessor System, 8087 Coprocessor, Concept, Architecture, Instruction Set And Programming.

**UNIT- 4** Introduction to 80386, 80486 and Pentium Family Processors:
Introduction to Pentium and Pentium Pro Architectures, Introduction to RISC and CISC Architecture, Real, Protected and Virtual Mode.

**UNIT- 5** Microcontrollers:
Introduction, Evolution, Architecture, Comparison with Microprocessor, Selection of a Microcontroller, MCS 51 Family, 8051 Architecture, I/O Ports and Memory Organization Addressing Modes, Instruction Set, Interrupts, Real World Interfacing.
Overview of ATMEL Microcontrollers 89CXX.

**Teaching Scheme:**

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TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. PPT Presentation. 05 Marks
2. Surprise test. 10 Marks
3. Assignment. 05 Marks
EE416: Industrial Organization and Management

Teaching Scheme:
- Lectures: 03 Hrs/ week
- Total Credits: 03

Evaluation Scheme:
- Class Test: 20 Marks
- Assignment: 20 Marks
- End–Semester Examination: 60 Marks

Prerequisites:
EE 356-Power System Analysis

Course Educational Objectives:
The objective of the course is to
1. Provide desirable experiences for the preparation of industrial arts.
2. Provide vocational-technical education that will enable qualified individuals.
3. Provide exploratory experiences in a variety of activities for effective living, as well as for recreational and a vocational values.
4. Provide experiences with a wide variety of materials for elementary teachers to better prepare them for teaching.
5. Provide service to the community, to provide trade extension and other vocational education of less than college grade for those individuals who have entered upon and desire or advance in an industrial occupation

Course Outcomes:
Students will be able to
1. Explain how a business as well as leadership, organizing, strategic planning, and management control functions in an industrial organisation.
2. Interpret an annual report from an industrial organisation, as well as be able to calculate and design the different parts of it at a basic level.
3. Explain the structure of the industrial company’s streams of payments.
4. Choose, construct, interpret and use cost calculations as part of the decision support for the industrial company’s different situations.
5. Connect industrial management to your future area of work.
6. View on industrial management, to explain how the different parts of the area fit together related to the objectives of the industrial organization.

UNIT-1  Industrial Organization:
Industrial ownership, selection of site, organization of manufacturing plant, Functions of management, Factory layout, Plant layout, Purchasing, Stores and production control.

UNIT-2  Industrial Psychology, Work environment, Time and motion study, Industrial safety, Labour welfare, Personnel management.

UNIT-3  Production Engineering, Work method design, Job- evaluation and merit rating, Design of manufacturing system, Forecasting, Inventory management, Manufacturing resources planning and enterprise resource planning.

UNIT-4  Reliability Engineering, Basics, Quality engineering, Tools for measurement of process performance, Total quality management basics, Quality standards basics, Six sigma, Kaizen, Lean manufacturing.
UNIT-5 Production economics, Depreciation methods, Financial management, Risk and return concepts and portfolio management, Project management.

TEXT AND REFERENCE BOOKS:


Assessment Methods:

Assessments should be based on topics such as-

1. PPT Presentation. 05 Marks
2. Surprise test. 10 Marks
3. Assignment. 05 Marks
EE417: Electrical Drives

Teaching Scheme:

| Lectures     | 04 Hrs/ week | Total Credits | 04 |

Evaluation Scheme:

| Class Test   | 20 Marks     |
| Assignment   | 20 Marks     |
| End–Semester Examination | 60 Marks |

Prerequisites:
EE 341 – Synchronous Machine

Course Educational Objectives:
The objectives of the course are to
1. Study the concepts and basic architecture of 8086, 8051 and other micro-controllers.
2. Know the design aspects of basic microprocessor.
3. Write assembly language programs in microprocessor and microcontrollers for various applications.

Course Outcomes:
Students will be able to
1. Understand the architecture of 8086 and 8051.
2. Write assembly language program in 8086 and 8051 for various applications.
3. Design memory for microprocessor.
4. Interface peripheral devices with techniques using 8086 and 8051.

UNIT-1 Introduction:
Concept of electric drives, Classification of electric drives, Classification of control schemes, Classification of methods of speed control, Components of electric drives.

UNIT-2 Speed Torque Characteristics of Motor:
DC shunt, series, compound motor, Induction motor-slip ring, Synchronous Motor, Types of loads, Types of braking.

UNIT-3 Speed control of DC motor, Stepper motor, Speed control of Induction Motor, Speed control of slip ring Induction Motor, Heating and rating of drive motors, Transient and dynamics, Motor starter and controllers.

UNIT-4 Thyristor power converters, AC regulators, Cycloconverter, Thyristor based Induction Motor control, Synchronous Motor control, DC motor control.

UNIT 5 Industrial application, Microprocessors in the control of electric drives.
TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. Assignments. 05Marks
2. Multiple Choice Question. 05Marks
3. Industrial visit report. 10Marks
EE425: Lab Advanced Microprocessors and Microcontrollers

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<td>Term Work</td>
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<td>25 Marks</td>
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<td>Practical/Oral</td>
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<td>25 Marks</td>
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Term work consists of record of minimum eight experiments out of listed below:

1. Study of 8086 Microprocessor Kit.
2. Execution of simple programs (Data transfer, arithmetic, logical operations).
3. Interfacing of 8255 to 8086.
4. Interfacing of LED, LCD display to 8086.
5. Interfacing of 8259 to 8086.
7. Interfacing of 8255 to 8051.
8. Interfacing of LED, LCD display to 8051.
9. Interfacing of stepper motor to 8051.
10. Interfacing of ADC/DAC to 8051.
EE426: Lab Electrical Drives

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Term work consists of record of minimum six experiments out of listed below:

1. Three experiments based on study and/or simulation of electric drives (mentioned in the syllabus) using MATLAB/SIMULINK/PSPICE.
2. Study of DC motor control.
5. Study of Synchronous Motor drive
Students will form a group consisting of minimum three students. Each group will undertake at least one design project.

2. Electrical transmission line design.
3. Illumination system design.
4. Industrial wiring.
5. Domestic wiring.
6. Reactive power compensation.
EE428: Project Phase II

**Teaching Scheme:**
- Practical: 04 Hrs/ week
- Total Credits: 04

**Evaluation Scheme:**
- Term Work: 75 Marks
- Practical/Oral: 75 Marks

Students will demonstrate the project and present the seminar on the project.
EE405: Electrical Machines Analysis and Modelling
(Elective)

Prerequisites:
EE 243 - Transformers and Dc Machines.
EE 251 - Asynchronous Machines
EE341- Synchronous Machines

Course Educational Objectives:
The objective of this course is to provide the students
1. In-depth understanding of generalized machine theory which forms the basis of Machine modeling.
2. Concept of transformation of variables to develop mathematical model of machines.
3. A good initiation to develop Mathematical modeling and analysis.
4. The concepts & techniques of Speed control of electrical machines which are essential for high performance drives.
5. An in-depth exposure to the various equivalent circuits and their application to performance analysis of Electrical Machines.

Course Outcomes:
The student will be able to
1. Explain generalized machines theory and Linear Transformations as applied to Electrical Machines.
2. Develop Mathematical models of Electrical Machines.
3. Design Machines and analysis of their performance as per applications.
4. Use tools like MATLAB, SIMULINK, and ANSYS for analysis.
5. Suggest the proper drive as per need of industrial applications.


UNIT- 4 Theory of Symmetrical Induction Machines and Synchronous Machines, Voltage Torque Equation in Machine Variables, Equations of Transformation for Rotor Circuits, Voltage...


TEXT AND REFERENCE BOOKS:


Assessments Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question. 05 Marks
2. Assignment. 10 Marks
3. PPT Presentation. 05 Marks
## EE 406: Energy and Environment Engineering

### Prerequisites:
EE402: Energy Conservation And Management  
GE 152 - Engineering Chemistry

### Course Educational Objectives:
The objective of this course is to

1. Explain how a business as well as leadership, organizing, strategic planning, and management control functions in an industrial organisation.
2. Interpret an annual report from an industrial organisation, as well as be able to calculate and design the different parts of it at a basic level.
3. Explain the structure of the industrial company’s streams of payments.
4. Choose, construct, interpret and use cost calculations as part of the decision support for the industrial company’s different situations.
5. Connect industrial management to your future area of work.
6. Explain how the different parts of the area fit together related to the objectives of the industrial organization

### Course Outcomes:
The student will be able to:

1. Construct and solve energy and entropy balances for calculation of heat requirements and work inputs/outputs of physical processes.
2. Use equations of state and/or thermodynamic charts and tables to determine the physical properties of substances.
3. Determine the compositions of gas and liquid mixtures using activity relationships, Raoult’s and Henry’s laws.
4. Calculate the compositions of reactive aqueous solutions from chemical equilibrium equations.
5. Analyze combustion processes and chemical/biological reaction systems using elemental mass balances.
6. Combine conservation equations and thermo physical property data to solve design problems in civil and environmental engineering

### UNIT-1  Energy and Environment Basic Issues:
Overview of global and local energy and environment scenario and policy, Concept of energy economics, concepts of environment economics, energy-environment–economy

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<td>Assignment 20 Marks</td>
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<td>End-Semester Examination 60 Marks</td>
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(Elective)
linkages, Emission assessment and policy relevance integrated assessment of energy and environment framework and models.

UNIT-2 Global and Local environmental Issues:
Overview of global climate changes, Clean development mechanism, Green buildings, Kyoto protocol, Global warming, Effect of various power plants on environment, New instruments for energy and environment policies, Carbon trading.

UNIT-3 Urban Energy Planning and Management:
Challenges faced by the urban environment, integration of conventional and renewable energy urban infrastructure, examples of cities or establishments that display sustainable urban environment and energy planning and management.

UNIT-4 Rural Energy Planning and Management:
Integration of non conventional and Renewable energy technology.

UNIT-5 Technological Options:
Technology, policies and measures for long –term energy and environment, Renewable energy issues and policies.

TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question. 05 Marks
2. Assignment. 10 Marks
3. PPT Presentation. 05 Marks
EE407: Industrial Automation and Control
(Elective)

Prerequisites:
EE 354 - Control Systems I
EE 342 - Digital Electronics

Course Educational Objectives:
The objectives of the course are to
1. Describe the various components of automation.
2. Explain the various configurations of control system.
3. Explain necessity and working of PLC
4. Describe the need of Robot Technology.
5. Describe the various intelligent controller.

Course Outcomes:
Students will be able to
1. Identify need of automation system and to formulate automation problem.
2. Identify and compare various control configuration.
3. Develop ladder diagram for any given logic.
4. Distinguish and compare various control system configuration.

UNIT-1 Automation and Control Strategy:
Automation Systems:
Expectations from automation, Basic functions, Historical development of control systems,
Processing systems, Supervisory Control and Data acquisition systems.
Direct digital control systems: DDC structure, DDC software.

UNIT-2 Programmable Controllers:
Introduction, Principles of operation, Architecture of programmable controllers,
Programming the programmable controllers, Software, configuration, Applications.

UNIT-3 Distributed Control Systems:
DCS introduction, Functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, Architecture, configuration, some popular distributed control system, Instrumentation Standard Protocols:
Field bus, CAN Bus, Profit bus, Industrial Ethernet, Real time programming, Modeling and simulation for plant automation.

UNIT-4 Robotics:
Introduction to robot technology, sensors, drives, kinematics, different manufacturing systems, CNC.

Teaching Scheme:

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Evaluation Scheme:

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| Assignment | 20 Marks |
| End–Semester Examination | 60 Marks |

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Evaluation Scheme:

| Class Test | 20 Marks |
| Assignment | 20 Marks |
| End–Semester Examination | 60 Marks |
UNIT- 5: Intelligent Controllers:
Fuzzy logic system, Neural network, Model predictive controllers, Expert Controllers.

TEXT AND REFERENCE BOOKS:

2. Webb and Reis,” Programmable Logic Controllers: Principles and Applications”, PHI.
7. Fu, Lee, Gonzalez, “Robotic Control, sensing and Intelligence”, Tata McgrawHill.

Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question. 05 Marks
2. Assignment. 10 Marks
3. PPT Presentation. 05 Marks
EE408: Engineering Materials
(Compulsory)

**Prerequisites:**
GE 142 - Engineering Physics
GE 152 - Engineering Chemistry

**Course Educational Objectives:**
The objectives of the course are to
1. Know the fundamental science and engineering principles relevant to materials.
2. Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
3. Have the experimental and computational skills for a professional career or graduate study in materials.
4. Possess knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.

**Course Outcomes:**
Students will be able to
1. Apply core concepts in Materials Science to solve engineering problems.
2. Be knowledgeable of contemporary issues relevant to Materials Science and Engineering.
3. Select materials for design and construction.
4. Understand the importance of life-long learning.
5. Design and conduct experiments, and to analyze data.
6. Understand the professional and ethical responsibilities of a materials scientist and engineer.
7. Work both independently and as part of a team.
8. Possess the skills and techniques necessary for modern materials engineering practice.

**UNIT-1 Conductivity of Metals:**
Structure of the Atom, Crystallinity, Anisotropy Factors affecting the resistivity of electrical materials, Motion of an electron in an electric field, Fermi-Dirac distribution, Photoelectric emission, Superconductivity, Electrical conducting materials, Thermoelectric effects, Operation of thermo-couple.

**UNIT-2 Dielectric Properties:**
Effect of a dielectric on the behavior of a capacitor, Polarization, Frequency dependence of electronic polarisability, Dielectric losses, Significance of the loss tangent, Dipolar relaxation, Frequency and temperature dependence of the dielectric constant of polar dielectrics, Dielectric properties of polymeric systems, Insulating materials, Ferroelectricity, Piezoelectricity.

**UNIT-3 Magnetic Properties of Materials:**
Classification of magnetic materials, the origin of permanent magnetic dipoles, Diamagnetism, Paramagnetism, ferromagnetism, the origin of ferromagnetic dipoles, ferromagnetic domains, the magnetic curve, Magnetization curve, the hysteresis loop, Magnetostriction, factors of affecting permeability and hysteresis loss, common magnetic materials, anti-ferromagnetic, ferromagnetic, magnetic resonance.

UNIT-4 Semiconductors:
Measurement of Electrical and Magnetic Properties:
Conductivity measurements, Dielectric measurements, Magnetic measurements,
Measurement of semi-conductor parameters.
Conduction in Liquids:
Faraday’s law of electrolysis, Ionic velocities, Chemical cells and convectional cells,
Irreversible and reversible cells, Practical cell, Electrolytic depositions, Corrosion of metals, Nature of corrosion.
Optical Properties of Solids:
Photo-emission, Photo-emission materials and types of photo-cathodes, Definitions of terms, Electroluminescence, Electroluminescent panels.

UNIT-5 Materials for Electric Components:
Reduction, Resistors, Capacitors, Inductors, Relays.
Mechanical Properties:
The stress/strain relationship, plastic behaviour, Block slip theory, hardening, Ductility.

TEXT AND REFERENCE BOOKS:

1. Indulakar,” Enginnering Material”, S. Chand Publications.

Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question. 05 Marks
2. Assignment. 10 Marks
3. PPT Presentation. 05 Marks
EE409: HVDC Transmission Systems
(Elective)

Prerequisites:
EE 356-Power System Analysis
EE 356-Power Electronics

Course Educational Objectives:
The objectives of the course are to
1. The objectives of the course are to make familiar with the principle of HVDC transmission technology.
2. Explain the converting principal and steady state performance of HVDC transmission.
3. To understand the concept of reactive load compensation and filtering converting station.
4. Complete analyses of harmonics and basic of protection of HVDC system.

Course Outcomes:
Students will be able to
1. Evaluate compare and select best HVDC links and essential components of HVDC system.
2. Analyse and design main converter and DC link associated with HVDC and select best converter topologies.
3. Analyse harmonic effect in HVDC and neighbouring system.
4. Design filter for specific harmonic numbers.
5. Analyse effect of faults on DC and AC side of HVDC system.
6. Design protection methods for HVDC system.
7. Simulate a range of extreme operating conditions.


UNIT-2 HVDC System Control, DC Link Control, Converter Control Characteristics, Control of Firing Angle, Current, Extinction Angle and Power.

UNIT-3 Harmonics and Filters, Generation of Harmonics, Design of AC and DC Filters, Carrier Frequency and RI Noise, Multi-Terminal DC Systems, Potential Applications, Types, Control and Protection.


Teaching Scheme:

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</table>

TEXT AND REFERENCE BOOKS:

1. Arillaga, High Voltage Direct Current Transmission Engineering, Peter Peregrinus Ltd.UK.
4. K.R.Padiyar, HVDC power transmission systems - Technology and System Interactions, New Age International Ltd.
5. S. S. Rao, EHV - AC & HVDC transmission Engg, & Practice, Khanna Publishers

Assessments Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question . 05 Marks
2. Seminar on subject related with HVDC transmission system. 05 Marks
3. Assignment. 10Marks
EE418: Flexible A.C. Transmission Systems
(Elective)

Teaching Scheme:

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Prerequisites:
EE246- Generation, transmission and distribution of electric Power
EE 343- Power System Analysis
EE 356- Power Electronics
EE 345- Control Systems I
EE 354- Control Systems II

Course Educational Objective:
The objectives of the course are to
1. Introduce to various FACTS controllers
2. Explain the working principle of shunt compensation
3. Describe the various power devices and converter topologies used in FACTs controller
4. Describe the hybrid FACTs controller.

Course Outcomes:
Students will be able to
1. Compare various types of FACT controller.
2. Design series compensation to power system.
3. Design Shunt compensation to power system.
4. Design Series compensation to power system
5. Identify appropriate power devices and converter topologies for implementation of FACTS controller.
6. Explain and design hybrid controller such as UPFC.


UNIT-3 Static Shunt Compensator, Methods of Controllable VAR Generation, Static VAR Compensators, Static VAR Systems.

UNIT-4 Static Series Compensator, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators, External Control for Series Reactive Compensators.

Evaluation Scheme:

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Prerequisites:
EE246- Generation, transmission and distribution of electric Power
EE 343- Power System Analysis
EE 356- Power Electronics
EE 345- Control Systems I
EE 354- Control Systems II

Course Educational Objective:
The objectives of the course are to
1. Introduce to various FACTS controllers
2. Explain the working principle of shunt compensation
3. Describe the various power devices and converter topologies used in FACTs controller
4. Describe the hybrid FACTs controller.

Course Outcomes:
Students will be able to
1. Compare various types of FACT controller.
2. Design series compensation to power system.
3. Design Shunt compensation to power system.
4. Design Series compensation to power system
5. Identify appropriate power devices and converter topologies for implementation of FACTS controller.
6. Explain and design hybrid controller such as UPFC.


UNIT-3 Static Shunt Compensator, Methods of Controllable VAR Generation, Static VAR Compensators, Static VAR Systems.

UNIT-4 Static Series Compensator, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators, External Control for Series Reactive Compensators.

TEXT AND REFERENCE BOOKS:


Assessments Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question . 05 Marks
2. Seminar on subject related with HVDC transmission system. 05 Marks
3. Assignment. 10 Marks
# EE419: Computer Aided Power System Analysis

**Prerequisites:**
EE 343 - Power System Analysis

**Course Educational Objectives:**
The objectives of the course are to
1. Understand graph theory for power system applications.
2. Develop and solve the positive, negative and zero sequence network for a given system.
3. Recognise the common cause of faults in power system.
4. Formulate the power flow problems using load flow methods.
5. Explain sparse matrix.

**Course Outcomes:**
Students will be able to
1. Determine impedance & admittance matrix of a given system.
2. Draw the sequence network for a given system.
3. Estimate Fault currents under different fault conditions.
4. Determine power flow for a given system.
5. Apply sparse matrix technique to solve large power system.

## UNIT-1
Modelling of Power System Components, Basic Concepts, Single Phase, Three Phase Models, Matrix Representation of Networks, Bus Admittance Matrix, Bus Impedance Matrix, Graph Theory.

## UNIT-2

## UNIT-3
Short Circuit Analysis, Effect of Short Circuits, Various Types of Faults, Symmetrical Components, Sequence Networks, Balance and Unbalanced Fault Analysis.

## UNIT-4
Computer Programming Aspects: Considerations for Large System Analysis, Sparse Matrix Techniques, Optimal Ordering of Nodes.

## UNIT-5

**Teaching Scheme:**

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**Evaluation Scheme:**

| Class Test | 20 Marks |
| Assignment | 20 Marks |
| End–Semester Examination | 60 Marks |

**Teaching Scheme:**

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**Evaluation Scheme:**

| Class Test | 20 Marks |
| Assignment | 20 Marks |
| End–Semester Examination | 60 Marks |
TEXT AND REFERENCE BOOKS:


Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Question. 05 Marks
2. Assignment. 10 Marks
3. PPT Presentation. 05 Marks
EE420: Power Quality

(Elective)

Prerequisites:
EE356 - Power Electronics

Course Educational Objectives:
The objectives of the course are to
1. Understand electrical power quality problems.
2. Develop ability for effective measurement of power quality problems.
3. Understand harmonic problem in system.
4. Overcome harmonics in system by designing harmonic filters.
5. Make aware about power quality measuring instruments /devices.
6. Identify the test location and duration of test for power quality problem, custom power devices, power quality standards, losses in system because of power quality disturbance.

Course Outcomes:
Students will be able to
1. Understand definitions of power quality, power quality standards.
2. Classify power quality problems.
3. Identify power quality disturbances.
4. Distinguish between voltage sag and swell.
5. Understand the methods to mitigate harmonics in system
7. Instruments/ devices to measure power quality.
8. Know test locations and duration for power quality measurements.
9. Introduced to custom power devices.

UNIT- 1  Introduction to Power Quality:
Definition of Power Quality, Power Quality Terminology, Power Quality Issues, Susceptibility Criteria, Cause and Effect, power quality disturbances, power quality standards.
Harmonics :
Definition & indices, harmonic sources, power system responses to harmonics, resonance, harmonic analysis methods, problems and challenges in the area of harmonics, mitigation, filter and filter design, mitigation, Other methods.

UNIT- 2  Sag and Swell:
Fault caused sags & swells, Motor starting sags, Calculation methods, Mitigation of sag & swell Disturbances.

UNIT- 3  Transients:
Capacitor-switching transients and lightning transients, Circuit analysis of cap-switching transients, Simulation, Mitigation of transients.
UNIT-4  Custom Power:
Basic components and configurations, Static circuit breaker, Static shunt and series compensator, Active harmonic filter.


TEXT AND REFERENCE BOOKS:

1. IEEE Std. 519, "Recommended Practices and Requirements for Harmonic Control in Electric Power Systems".
2. IEEE Std. 1159, "IEEE Recommended Practice for Monitoring Electric Power Quality".

Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Questions. 05Marks
2. Assignment. 10Marks
3. PQ analysis of any installation/plant. 05Marks
EE421: Biomedical Engineering
(Elective)

Prerequisites:
EE253-Electronic Devices and Circuits

Course Educational Objective:
The objectives of the course are to
1. Understanding of biology and physiology as related to biomedical engineering needs.
2. Ability to apply knowledge of advanced mathematics (including differential equations and statistics), sciences, and engineering to solve problems at the interface of engineering and biology and to model biological systems.
3. Ability to design and conduct experiments, including making measurements and interpreting experimental data from living systems and addressing the problems associated with the interaction between living systems and non-living materials and systems.

Course Outcomes:
Students will be able to
1. Identify, formulate and solve biomedical engineering problems.
2. Design systems or processes to meet desired needs.
3. Understanding of professional and ethical responsibility and the impact of engineering in our global society.
4. Recognize the need for and engage in life-long learning.
5. Liberal education to provide knowledge of contemporary issues.

UNIT-1 Introduction:
Biomedical instrumentation, Introduction to human body systems, Cell, Electrophysiology, Biomedical signals and their ratings and features, the body as a control system.
Electrodes and Transducers for Biomedical Measurements:
Electrodes for Biophysical sensing, Electrode model circuit, Medical surface electrodes, Microelectrodes, Cup electrodes, Disposable electrodes, Transducers used in Biomedical Instrumentation.

UNIT-2 Bioelectric Amplifiers:
Operational amplifiers, High-impedance PH probe amplifier, Balanced piezoelectric infrared (heat) detector, Circuit for driving large capacitive loads, Low-droop positive peak detector, Multiple input amplifier, Differential amplifier, Instrumentation amplifier with NPN and FET inputs, PH probe electrometer instrumentation amplifier, Bridge amplifier, load cell weighing scale instrumentation amplifier, Input protection circuit, signal processing circuits, Offset null methods, Auto-zero amplifier, Isolation amplifier, Reduction of interference in an isolation amplifier (IA), Comparison of CMRR and IMRR(Isolation-mode rejection ratio), Carrier-type isolation amplifier, synchronous demodulator, Optically coupled circuits, Current-loading type of IA, Differential-capacitive IA, Fiber optic IA using voltage- to- frequency Converter, Right-leg-driven ECG amplifier with defibrillator protection and calibrator, Isolation power line monitor, Thermocouple amplifier with
grounded loop elimination chopper stabilized amplifier, Input guarding, current source using voltage reference and Op-Amp.

UNIT-3 Electrographs:
The heart as a potential source, the ECG waveform, standard lead system, ECG preamplifier, Defibrillator protection circuit, Electro surgery UNIT interference filter, multichannel physiological monitoring system, five patient electrode (6-lead) ECG system, QRS and pacer pulse detector system, ECG machine mechanism, patient cables, ECG machine maintenance, ECG faults and trouble shooting.
Physiological Pressure Measurements: pressure measurements, blood pressure measurements, Oscillometric and ultrasonic Noninvasive pressure measurements, Direct methods (H₂O manometers), Pressure transducers, Pressure amplifiers, Calibration methods, systolic, Diastolic and mean detector circuits, Pressure differentiation (dP/dt) circuits, Automatic zero circuits, Practical problems in pressure monitoring.


UNIT-5 Respiratory System:
Human respiratory system, Gas laws, internal (cellular) respiration, External (Lung) respiration, Organs of respiration, Mechanics of breathing, parameters of respiration, regulation of respiration, Unbalanced and diseased stages, Major measurements of pulmonary functions, Respiratory Instrumentation, Respiratory transducers and instruments, Spiro meters, Respiratory therapy equipment, oxygen therapy, artificial mechanical ventilator.
Instrumentation for Measuring Brain Parameters:
Organization of the nervous system, the neuron, cerebral angiography, computerized axial tomography (CAT), EEG, EEG electrodes and the 10-20 system, EEG amplitude and frequency bands, EEG diagnostic uses, EEG amplifiers, EEG telemetry systems.
Medical Laboratory Instrumentation:
Blood components, Blood tests, colorimeter, plane photometer, spectrophotometer, Blood cell counter, PH/ Blood Gas analyzers, chromatograph, auto analyzer, medical ultrasound, Endoencephelograph, Echo cardiograph, Fetal meter, Doppler flow detector.
Radiology and Nuclear Medicine Equipments:
Physics of sound waves, Ultrasound energy, ultrasound transducer, Types and uses of X-Ray and Nuclear Medicine equipments, Generation of X-Ray in an X-Ray tube, Block diagram and operation of X-Ray machine.
Electrical Safety in the Medical Environment:
Definition of electrical safety, Macro shock, Design considerations for reducing electric hazards, Line isolation system, Equipotential grounding systems, Ground fault interrupters, Electric safety test equipments.
TEXT AND REFERENCE BOOKS:

2. R.S. Khandpur, “Handbook of Biomedical Instrumentation”.
3. Leslie Cromwell and Weibell, “Biomedical Instrumentation and Measurements”.

Assessment Methods:

Teacher assessment will be based on following:

1. Multiple Choice Questions. 05Marks
2. Assignment. 10Marks
3. PQ analysis of any installation/plant. 05Marks
EE422: Communication Engineering
(Elective)

**Prerequisites:**
EE 244 - Network analysis
EE 253 - Electronic devices and circuit

**Course Educational Objective:**
The objectives of the course are to
1. Modern Communication and information system.
2. Acquire knowledge of worldwide information services.

**Course Outcomes:**
Students will be able to
1. Learn and understand Modern Communication and information system.
2. Develop and design information systems.

**UNIT -1 Introduction:**

**UNIT -2 Linear CW Modulation:**

**UNIT -3 Exponential CW Modulation:**
UNIT - 4  Sampling and Pulse Modulation:

UNIT - 5  Analog Communication Systems:
Receivers for CW Modulation, Super heterodyne Receivers, Direct Conversion Receivers, Special-Purpose Receivers, Receiver Specifications, Scanning Spectrum Analyzers, Multiplexing Systems Frequency-Division Multiplexing, Quadrature-Carrier Multiplexing, Time-Division Multiplexing Cross Talk and Guard Times Comparison of TDM and FDM, Phase-Lock Loops (PLL), Operation and Lock-In Synchronous Detection and Frequency Synthesizers, Linearized PLL Models and FM Detection, Television Systems Video Signals, Resolution, and Bandwidth Monochrome Transmitters and Receivers Colour Television HDTV.
Basic Telephony: Introduction, Working of Telephone exchange, Types of Telephone exchanges, advances in telephony.

TEXT AND REFERENCE BOOKS:


Assessments Methods:

Teacher assessment will be based on following:
1. Report based on visit of information system/ network/EPBX system. 10 Marks
2. Assignment. 10 Marks
EE423: Reliability and Condition Monitoring
(Elective)

Teaching Scheme:
Lectures: 03 Hrs/ week
Total Credits: 03

Evaluation Scheme:
Class Test: 20 Marks
Assignment: 20 Marks
End–Semester Examination: 60 Marks

Prerequisites:
EE 354- Control Systems II
GE 241 -Engineering Mathematics-III
GE 252- Engineering Mathematics IV

Course Educational Objective:
The objectives of the course are to
1. Know engineering system monitoring and fault diagnosis and explains the basic concepts of condition monitoring.
2. Know how modern technology, quality control and environmental issues have affected current thinking.
3. Protect themselves and others in the workplace and focuses on the safety measures needed when carrying out monitoring activities, especially those for isolating equipment.
4. Know how to use a range of condition monitoring equipment and will develop the skills and knowledge required for the location and identification of faults in engineering systems.
5. Learners will be required to select the appropriate monitoring technique and equipment based on the type of plant or equipment being monitored and the conditions checked.

Course Outcomes:
Students will be able to
1. Know the health and safety requirements relevant to monitoring and fault diagnosis of engineering Systems.
2. Know about system monitoring and reliability.
3. Use monitoring and test equipment.
4. Carry out fault diagnosis on electrical engineering equipment.

UNIT-1 Overview of Maintenance and Reliability Engineering:
Scope of industrial preventive/predictive maintenance programs, Definition of terminology, Reliability, availability and maintainability, Reliability models and failure distributions, Reliability function estimation, Residual life estimation as a prognosis activity; model development and forecasting, Case studies of applications to rotating machinery and heat exchangers.

UNIT-2 Maintenance planning and management, Computerized maintenance management systems (CMMS), Interaction between the production line and maintenance strategy, Criteria for evaluating maintenance performance, cost-benefit analysis.

UNIT-3 Monitoring and maintenance of process instruments, Principles of temperature, pressure and flow transmitters, Principles of motor current, voltage and flux measurements, Description of a typical instrumentation channel and classification of problems, Scope and
purpose of instrument surveillance and calibration reduction, Validation of plant sensors using digital signal processing techniques, Case studies of applications to process sensors, Instrumentation maintenance, smart sensors.

UNIT-4 Electrical signature analysis for machinery condition monitoring, Objectives of electrical system condition monitoring; types of faults, Methods of monitoring integrity of cables, instrument channels and case studies, Electric motor monitoring and diagnosis using electrical signatures (motor as a transducer), Case studies of motor monitoring using motor current, flux and power.

UNIT-5 Digital signal processing (DSP) and information extraction from machinery measurements. Demonstration of data acquisition and analysis
1. Instrumentation systems and measurements.
2. Data acquisition from machinery sensors, data sampling.
4. Time-domain and frequency-domain signatures.
5. Demonstration of a typical data acquisition and analysis system.

TEXT AND REFERENCE BOOKS:

Assessment Methods:

Teacher assessment will be based on following:
1. Multiple Choice Question. 05 Marks
2. Industry Visit reported related to maintenance and testing and equipments. 10 Marks
3. PPT Presentation . 05 Marks
EE513: Optimization Techniques

(Elective)

Teaching Scheme:
- Lectures: 03 Hrs/week
- Total Credits: 03

Evaluation Scheme:
- Class Test: 20 Marks
- Assignment: 20 Marks
- End–Semester Examination: 60 Marks

Prerequisites:
- GE241- Engineering Mathematics-III
- GE 252- Engineering Mathematics IV
- EE343- Power System Analysis

Course Educational Objective:
The objectives of the course are to
1. Give students the basic knowledge and tools to recognize, classify and solve different questions related to optimization problems as they appear in engineering.
2. Topics to be covered include basics of convex analysis, least-squares, linear and quadratic programs, semi definite programming, optimality conditions, duality theory, interior point methods.
3. Applications to a variety of electrical engineering problems will be presented.
4. The emphasis will be on training students to translate questions in optimization to the correct mathematical formalization and to apply the correct techniques to solve such questions.

Course Outcomes:
Students will be able to
1. Recognize and formulate problems that arise in engineering in terms of optimization problems
2. Able to present the basic theory of such problems related to power system
3. Able to understanding, tools and some experience of how such problems are solved
4. Implemented different technique to electrical engineering field

UNIT- 1 Linear Programming, Simplex Method, Revised Simplex Method, Duality, Sensitivity Analysis.


UNIT- 3 Unconstrained Optimization Methods, Univariate and Pattern Search Methods, Rosenbrocks Method of Rotating Coordinates, Simplex Method. Descent Methods, Steepest Descent Method, Conjugate Gradient Method (Fletcher- Reeves Method), Davidon- Fletcher- Powell Method.

TEXT AND REFERENCE BOOKS:


Assessments Methods:

Teacher assessment will be based on following:

1. Multiple Choice Questions. 05 Marks
2. Assignment. 10 Marks
3. PQ analysis of any installation/plant. 05 Marks
EE514: Renewable Electrical Power Systems
(Elective)

Teaching Scheme:
Lectures 03 Hrs/ week
Total Credits 03

Evaluation Scheme:
Class Test 20 Marks
Assignment 20 Marks
End–Semester Examination 60 Marks

Prerequisites:
GE 142- Engineering Physics
GE 141-Engineering Mathematics-I
EE 243 -Transformer & Dc Machines

Course Educational Objective:
The objectives of the course are to
1. Understand problems and limitations of fossil fuels for electrical power generation.
2. Impact concept of distributed generation.
3. Study and make aware about Photovoltaic power systems.
4. Create awareness about renewable energy sources.
5. Sensitize impact of electrical power generation from wind turbines.
6. Make aware about Biomass and Fuel cells

Course Outcomes:
Students will be able to
1. Understand concept of distributed power generation.
2. Classify wind turbines.
3. Calculate maximum output power from wind turbine.
4. Understand Micro-Hydro Power system.
5. Plot I-V Characteristics of solar cell.
6. Distinguish between stand alone and grid connected PV systems.
7. Understand standard test conditions and impacts of shading on I-V curves of solar cell.

UNIT- 1 Distributed Generation:

UNIT- 2 Wind Power Systems:

UNIT- 3 The Solar Resource:
UNIT- 4 Photovoltaic Materials and Electrical Characteristics:

TEXT AND REFERENCE BOOKS:

Assessments Methods:
Teacher assessment will be based on following:
1. Multiple Choice Questions. 05 Marks
2. Assignment. 10 Marks
3. PQ analysis of any installation/plant. 05 Marks