# M.E. POWER ELECTRONICS AND DRIVES
## REGULATIONS 2016
### (CHOICE BASED CREDIT SYSTEM)

## CURRICULUM

### SEMESTER III

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### LIST OF ELECTIVES

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#### ELECTIVES V

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COURSE OBJECTIVES

- To infer knowledge on renewable energy resources.
- To analyze the concepts of wind energy and its application.
- To study characteristics of solar and photovoltaic cell.
- To infer knowledge on overview of power electronics converters.
- To discuss the fundamental concepts of grid connectors in wind and solar.

UNIT I  INTRODUCTION

Environmental aspects of electric energy conversion: Renewable energy resources and their importance - Qualitative study of Solar PV, wind electrical systems-control strategy, operating area, operating principles and characteristics. Trends in energy consumption - World energy scenario – Energy sources and their availability - Conventional and renewable sources - Need to develop new energy technologies.

UNIT II  WIND ENERGY


UNIT III  SOLAR ENERGY


UNIT IV  POWER CONVERTERS


UNIT V  GRID CONNECTED WIND & SOLAR ENERGY CONVERSION SYSTEMS

COURSE OUTCOMES
At the end of this course, students will be able to

- understand renewable energy resources and their importance.
- describe about the basic components in wind energy system.
- understand the characteristics of solar cell and photovoltaic system.
- explain the modern power converters for renewable energy power harness.
- evaluate grid connection issues, performance improvements of wind and solar.

REFERENCES

WEB LINKS
1. https://www.youtube.com/watch?v=mpHZWYpKDJg
2. https://www.youtube.com/watch?v=gMxPkVQYXz8
3. https://www.youtube.com/watch?v=IPxRujJ4_oY
COURSE OBJECTIVES

- To understand Conventional power generation
- To analyze interconnecting distributed resources to electric power systems.
- To point out the impact of grid integration with NCE sources on existing power system.
- To study concept and definitions of Microgrid and its configuration.
- To produce knowledge on various power quality issues in micro grids.

UNIT I INTRODUCTION


UNIT II DISTRIBUTED GENERATIONS (DG)


UNIT III GRID INTEGRATION IN DG

Requirements for grid interconnection, limits on operational parameters: Voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV MICROGRIDS

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids, communication infrastructure, modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes.

UNIT V POWER QUALITY ISSUES IN MICROGRIDS


TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- upon completion of the course, students will be able to
- understand the basic concept of distributed generation.
- summarize the interconnecting Distributed resources to electric power systems.
- analyze the impact of grid integration with NCE sources on existing power system.
- study the concepts and definitions of Microgrid and its configuration.
- demonstrate the availability based tariff and framework of Indian power sector.
REFERENCES

WEB LINKS
1. nptel.ac.in/courses/108108034/
2. www.egr.msu.edu/~mitraj/misc/Mitra_seminar_LANL.pdf
3. https://www.ee.iitb.ac.in/wiki/faculty/sak
COURSE OBJECTIVES

- To infer knowledge on battery technology.
- To understand battery management system.
- To know various types of batteries and their reactions.
- To acquire the knowledge on energy storage and generation system.
- To overview the applications of batteries.

UNIT I  BATTERY TECHNOLOGY OVERVIEW  9

UNIT II  BATTERY MANAGEMENT SYSTEM  9
Building Units of a Battery Management System: Sensors, Monitoring Unit, Diagnostics Unit, Protection Unit, Control Unit, Communications – Battery Charger Framework: Fundamentals and Description of Building Components– Required Protections.

UNIT III  BATTERIES AND REACTIONS  9

UNIT IV  ENERGY STORAGE AND GENERATION  9

UNIT V  APPLICATIONS OF BATTERIES  9
Stationary applications- Load Leveling, lead-acid batteries for telecommunications and UPS, Lead-acid batteries for solar and wind energy storage- Miscellaneous applications- Tracking Systems, Toll Collection, Oil Drilling, Car Accessories, Oceanography- Battery management and life prediction- Battery collection and recycling- World market for industrial batteries.

TOTAL PERIODS  45

COURSE OUTCOMES
At the end of this course, students will be able to

- discuss the overall view on Battery management System.
- understand the knowledge on Battery Management System.
- summarize batteries and their reactions.
- define the energy storage and generation.
- familiarize different kinds of applications by using of batteries.
REFERENCES

WEB LINKS
ELECTIVE V

PPE16551  SPECIAL ELECTRICAL MACHINES AND CONTROLLERS  3 0 0 3

COURSE OBJECTIVES

- To provide knowledge about the features and principles of several of special machines.
- To know the construction and control scheme of the machines.
- To compare and analyze the static and dynamic characteristics of SRM.
- To provide knowledge about the features, characteristic of PMDC motors and its controllers.
- To walk with the various applications on special electrical machines.

UNIT I  STEPPING MOTORS  9

Stepping Motors – Types – Constructional features – principle of operation – modes of excitation, torque production – Characteristics – Linear and Non Linear Analysis - Drive systems, Controllers for stepping motor.

UNIT II  SYNCHRONOUS RELUCTANCE MOTORS  9


UNIT III  SWITCHED RELUCTANCE MOTORS  9

Constructional features-principle of operation-Inductance profile-Torque equation- Types of Power controllers and converter topologies used – Current control schemes – Torque Speed Characteristics – Hysteresis and PWM - Microprocessor based controller and Sensor less Controller.

UNIT IV  PERMANENT MAGNET BRUSHLESS DC MOTORS  9

Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and Emf equation, Torque-Speed characteristics, Controllers-Magnetic Circuit Analysis- microprocessor based controller.

UNIT V  LINEAR MOTORS  9


TOTAL PERIODS  45

COURSE OUTCOMES

At the end of this course, students will be able to

- know the construction and operating principles of special electrical machines.
- analyze the performance of special electrical machines.
- analyze the different types of controllers and control techniques.
- familiarize with various applications on special electrical machines.
- demonstrate control strategies for applications using special machines.
REFERENCES

WEB LINKS
COURSE OBJECTIVES

- To acquire knowledge of power system harmonics.
- To understand fundamentals of PWM methods for Voltage Source Converters.
- To learn various switching operation in resonant converters.
- To analyze state space model to various converters.
- To walk around the various scheme to control the converter.

UNIT I  POWER SYSTEM HARMONICS & LINE COMMUTATED RECTIFIERS  9
Average power-RMS value of a waveform-Power factor-AC line current harmonic standards IEC 1000-IEEE 519- The Single phase full wave rectifier-Continuous Conduction Mode-Discontinuous Conduction Mode-Behavior when C is large- Minimizing THD when C is small-Three phase rectifiers- Continuous Conduction Mode- Discontinuous Conduction Mode-Harmonic trap filters.

UNIT II  PULSE WIDTH MODULATED RECTIFIERS  9
Properties of Ideal rectifiers-Realization of non ideal rectifier-Control of current waveform-Average current control-Current programmed Control- Hysteresis control- Nonlinear carrier control-Single phase converter system incorporating ideal rectifiers- Modeling losses and efficiency in CCM high quality rectifiers-Boost rectifier Example - expression for controller duty cycle-expression for DC load current-solution for converter Efficiency η.

UNIT III  RESONANT CONVERTERS  9

UNIT IV  DYNAMIC ANALYSIS OF SWITCHING CONVERTERS  9
Review of linear system analysis-State Space Averaging-Basic State Space Average Model-State Space Averaged model for an ideal Buck Converter, ideal Boost Converter, ideal Buck Boost Converter, for an ideal Cuk Converter.

UNIT V  CONTROL OF RESONANT CONVERTERS  9
Pulse Width Modulation-Voltage Mode PWM Scheme-Current Mode PWM Scheme- Design of Controllers: PI Controller, Variable Structure Controller, Optimal Controller for the source current shaping of PWM rectifiers.

TOTAL PERIODS  45

COURSE OUTCOMES
At the end of this course, students will be able to

- know about the harmonics and line commutated rectifiers.
- understand the concepts and operations of Pulse Width Modulated Rectifier.
- identify the different types of resonant converters.
- understand the analysis of switching converters.
- discriminate the concepts of control methods in resonant converter.
REFERENCES


WEB LINKS

COURSE OBJECTIVES

• To acquire knowledge on the basic industrial control.
• To study the elements in industrial control systems.
• To impart knowledge on the instrumentation devices.
• To understand the concept of intelligent controllers.
• To analyze the application of servo motor control.

UNIT I INTRODUCTION


UNIT II SENSORS AND ACTUATORS

Sensors and actuators-Industrial optical sensors-Industrial physical sensors-Industrial measurement sensors-Industrial actuators. Transducers and valves-Industrial switches- Industrial transducers-Industrial valves.

UNIT III INDUSTRIAL INTELLIGENT CONTROLLERS

Signal conditioners – Instrumentation amplifiers – Isolation circuits – opto-electronic devices and control, electronic circuits for photo-electric switches - output signals for photo electric controls; Application of opto-isolation, interrupter modules and photo sensor; Fibre optics; Bar code equipment.

UNIT IV DYNAMIC ANALYSIS OF SWITCHING CONVERTERS

PLC controllers –Components and Architecture –PLC control mechanisms - PLC programming – CNC controllers – CNC control mechanism and its programming -FLC controllers – FLC control modeling and industrial controllers.

UNIT V SERVO AND STEPPER MOTOR


TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

• describe the basic industrial control.
• categorize the elements in industrial control systems.
• realize the knowledge of various devices.
• describe the concept of intelligent controllers.
• understand the application of servo motor control.

REFERENCES


WEB LINKS

2. https://books.google.co.in/books?isbn=0123820375
3. https://books.google.co.in/books?isbn=8120349903
Elective VI

PPE16651 Data Communication and Networks 3 0 0 3

Course Objectives

- To understand the fundamental concepts of computer networking.
- To familiarize the student with the basic taxonomy and terminology of the networking.
- To introduce the student to advanced networking in computer networking.
- To make the student to gain expertise in design and maintenance of individual networks.
- To walk around the various applications of computer networks.

Unit I  Computer Networks 9
Evolution of data networks, Network architecture, ISO Reference model examples of networks, Application of networks, Physical layer, and communication medium characteristics - Topologies.

Unit II  Medium Access Sub Layer and Data Link Layer 9

Unit III  Network and Transport Layers 9

Unit IV  Application Layer 9

Unit V  Cryptography & Network Security 9

Total Periods 45

Course Outcomes
At the end of this course, students will be able to

- independently understand basic computer network technology.
- understand and explain Data Communications System and its components.
- identify the different types of network topologies and protocols.
- enumerate the layers of the OSI model and TCP/IP, Explain the function of each layer.
- identify the different types of network devices and their functions with-in a network.
REFERENCES

WEB LINKS
2. http://www.sjbit.edu.in/app/course-material/ece/vii/computer%20communication%20network%20%5b06ec71%5d/ece-vii-computer%20communication%20network%20%5b06ec71%5d-notes.pdf
COURSE OBJECTIVES

- To describe the significance of CMOS technology and fabrication process.
- To understand the importance and architectural features of programmable logic devices.
- To apply the ASIC construction, design algorithms and basic analog VLSI design techniques.
- To explain the concepts of sequential system and floor planning.
- To study the logic synthesis and simulation of digital system using VHDL and Verilog HDL.

UNIT I CMOS DESIGN
Overview of digital VLSI design Methodologies- Logic design with CMOS-transmission gate circuits - Pass Transistor - Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- Layout diagram, Stick diagram-IC fabrications – Trends in IC technology.

UNIT II PROGRAMMABLE LOGIC DEVICES

UNIT III BASIC CONSTRUCTION, PLACEMENT AND ROUTING

UNIT IV SEQUENTIAL SYSTEMS AND FLOOR PLANNING

UNIT V LOGIC SYNTHESIS AND SIMULATION

TOTAL PERIODS 45

COURSE OUTCOMES
At the end of this course, students will be able to

- understand the basic concepts of CMOS circuits.
- acquire knowledge on architectural features of programmable logic devices.
- understand basic analog VLSI design techniques.
- apply and use the sequential system circuits.
- design and simulate the basic analog and digital circuits using Verilog HDL.
REFERENCES


WEB LINKS

1. https://docs.google.com/file/d/0B9LJy8vattSMeWxOMD1l1Sk43Sjg/edit
2. etidweb.tamu.edu/.../VHDL%20Programming%20By%20Example%20d.
COURSE OBJECTIVES

- To infer knowledge on Virtual instrumentation Architecture.
- To analyze the new concepts on Graphical programming.
- To understand the programming structure for various parameters.
- To discuss the data acquisition and instrument control.
- To use the applications of hardware and software specifications.

UNIT I INTRODUCTION


UNIT II INSTRUMENT INTERFACE


UNIT III PROGRAMMING TECHNIQUE

FOR loops, WHILE loop, CASE structure, formula node, Sequence structures – Arrays and Clusters - Array operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's.

UNIT IV DATA ACQUISITION

Installing hardware, installing drivers - Configuring the hardware - Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT V APPLICATIONS


COURSE OUTCOMES

At the end of this course, students will be able to

- discuss the knowledge on Virtual instrumentation Architecture.
- apply the new concepts in Graphical programming.
- understand the programming structure for various parameters.
- summarize the data acquisition and instrument control.
- implement the applications of hardware and software specifications.
REFERENCES

WEB LINKS
1. www.ni.com/labview/