COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.TECH-POWER ELECTRONICS

For
M.TECH TWO YEAR DEGREE PROGRAMME
(Applicable for the batches admitted from 2018-2019)

VAAGDEVI COLLEGE OF ENGINEERING
(Autonomous)
Bollikunta, Warangal-506 005
Telangana State, India.

VAAGDEVI COLLEGE OF ENGINEERING

Autonomous

Bollikunta, Warangal

Department of Electrical and Electronics Engineering

M.Tech. (Power Electronics)

COURSE STRUCTURE

(R18 Regulations applicable for the batches admitted from Academic Year 2018-19 onwards)

I-SEMESTER

Sl.No.	Course Code	Title of the Course	L	T	P	Credits
1	M18PE01	Analysis of Power Electronic Converters	3	0	0	3
2	M18PE02	Power Electronic Control of DC Drives	3	0	0	3
3	M18PE03 M18PE04 M18PE05 M18EC01	**Program Elective-I** Modeling and Analysis of Electrical Machines Renewable Energy Systems Modern Control Theory Programmable Logic Controllers and theirApplications	3	0	0	3
4	M18PE06 M18PE07 M18EC02	**Program Elective-II** Modelling of Power Semiconductor Devices Digital Control of Power Electronics and Drive Systems Microcontrollers and Applications	3	0	0	3
5	M18PE08	Power ConvertersSimulation Lab	0	0	4	2
6	M18PE09	Power Converters Lab	0	0	4	2
7	M18MC01	Research Methodology	2	0	0	2
8	M18AC02	**Audit Course-I** Stress Management	2	0	0	0
		Total Credits	**16**	**00**	**08**	**18**

II- SEMESTER

Sl.No.	Course Code	Title of the Course	L	T	P	Credits
1	M18PE10	ModernPower Electronic Converters	3	0	0	3
2	M18PE11	Power Electronic Control of AC Drives	3	0	0	3
3	M18PE13 M18PE14 M18PE15	**Program Elective-III** Electrical and Hybrid Vehicles Digital Control Systems Power Quality	3	0	0	3
4	M18EC03 M18PE16 M18PS11	**Program Elective-IV** Embedded Systems Dynamics of Electrical Machines AI Techniques in Electrical Engineering	3	0	0	3
5	M18PE17	Power Convertersand Drives Simulation Lab	0	0	4	2
6	M18PE18	Power Convertersand Drives Lab	0	0	4	2
7	M18PE19	Mini Project	0	0	4	2
8	M18AC01	**Audit Course-II** English for Research Paper Writing	2	0	0	0
		Total Credits	**14**	**00**	**12**	**18**

III-SEMESTER

Sl.No.	Course Code	Title of the Course	L	T	P	Credits
1	M18PE12 M18PE20 M18PS17 M18EC04	**Program Elective-V** HVDC & FACTS Switched Mode Power Supplies Smart Grid Technologies Advanced Digital Signal Processing	3	0	0	3
2	M18EE01 M18EE02 M18ME01	**Open Elective** Energy Auditing, Conservation &Management Optimization Techniques Industrial Safety	3	0	0	3
3	M18PE21	Dissertation Phase-I	0	0	20	10
		Total Credits	**06**	**00**	**20**	**16**

IV-SEMESTER

Sl.No.	Course Code	Title of the Course	L	T	P	Credits
1	M18PE22	Dissertation Phase-II	0	0	32	16
		Total Credits	**00**	**00**	**32**	**16**

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE01) ANALYSIS OF POWER ELECTRONIC CONVERTERS

M. TECH: I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronics

UNIT I:

SINGLE PHASE & THREE PHASE CONVERTERS: Single phase converters – Half controlled and Fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – single phase dual converters – power factor Improvements Techniques– Extinction angle control – symmetrical angle control, PWM – single phase sinusoidal PWM – single phase series converters – overlap analysis – Applications & Problems.

Three phase converters – Half controlled and fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – three phase dual converters – power factor Improvements Techniques– three phase PWM - twelve pulse converters – Applications – Problems – Design of converters.

UNIT II:

AC VOLTAGE CONTROLLERS: Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive inductive-induced e.m.f. loads – ac voltage controllers with PWM Control – Effects of source and load inductances - Synchronous tap changers.

Three phase AC voltage controllers – Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads – Effects of source and load Inductances – Applications & Problems.

UNIT III:

CYCLO-CONVERTERS: Single phase to single phase cyclo-converters – analysis of midpoint and bridge Configurations – Three phase to three phase cyclo-converters –analysis of Midpoint and bridge configurations – Limitations – Advantages – Applications & Problems - Matrix Converter.

UNIT IV:

D.C. TO D.C. CONVERTERS: Analysis of step-down and step-up dc to dc converters with Resistive and Resistive-inductive loads – Switched mode regulators – Analysis of Buck Regulators - Boost regulators – buck and boost regulators – Cuk regulators – Condition for continuous inductor current and capacitor voltage – comparison of regulators –Multi output boost converters – advantages – Applications – Problems.

UNIT V:

PULSE WIDTH MODULATED INVERTERS: Principle of operation – performance parameters – single phase bridge inverter- evaluation of output voltage and current with resistive, inductive and Capacitive loads– Voltage control of single phase inverters – single PWM – Multiple PWM – sinusoidal PWM – modified PWM – phase displacement Control – Advanced modulation techniques for improved performance – Trapezoidal, staircase, stepped, harmonic injection and delta modulation – Advantages – Applications & Problems.

Three phase inverters – analysis of 180-degree conduction for output voltage and current with resistive, inductive loads – analysis of 120-degree Conduction – voltage control of three phase inverters – sinusoidal PWM – Third Harmonic PWM – 60-degree PWM – space vector modulation – Comparison of PWM techniques – harmonic reductions – Problems.

TEXT BOOKS:

1. Mohammed H. Rashid “Power Electronics” Pearson Education, 2004.

2. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics: Converters, Applications, and Design" - John Wiley & Sons – Third Edition.

REFERENCES:

1. Milliman Shepherd and Lizang – "Power Converters Circuits" – Chapter 14 (Matrix converter) PP- 415-444,
2. M.H.Rashid – "Power Electronics Hand Book" Academic Press, 2006
3. Marian P. Kaźmierkowski, Ramu Krishnan, FredeBlabjerg "Control in Power Electronics" Academic Press, 2002.

Course Outcomes: After the completion of this course, students should be able to

CO 1. Analyze the principle of operation of single phase and three phase converters.
CO 2. Analyze the single phase and three phase AC voltage controller for various loads.
CO 3. Understand the various configurations of cycloconverters and their limitations.
CO 4. Gain knowledge on various DC to DC converter topologies.
CO 5. Understand the various control techniques for DC to AC converters including pulse width modulation techniques.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE02) POWER ELECTRONIC CONTROL OF DC DRIVES

M. TECH: I- SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronics and DC Machines

UNIT–I:
SINGLE-PHASE RECTIFIER CONTROLLED DC MOTOR: Separately excited DC motors and DC series motors with rectified single-phase supply – single phase semi converter and single-phase full converter for continuous and discontinuous modes of operation – power and power factor.

UNIT–II:
THREE-PHASE RECTIFIERS CONTROLLED DC MOTOR (SEPARATELY EXCITED & SERIES): Three-phase controlled converter, control circuit, control modeling of three phase converter – Steady state analysis of three phase converter control DC motor drive – Two quadrant, three phase converter controlled DC motor drive – DC motor and load, converter.

UNIT–III:
CLOSED LOOP CONTROL OF DC DRIVE: Current and speed controllers - Current and speed feedback – Design of controllers – Current and speed controllers – Motor equations – filter in the speed feedback loop speed controller – current reference generator – current controller and flow chart for simulation – Harmonics and associated problems – sixth harmonics torque.

UNIT–IV:
CHOPPER CONTROLLED DC MOTOR DRIVES: Principle of operation of the chopper – Chopper with other power devices – model of the chopper – input to the chopper – steady state analysis of chopper-controlled DC motor drives – rating of the devices – Pulsating torque. Closed loop operation: Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller – modeling of current controller – design of current controller.

UNIT–V:
FOUR QUADRANT OPERATION OF DC DRIVES: Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Four quadrant operation of D.C motors by single phase, three phase dual converters and Choppers – Closed loop operation of DC motor.

TEXT BOOKS:
1. Power Electronics and Motor Control – Shepherd, Hulley, Liang – Cambridge University Press.
2. Electric motor drives modeling Analysis and control – R. Krishnan, Prentice Hall India.
3. Power Electronics circuits, Devices and Applications – MH Rashid – PHI Publishers.
4. Power Semiconductor Drives – G. K. Dubey, Narosa Publishers

REFERENCES:
1. Fundamentals of Electric Drives – GK Dubey, Narosa Publishers 1995
2. Power Semiconductor drives – SB Dewan and A Straughen -1975.

Course Outcomes: After the completion of this course, students should be able to

CO 1. Understand the principle of operation of single phase and three phase AC to DC converters fed DC motor drives.
CO 2. Analyze the steady state operation of converter fed series and separately excited DC motors.

CO 3. Analyze the closed loop speed control and current control of DC motor drive and design of controllers.

CO 4. Understand the principle of operation of chopper fed DC motor drives and design the various current controllers for these drives.

CO 5. Acquire the knowledge on four quadrant operation of DC motor drives.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE03) MODELLING AND ANALYSIS OF ELECTRICAL MACHINES
(Program Elective-I)

M. TECH:I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Electrical Machines

UNIT-I:
Basic Two-pole DC machine - primitive 2-axis machine – Voltage and Current relationship – Torque equation.
Mathematical model of separately excited DC motor and DC Series motor in state variable form – Transfer function of the motor - Numerical problems. Mathematical model of D.C. shunt motor D.C. Compound motor in state variable form – Transfer function of the motor - Numerical Problems

UNIT-II:
Linear transformation – Phase transformation (a, b, c to α, β, 0) – Active transformation (α .β, 0 to d, q). Circuitmodel of a 3 phase Induction motor – Linear transformation - Phase Transformation – Transformation to a Reference frame – Two axis models for induction motor - dq model based DOL starting of Induction Motors

UNIT-III:
Voltage and current Equations in stator reference frame – equation in Rotor reference frame – equations in a synchronously rotating frame – Torque equation - Equations in state – space form.

UNIT-IV:
Circuits model of a 3ph Synchronous motor – Two axis representation of Synchronous Motor. Voltage and current Equations in state – space variable form – Torque equation - dq model based short circuit fault analysis- emphasis on voltage, frequency and recovery time.

UNIT-V:
Modeling of Permanent Magnet Synchronous motor – Modeling of Brushless DC Motor.

TEXT BOOKS:
1. Generalized Machine Theory - P.S. Bimbhra, Khanna Publishers
2. Analysis of Electric Machinery and Drives Systems - Paul C. Krause, Oleg wasynezuk, Scott D.Sudhoff, Wiley Publishers.

REFERENCES:
1. Power System Stability and Control –PrabhaKundur, EPRI.
2. Thyristor Control of Electric Drives – VedamSubranmanyam,Tata McGraw-Hill Publishers.

Course Outcomes: After the completion of this course, students should be able to

CO 1. Understand the mathematical modelingof series and separately excited DC motors.
CO 2. Gain the knowledge on various transformation techniques for induction motor.
CO 3. Analyze the voltage, current and torque equations for different reference framesof induction motors.
CO 4. Analyze the dq model of synchronous machine and study the impact on voltage and frequency under short circuit fault.
CO 5. Gain knowledge on modeling of PMSM and BLDC motors.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE04) RENEWABLE ENERGY SYSTEMS
(Program Elective – I)

M. TECH: I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: None

UNIT- I:
SOLAR ENERGY SYSTEMS: Introduction – solar radiation - solar thermal energy conversion - Flat plate collector - concentric collectors- solar pond - central receiver system- solar pumping - Solar photovoltaic systems - characteristics of PV cell- Photo voltaic modules - Types of Photo voltaic systems.

UNIT-II:
WIND ENERGY AND BIO GAS: Basics of wind energy - classification of turbines - wind characteristics - energy extraction - Betz limit - Modes of wind power generation- Bio Mass energy conversion - Anaerobic Digestion - Aerobic Digestion - Gasification-Bio Gas Plants.

UNIT-III:
OCEAN ENERGY CONVERSION: Tidal Energy generation - characteristics of Tides - Power generation schemes - Components in Tidal power plant- Wave Energy - Principle of wave energy plant - Wave energy conversion machines - Ocean Thermal Energy conversion - Principle - cycles of operation - Types of OTEC plants - Applications

UNIT-IV:
GEO-THERMAL ENERGY AND FUEL CELLS: HYBRID ENERGY SYSTEMS: Geothermal Energy - Structure of Earth's interior - Geothermal fields, gradient, resources - Geothermal power generation - Fuel cells – Introduction - Principle of operation - Types of Fuel cells - State of art fuel cells-energy output of a fuel cell - operating characteristics of fuel cells - thermal efficiency - Need for Hybrid systems - Types of Hybrid systems.

UNIT-V:
ENVIRONMENTAL ASPECTS OF ELECTRIC ENERGY GENERATION: Introduction - Thermal pollution - Hydel power projects - Impact on environment - Nuclear power generation – Impact on environment - Impact of renewable energy generation on environment - Global environmental awareness.

TEXT BOOKS:
1. D.P.Kothari, K.C.Singal, R.Ranjan ,"Renewable Energy Resources and Emerging Technologies"- PHI 2/e 2011
2. John Twidell and Tony Weir, "Renewable Energy Resources" - 2nd edition, CRC Press
3. Rakosh Das Begamudre, "Energy Conversion Systems"- New Age International Publishers, New Delhi - 2000.

REFERENCES:
1. Volker Quaschning "Understanding Renewable Energy Systems" Earthscan Publishers 2005
2. Faner Lin and Luo Honer Ye "Renewable Energy Systems-Advanced Conversion, Technologies & Applications" CRC press.

Course Outcomes: After the completion of this course, students should be able to

CO 1. Understand the characteristics of PV cell- Photo voltaic modules and its applications.
CO 2. Understand the basics of wind energy conversion systems and bio-gas energy generation.

CO 3. Analyze various Wave energy conversion machines - Ocean Thermal Energy conversion schemes.
CO 4. Gain Knowledge on the need of hybrid energy systems such as geothermal and fuel cells.
CO 5. Assess the impact of various renewable energy sources on environment.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE05) MODERN CONTROL THEORY
(Program Elective – I)

M. TECH: I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisites: Control Systems

UNIT-I:
Mathematical Preliminaries and State Variable Analysis: Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen values, Eigen Vectors and a Canonical form representation of Linear systems – The concept of state – State space model of Dynamic systems – Time invariance and Linearity – Non uniqueness of state model – State diagrams for Continuous Time State models - Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and it's properties. Complete solution of state space model due to zero input and due to zero state.

UNIT II:
Controllability and Observability: General concept of controllability – Controllability tests, different state transformations such as diagonalization, Jordon canonical forms and Controllability canonical forms for Continuous-Time Invariant Systems – General concept of Observability – Observability tests for Continuous-Time Invariant Systems – Observability of different State transformation forms.

UNIT III:
State Feedback Controllers and Observers: State feedback controller design through Pole Assignment, using Ackkermans formula– State observers: Full order and Reduced order observers.

UNIT IV:
Non-Linear Systems: Introduction – Non-Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc; Linearization of nonlinear systems, Singular Points and its types– Describing function–describing function of different types of nonlinear elements, – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Stability analysis of nonlinear systems based on phase-plane method.

UNIT V:
Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method.

TEXT BOOKS:
1. M.Gopal, Modern Control System Theory, New Age International – 1984
2. Ogata. K, Modern Control Engineering, Prentice Hall - 1997
3. N K Sinha, Control Systems, New Age International – 3rd edition.

REFERENCES:
1. Donald E.Kirk, Optimal Control Theory an Introduction, Prentice - Hall Network series – 1st edition.

Course Outcomes: After the completion of this course, students should be able to

CO 1. Gain knowledge onbasic concepts and various terms related to modern control system concepts.
CO 2. Understand the concepts of controllability and observability.
CO 3. Analyze the state feedback controller design and gain knowledge on full order and reduced order observers.

CO 4. Understand the concepts of linearization of nonlinear systems.
CO 5. Assess the stability of the system by using Lyapunov stability analysis.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18EC01) PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS
(Program Elective – I)

M. TECH: I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: None

UNIT-I:
PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT-II:
PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-III:
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT-IV:
Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT-V:
Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOKS:

1. Programmable Logic Controllers – Principle and Applications by John W. Webb & Ronald A. Reiss, PHI, 5th Edition.
2. Digital Design by Morris Mano, PHI, 3rd Edition 2006.

REFERENCES:

1. Programmable Logic Controllers, Frank D. Petruzella, McGraw Hill Publishers, 4th Edition.
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth & F.D Hackworth Jr. – Pearson, 2004.
3. Programmable Logic Controllers and their Engineering Applications, Alan J. Crispin, McGraw-Hill, 2nd Edition.

Course Outcomes: After the completion of this course, the student will be able to

CO 1. Understand the basics of Programmable Logic Controller (PLC), IO Modules and interfacing equipment.
CO 2. Comprehend the Ladder Logic programming for various applications.
CO 3. Explore various PLC registers, functions and counters for industrial applications.
CO 4. Understand the various data handling functions and their applications.
CO 5. Gain knowledge on PID controllers and its Tuning.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE06) MODELLING OF POWER SEMICONDUCTOR DEVICES
(Program Elective – II)

M. TECH:I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronics

UNIT I:
Power Diodes, Basic Structure and 1-V Characteristics - on State Losses, Switching Characteristics, Turn on Transient, Turn off Transient, Reverse Recovery Transient, Schottky Diodes-Thyristors – Basic Structure, V-I Characteristics – Turn on Process, On State operation – Turn off process Switching Characteristics, Turn on Transient and di/dt limitations, Turn off Transient, Turn off time and dv/dt limitations, Ratings of Thyristors. Snubber Requirements and snubber design-Triacs. Basic structure and operation, V-I Characteristics, Ratings, Snubber Requirements- Gate Turnoff Thyristor (GTO). Basic Structure and operation. GTO Switching Characteristics, GTO Turn on Transient, GTO Turn off Transient, Minimum ON and OFF State times.

UNIT II:
Power BJTs, Basic Structure and I-V Characteristics, Breakdown Voltages and Control, Second Breakdown and its Control- FBSOA and RBSOA Curves –On State – Switching Characteristics, Resistive Switching Specifications, Turn on Transient, Turnoff Transient, Storage Time- Base Drive Requirements. Switching Losses. Device Protection- Snubber. Requirements for BJTs and Snubber Design – Switching Aids. Power MOSFETs-Basic Structure. V-I Characteristics. Turn on Process. On state operation. Turn off process. Switching Characteristics. Resistive Switching Specifications. Turn on Transient and di/dt limitations. Turn off Transient. Turn off time. Switching Losses. Effect of Reverse Recovery Transients on Switching Stresses and Losses- dv/dt limitations.

UNIT III:
Insulated Gate Bipolar Transistor (IGBTs). Basic Structure and Operation. Latch up IGBT Switching Characteristics. Resistive Switching Specifications. Clamped Inductive Switching Specifications – IGBT Turn on Transient- IGBT Turn off Transient – Current Tailing- Ratings of MOSFETs. FBSOA and RBSOA Curves. Switching Losses-Minimum ON and OFF State times-Switching Frequency Capability – Over current protection of IGBTs. Short Circuit Protection. Snubber Requirements and Snubber Design.

UNIT IV:
IGCT and ETO power semiconductor devices. Thermal design of power electronics equipment. Modeling of power semiconductors (principles).

UNIT V:
Gating Requirements for Thyristor, Component Temperature Control and Heat Sinks. Control of device temperature. Heat transfer by conduction. Transient thermal impedance- heat sinks heat transfer byradiation and convection – Heat Sink Selection for SCRs and GTOs. Modelling of power diode – Modelling of power MOSFET-Modelling of bipolar transistor-Modelling of IGBT.

TEXT BOOKS:
1. Ned Mohan et.al, “Power Electronics”, John Wiley and Sons, 2006.
2. G. Massobrio, P.Antognet, “Semiconductor Device Modeling with Spice”, McGraw-hill, Inc., 1988.

REFERENCES:

1. B.J. Baliga, "Power Semiconductor Devices", Thomson, 2004.
2. V. Benda, J Gowar, D.A. Grant, "Power Semiconductor Devices. Theory and Applications", John Wiley & Sons 1994-99

Course Outcomes: After the completion of this course, the student will be able to

CO 1. Choose the power semiconductor switches based on their characteristics.
CO 2. Design the drive circuits using power semiconductor devices.
CO 3. Design appropriate protective system as per requirement.
CO 4. Design suitable temperature control system for the devices with heat sinks.
CO 5. Model the converter devices & power semiconductor switches.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE07) DIGITAL CONTROL OF POWER ELECTRONICS AND DRIVE SYSTEMS
(Program Elective – II)

M. TECH : I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Control Systems, Power Electronics, Electric Drives

UNIT I:

Simulation of Rectifiers: Basic Terms & Definitions - Power Electronic Switches- Uncontrolled rectifiers and Controlled Rectifiers- Half wave rectifiers- Full wave rectifiers- Analysis of rectifiers for various loads-dual converters.

UNIT II:

Simulation of Choppers &Cycloconverters: Basic chopper - operation & control techniques-step-down & up choppers-buck-Boost chopper-Types of choppers-Chopper commutation techniques- step-up cycloconverter - step down cycloconverter

UNIT III:

Simulation of single phase & three phase inverters: Single-phase Inverters-Half-wave Inverter-Full-wave Inverter-Full wave Inverter with R-L Load-Current Source Inverter-Three-phase Inverters-Three-phase 180^o Conduction mode Inverter-Three phase 120 degrees Conduction Mode Inverter PWM Inverter.

UNIT IV:

Simulation DC & AC machines: DC machines- Separately Excited DC Machines-DC Series Motor-DC Shunt Motor-AC Motors- Three-phase Induction Motor-Three-phase Synchronous Motor.

UNIT V:

Simulation of Matrix Converters: Introduction to Matrix Converter-Basics of Matrix Converter-Bi-directional switches, Commutation problem-Modulation techniques-Programming and simulation of Matrix Converters- Introduction to PWM rectifier-Control Techniques.

TEXT BOOKS:

1. M. B. Patil, V. Ramanarayanan, V.T.Ranganathan, M.C.Chandorkar" Simulation of Power Converters",1st edition, Narosa Publishers,2010.
2. V. Rajagopalan, " Modeling& Simulation of PE systems", Marcel Dekkar Inc.

REFERENCES:

1. MATLAB and Simulink for ENGINEERS, A.K.Tyagi, OXFORD
2. Simulink Reference Manual, Math works, USA

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Model and analyze various rectifier configurations.
CO 2. Gain the knowledge on modeling choppers and cyclo converters.
CO 3. Design single phase and three phase inverters for various control techniques.
CO 4. Model and simulate the various dc and ac motors.
CO 5. Understand the modeling of matrix converter and explore various PWM control techniques for rectifiers.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18EC02) MICROCONTROLLERS AND APPLICATIONS
(Program Elective – II)

M. TECH: I-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Microprocessors and Interfacing Devices

UNIT-I:
OVERVIEW OF ARCHITECTURE & MICROCONTROLLER RESOURCES: Architecture of a microcontroller – Microcontroller resources – Resources in advanced and next generation microcontrollers – 8051 microcontroller – Internal and External memories – Counters and Timers – Synchronous serial-cum asynchronous serial communication - Interrupts.

UNIT-II:
8051- MICROCONTROLLERS INSTRUCTION SET: Basic assembly language programming – Data transfer instructions – Data and Bit manipulation instructions – Arithmetic instructions – Instructions for Logical operations on the test among the Registers, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

UNIT-III:
REAL TIME CONTROL INTERRUPTS: Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-maskable interrupt sources – Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051. TIMERS: Programmable Timers in the MCU's – Free running counter and real time control – Interrupt interval and density constraints.

UNIT-IV:
SYSTEMS DESIGN DIGITAL AND ANALOG INTERFACING METHODS: Switch, Keypad and Keyboard interfacings – LED and Array of LEDs – Keyboard-cum-Display controller (8279) – Alphanumeric Devices – Display Systems and its interfaces – Printer interfaces – Programmable instruments interface using IEEE 488 Bus – Interfacing with the Flash Memory – Interfaces – Interfacing to High Power Devices – Analog input interfacing – Analog output interfacing – Optical motor shaft encoders – Industrial control – Industrial process control system – Prototype MCU based Measuring instruments – Robotics and Embedded control – Digital Signal Processing and digital filters.

UNIT-V:
REAL TIME OPERATING SYSTEM FOR MICROCONTROLLERS: Real Time operating system – RTOS of Keil (RTX51) – Use of RTOS in Design – Software development tools for Microcontrollers. 16-BIT MICROCONTROLLERS: Hardware – Memory map in Intel 80196 family MCU system – IO ports – Programmable Timers and High-speed outputs and input captures – Interrupts – instructions. ARM 32 Bit MCUs: Introduction to 16/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set – Development tools.

TEXT BOOKS:
1. Raj Kamal, "Microcontrollers Architecture, Programming, Interfacing and System Design" – Pearson Education, 2005.
2. Mazidi and Mazidi, "The 8051 Microcontroller and Embedded Systems" – PHI, 2000.

REFERENCES:
1. A.V. Deshmuk, "Microcontrollers (Theory & Applications)" – WTMH, 2005.

2. John B. Peatman, "Design with PIC Microcontrollers" – Pearson Education, 2005.
3. Julio Sanchez, Maria P. Canton "Microcontroller Programming", CRC Press.
4. Ayala, "The 8051 Microcontroller", Cengage Learning.
5. Krishna Kant "Microprocessors and Microcontrollers, Architecture, Programming and System Design", PHI Learning PVT. Ltd.
6. Nilesh B. Bahadure "Microprocessors", PHI Learning PVT. Ltd.

Course Outcomes: After the completion of this course, the student will be able to

CO 1. Relate the basic architecture and addressing modes of a microcontroller.
CO 2. Gain knowledge on various instruction sets for 8051 microcontrollers.
CO 3. Analyze a typical I/O interface and understandinterrupts and timer circuits.
CO 4. Demonstrate assembly language programs for 16-bit Microcontroller, assembly language code for high-level language structures such as IF-THENELSE and DO-WHILE.
CO 5. Translate Hardware applications using Microcontrollers.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE08) POWER CONVERTERS SIMULATION LAB

M. TECH: I-SEMESTER **L/T/P/C**
-/- /4/2

List of Experiments

PART A:

1. Single Phase Full Converter using RL and E loads.
2. Single Phase Semi Converter using RL and E loads.
3. Three Phase Full Converter using RL and E loads.
4. Three Phase Semi Converter using RL and E loads.
5. Single Phase AC Voltage controller using RL load.
6. Stepdown Chopper with R and RL loads.
7. Step-up Chopper with R and RL loads.
8. Write program and simulate dynamical system of following models:
    i. I/O Model
    ii. State variable model Also identify time domain specifications of each.
9. Obtain frequency response of a given system by using various methods:
    i. General method of finding the frequency domain specifications.
    ii. Polar plot
    iii. Bode plot
    iv. Also obtain the Gain margin and Phase margin.
10. Transform a given dynamical system from I/O model to state variable model and vice versa.

Note:
Use the suitable software for each simulation.

Course Outcomes: After the completion of this course, the student will be able to

CO.1. Simulate various converter circuits with different types of loads.
CO.2. Simulate stepup and stepdown chopper.
CO.3. Assess the frequency response of the system.
CO.4. Analyze the dynamical system using I/O model and stet variable model.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE09) POWER CONVERTERS LAB

M. TECH:I-SEMESTER **L/T/P/C**
-/- /4/2

LIST OF EXPERIMENTS

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase Cycloconverter with R and RL loads
5. Single Phase Parallel Inverter with R & RL Loads.
6. Single Phase Fully Controlled Converter with inductive load.
7. Single Phase Half Controlled Converter with inductive load.
8. Single phase Dual Converter with R & RL Loads.
9. Operation of MOSFET based Step-down Chopper.
10. Operation of MOSFET based Step-up Chopper.

Course Outcomes: After the completion of this course, the student will be able to

CO.1. Study the characteristics of various semiconducting devices and Gate Firing Circuits.
CO.2. Understand converter circuits for different types of loads.
CO.3. Understand the operation of ac voltage controllers and cycloconverters.
CO.4. Understand the operation of DC to DC converters.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18MC01) RESEARCH METHODOLOGY

M. TECH – I SEMESTER **L/T/P/C**
2/- /- /2

Prerequisites: English

UNIT I:

RESEARCH METHODOLOGY: Objectives and Motivation of Research, Significance of Literature review, Types of Research, Research Approaches, and Research Methods verses Methodology, Research and Scientific Method, Importance of Research Methodology, Research Process, Criteria of Good Research.

UNIT II:

RESEARCH DESIGN: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Data collection methods, Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data.

UNIT III:

RESEARCH REPORT WRITING: Format of the Research report, Synopsis, Dissertation, References/Bibliography/ Webliography, Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNITIV:

NATURE OF INTELLECTUAL PROPERTY: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

UNIT V:

PATENT RIGHTS: Scope of Patent Rights. Licensing and transfer of technology. Patentinformation and databases. New Developments in IPR: Administration of Patent System.

TEXT BOOKS:

1. C.R Kothari, "Research Methodology, Methods &Technique".New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Aspen Publishers, 2016.
4. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.
5. Satarkar, S.V,."Intellectual property rights and copy right". ESS Publications, 2000.

REFERENCES:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", SAGE Publications Ltd.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Gain the knowledge on literature review collection.
CO 2. Analyze research related information.
CO 3. Understand research problem formulation.
CO 4. Emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO 5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18AC02) STRESS MANAGEMENT
(Audit Course-I)

M. TECH: I-SEMESTER **L/T/P/C**
2/- /- /0

Prerequisites: -NIL

UNIT-I

Understanding Stress: Meaning – Symptoms – Work Related Stress – Individual Stress – Reducing Stress -sources of stress –consequence of stress-burnout-symptoms of Burnout- stress verses Burnout-model of stress-strategies for coping stress (individual and organizational strategies) –case study

UNIT-II

Time Management: Techniques – Importance of Planning the day –developing concentration – Prioritizing Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say "No"

UNIT-III

Career Plateau: Career plateau – Identifying Career plateaus – Structural and Content - Plateauing – Making a fresh start – Importance of Sabbaticals – Counseling out – Executive leasing – Sustaining a marketable Career.

UNIT-IV

Crisis Management: Implications – People issues – Structure issues – Environmental issues – Learning to keep calm - Preventing interruptions – Controlling crisis – Pushing new ideas – Empowerment – Work place Humor, developing a sense of Humor – Learning to laugh – role of group cohesion and team spirit.

UNIT-V

Self-Development: Improving personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Mediation for peace – Yoga for Life

TEXT BOOKS

1. Bhatia R.L., The Executive Track: An Action Plan for Self-Development Wheeler Publishing, New Delhi

2. Charavathy.S.K, "Human Values for Manager", McGraw Hill/Henely Management Series

REFERENCES

1. Jeffr Davison, Managing Stress, Prentice Hall of India, New Delhi

2. Jerrold S Greenberg, Comprehensive Stress Management, Jain Books, 2009

Course Outcomes: After completion of the course the student will be able to

CO 1. Enhance of Physical strength and flexibility.
CO 2. Learn to relax and focus.
CO 3. Relieve physical and mental tension
CO 4. Improve work performance/ efficiency.
CO 5. Gain knowledge about yoga and mediattion.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE10) MODERN POWER ELECTRONIC CONVERTERS

M. TECH: II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronics

UNIT I:

MODERN POWER SEMICONDUCTOR DEVICES: Modern power semiconductor devices – Insulated Gate Bipolar Transistor (IGBT) – MOSFET-MOS Turn off Thyristor (MTO) – Emitter Turn Off Thyristor (ETO) – Integrated Gate-Commutated Thyristor (IGCTs) – MOS-controlled thyristors (MCTs)– Power integrated circuits (PICs) – symbol, structure and equivalent circuit – comparison of their features.

UNIT II:

RESONANT PULSE INVERTERS: Resonant pulse inverters – series resonant inverters – series resonant inverters with unidirectional switches – series resonant inverters with bidirectional switches – analysis of half bridge resonant inverter – evaluation of currents and voltages of a simple resonant inverter – analysis of half bridge and full bridge resonant inverter with bidirectional switches – Frequency response of series resonant inverters – for series loaded inverter – for parallel loaded inverter – For series and parallel loaded inverters – parallel resonant inverters – Voltage control of resonant inverters – class E resonant inverter – class E resonant rectifier – evaluation of values of C's and L's for class E inverter and Class E rectifier – numerical problems.

UNIT III:

RESONANT CONVERTERS: Resonant converters – zero current switching resonant converters – L type ZCS resonant converter – M type ZCS resonant converter – zero voltage switching resonant converters – comparison between ZCS and ZVS resonant converters – Two quadrant ZVS resonant converters – resonant dc-link inverters – evaluation of L and C for a zero current switching inverter – Numerical problems.

UNIT IV:

MULTILEVEL INVERTERS: Multilevel concept – Classification of multilevel inverters – Diode clamped Multilevel inverter – principle of operation – main features – improved diode Clamped inverter – principle of operation – Flying capacitors multilevel inverter-principle of operation – main features – cascaded multilevel inverter – principle of operation – main features – Multilevel inverter applications – reactive power compensation – back to back intertie system – adjustable drives - Switching device currents – dc link capacitor voltage balancing – features of Multilevel inverters – comparisons of multilevel converters.

UNIT V:

D.C & A.C POWER SUPPLIES: DC power supplies – classification - switched mode dc power supplies – fly back Converter – forward converter – push-pull converter – half bridge converter – Full bridge converter – Resonant dc power supplies – bidirectional power supplies – Applications.
AC power supplies – classification – switched mode ac power supplies – Resonant AC power supplies – bidirectional ac power supplies – multistage conversions – control circuits – applications. Introduction – power line disturbances – power conditioners – Uninterruptible Power supplies – applications.

TEXT BOOKS:

1. Mohammed H. Rashid –"Power Electronics"– Pearson Education, Third Edition – first Indian reprint -2004.
2. Ned Mohan, Tore M. Undeland and William P. Robbins- "Power Electronics"– John Wiley & Sons – Second Edition.

REFERENCES

1. Bin Wu "High-Power Converters and AC Drives", Wiley IEEE-Press
2. Daniel W. Hart "Power Electronics", Tata McGraw-Hill Education, 2011

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Understand various advanced power semiconductor devices structure and equivalent circuits.

CO 2. Analyze operation of the series and parallel resonant pulse inverters for different loading arrangements.

CO 3. Gain Knowledge on ZVC and ZCS resonant converters and understand the design considerations of resonant converters.

CO 4. Understand the operation of multi-level inverters with switching strategies for high power applications.

CO 5. Explore various AC and DC switched mode power supplies.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE11) POWER ELECTRONIC CONTROL OF AC DRIVES

M. TECH:II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronic Devices and AC Machines

UNIT-I:
INTRODUCTION: Introduction to motor drives – Torque production – Equivalent circuit analysis – Speed – Torque Characteristics with variable voltage operation Variable frequency operation constant v/f operation – Variable stator current operation – Induction motor characteristics in constant torque and field weakening regions.
STATOR SIDE CONTROL OF INDUCTION MOTOR DRIVES: Scalar control – Voltage fed inverter control – Open loop volts/Hz control – speed control slip regulation – speed control with torque and flux control – current controlled voltage fed inverter drive – current fed inverter control – Independent current and frequency control – Speed and flux control in Current Fed inverter drive – Volts/Hz control of Current fed inverter drive – Efficiency optimization control by flux program – closed loop operation.

UNIT–II:
ROTOR SIDE CONTROL OF INDUCTION MOTOR DRIVES Slip power recovery drives – Static Kramer Drive – Phasor diagram – Torque expression – speed control of Kramer Drive – Static Scheribus Drive – modes of operation.

UNIT–III:
CONTROL OF SYNCHRONOUS MOTOR DRIVES: Synchronous motor and its characteristics – Control strategies – Constant torque angle control – Unity power factor control – Constant mutual flux linkage control – closed loop operation. Controllers: Flux weakening operation – Maximum speed – Direct flux weakening algorithm – Constant Torque mode controller – Flux Weakening controller – indirect flux weakening – Maximum permissible torque – speed control scheme – Implementation strategy speed controller design.

UNIT–IV:
VARIABLE RELUCTANCE MOTOR DRIVE: Variable Reluctance motor drive – Torque production in the variable reluctance motor Drive characteristics and control principles – Current control variable reluctance motor service drive.
PMSM &BRUSHLESS DC MOTOR DRIVES: Three phase full wave Brushless dc motor – Sinusoidal type of Brushless dc motor- current controlled Brushless dc motor Servo drive.

UNIT–V:
VECTOR CONTROL OF INDUCTION MOTOR DRIVES: Principles of Vector control – Vector control methods – Direct methods of vector control – Indirect methods of vector control – Adaptive control principles – Self tuning regulator Model referencing control – Direct torque control of AC motors.

TEXT BOOKS:
1. Electric Motor Drives Modeling, Analysis and Control – R. Krishnan – Pearson Publications – 1st edition – 2002.
2. Modern Power Electronics and AC Drives B K Bose – Pearson Publications 1st edition
3. Power Electronics and Control of AC Motors – MD Murthy and FG Turn, Pergman Press 1st edition

REFERENCE BOOKS:
1. Power Electronics and AC Drives – BK Bose – Prentice Hall 1st edition
2. Power Electronic circuits Deices and Applications – M H Rashid – PHI – 1995.

3. Fundamentals of Electrical Drives – G. K. Dubey – Narosa publications – 1995.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Gain knowledge on speed torque characteristics of induction motor with variable voltage, variable frequency and constant volts/frequency.
CO 2. Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
CO 3. Gain knowledge on synchronous motor drives and their control strategies for different operating conditions.
CO 4. Understand the principle of operation of reluctance, PMSM and BLDC motor drives.
CO 5. Analyze the various direct and indirect vector control techniques for induction motor drives.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE13) ELECTRICAL AND HYBRID VEHICLES
(Program Elective-III)

M. TECH: II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Electrical Machines, Electric Drives, Power Electronics

UNIT I:

Introduction to Electric Vehicles: Introduction, EV components, EV advantages, Vehicle mechanics- Roadway fundamentals, Vehicle kinetics, Dynamics of vehicle motion, Propulsion Power-Force-velocity characteristics, Maximum Gradability, Velocity and Acceleration.

UNIT II:

Battery: Basics-Types- Li and Nickle batteries, Parameters- capacity, discharge rate, state of charge and discharge, depth of discharge, Technical characteristics, Battery pack design, Properties of batteries, Fuel cells- Types, characteristics, Super Capacitors and Ultra Capacitors.

UNIT III:

Power Electronics and Motor Drives: DC Motor- Brushless DC Motor, AC Motor- Induction Motor, Optimization of Induction motors for Electric vehicles, Electric drive components, two –quadrant chopper, Open-loop drive- steady state analysis of quadrant-I, ripple reduction and I_a, Acceleration in CCM, DCM and Uncontrollable mode, Braking Operation (CCM in steady state), Regenerative power.

UNIT IV:

Electric Vehicle drive Train: EV transmission configuration, Components-gears, differential, clutch, brakes, regenerative braking, Motor sizing.

UNIT V:

Hybrid Electric Vehicles: Types-Series and Parallel EHVs, Advantages and disadvantages, Types of internal combustion engines, Design of an HEV-hybrid drive trains, sizing of components.

Text Books:

1. Iqbal Husain, "Electric and Hybrid Vehicles-Design Fundamentals", second edition, CRC press ,2011
2. James Larminie , " Electric vehicle technology explained" . John wiley& sons,2003

References:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric & Fuel cell Vehicles: Fundamentals, Theory & Design", CRC press, 2010.
2. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000
3. http://nptel.ac.in//courses//108103009

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Acquire and interpret fundamental concepts of advanced batteries and super capacitors.
CO 2. Identify various energy conversion devices for vehicle electrification.
CO 3. Acquire knowledge on series and parallel connections of EHV.
CO 4. Understand the concept of multi quadrant operation of motors.
CO 5. Distinguish between conventional and electric vehicles from the view point of ecological balance of nature.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE14) DIGITAL CONTROL SYSTEMS
(Program Elective – III)

M. TECH: II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: None

UNIT – I:
Introduction: Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals –ZOH. Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transforms –limitations of z-transforms –pulse transfer function –pulse transfer function of ZOH –relation between G(s) and G(z) – signal flow graph method applied to digital systems.

UNIT- II:
State Space Analysis: State space modeling of digital systems with sample and hold – state transition equation of digital time in variant systems – solution of time in variant discrete state equations by the Z-Transformation – transfer function from the state model – Eigen values – Eigen vector and diagonalisation of the A-matrix – Jordan canonical form. Computation of state transition matrix-Transformation to phase to variable canonical form-The state diagram – decomposition of digital system – Response of sample data system between sampling instants using state approach. Stability: Definition of stability – stability tests – The second method of Liapunov.

UNIT- III:
Time Domain Analysis: Comparison of time response of continuous data and digital control systems-correlation between time response and root locus j the s-plane and z-plane – effect of polezero configuration in the z-plane upon the maximum overshoot and peak time of transient response – Root loci for digital control systems – steady state error analysis of digital control systems – Nyquits plot – Bode plot-G.M and P.M.

UNIT- IV:
Design: The digital control design with digital controller with bilinear transformation – Digital PID controller-Design with deadbeat response-Pole placement through state feedback-Design of full order state observer-Discrete Euler Lagrance Equation – Discrete maximum principle.

UNIT-V:
Digital State Observer: Design of - Full order and reduced order observers. Design by max. Principle: Discrete Euler language equation-discrete maximum principle.

TEXT BOOKS:
1. Discrete-Time Control systems - K. Ogata, Pearson Education/PHI, 2nd Edition.
2. Digital Control and State Variable Methods by M. Gopal, TMH.

REFERENCE BOOKS:
1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control Engineering, M. Gopal, New Age International Private Limited.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Acquire a strong foundation in sampling and reconstruction Z-transforms.
CO 2. Apply knowledge of Mathematics, Z-plane analysis to discrete time control systems.

CO 3. Replace the conventional control system with Digital control system.
CO 4. Evaluate andapply Z-plane analysis of discrete time control systems
CO 5. Apply state feedback controllers and observers

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE15) POWER QUALITY
(Program Elective – III)

M. TECH: II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite:
Power Systems
Power Electronics

Course Objectives:

1. To study, understand and analyze various power quality issues.
2. To be able to address power quality problems with various mitigation techniques.

UNIT-I: Power quality problems and definitions

Voltage sag, Voltage swells, Voltage spikes, Voltage notches, Voltage fluctuations, Over/Under voltages, Interruptions, transients, unbalance and Harmonics. Causes and effects of power quality disturbances on various power system equipments. Overview of power quality phenomenon and compensation techniques. Power outages: System average interruption frequency index (SAIFI), Customer average interruption frequency index (CAIFI), System average Interruption duration index (SAIFI), Customer average interruption duration index (CAIDI), Momentary average interruption frequency index (MAIFI)
Unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers.
voltage sag: Voltage sag energy, Voltage sag lost energy index (VSLEI), and Distortions,

UNIT-II: Single phase circuits: power definitions and its components

Power terms in a single-phase systems- Active power, Reactive power, Apparent power, Non active power, Distortion power and power factor- for sinusoidal voltage source supplying non-linear load current, Non-sinusoidal voltage supplying non-linear loads.

UNIT III: Three phase balanced/unbalanced sinusoidal/non-sinusoidal circuits: power definitions and its components

Three-phase sinusoidal system: Three-phase instantaneous active and reactive power, power invariance in *abc* and $\alpha\beta 0$ coordinates.
Three-phase non-sinusoidal balanced system: Three-phase instantaneous active, reactive powers and oscillatory powers, Symmetrical components, Effective apparent power, positive sequence powers and unbalance power. Neutral current, Line to Line voltage, apparent power with budeanu resolution for balanced distortion case. Effective apparent power for balanced non-sinusoidal systems
Three phase unbalanced non-sinusoidal system: Three-phase instantaneous powers, Arithmetic and Vector Apparent Power with Budeanu's Resolution, Effective apparent power.

UNIT-IV: Passive and active shunt compensator/power filters:

Passive compensators: Classification, Principle of operation, Analysis and design for single-phase/three-phase power factor correction and zero voltage regulation.
Passive power filters: Introduction, classification, Principle of operation, Analysis and design, parallel resonance and its mitigation.
Active compensation: Load compensation using symmetrical component theory
Active power filter: Synchronous reference frame theory based control

UNIT-V: Passive and Active series compensator:

Introduction, Classification of series compensators, Design and principle of operation, Series active compensator: Control or series compensator based on synchronous reference frame theory.

Text Books:

1. Ghosh, Arindam, and Gerard Ledwich. *Power quality enhancement using custom power devices*. Springer Science & Business Media, 2012.
2. Singh, Bhim, Ambrish Chandra, and Kamal Al-Haddad. *Power quality: problems and mitigation techniques*. John Wiley & Sons, 2014.

Reference book:

1. Bollen, Math HJ. "Understanding power quality problems." *Voltage sags and Interruptions*. IEEE press, 2000.
2. Chattopadhyay, Surajit, Madhuchhanda Mitra, and Samarjit Sengupta. "Electric power quality." *Electric Power Quality*. Springer, Dordrecht, 2011. 5-12.

Course Outcomes:

After completion of the course, the student should be able to

1. Know the terminology, and definitions of various power quality problems and their analysis.
2. Define and understand the components of current/power in sinusoidal/non-sinusoidal single-phase supply/load systems.
3. Define and understand the components of current/power in sinusoidal/non-sinusoidal three-phase supply/load systems.
4. Design of passive/active shunt compensators and power filters.
5. Design of passive/active series compensators.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18EC03) EMBEDDED SYSTEMS
(Program Elective – IV)

M. TECH: II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Microprocessors and Interfacing Devices

UNIT- I:
OVERVIEW OF EMBEDDED SYSTEM: Embedded System, types of Embedded System, Requirements of Embedded System, and Issues in Embedded software development, Applications.

UNIT-II:
PROCESSOR & MEMORY ORGANIZATION: Structural units in a processor, Processor selection, Memory devices, Memory selection, Memory Allocation & Map, Interfacing.

UNIT-III:
DEVICES, DEVICE DRIVERS & BUSES FOR DEVICE NETWORKS: I/O devices, Timer & Counter devices, Serial Communication, Communication between devices using different buses. Device drives, Parallel and serial port device drives in a system, Interrupt servicing mechanism, context and periods for context switching, Deadline and Interrupt Latency.

UNIT-IV:
PROGRAMMING & MODELING CONCEPTS: Program elements, Modeling Processes for Software Analysis, Programming Models, Modeling of Multiprocessor Systems, Software algorithm Concepts, design, implementation, testing, validating, debugging, Management and maintenance, Necessity of RTOS.

UNIT-V:
HARDWARE AND SOFTWARE CO-DESIGN: Embedded system design and co-design issues in software development, design cycle in development phase for Embedded System, Use of ICE & Software tools for development of ES, Issues in embedded system design.

TEXTBOOKS:
1. Embedded systems: Architecture, programming and design by Rajkamal, TMH
2. Embedded system design by Arnold S Burger, CMP

REFERENCES:
1. An embedded software primer by David Simon, PEA
2. Embedded systems design:Real world design be Steve Heath; Butterworth Heinenann, Newton mass USA 2002

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Understand the basics of an embedded system.
CO 2. Learn the method of designing an embedded system for any type of applications.
CO 3. Understand the operating systems concepts, types and choosing RTOS.
CO 4. Understand types of memory and interacting to external world.
CO 5. Learn embedded firmware design approaches.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE16) DYNAMICS OF ELECTRICAL MACHINES
(Program Elective – IV)

M. TECH: II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Machine Modeling and Analysis

UNIT-I:
BASIC MACHINE THEORY: Electromechanical Analogy – Magnetic Saturation – Rotating field theory – Operation of Inductor motor – equivalent circuit – Steady state equations of DC machines – operations of synchronous motor – Power angle characteristics

UNIT-II:
ELECTRODYNAMICAL EQUATION & THEIR SOLUTIONS Spring and Plunger system - Rotational motion – mutually coupled coils – Lagrange's equation – Application of Lagrange's equation solution of Electro dynamical equations.

UNIT-III:
DYNAMICS OF DC MACHINES Separately excited d.c. generations – stead state analysis – transient analysis – Separately excited d. c. motors – stead state analysis – transient analysis – interconnection of machines – Ward Leonard system of speed control.

UNIT-IV:
INDUCTION MACHINE DYNAMICS: Induction machine dynamics during starting and braking – accelerating time – induction machine dynamic during normal operation – Equation for dynamical response of the induction motor.

UNIT-V:
SYNCHRONOUS MACHINE DYNAMICS: Electromechanical equation – motor operation – generator operation – small oscillations – general equations for small oscillations – representation of the oscillation equations in state variable form.

TEXT BOOKS:
1. Sen GuptaD.P. and J.W" Electrical Machine Dynamics" Macmillan Press Ltd 1980.
2. Bimbhra P.S. "Generalized Theory of Electrical Machines " Khanna Publishers 2002.

REFERENCES:
1. Mulukutla S. Sarma "Electric Machines: Steady-State Theory and Dynamic Performance", Springer

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Gain the knowledge on basics of dynamic modeling of AC and DC machines.
CO 2. Understand the Lagrange's solution for electro dynamical equations.
CO 3. Gain knowledge on steady state and transient state analysis of DC machines.
CO 4. Understand the dynamic behavior of induction motor during various operating points.
CO 5. Understand the synchronous machine operation and analyze oscillation equations.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PS11) AI TECHNIQUES IN ELECTRICAL ENGINEERING
(Program Elective – IV)

M. TECH:II-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: None

UNIT-I:
Artificial Neural Networks: Introduction-Models of Neural Network - Architectures – Knowledge representation – Artificial Intelligence and Neural networks–Learning process – Error correction learning – Hebbian learning –Competitive learning –Boltzman learning –Supervised learning – Unsupervised learning – Reinforcement learning- learning tasks..

UNIT-II:
ANN Paradigms : Multi – layer perceptron using Back propagation Algorithm-Self – organizing Map – Radial Basis Function Network – Functional link, network – Hopfield Network.

UNIT-III:
Fuzzy Logic: Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets – Fuzzy cartesion Product –Operations on Fuzzy relations– Fuzzy logic – Fuzzy Quantifiers-Fuzzy Inference-Fuzzy Rule based system-Defuzzification methods.

UNIT-IV:
Genetic Algorithms: Introduction-Encoding –Fitness Function-Reproduction operators-Genetic Modeling –Genetic operators-Crossover-Single – site crossover-Two point crossover –Multi point crossover Uniform crossover – Matrix crossover-Crossover Rate-Inversion & Deletion –Mutation operator Mutation –Mutation Rate-Bit-wise operators-Generational cycle-convergence of Genetic Algorithm**.**

UNIT-V:
Applications of AI Techniques: Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability) Reactive power control – speed control of DC and AC Motors.

TEXT BOOKS:

1. Neural Networks, Fuzzy Logic & Genetic Algorithms, S.Rajasekaran and G.A.V.Pai, PHI, New Delhi, 2003.

REFERENCES:

1. Neural Computing Theory & Practice, P.D.Wasserman,Van Nostrand Reinhold, New York,1989.
2. Neural Network & Fuzzy System, Bart Kosko, Prentice Hall, 1992.
3. Fuzzy sets,Uncertainty and Information, G.J.Klir and T.A.Folger, PHI, Pvt.Ltd,1994.
4. Genetic Algorithms, D.E.Goldberg, Addison Wesley 1999.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Gain knowledge on models and architecture of artificial neural networks and various learning process involved in neural networks.
CO 2. Explore various paradigms of artificial neural network such as BPA, RBF and SO Mapping etc.,
CO 3. Get the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy rules.

CO 4. Acquire complete knowledge on genetic algorithm, including three genetic operators
CO 5. Apply AI techniques to assess system stability.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE17) POWER CONVERTERS AND DRIVES SIMULATION LAB

M. TECH:II-SEMESTER **L/T/P/C**
-/- /4/2

List of Experiments

1. Spectrum Analysis of Single Phase Unipolar Inverter.
2. Spectrum Analysis of Single Phase Bipolar Inverter.
3. Single Phase Mid-Point Cycloconverter.
4. Three Phase Inverter with PWM Controller.
5. Three Phase Neutral Point Clamped Inverter.
6. Three Phase Cascaded H-Bridge Inverter.
7. Modeling of Separately Excited DC Motor.
8. Modeling of Three Phase Induction Motor.
9. Open Loop Scalar Control of Three Phase Induction Motor.
10. Closed Loop Scalar Control of Three Phase Induction Motor.

Note:
Use the suitable software for each simulation.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Perform spectrum analysis of unipolar and bipolar converters.
CO 2. Analyse inverters operation with PWM controllers.
CO 3. Develop Mathematical model three phase induction motor.
CO 4. Modelscalar control techniques adopted for three phase induction motor.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE18) POWER CONVERTERS AND DRIVES LAB

M. TECH: II-SEMESTER **L/T/P/C**
-/- /4/2

LIST OF EXPERIMENTS

1. Speed Measurement and closed loop control using PMDC Motor.
2. Thyristorised drive for PMDC Motor with speed measurement and closed loop control.
3. Thyristorised drive for 1 HP DC Motor with closed loop control.
4. Three Phase Input, Thyristorised Drive, 3 HP DC Motor with closed loop control.
5. Speed control of Three Phase Wound Rotor Induction Motor.
6. PWM generation using TMS320F2812 DSP.
7. Fibonacci series using TMS320F2812 DSP.
8. Characteristics of solar PV system
9. Maximum power point tracking with charge controller.
10. Inverter control for solar PV based system.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Learn basic implementation of closed loop control in PMDC motor.
CO 2. Explore the improved control of thyristor drive for PMDC motor over conventional control.
CO 3. Explore and generate PWM signals using DSP.
CO 4. Explore the inverter controls for solar PV systems.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18AC01) ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course-II)

M. TECH:II-SEMESTER **L/T/P/C**
2/- /- /0

Prerequisites: NIL

UNIT I:

ACADEMIC WRITING: What is Research? - Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT II:

RESEARCH FORMAT: Title – Abstract – Introduction – Discussion - Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT III:

RESEARCH METHODOLOGY: Methods (Qualitative – Quantitative) – Literature Review – Who did what – Criticizing, Paraphrasing & Plagiarism.

UNIT IV:

PROCESS OF WRITING A RESEARCH PAPER: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - Typing the final draft

UNIT V:

HOW TO & WHERE TO GET PUBLISHED: Reputed Journals – National/International – ISSN No, No. of volumes, Scopes Index/UGC Journals – Freepublications - Paid Journal publications – /Advantages/Benefits

TEXT BOOKS:

1. MLA Hand book for writers of Research Papers, East West Press Pvt. Ltd, New Delhi, 7th Edition.
2. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4th Edition.
3. Lauri Rozakis, Schaum's Quick Guide to Writing Great Research Papers, Tata McGraw Hills Pvt. Ltd, New Delhi.
4. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers

REFERENCES:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

Course Outcomes: After completion of the course the student will be able to

CO 1. Write a research paper with required writing skills and be confident to share their writing with others
CO 2. Publish a paper using the requisite standard in a journal and Review the research papers and articles in a scientific manner.
CO 3. Work on citations and ably place them in her research paper.
CO 4. Check plagiarism and be able to develop their own writing skills in presenting the research work.
CO 5. Gain knowledge on publishing papers with peer reviewed journals.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE12) HVDC & FACTS
(Program Elective-V)

M. TECH: III-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronics and Power Systems

UNIT-I:
Need for power system interconnections – Evolution of AC and DC transmission systems – Comparison of HVDC and HVAC Transmission systems – Types of DC links – relative merits – Components of a HVDC system – Modern trends in DC Transmission systems – Pulse number –choice of converter configurations – Analysis of Graetz circuit with and without overlap – voltage waveforms – Analysis of two and three valve conduction mode

UNIT-II:
Converter Bridge characteristics –Inverter mode of operation – voltage waveforms – Principles of DC link control – Converter Control characteristics – system control – Constant current Control – CEA Control – firing angle control of valves – Starting and stopping of a dc link – Power control

UNIT-III:
Harmonics & Filters – effects of Harmonics – sources of harmonic generation – Types of filters – Design examples – Power flow Analysis in AC/DC systems – Modelling of DC links – solutions of AC-DC Power flow

UNIT-IV:
Power flow in AC systems – Relative importance of controllable parameters – Basic types of FACTS controllers – shunt and series controllers – Current source and Voltage source converters –Objectives of shunt compensation – Methods of controllable VAR generation – Static Var Compensator – its characteristics – TCR – TSC – FC –TCR configurations – STATCOM – basic operating principle – control approaches and characteristics

UNIT-V:
Objectives of series compensator – variable impedance type of series compensators – TCSC – TSSC – operating principles and control schemes – SSSC – Power Angle characteristics – Control range and VAR rating – Capability to provide reactive power compensation – external control – Introduction to Unified Power Flow Controller – Basic operating principles – Conventional control capabilities – Independent control of real and reactive power

TEXT BOOKS:
1. E.W. Kimbark"Direct current Transmission", Wiely Inter Science – New York.
2. S. Kamakshaiah, V. Kamaraju "HVDC Transmission", Tata McGraw Hill Publishers.
3. J. Arillaga"HVDC Transmission" Peter Peregrinus Ltd. London UK 1983.
4. Hingorani H G and Gyugyi. L "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems" IEEE Press, 2000.
5. Padiyar.K.R, " FACTS Controllers in Power Transmission and Distribution" New Age Int. Publishers, 2007

REFERENCES:
1. K. R. Padiyar, "High Voltage Direct Current Transmission", Wiely Eastern Ltd New Delhi – 1992.
2. E. Uhlman, "Power Transmission by Direct Current", Springer Verlag, Berlin Helberg. 1985.

3. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modeling and Control", Springer, 2012
4. Yong-Hua Song, Allan Johns, "Flexible AC Transmission Systems", IET, 1999.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Gain knowledge on DC transmission system and its advantages over AC transmission.
CO 2. Understand the reactive power control in HVDC transmission.
CO 3. Study the impact of FACTS devices in the power flow in the AC system.
CO 4. Analyze various shunt compensation techniques using SVC and STATCOM.
CO 5. Explore various series compensators such as TCSC, TSSC.

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PE20) SWITCHED MODE POWER SUPPLIES
(Program Elective – V)

M. TECH:III-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Power Electronic Devices and Circuits

UNIT – I:

BASIC CONVERTER CIRCUITS: Buck Regulator, Buck- Boost Regulator, Boost Regulator, Cuk Converters and Resonant Converters. Choice of switching frequency.

UNIT – II:

ISOLATED SMPS: Fly back Converter, Forward Converter, Half-Bridge and Full Bridge Converters, Push-Pull Converter and SMPS with multiple outputs. Choice of switching frequency.

UNIT – III:

CONTROL ASPECTS: PWM Controllers, Isolation in feedback loop, Power Supplies with multiple output. Stability analysis using Bode Diagrams.

UNIT – IV:

DESIGN CONSIDERATIONS:

Selection of output filter capacitor, Selection of energy storage inductor, Design of High Frequency Inductor and High frequency Transformer, Selection of switches. Snubber circuit design, Design of driver circuits.

UNIT – V:

ELECTRO MAGNETIC INTERFERENCE (EMI): EMI Filter Components, Conducted EMI suppression, Radiated EMI suppression, Measurement.

PROTECTION: Over current protection, Over voltage protection, Inrush current protection.

THERMAL MODEL: Thermal Resistance, Cooling Considerations, Selection of Heat sinks, Simple Heat sink calculations.

TEXT BOOKS:

1. Switched Mode Power Supplies, Design and Construction, H. W. Whittington, B. W. Flynn and D. E. MacPherson, Universities Press, 2009 Edition.
2. Mohan N. Undeland . T & Robbins W, Power Electronics Converters, Application and Design. John Wiley, 3rd edition, 2002
3. Umanand L., Bhat S.R., Design of magnetic components for switched Mode Power Converters. , Wiley Eastern Ltd.,1992
4. Robert. W. Erickson, D. Maksimovic .Fundamentals of Power Electronics., Springer International Edition, 2005
5. Course Material on Switched Mode Power Conversion, V. Ramanarayanan.

REFERENCES:

1. KreinP.T .Elements of Power Electronics., Oxford University Press
2. M.H.Rashid, Power Electronics. Prentice-Hall of India

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Apply the basic concepts of power electronics for designing converters.
CO 2. Explore various design considerations.
CO 3. Explore various control circuits.
CO 4. Design and implement practical circuits for UPS, SMPS.
CO 5. Understand the effect of Electromagnetic interference (EMI)and various protection aspects for the converters.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18PS17) SMART GRID TECHNOLOGIES
(Program Elective – V)

M. TECH:III-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Electrical and Electronic Instrumentation

UNIT-I:
INTRODUCTION: Introduction to smart grid- Electricity network-Local energy networks-Electrictransportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smartgrid.
SMART GRID TO EVOLVE A PERFECT POWER SYSTEM: Introduction- Overview of the perfect power systemconfigurations- Device level power system- Building integrated power systems- Distributed powersystems- Fully integrated power system-Nodes of innovation.

UNIT-II:
DC DISTRIBUTION AND SMART GRID: AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.
INTELLIGRID ARCHITECTURE FOR THE SMARTGRID: Introduction- Launching intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

UNIT-III:
DYNAMIC ENERGY SYSTEMS CONCEPT: Smart energy efficient end use devices-Smart distributedenergy resources-Advanced whole building control systems- Integrated communications architectureEnergymanagement-Role of technology in demand response-Current limitations to dynamic energymanagement-Distributed energy resources-Overview of a dynamic energy management-Keycharacteristics of smart devices- Key characteristics of advanced whole building control systems-Keycharacteristics of dynamic energy management system.

UNIT-IV:
ENERGY PORT AS PART OF THE SMART GRID: Concept of energy -Port, generic features of the energy port.Policies and Programs to Encourage End – Use Energy Efficiency: Policies and programs inaction -multinational - national-state-city and corporate levels.
MARKET IMPLEMENTATION: Framework-factors influencing customer acceptance and response -program planning-monitoring and evaluation.

UNIT-V:
Efficient Electric End – Use Technology Alternatives: Existing technologies – lighting – Spaceconditioning - Indoor air quality - Domestic water heating - hyper efficient appliances – Ductlessresidential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street andarea lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating -Cogeneration, Thermal energy storage - Industrial energy management programs – Manufacturingprocess-Electro-technologies, Residential, Commercial and industrial sectors.

TEXT BOOKS:

1. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiencyand Demand Side Response"- CRC Press, 2009.
2. Jean Claude Sabonnadière, NouredineHadjsaïd, "Smart Grids", Wiley-ISTE, IEEE Press,May2012

REFERENCES:

1. JanakaEkanayake, KithsiriLiyanage,Jianzhong.Wu, Akihiko Yokoyama, Nick Jenkins, "SmartGrid: Technology and Applications"- Wiley, 2012.
2. James Momoh, "Smart Grid:Fundamentals of Design and Analysis"-Wiley, IEEE Press, 2012

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Learn the attributes of smart grid and explore the structure of an electricity market in regulated and deregulated market conditions.

CO 2. Understand the advantages of DC distribution in power delivery systems and developing AI technologies in future grids.

CO 3. Apply various distributed energy resources and build a dynamic energy management system.

CO 4. Understand the policies and programs enacted for energy ports and market implementation.

CO 5. Analyze the development of smart and intelligent domestic, commercial and industrial systems.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18EC04) ADVANCED DIGITAL SIGNAL PROCESSING
(Program Elective – V)

M. TECH:III-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Digital signal processing

UNIT–I:
DIGITAL FILTER STRUCTURES: Block diagram representation – Equivalent Structures – FIR and IIR digital filter Structures AII pass Filters - tunable IIR Digital Sine-cosine generator - Computational complexity of digital filter structures.

UNIT-II:
DIGITAL FILTER DESIGN: Preliminary considerations- Bilinear transformation method of IIR filter design –design of Low pass high pass – Band pass, and Band stop- IIR digital filters – Spectral transformations of IIR filters – FIR filter design – based on Windowed Fourier series – design of FIR digital filters with least – mean square-error – constrained Least – square design of FIR digital filters.

UNIT-III:
DSP ALGORITHM IMPLEMENTATION: Computation of the discrete Fourier transform Number representation – Arithmetic operations – handling of overflow – Tunable digital filters – function approximation.

UNIT-IV:
ANALYSIS OF FINITE WORD LENGTH EFFECTS: The Quantization process and errors Quantization of fixed –point and floating –point Numbers – Analysis of coefficient Quantization effects – Analysis of Arithmetic Round-off errors- Dynamic range scaling – signal –to- noise in Low – order IIR filters- Low – Sensitivity Digital filter – Reduction of Product round-off errors feedback – Limit cycles in IIR digital filter – Round – off errors in FFT Algorithms.

UNIT-V:
POWER SPECTRUM ESTIMATION: Estimation of spectra from Finite Duration Observations signals- Non-parametric methods for power spectrum Estimation- parametric method for power spectrum Estimation- Estimation of spectral form-Finite duration observation of signals- Non-parametric methods for power spectrum estimation – Walsh methods – Blackman and torchy method.

TEXT BOOKS:
1. Sanjit K. Mitra, Digital signal processing – TMH second edition
2. Alan V. Oppenheim, Ronald W, Shafer, Discrete Time Signal Processing – PHI 1996 1st Edition reprint
3. John G. Proakis, Digital Signal Processing principles – Algorithms and Applications – PHI – 3rd edition 2002.

REFERENCE BOOKS:
1. S Salivahanan. A. Vallavaraj C. Gnanapriya, Digital Signal Processing – TMH – 2nd reprint 2001.
2. Lourens R RebinarandBernold, Theory and Applications of Digital Signal Processing.
3. Auntoniam, Digital Filter Analysis and Design, TMH.

Course Outcomes: After completion of this course, the students will be able to

CO 1. Gain the fundamental knowledge on analysis and process of digital systems
CO 2. Study the relationship between continuous time and discrete time signals and systems

CO 3. Study the fundamentals of time, frequency and Z-Plane analysis and their interrelationships.
CO 4. Study and design digital filters form analysis to synthesis
CO 5. Get acquainted with FFT algorithms, multi-rate signal processing techniques.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18EE01) ENERGY AUDITING, CONSERVATION &MANAGEMENT
(Open Elective)

M. TECH:III-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: Electrical Distribution Systems

UNIT-I:
Basic Principles of Energy Audit: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language, Questionnaire – check list for top management.

UNIT-III:
Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT-IV:
Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, Pf with nonlinear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control,lighting energy audit – Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers,lux meters, tongue testers ,application of PLC's.

UNIT-V:
Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:
1. Energy management, W.R. Murphy, G. Mckay Butter worth, Heinemann publications.
2. Energy management, Paul O Callaghan, Mc-graw Hill Book company-1st edition, 1998.

REFERENCES:
1. Energy efficient electric motors by John.C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995.
2. Energy management hand book by W.C.Turner, John wiley and sons.
3. Energy management and good lighting practice: fuel efficiency- booklet12-EEO.

Course Outcomes: After the completion of this course, the students should be able to
CO 1. Understand the basic principles of energy audit and energy conservation schemes.
CO 2. Generalize the methods of energy management
CO 3. Explore the construction and characteristics of energy efficient motors.

CO 4. Analyze the power factor improvement methods and design a good illumination system.
CO 5. Analyze the economic aspects of various energy saving equipment.

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

(M18EE02) OPTIMIZATION TECHNIQUES
(Open Elective)

M. TECH:III-SEMESTER **L/T/P/C**
3/- /- /3

Prerequisite: None

UNIT – I:
Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.
Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II:
Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT – III:
Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. **Unconstrained Nonlinear Programming:** One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method

UNIT – IV
Unconstrained Optimization: Techniques Univariate method, Powell's method and steepest descent method.
Constrained Nonlinear Programming: Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT – V:
Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:
1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. "Introductory Operations Research" by H.S. Kasene& K.D. Kumar, Springer(India), Pvt. LTd.

REFERENCES:
1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research – by Dr. S.D.Sharma, Ramnath &Co Publishers
3. "Operations Research: An Introduction" by H.A. Taha, PHI Pvt. Ltd., 6th edition 4. Linear Programming by G. Hadley

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Study the need of optimization in electrical engineering problems
CO 2. Learn the conventional or classical optimization techniques
CO 3. Learn to formulate the problem with constrained and unconstrained cases
CO 4. Explore various modern intelligent optimization techniques
CO 5. Apply these techniques to real world problems such as transportation problem, travelling salesman problem

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VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. TECH – III SEMESTER **L/T/P/C**
3/- /- /3

(M18ME01) INDUSTRIAL SAFETY
(Open Elective)

Prerequisites: Nil

UNIT-I:
Industrial safety-Importance and objectives of safety, safety programs – components and realisation. Evolution of modern safety concept, safety policy, safety organisation. implementation of safety procedures-periodic inspection and replacement.

UNIT-II:
Accidents causes, types, results and control, mechanical and electrical hazards types, causes and preventive steps, describe salient points and factories act 1948 for health and safety, wash rooms, drinking water layout, lights, cleanliness fire guarding etc. safety colour code, fire prevention and firefighting equipments and methods.

UNIT-III:
Fundamentals of maintenance engineering. Definition aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, types of maintenance, types of applications of tools used for maintenance, maintenance cost and its relations with replacement economy, service life of equipment.

UNIT-IV:
Quality and safety in maintenance: needs for quality maintenance process, maintenance work quality, use of quality control, charts in maintenance work sampling, post maintenance testing, reasons for safety problems in maintenance, guidelines to safety in maintenance work, safety officers' role in maintenance work, Protection of maintenance workers.

UNIT-V:
Periodic and preventive maintenance: - Periodic inspection – concept and need, degreasing, cleaning and repairing schemes, over hauling of mechanical components, overhauling of electrical motors, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

TEXT BOOKS:
1. Krishnan N.N. "Safety management in industries", Jaico publishing house, Bombay, 1997.
2. H.P. Garg, S., "Maintenance Engineering", S. Chand and company.

REFERENCE BOOKS:
1. Handley,W."Industrial safety Hand book", 2nd Edn, McGraw-Hill Book Company, 1969
2. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
3. Mc Cornick, E.J., Human Factors in Engineering and design, Tata McGraw-Hill, 1982.

Course Outcomes: After the completion of this course, the students should be able to

CO 1. Know the need for safety in industries.
CO 2. Know about factory acts and industrial safety regulations.
CO 3. Analyse causes and types of different hazards on their preventions.
CO 4. Assess quality maintenance processes and maintenance work quality.
CO 5. Know about periodic and preventive maintenance activities in industries.

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