# M.E. / M. Tech REGULAR xvii REGULATIONS 2015

## PROGRAMME : M.E. POWER ELECTRONICS AND INDUSTRIAL DRIVES CURRICULUM

### SEMESTER 1

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**PRACTICAL**

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**TOTAL CREDITS 27**

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**L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS**
## SEMESTER 4

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COURSE OBJECTIVE

- The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments.

UNIT 1 MATRIX THEORY 11 Hrs.
QR decomposition – Eigen values using shifted QR algorithm- Singular Value Decomposition - Pseudo inverse- Least square approximations

UNIT 2 CALCULUS OF VARIATIONS 13 HRS.
Concept of Functionals - Euler’s equation – functional dependent on first and higher order derivatives – Functionals on several dependent variables – Iso perimetric problems - Variational problems with moving boundaries

UNIT 3 TRANSFORM METHODS 12 Hrs.

UNIT 4 ELLIPTIC EQUATIONS 11 Hrs.

UNIT 5 LINEAR AND NON-LINEAR PROGRAMMING 13 HRS.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70
Exam Duration : 3 Hrs.
PART A : 10 Questions of 2 Marks each – No choice 20 Marks
PART B : 2 Questions from each unit of internal choice, each carrying 10 Marks 50 Marks
COURSE OBJECTIVE

- To analyze and comprehend the various operating modes of different configurations of power converters namely AC to DC, DC to DC and AC to AC converters.

UNIT 1 SINGLE PHASE RECTIFIERS 12 Hrs.

UNIT 2 THREE PHASE RECTIFIERS 12 Hrs.
Three phase half wave converter – Three phase semi converter – Three phase full converter with RL loads. – Effect of source and load inductance - Three phase dual converter – Power factor improvements

UNIT 3 DC CHOPPERS 12 Hrs.

UNIT 4 AC CHOPPERS 12 Hrs.

UNIT 5 CYCLOCONVERTER AND SPECIAL CONVERTERS 12 Hrs.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70  Exam Duration : 3 Hrs..
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVES

- Ability to analyse and comprehend the various operating modes of different configurations of power converters
- Ability to design different single phase and three phase inverters.

UNIT 1 SINGLE PHASE INVERTER 12 Hrs.

UNIT 2 VOLTAGE SOURCE AND CURRENT SOURCE INVERTER 12 Hrs.
Three phase bridge Inverter with 180º and 120º mode of operation – Voltage control of three phase Inverters - Analysis of single phase and three phase auto sequential current source Inverter - Current source bridge Inverter– Harmonic Elimination Techniques.

UNIT 3 Z-SOURCE INVERTER 12 Hrs.
Comparison with VSI and CSI-Equivalent circuit and operation –Circuit analysis and calculation. Introduction to Quasi Z- source inverter-basic topology-Extended boost quasi Z- source inverter topologies

UNIT 4 RESONANT PULSE INVERTERS 12 Hrs.

UNIT 5 MULTILEVEL INVERTER 12 Hrs.
Multilevel concept – Diode clamped – Flying capacitor – Cascade type multilevel Inverters - Comparison of multi-level Inverters - Application of multilevel Inverters

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70
Exam Duration : 3 Hrs..

PART A : 5 questions of 4 marks each – No choice
20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 10 marks
50 Marks
COURSE OBJECTIVES

- To study the characteristics of advanced power semiconducting switches.
- To analyse the on-state and switching losses involved in the operation of power semiconducting switches.
- To study the firing and protection circuits of advanced power semiconducting switches.

UNIT 1  INTRODUCTION
Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching – Power diodes - Types, forward and reverse characteristics, switching characteristics – Rating.

UNIT 2  CURRENT CONTROLLED DEVICES
BJT's – Construction, static characteristics, switching characteristics; Negative temperature co-efficient and secondary breakdown; Power Darlington – Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy – concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation; comparison of BJT and Thyristor – Steady state and dynamic models of BJT & Thyristor.

UNIT 3  VOLTAGE CONTROLLED DEVICES
Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs – Basics of GTO, MCT, FCT, RCT and IGCT.

UNIT 4  FIRING AND PROTECTING CIRCUITS
Necessity of isolation, pulse transformer, opto-coupler – Gate drive circuits: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

UNIT 5  THERMAL PROTECTION
Heat transfer – conduction, convection and radiation; Cooling – Liquid cooling, vapour – Phase cooling; Thermal modelling of power switching devices: Thermal equivalent circuit, Coupling of electrical & thermal components, heat sink types and design – Mounting types.

TEXT / REFERENCE BOOKS


END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70  
Exam Duration : 3 Hrs.

PART A : 5 questions of 4 marks each – No choice  
20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 10 marks  
50 Marks
COURSE OBJECTIVE

- To study and analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT 1 REVIEW OF CONVENTIONAL DC DRIVES 12 Hrs.
Different techniques of speed control and methods of braking of series and separately excited DC motor, Ward leonard speed control, Model and transfer function of series and separately excited DC motor.

UNIT 2 CONVERTER CONTROL OF DC MOTORS 12 Hrs.
Analysis of series and separately excited DC motor with single phase and three phase converters operating in different modes and configurations, Problems on DC machines fed by converter supplies, drive employing dual converter.

UNIT 3 CHOPPER CONTROL OF DC MOTORS 12 Hrs.
Introduction to time ratio control and frequency modulation; Class A,B,C,D and E chopper controlled DC motor – Performance analysis, multiquadrant control – Chopper based implementation of braking schemes – Multiphase Chopper.

UNIT 4 DESIGN OF CONVERTER AND CHOPPER FOR DC DRIVES 12 Hrs.
Speed loop, P, PI, PID controllers, Current loop, Armature current reversal, Field current reversal - Digital controller and firing circuits, Simulation.

UNIT 5 INDUSTRIAL DC DRIVES 12 Hrs.
Introduction to Siemens drive system - Speed control with emf feedback & tachogenerator - Current measurement & Torque Measurement - Tuning of drive, Phase locked loop control of DC drives.

Max. 60 Hours

TEXT / REFERENCE BOOKS
5. Siemens’s Course Material

WEB SITES
1. www.automation.siemens.com
2. www.legacypower.net

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70
Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVES

- To analyse and comprehend the various PWM techniques of single and three phase inverters.
- To analyse and design space vector modulation.

UNIT 1 INVERTER CONTROL STRATEGY  12 Hrs.
Introduction - Operation principle – Performance Parameters – PWM with Unipolar and Bipolar voltage switching – Effect of blanking time on voltage in PWM inverter – Voltage control of single phase inverter and three phase inverter

UNIT 2 ADVANCED PWM TECHNIQUES  12 Hrs.
Different types of advanced modulation techniques - Analysis of third harmonics modulation – Output filter requirement for different PWM techniques - Comparison of PWM techniques – Harmonic reduction

UNIT 3 SPACE VECTOR MODULATION (SVM)  12 Hrs.
Space Vector Modulation – Introduction - Concept of a space vector – Inverter switching states – Modulation Index - dq components for three phase sine wave source / level – Space vector sequence - Minimizing switching losses

UNIT 4 SVM MODULATION REGIONS  12 Hrs.

UNIT 5 APPLICATIONS  12 Hrs.
SVM implementation of three level diode clamped inverter – Three level inverter switching states, space vector diagram and modulation regions – Flow diagram for SVM implementation of three level inverter – Motor voltage and current waveforms for three level inverter in different regions – Five level diode clamped inverter – Switching states – Five level flying capacitor inverter – Switching states.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
SEC6547: EMBEDDED SYSTEM FOR POWER ELECTRONICS LAB
(For PEID)

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SUGGESTED LIST OF EXPERIMENTS

EMBEDDED LAB USING ARM CONTROLLER
1. Arithmetic operations manipulation and logical operations
2. Interfacing of Switch
3. Interfacing of LED
4. Interfacing of LCD
5. Interfacing of DC Motor.

DSP LAB EXPERIMENTS USING 2407 & ASSOCIATED PERIPHERALS
2. Study on PWM generation using Timer 1, 2, 3.
3. Study of two PWM generation using full compare unit.
4. Study of six pulse PWM generation using full compare unit with dead band timer.
5. Perform Analog to Digital conversion for an Analog input.
6. Perform variable speed of DC Motor using TMS 3202407

SEE6530: POWER ELECTRONICS LAB
(for PEID)

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SUGGESTED LIST OF EXPERIMENTS

3. Speed control of PMDC motor using Voltage Commutated Chopper.
4. Speed control of PMDC motor using Current Commutated Chopper.
5. IGBT based speed control of three phase induction motor using PWM technique.
6. Three Phase AC voltage regulator.
7. Four quadrant chopper fed DC motor
8. Modified McMurray - Bedford Inverter.
9. Resonant DC to DC Converter.
10. single phase cycloconverter.

SEE6531: POWER ELECTRONICS SIMULATION LAB
(for PEID)

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SUGGESTED LIST OF EXPERIMENTS:

1. Open Loop Control of Separately Excited DC Motor.
2. Open Loop Control of DC Series Motor.
3. Closed Loop Control of Separately Excited DC Motor.
4. Thyristor Static and Dynamic Behavior
5. Simulation of Single Phase Semi Converter with motor load.
6. Simulation of Three Phase Converter with different loads.
7. Simulation of Single and Three phase PWM circuits.
8. AC – DC – AC PWM converter
COURSE OBJECTIVES

- Ability to understand and analyse the VSI and CSI fed drive
- Understand the speed control of induction motor by stator and rotor side control
- Ability to learn synchronous motor drives with fixed and variable frequency

UNIT 1 STATOR VOLTAGE CONTROL OF INDUCTION MOTOR  12 Hrs.
Torque, Slip characteristics, Equivalent circuit, Speed control – Variable Voltage, Variable Frequency, Constant V/F operation. Operation with different types of loads, Performance, Comparison of different AC power controllers, Speed reversal, Closed loop control.

UNIT 2 STATOR FREQUENCY CONTROL  13 HRS..
Operation of induction motor with non sinusoidal supply waveforms, Variable frequency operation of 3 phase induction motors, Constant flux operation, Current fed operation, Dynamic and regenerative braking of CSI and VSI fed drives.

UNIT 3 ROTOR RESISTANCE CONTROL  12 Hrs.
Torque, Slip characteristics, Types of rotor choppers, Torque equations, Constant torque operation, TRC strategy, Closed loop speed control.

UNIT 4 SLIP POWER RECOVERY SCHEME  12 Hrs.
Equivalent circuit, Torque equation, Torque - Slip characteristics - Power factor considerations - Sub synchronous operation and closed loop speed control, Vector or Field control - Direct Vector control.

UNIT 5 SYNCHRONOUS MOTOR DRIVES  11 Hrs.
Need for leading PF operation - Open loop VSI fed drive and its characteristics - Self control - Torque angle control - Power factor control - Brush less excitation system - Starting methods - Principles of vector control.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice  20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks  50 Marks
COURSE OBJECTIVES
• To study the ARM processor and ARM instruction sets
• To understand RTOS concepts and Embedded networking concepts
• To understand basic ARM interfacing

UNIT 1 ARM ARCHITECTURE 12 Hrs.
ARM Architecture, ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families.

UNIT 2 ARM INSTRUCTION SET 12 Hrs.
Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions. Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single Register and Multi Register Load -Store Instructions, Stack, Software Interrupt Instructions.

UNIT 3 REAL TIME OPERATING SYSTEM 12 Hrs.
Real time operating systems (RTOS) – real time kernel – OS tasks – task states – task scheduling – interrupt processing – clocking communication and synchronization – control blocks – memory requirements and control – kernel services.

UNIT 4 EMBEDDED NETWORKS 12 Hrs.
Embedded Networks - Distributed Embedded Architecture – Hardware and Software Architectures, Networks for embedded systems– I2C, CAN Bus, Ethernet, Internet, Network–Based design– Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

UNIT 5 SYSTEM DESIGN 12 Hrs.
Switches and LED interfacing-LCD Display interfacing- Analog sensors interfacing for digital data conversion -Access control using analog keypad - Pulse width modulation technique for motor speed control

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70 Exam Duration : 3 Hrs.
PART A : 5 Questions of 4 Marks each-No choice 20 Marks
PART B : 2 Questions from each unit with internal choice, each carrying 10 Marks 50 Marks
SEEC6547  EMBEDDED SYSTEM FOR POWER ELECTRONICS LAB  
(For PEID)

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SUGGESTED LIST OF EXPERIMENTS

EMBEDDED LAB USING ARM CONTROLLER

1. Arithmetic operations manipulation and logical operations
2. Interfacing of Switch
3. Interfacing of LED
4. Interfacing of LCD
5. Interfacing of DC Motor.

DSP LAB EXPERIMENTS USING 2407 & ASSOCIATED PERIPHERALS

2. Study on PWM generation using Timer 1,2,3.
3. Study of two PWM generation using full compare unit.
4. Study of six pulse PWM generation using full compare unit with dead band timer.
5. Perform Analog to Digital conversion for an Analog input.
6. Perform variable speed of DC Motor using TMS 3202407

SEE6530  POWER ELECTRONICS LAB  
(for PEID)

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SUGGESTED LIST OF EXPERIMENTS

3. Speed control of PMDC motor using Voltage Commutated Chopper.
4. Speed control of PMDC motor using Current Commutated Chopper.
5. IGBT based speed control of three phase induction motor using PWM technique.
6. Three Phase AC voltage regulator.
7. Four quadrant chopper fed DC motor
8. Modified McMurray - Bedford Inverter.
9. Resonant DC to DC Converter.
10. single phase cycloconverter.

SEE6531  POWER ELECTRONICS SIMULATION LAB  
(for PEID)

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SUGGESTED LIST OF EXPERIMENTS:

1. Open Loop Control of Separately Excited DC Motor.
2. Open Loop Control of DC Series Motor.
3. Closed Loop Control of Separately Excited DC Motor.
4. Thyristor Static and Dynamic Behavior
5. Simulation of Single Phase Semi Converter with motor load.
6. Simulation of Three Phase Converter with different loads.
7. Simulation of Single and Three phase PWM circuits.
8. AC – DC – AC PWM converter
DSP BASED SYSTEM DESIGN
(For PEID)

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**COURSE OBJECTIVES**

- To study the architectural details and assembly language programming concept for TMS320C24X DSP controller.
- To study the PWM waveform generation concept using event manager block in TMS320C24X.
- To study peripheral and communication interfacing for developing a DSP based system.

**UNIT 1  INTRODUCTION**

- TMS320 Family overview - The 320C24X Series of DSP Controllers - Architecture overview - C24X CPU Internal Bus structure - Memory - CALU – ARALU - Program control - Address modes

**UNIT 2  INSTRUCTION SET**

- Assembly Language Instruction - Instruction Set Summary - Instruction description - Accumulator, arithmetic and logic instruction - Auxiliary Register and Data page Pointer instructions - TREG, PREG and Multiply Instruction - Branch Instructions - Control Instructions - I/O and Memory instruction.

**UNIT 3  EVENT MANAGER AND PWM GENERATION CIRCUITS**

- Event manager (EV) functional blocks - General purpose timers - Compare units - PWM circuits associated with compare unit - PWM waveform generation with compare units and PWM circuits - Space vector PWM

**UNIT 4  PERIPHERAL UNITS AND INTERRUPT STRUCTURE**

- Capture unit - Quadrature Encoder pulse circuit - Event manager (EV) Interrupts - ON-Chip ADC – Overview - ADC clock - Pre-scalar – Calibration - Register Bit Description.

**UNIT 5  SYSTEM DESIGN**

- Serial Communication interface (SCI) for 2407 - SCI Communication format - Serial peripheral communication (SPI) SPI operation - - CAN controller module - Overview of the CAN network - Getting started with code compose studio IDE - DSP Based system Design using PMDC - DSP-Based Control of Stepper Motors.

**TEXT / REFERENCE BOOKS**


**END SEMESTER EXAM QUESTION PAPER PATTERN**

Max. Marks : 70  Exam Duration : 3 Hrs.

**PART A**
- 5 Questions of 4 Marks each – No choice

20 Marks

**PART B**
- 2 Questions from each unit with internal choice, each carrying 10 Marks

50 Marks
SATHYABAMA UNIVERSITY FACULTY OF ELECTRICAL AND ELECTRONICS

SEC6547  EMBEDDED SYSTEM FOR POWER ELECTRONICS LAB
        (For PEID)

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SUGGESTED LIST OF EXPERIMENTS

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SEE6530  POWER ELECTRONICS LAB
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SUGGESTED LIST OF EXPERIMENTS

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SEE6531  POWER ELECTRONICS SIMULATION LAB
         (for PEID)

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SUGGESTED LIST OF EXPERIMENTS:

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4. Thyristor Static and Dynamic Behavior
5. Simulation of Single Phase Semi Converter with motor load.
6. Simulation of Three Phase Converter with different loads.
7. Simulation of Single and Three phase PWM circuits.
8. AC – DC – AC PWM converter
COURSE OBJECTIVES
- To impart knowledge on working principle and characteristics of switched reluctance motors, permanent magnet brushless motors, permanent magnet synchronous motors
- To study the working principle of novel motors

UNIT 1 STEPPER MOTORS 12 Hrs.

UNIT 2 SWITCHED RELUCTANCE MOTORS 12 Hrs.

UNIT 3 PERMANENT MAGNET BRUSHLESS DC MOTORS 12 Hrs.
Commutation in DC motor - Difference between mechanical and electronic commutators - Hall effect sensors -Optical sensors - Multiphase brushless motor - Square wave permanent magnet brushless motor drives - Torque and EMF equation – Torque - speed characteristics – Controllers

UNIT 4 PERMANENT MAGNET SYNCHRONOUS MOTORS 12 Hrs.
Construction and operation of synchronous motors-d-q transformation and d-q model - Closed loop control in d-q reference frame - Vector control of permanent magnet synchronous motors - DTC of VSI and CSI fed electrically excited synchronous motors.

UNIT 5 NOVEL MOTORS 12 Hrs.
Construction and operation of Written pole motors - Piezoelectric Motors - Bearingless motors - Slotless motors – Coreless Stator PM brushless motors: Disc type coreless motors, Cylindrical type motors with coreless stator winding.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks

M.E. / M. Tech REGULAR REGULATIONS 2015
**SEE5602**

**POWER ELECTRONICS IN POWER SYSTEMS**

(For PEID)

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**COURSE OBJECTIVES**

- To provide a chance for the students to learn more about FACTS devices, since they must be aware of reactive power compensation & power factor improvement.
- To impart more knowledge about the different power converter circuits which helps in energy storage and effective utilization.

**UNIT 1 LOAD COMPENSATION**


**UNIT 2 INTRODUCTION TO FACTS DEVICES**

Thyristor Controlled Reactor (TCR) – Thyristor Switched Capacitor (TSC) – Saturable Reactor – Saturated Reactor Compensator – Static VAR Compensator (SVC) – Thyristor Controlled Series Capacitor (TCSC) – STATCOM – Dynamic Voltage Restorer (DVR)

**UNIT 3 HARMONICS CONTROL & POWER FACTOR IMPROVEMENT**

Reactive power variation for fully controlled converter – Half controlled converter – Fully controlled converter with controlled freewheeling – Methods of employing natural commutation – Methods of employing forced commutation – Implementation of forced commutation

**UNIT 4 VOLTAGE CONTROL USING STATIC TAP CHANGER**

Introduction to voltage regulators – Single Phase voltage controllers – Sequence control of AC voltage controllers – Manually controlled voltage regulator (Conventional Methods) – Static Tap changer using thyristors.

**UNIT 5 UNINTERRUPTIBLE POWER SUPPLY SYSTEMS**

Switched mode power supply (SMPS) – Parallel UPS – Rotating UPS – Static UPS types – UPS using resonant power converters – High voltage DC transmission – Static circuit breakers

Max. 60 Hours

**TEXT / REFERENCE BOOKS**


**END SEMESTER EXAM QUESTION PAPER PATTERN**

Max. Marks : 70  Exam Duration : 3 Hrs.

**PART A** : 5 questions of 4 marks each – No choice 20 Marks

**PART B** : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVES
- To impart knowledge in State Space Analysis
- To understand and implement various stability analysis in Non linear systems
- To gain knowledge in MIMO system analysis

UNIT 1 PHYSICAL SYSTEMS AND STATE ASSIGNMENTS 12 Hrs.
State space modelling of Electrical, Mechanical, Hydraulic, Pneumatic, Thermal systems – Modelling of some typical systems like DC Machines - Inverted Pendulum.

UNIT 2 STE STATE SPACE ANALYSIS 12 Hrs.

UNIT 3 MIMO SYSTEMS FREQUENCY DOMAIN DESCRIPTIONS 12 Hrs.

UNIT 4 NON-LINEAR SYSTEMS 12 Hrs.
Types of non-linearity – Typical examples – Equivalent linearization - Describing functions - Analysis using Describing functions - Phase plane analysis.

UNIT 5 STABILITY 12 Hrs.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVES

- To analyze the steady state and dynamic characteristics of DC Machines through mathematical modeling.
- To analyze the steady state and dynamic characteristics of Three phase Induction Machines and Three phase Synchronous Machines using reference frame theory.

UNIT 1  PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION  12 Hrs.
Magnetic circuits, permanent magnet, stored magnetic energy, co-energy - force and torque in singly and doubly excited systems – machine windings and air gap mmf - winding inductances and voltage equations.

UNIT 2  DC MACHINES  12 Hrs.
Elementary DC machine and analysis of steady state operation - Voltage and torque equations – dynamic characteristics of permanent magnet and shunt d.c. motors –Time domain block diagrams - solution of dynamic characteristic by Laplace transformation

UNIT 3  REFERENCE FRAME THEORY  12 Hrs.
Historical background – phase transformation and commutator transformation – transformation of variables from stationary to arbitrary reference frame - variables observed from several frames of reference.

UNIT 4  INDUCTION MACHINES  12 Hrs.

UNIT 5  SYNCHRONOUS MACHINES  12 Hrs.
Three phase synchronous machine and analysis of steady state operation - voltage and torque equations in machine variables and rotor reference frame variables (Park’s equations) – analysis of dynamic performance for load torque variations

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice  20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks  50 Marks
SEE5605

INDUSTRIAL MANAGEMENT IN POWER ELECTRONICS

(For PEID)

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COURSE OBJECTIVES
- To impart knowledge on operation, modelling and control of industrial management in power electronics
- To provides an integrated set of control, supervision and management functions for power generation, distribution and supply in industrial plants

UNIT 1  POWER MANAGEMENT TECHNOLOGIES  12 Hrs.

UNIT 2  CIRCUITS  12 Hrs.

UNIT 3  CONVERTERS AND DC-DC CONVERSION ARCHITECTURES  12 Hrs.

UNIT 4  AC-DC ARCHITECTURES  12 Hrs.

UNIT 5  FUTURE DIRECTIONS AND SPECIAL APPLICATIONS  12 Hrs.
Voltage Regulation with Power Factor Correction, Green Power (Energy Management), Motor Drivers For Portable Electronic Applications - Camera Basics - Motor And Motor Drivers - Drive Implementation, Efficiency - DSC Power consumption.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70
Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVES

- To provide the requisite knowledge necessary to appreciate the dynamical equations involved in the analysis of different power electronic device configurations.
- To provide knowledge on modelling and simulation of machines and power simulation circuits and systems.

UNIT 1  INTRODUCTION AND MODELLING OF POWER ELECTRONICS ELEMENT  12 Hrs.

UNIT 2:  SYSTEMATIC METHOD OF FORMULATION & SOLVING STATE EQUATION  12 Hrs.

UNIT 3  MACHINE MODELLING  12 Hrs..

UNIT 4  PHASE CONTROLLED DC MOTOR DRIVES  12 Hrs.

UNIT 5  VECTOR CONTROLLED INDUCTION MOTOR DRIVES  12 Hrs.
Introduction to principle of vector control – Description of direct vector control-Flux and torque processor-Implementation with six step current source-Implementation of voltage source-Derivation of indirect vector control scheme-Indirect vector control scheme-Implementation of an indirect vector control scheme.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVE

- This subject aims to furnish ideas related to neural network, fuzzy logic, genetic algorithm and its implementation ideas in electric drives to students to develop and learn issues related to the power converters

UNIT 1 INTRODUCTION 12 Hrs.

UNIT 2 ARTIFICIAL NEURAL NETWORKS 12 Hrs.
Concept of Artificial Neural Networks and its basic mathematical model, McCulloch - Pitts neuron model, simple Perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Hopfield network, Self Organizing network and Recurrent network- Back propagation networks. Principal Component analysis and wavelet transformations related to power electronics.

UNIT 3 OPTIMIZATION TECHNIQUES 12 Hrs.
Objective function-Uni modal-Multi model Constraints-Fitness Function-Operators Genetic Algorithm, Tabu search, ant-colony search

UNIT 4 FUZZY LOGIC SYSTEM 12 Hrs.
Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modelling and control. Fuzzification, inferencing, defuzzification. Fuzzy knowledge and rule bases. Fuzzy modelling and control schemes for nonlinear systems. Self-organizing fuzzy logic control- Neuro fuzzy controllers.

UNIT 5 APPLICATION (QUANTITATIVE APPROACH ONLY) 12 Hrs.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70  Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice  20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks  50 Marks
COURSE OBJECTIVES:
- To provide the knowledge of photo voltaic system and wind energy system
- To learn the hybrid connected PV and wind energy system with diesel power plant

UNIT 1 INTRODUCTION

UNIT 2 POWER ELECTRONICS FOR PHOTOVOLTC SYSTEMS

UNIT 3 HYBRID AND GRID CONNECTED PV SYSTEMS
PV Diesel hybrid systems – Control of PV – Diesel hybrid system – Grid connected PV systems – Inverters for grid connected applications – Inverter – Inverter types – Power control through PV inverters – System configuration – Grid inverter characteristics.

UNIT 4 POWER ELECTRONICS FOR WIND POWER SYSTEM

UNIT 5 SYSTEM MANAGEMENT OF WIND ENERGY CONVERTER
Prototype development – Control circuitry – Microcontroller – Complex programmable logic device – Gate driver circuitry for wind energy applications.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70 Exam Duration : 3 Hrs.
PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVES

- To have an understanding in various Reactive power Compensators
- To model and implement the FACTS controllers in enhancement of power system performance
- To have a knowledge in coordination of FACTS controllers

UNIT 1 INTRODUCTION

UNIT 2 STATIC VAR COMPENSATOR (SVC)
Thyristor Controlled Reactor (TCR) - Thyristor Switched Reactor (TSR) - Thyristor Switched Capacitor (TSC) - Fixed Capacitor - Thyristor Controlled Reactor (FC-TCR) - Thyristor Switched Capacitor - Thyristor Controlled Reactor (TSC -TCR) – V-I Characteristics of Static Var Compensator (SVC) - Advantages of slope in dynamic Characteristic – Voltage control by SVC – Design of SCV voltage regulator. Applications: Increase in power transfer capacity – Enhancement of transient stability – Prevention of voltage instability.

UNIT 3 THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC)

UNIT 4 EMERGING FACTS CONTROLLER

UNIT 5 SUB SYNCHRONOUS RESONANCE (SSR)
NGH-SSR damping scheme – Thyristor controlled braking resistor (TCBR) – Coordination of Multiple Controllers using Linear Control Techniques – Approximate multimodal decomposition method for the design of FACTS controllers.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 70

PART A : 5 questions of 4 marks each – No choice 20 Marks
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SATHYABAMA UNIVERSITY

FACULTY OF ELECTRICAL AND ELECTRONICS

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COURSE OBJECTIVES

- To impart knowledge on operation, modelling and control of HVDC link.

UNIT 1 DC POWER TRANSMISSION TECHNOLOGY 12 Hrs.

Introduction - Comparison of AC and DC transmission - Application of DC transmission – Description of DC transmission system - Planning for HVDC transmission - Modern trends in DC transmission.

UNIT 2 ANALYSIS OF HVDC CONVERTERS 12 Hrs.

Pulse number, choice of converter configuration - Simplified analysis of Graetz Circuit - Converter bridge characteristics – Characteristics of a twelve pulse converter - Detailed analysis of converters.

UNIT 3 CONVERTER AND HVDC SYSTEM CONTROL 12 Hrs.

General principles of DC link control - Converter control characteristics - System control hierarchy - Firing angle control - Current and extinction angle control - Starting and stopping of DC link - Power control - Higher level controllers - Telecommunication requirements.

UNIT 4 MULTITERMINAL DC SYSTEM 12 Hrs.


UNIT 5 HARMONICS AND CONVERTER COMPONENT MODEL 12 Hrs.

Introduction - Generation of harmonics - Design of AC filters - DC filters - Carrier frequency and RI noise. Converter model - Continuous time model - Discrete time converter model - Detailed model of the converter.

Max. 60 Hours

TEXT / REFERENCE BOOKS


END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70  Exam Duration : 3 Hrs.

PART A : 5 questions of 4 marks each – No choice 20 Marks
PART B : 2 questions from each unit of internal choice, each carrying 10 marks 50 Marks
COURSE OBJECTIVE

To enable students to understand and learn basic concepts of VLSI and to design both combinational and sequential circuit design. This will further enhance the idea of building basic blocks of digital operations along with front end design tool called VHDL.

UNIT I


UNIT II


UNIT III

Behavior of bistable elements - Clocked latch and flip flop circuits, CMOS D latch and edge triggered flipflop – Two pass clocking- TSPCL- Pipelining.

UNIT IV


UNIT V


Max. 60 Hours

TEXT / REFERENCE BOOKS

8. Pucknell, Basic VLSI Design . PHI Ltd

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 70

PART A : 5 Questions of 4 marks each-No choice

PART B : 2 Questions from each unit with internal choice, each carrying 10 marks

Exam Duration: 3 Hrs.

20 Marks

50 Marks
COURSE OBJECTIVE

- To enhance the idea of implementation of digital system design using hardware description knowledge for FPGA and applications related to the system design

UNIT I VHDL FUNDAMENTALS 12 Hrs.

UNIT II COMPOSITE DATA TYPES AND BASIC MODELING CONSTRUCTS 12 Hrs.

UNIT III SUBPROGRAMS AND PACKAGES 12 Hrs.

UNIT IV SIGNALS, COMPONENTS AND CONFIGURATIONS 12 Hrs.

UNIT V FPGA AND CPLD 12 Hrs.

Max. 60 Hours

TEXT / REFERENCE BOOKS

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SATHYABAMA UNIVERSITY
FACULTY OF ELECTRICAL AND ELECTRONICS

SEC5633
EMBEDDED CONTROL SYSTEMS
(For AE, EMB, E&C, PEID & PSE)

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COURSE OBJECTIVES

- To learn the fundamental principles of various peripherals and its operation
- To learn the principles of DAC and ADC conversions
- To discuss about the operation of Asynchronous serial communication
- To apply the basic concept of control system in real time embedded application

UNIT 1 INTRODUCTION
12 Hrs.
Nonlinear controller elements - Controller implementation and testing in Embedded Systems. Controlling the hardware with software – Data lines – Address lines - Ports – Schematic representation – Bit masking – Programmable peripheral interface – Switch input detection – 74 LS 244.

UNIT 2 INPUT-OUTPUT DEVICES
12 Hrs.

UNIT 3 D/A AND A/D CONVERSION
12 Hrs.
R 2R ladder - Resistor network analysis - Port offsets - Triangle waves analog vs. digital values - ADC0809 – Auto port detect - Recording and playing back voice - Capturing analog information in the timer interrupt service routine - Automatic, multiple channel analog to digital data acquisition.

UNIT 4 ASYNCHRONOUS SERIAL COMMUNICATION
12 Hrs.

UNIT 5 CASE STUDIES: EMBEDDED C PROGRAMMING
12 Hrs.
Multiple closure problems – Basic outputs with PPI – Controlling motors – Bi-directional control of motors – H bridge – Telephonic systems – Stepper control – Inventory control systems- Burger alarms- Fire alarms.

Max. 60 Hours

TEXT / REFERENCE BOOKS

END SEMESTER EXAM QUESTION PAPER PATTERN
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