R22

M.Tech. (POWER ELECTRONICS)

M.Tech. R22 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE DEPARTMENT

To excel in Education, Technology and Research in Electrical and Electronics Engineering leading to sustainable socioeconomic development of the nation.

MISSION OF THE DEPARTMENT

- Excellent teaching-learning environment imbibed with professional ethics and social responsibility in promoting quality education.

- Promoting research through industry collaborations and innovative projects.

M.TECH.
(POWER ELECTRONICS)

M.TECH. (PE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: Proficient in applying sustainable and inclusive technologies to analyse, formulate and provide solutions for real time problems in diversified fields

PEO-II: Solve complex technological problems using emerging technologies and tools

PEO-III: Work effectively as an individual and team member with good communication skills in project execution

PEO-IV: Demonstrate interdisciplinary skills and professional ethics in relating engineering issues to broader societal context

PEO-V: Engage in life long learning for a successful professional career.

M.TECH. (PE)

PROGRAM OUTCOMES

PO-1: An ability to independently carry out research /investigation and development work to solve practical problems in Power Electronics and Allied Fields.

PO-2: An ability to write and present a substantial technical report/document.

PO-3: An ability to demonstrate a degree of mastery over the Power Electronics and Systems.

PO-4: Design and conduct experiments, as well as analyze the power electronic converters & drives and interpret the data.

PO-5: Function on multidisciplinary technological issues related to power electronics advancements.

PO-6: Use the techniques, skills, and modern engineering simulation tools necessary for the design and development of power converter topologies and engage in life long learning.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(POWER ELECTRONICS)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1PL01	Power Electronic Converters	3	0	0	3
Professional Core-II	22PC1PL02	Modeling and Analysis of Electrical Machines	3	0	0	3
Professional Core-III	22PC1PL03	Electric Drives System	3	0	0	3
Professional Elective-I	22PE1PS01	Renewable Energy Technologies	3	0	0	3
	22PE1PL01	Advanced Micro Controller-based Systems				
	22PE1VS19	VLSI Design				
	22PE1PS02	Smart Grids				
	22PE1PL02	Data Science Applications in Power Engineering				
Professional Elective-II	22PE1PL03	Predictive Control of Power Converters and Drives	3	0	0	3
	22PE1PL04	Digital Signal Processing for Power and Control				
	22PE1PS05	Reactive Power Conservation and Management				
	22PE1PL05	Electric and Hybrid Vehicles				
	22PE1PL06	Machine Learning Applications				
Professional Core Lab-I	22PC2PL01	Python for Electrical Systems and Applications Laboratory	0	0	2	1
Professional Core Lab-II	22PC2PL02	Modeling and Simulation of Electrical Drives Laboratory	0	0	2	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing	0	0	2	1
Project	22PW4PL01	Technical Seminar	0	0	4	2
Mandatory	22MN6HS01	Research Methodology and IPR	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(POWER ELECTRONICS)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1PL04	Advanced Power Electronic Converters	3	0	0	3
Professional Core-V	22PC1PL05	Digital Controllers in Power Electronic Applications	3	0	0	3
Professional Core-VI	22PC1PL06	Advanced Control Systems	3	0	0	3
Professional Elective-III	22PE1PS06	Voltage Stability	3	0	0	3
	22PE1ES18	Embedded Systems				
	22PC1PS05	Power Quality				
	22PE1PS09	Evolutionary Algorithm Applications in Power Engineering				
	22PE1PL07	Advanced Control Techniques for Power Electronics				
Professional Elective-IV	22PE1PL08	Electro Magnetic Interference and Compatibility	3	0	0	3
	22PE1PL09	Artificial Intelligence Techniques				
	22PE1PL10	Power Converter and Control Technique for Micro Grid				
	22PS1PC06	Flexible AC Transmission Systems				
	22PE1PL11	Design of Power Electronics Converters				
Professional Core Lab-III	22PC2PL03	Advanced Power Electronic Converters Laboratory	0	0	2	1
Professional Core Lab-IV	22PC2PL04	Power Electronic Converters and Applications Laboratory	0	0	2	1
Industry Engagement	22SD5PL01	Industry Engagement	0	0	2	1
Project	22PW4PL02	Mini-Project	0	0	4	2
Mandatory	22MN6HS02	Ancient Wisdom	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. II YEAR COURSE STRUCTURE AND SYLLABUS

(POWER ELECTRONICS)

III SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	22PE1PL12	Control and Integration of Renewable Energy Sources	3	0	0	3
	22PC1CP05	Internet of Things				
	22PE1PL13	Energy Storage Technologies				
	22PE1PL14	Energy Conservation and Auditing				
	22PLE1PL15	HVDC Transmission				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Industrial Safety				
	22OE1AM02	Operations Research				
	22OE1AM03	Entrepreneurship and Start-ups				
	22OE1PS01	Waste to Energy				
Project	22PW4PL03	Project Part - I	0	0	16	8
Total			**6**	**0**	**16**	**14**

IV SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	22PW4PL04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1PL01) POWER ELECTRONIC CONVERTERS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics

COURSE OBJECTIVES:

- To design/develop suitable power converter for efficient control or conversion of power in drive applications
- To design / develop suitable power converter for efficient transmission and utilization of power in power system applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the operating characteristics of various power electronic devices and the design aspects
CO-2: Analyze operating principles of different converters and find their applications
CO-3: Design the control range/ control methodologies for various power electronic converters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	3	3	2	2
CO-2	2	-	3	3	2	3
CO-3	3	-	3	3	3	3

UNIT-I:

Power Semiconductor Switches for Power Control and Conversion: Ideal Switch; operation, static and dynamic characteristics, power dissipation of various semiconductor switches-Diodes - Bipolar Power Transistors - Power MOSFETS - Insulated Gate Bipolar Transistor (IGBT) - Silicon-Controlled Rectifier – DIAC - TRIAC and Gate Turn-off Thyristor (GTO).

UNIT-II:

AC to DC Converters: Principle of Phase controlled converter operation, single phase and three phase bridge rectifiers, single phase and three phase half controlled and fully controlled converters with R, RL& RLE loads, Freewheeling diode, evaluation of performance parameters-input harmonics- power factor and output ripple, control strategies for power factor improvement.

UNIT-III:

DC-DC Converters: Principle of operation of step down and step up converters, Switching mode Regulators- analysis and design of Buck, Boost, Buck-Boost and Cukregulators, limitations of single stage conversion-comparison of regulators.

UNIT-IV:

DC-AC Converters and AC-AC Converters: Single phase bridge inverters - Principle of operation-performance parameters, Three phase inverters - 180 and 120 degree Conduction modes, Voltage control and waveform improvement techniques - Comparison of PWM techniques- harmonic reduction - Current Source Inverters - advantages -applications, Principle of phase control, single phase bidirectional controllers with R and RL Loads, Performance Analysis, Three Phase bidirectional controllers-different configurations, AC voltage controllers with PWM control, Principle of operation of single phase and three phase cyclo converters,Reduction of output harmonics, Introduction to Matrix converter- principle of operation.

UNIT-V:

Design Aspects of Converters: Gate Drive Circuits-MOSFET gate drive & BJT base drive control circuits, Isolation of Gate and Base drives, Thyristor firing circuits, Cooling and heat sinks, Thermal modeling of power switching devices, Snubber circuit, reverse recovery transients, supply and load side transients, voltage protection and current protection, Electro Magnetic Interference.

TEXT BOOKS:

1. Power Electronics, M. H. Rashid, Prentice Hall of India 1994
2. Power Electronics - Converters, Application and Design, Ned Mohan, Undeland and Robbins, John Wiley and Sons
3. Power Electronics - Essentials and Applications, L. Umanand, Wiley India

REFERENCES:

1. Fundamentals of Power Electronics, Erickson R. W., Chapman and Hall
2. High Power Converters and Drives, Bin Wu, IEEE Press, Wiley Interscience

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1PL02) MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Electrical Machines, Control Systems

COURSE OBJECTIVES:

- To comprehend the basic electro-mechanical energy conversion in rotating machines
- To develop the mathematical models of different electrical machines
- To recognize the different frames for modeling of different ac machines
- To express the voltage and torque equations in state space form
- To understand the operation of special electrical machines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the electromechanical energy conversion and basic concepts of rotating Machines
CO-2: Write the voltage and torque equations for different machines like dc, induction and Synchronous machines
CO-3: Model different AC machines using Linear transformations with suitable reference frame selection
CO-4: Know the operation and constructional features of special electrical machines

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	1	1	1	1
CO-2	3	2	2	3	2	3
CO-3	3	2	2	3	2	3
CO-4	2	1	2	2	3	2

UNIT-I:
Electromagnetic Energy Conversion: Principles of Electromagnetic Energy Conversion, General expressions of stored Magnetic Energy, Co-energy and Force/Torque, examples of Single and Doubly excited systems, Basic Concepts of Rotating Machines, Calculation of Air Gap mmf and machine inductance per phase using physical machine data. Conventions used in Machine Modeling.

UNIT-II:
Modeling of DC Machines: Basic Two-pole DC machine - primitive 2-axis machine - Voltage and Current relationships in matrix form - Torque equation in matrix form, Mathematical model of DC separately excited, Series, Shunt and Compound motors-

state variable forms and Transfer functions, Representation of Compensating Winding in modeling-Numerical problems.

UNIT-III:

Modeling of Induction Machines: Linear transformations-Phase transformation (a,b,c to α,β,o)-Power and MMF invariance-Active transformation(α,β,o to d,q,o), Mathematical Modeling of 3 Ph Induction Motor-voltage and current equations without transformations- α,β modeling of Three Phase Induction motor-Transformation to Arbitrary Reference Frame.

Transformation to Commonly used reference frames-Stator, Rotor, Synchronously rotating reference frames (air gap)- Torque Equations-Equations in state variable form for arbitrary reference frame, Mathematical modeling of two phase asymmetrical and single phase induction machines.

UNIT-IV:

Modeling of Synchronous Machines: Basic 3phase Synchronous motor –Assumptions for modeling-Two axis representation of Synchronous Motor, Mathematical model to Rotor reference frame, Electromagnetic Torque, Equivalent dqo circuits, Determination of Synchronous machine dynamic equivalent circuit parameters

UNIT-V:

Special Machines: Special Machines - Permanent Magnet Synchronous Machine, Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines, Construction and operating principle, Brushless D.C. Motor for space Applications, Analysis of Switched Reluctance Motors, Recent trends in Special Electrical Machines-Axial Flux machines.

TEXT BOOKS:

1. Analysis of Electric Machine, P. C. Krause, 3rd Edition, Wiley IEEE Press
2. Generalized Machine Theory, P. S. Bimbhra, Khanna Publishers, 2002
3. Special Electrical Machines, K. Venkataraman, CRC Press, 2008

REFERENCES:

1. Dynamic Simulations of Electric Machinery: Using MATLAB, Chee-Mun Ong, Prentice Hall, 1998
2. Electric Machinery, Charles Kingsle Jr., A. E. Fitzgerald, Stephen D. Umans, Tata McGraw Hill
3. Electric Motor & Drives: Modeling, Analysis and Control, R. Krishnan, Prentice Hall
4. Brushless Permanent Magnet and Reluctance Motor Drives, Miller T. J. E., Clarendon Press
5. Thyristor Control of Electric Drives, Vedam Subramanyam, Tata McGraw Hill, 1988

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1PL03) ELECTRIC DRIVES SYSTEM

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics, Electrical Machines and Control Systems

COURSE OBJECTIVES:
- To understand basic electrical drives and their analysis
- To analyze speed control of electrical DC and AC drives
- To design power electronic controllers for electric drives

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the fundamentals of DC and AC drives
CO-2: Analyze the operation and control of the DC drives using various power electronic convertors
CO-3: Analyze the operation and control of AC drives and special machines

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	3	-	1	1
CO-2	3	1	-	1	2	1
CO-3	1	1	2	1	2	2

UNIT–I:
Fundamentals of Electric Drives: Introduction to Power semiconductor drive and its elements, Dynamics of motor load system- Fundamentals of torque equation, Speed-torque conventions and multi quadrant operation, components of load torques, Nature and classification of load torques, steady state stability, Regenerative braking, modes of operation of electrical drive, speed control and drive classification, closed loop control of drives-Current limit control, Closed-loop torque control and Closed - loop speed control.

UNIT–II:
Phase Controlled Converter Fed DC Drives: Introduction to DC motor drives -constant torque and constant power operation- Orthogonal relationship between field and armature currents - Single phase semi and fully controlled converters connected to DC separately excited motor – continuous current operation– Speed and Torque expressions – Speed – Torque Characteristics-Problems.
Three phase semi and fully controlled converters connected to DC separately excited motor— continuous current operation-Speed and Torque expressions –Speed – Torque characteristics – Problems-Closed loop operation of two quadrant DC drive-Transfer functions of the subsystems.

UNIT–III:

Chopper Fed DC Drives: Principle of operation of the chopper, Control techniques, Four Quadrant chopper drive, Model of the chopper, steady state analysis of chopper fed DC Drive for continuous current conduction, closed loop control: Block diagram, Current control loop - PWM controller, Hysteresis controller – Comparison of current Controllers.

UNIT-IV:

Induction Motor Drives: Induction Motor: Principle -Torque expression - Equivalent circuit analysis-Stator voltage and frequency control, V/f control, drive operating Regions, Voltage fed inverter control: Open loop volts/Hz control, speed control by slip regulation, Rotor side control of Induction motor: Rotor Resistance control and Slip power recovery schemes, Current source inverter fed induction motor drive.
Introduction, DC drive analogy, principle of vector control, Vector control methods: Direct method, Flux vector estimation, indirect vector control, Direct Torque Control, Adaptive control principles: Self Tuning Regulator, Model reference adaptive control.

UNIT-V:

Permanent Magnet AC Motor Drives: Sinusoidal PMAC motor drive, Current regulated VSI fed Sinusoidal PMAC motor, Brushless DC motor drive, Current regulated VSI fed Brushless DC motor, Features, and applications of Brushless DC motor, Solar powered Pump drives, Battery powered Vehicles.
Switched Reluctance Motor: Construction, Principle, Modes of Operation

TEXT BOOKS:

1. Fundamentals of Electric Drives, G. K. Dubey, 2nd Edition, Narosa Publishing, 2011
2. Electric Motor Drives Modeling, Analysis and Control, R. Krishanam, PHI, 2009
3. Modern Power Electronics and AC Drives, B. K. Bose, 1st edition, Prentice Hall, 2001

REFERENCES:

1. Power Semiconductor-Controlled Drives, G. K., Dubey, Prentice Hall, 1989
2. Analysis of Electric Machinery and Drive Systems, P. C. Krause, 3rd Edition, Wiley-IEEE Press
3. Vector Control of AC Machines, Peter Vas, Oxford University Press, 1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PS01) RENEWABLE ENERGY TECHNOLOGIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Systems, Switch Gear Protection, Power Electronics

COURSE OBJECTIVES:

- To provide necessary knowledge about the modeling, design and analysis of various PV& WECS
- To understand the power conditioning of PV & WECS system's power output
- To gain understanding of integrated operation of renewable energy systems and its LCC
- To estimate sizing and feasibility analysis of energy storage system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model, analyze and design various PV & WECS
CO-2: Design appropriate power conditioning system for PV &WEC system
CO-3: Design efficient stand alone and grid connected PV and WEC systems
CO-4: Design efficient storage systems for Renewable Energy systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	2	2	2
CO-2	1	2	2	1	2	2
CO-3	2	3	2	1	2	1
CO-4	1	1	1	1	2	1

UNIT-I:
Photovoltaic Energy Conversion System: Basics- solar constant-extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation and sunshine , PV Cell-Crystalline Solar cells-Thin film solar cell, Module, Array, Equivalent Electrical circuit, I-V, P-V Curves , effect of temperature and irradiation and series/shunt resistances on the open circuit voltage and short circuit current, hot spot problem in a PV module .

UNIT-II:
Wind Energy Conversion System: Basic Principle of wind energy conversion -nature of wind -wind survey in India -Power in the wind -components of a wind energy -conversion system -Performance of induction generators for WECS, Site selection, classification of WECS.

UNIT-III:

Sizing of PV and Energy Storage Systems: Sizing PV without batteries and Sizing PV with batteries -Battery Parameters-C-rate,DOD,SOC Battery selection,PV system design-Load profile-Days of autonomy and recharge-Battery size-PV array size.

UNIT-IV:

Converter Control and its Algorithms: DC Power conditioning converters-Buck , Boost, Buck-Boost , AC power conditioners converters-Line commutated inverters - maximum power point tracking -Impedance control methods-P&O, INC,Hill Climbing methods

UNIT-V

Grid Integration: Grid connection principle, Grid integration topologies, Direct Machine Coupling with the Grid, Full Power Electronics Coupling with the Grid, Partial Power Electronics Coupling to the Grid, Distributed Power Electronics Interface,d-q controlled grid connection for three-phase, Impact of Interface on the Power System. Case study of comparison between Off grid and grid connected systems.

TEXT BOOKS:

1. Non-conventional Energy Sources, Rai G. D., Khanna Publishers, 2002
2. Wind and Solar Power Systems, Mukund R. Patel, CRC Press, 2004
3. Energy Storage Technologies and Applications, Ahmed Faheem Zobaa, InTech Publishers, 2013

REFERENCES:

1. Solar Energy Utilization, Rai G. D., Khanna Publishers,1997
2. Wind Energy Systems, Gray L. Johnson, Prentice Hall Inc., 1985
3. Design of Photovoltaic Systems, L. Umanand (https://nptel.ac.in/courses/117108141)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PL01) ADVANCED MICRO-CONTROLLER BASED SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Microprocessors and Micro-controllers

COURSE OBJECTIVES:
- To understand the architecture of advance microprocessor and microcontrollers
- To understand the applications of these controllers
- To get introduction to Embedded Systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the architecture of advanced microprocessors and microcontrollers
CO-2: Learn how to program a processor and develop an advanced processor-based system
CO-3: Understand the application of Microprocessor and microcontrollers as building unit for Embedded Systems.

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	3	3	2
CO-2	3	1	3	3	3	2
CO-3	2	1	2	2	3	2

UNIT-I:
Basics of Micro Processors & Embedded Concepts: Microprocessor architecture, word Lengths, addressable memory, Microprocessor's speed architectural characteristics, registers, instruction, memory addressing architecture ,ALU, GPR's Control logic & internal data bus.
An Embedded system, processor in the system, other hardware units, software embedded into a system, exemplary embedded systems, embedded system – on – chip (SOC) and in VLSI circuit. Processor and memory organization – Structural units in a Processor, Processor selection for an embedded system, memory devices, memory selection for an embedded systems, memories and Input Output Devices.

UNIT-II:
ARM Architecture: Types of computer Architectures, ISA's and ARM History. Embedded System Software and Hardware, stack implementation in ARM, Endianness, condition codes. ARM Architecture Versions, Processor Naming, Processor core VS CPU core, ARM7TDMI Interface signals, Memory Interface,Bus Cycle types, Register set, Operational Modes. Instruction Format,ARM Core Data Flow Model,ARM 3 stage

Pipeline,ARM family attribute comparison.ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution.

UNIT-III:

Overview of Cortex-M3: Cortex-M3 Basics: Instruction Set Development, Thumb-2, Registers, General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Stack Memory Operations, Reset Sequence. Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions.

UNIT-IV:

Cortex-M3 Implementation Overview: Pipeline, Block Diagram, Bus Interfaces on Cortex-M3, I-Code Bus, D-Code Bus, System Bus, External PPB and DAP Bus. Exceptions: Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending Behavior, Fault Exceptions, Supervisor Call and Pendable Service Call. NVIC: Nested Vectored Interrupt Controller Overview, Basic Interrupt Configuration, Software Interrupts and SYSTICK Timer. Interrupt Behavior: Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail-Chaining Interrupts, Late Arrivals and Interrupt Latency

UNIT-V:

Cortex-M3/M4 Programming & Microcontroller: Cortex-M3/M4 Programming: Cortex-M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS (Cortex Microcontroller Software Interface Standard), Using Assembly. 9 5 /78 Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation. Memory Protection Unit and other Cortex-M3 features: MPU Registers, Setting Up the MPU, Power Management, Multiprocessor Communication. STM32L15xxx ARM Cortex M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control. STM32L15xxx Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART.

TEXT BOOKS:

1. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, 2nd Edition, Elsevier, 2010
2. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK
3. Andrew N Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide - Designing and Optimizing System Software, 2006, Elsevier

REFERENCES:

1. ARM Architecture Reference Manual, David Seal, 2001 Addison Wesley, Morgan Kaufmann Publishers
2. ARM System-on-Chip Architecture, Steve Furber, 2nd Edition, Pearson Education
3. Cortex-M series-ARM Reference Manual
4. Cortex-M3 Technical Reference Manual (TRM)
5. STM32L152xx ARM Cortex M3 Microcontroller Reference Manual

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1VS19) VLSI DESIGN

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Electronic Devices and Circuits, Digital IC Concepts

COURSE OBJECTIVES:

- To learn the fabrication process of integrated circuit and electrical properties of MOSFET
- To study the concepts of stick diagrams and layouts with the knowledge of MOS layers through design rules
- To learn the design of digital systems using subsystem design approach
- To understand the concepts of PLD's, design capture tools and CMOS testing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand IC Fabrication process steps required for various MOS circuits
CO-2: Analyze electrical properties and layout flow for circuit level and gate level models
CO-3: Design the digital circuits by using subsystem approach
CO-4: Implement and verify the VLSI systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	2	1	-	-
CO-2	3	-	2	1	2	2
CO-3	3	-	2	1	2	2
CO-4	2	-	2	1	2	2

UNIT-I:
Introduction: Introduction to MOS Technology – MOS, PMOS, NMOS, CMOS and BiCMOS technologies, fabrication fundamentals: Oxidation, Lithography, Diffusion, Ion implantation, Metallization and Encapsulation.
Basic Electrical Properties: Basic Electrical Properties of MOS, CMOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit wo, Pass transistor, NMOS inverter, Various pull-ups, Determination of pull-up to pull-down ratio (Zpu/Zpd), CMOS Inverter analysis and design, BiCMOS inverters, Latch-up in CMOS circuits.

UNIT-II:
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layouts, Lambda based design rules, Contact cuts , CMOS Lambda based

design rules, Layout Diagrams for logic gates, Transistor structures, wires and vias, Scaling of MOS circuits- Scaling models, scaling factors, scaling factors for device parameters, Limitations of Scaling.

UNIT-III:

Basic Circuit Concepts: Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations, the delay unit, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and Fan-out, Choice of layers.

UNIT-IV:

Gate Level Design: Architectural issues, Switch logic, Gate logic, Combinational Circuit Design: CMOS logic families including Ratioed Logic, Static, dynamic and Domino Logic, Pass-Transistor Logic and Transmission gate logic.

Sequential Circuit Design: Design of latches and Flip-flops.

UNIT-V:

Subsystem & Semiconductor Integrated Design:

Adders: Carry Ripple adder, Carry Skip adder, Carry look ahead adder, Carry select adder, ALU, Multipliers: Array multiplier, Serial-Parallel multiplier, Parity generator, Comparators, Zero/One Detectors, Up/Down Counter, Memory elements, Shifter.

Introduction to ROM, PAL and PLA(PLDs), FPGAs, CPLDs.

CMOS TESTING CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Over view of Chip level Test Techniques and System-level Test Techniques, Layout Design for Improved Testability.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Dougles and A. Pucknell, PHI Edition, 2005
2. Modern VLSI Design, Wayne Wolf, 3rd Edition, Pearson Education, 1997
3. CMOS VLSI Design, A Circuits And Systems Perspective, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson, 2009

REFERENCES:

1. CMOS Logic Circuit Design, John P. Uyemura, Springer, 2007
2. VLSI Design, K. Lal Kishore, VSV Prabhakar, I. K. International, 2009
3. VLSI Design, A. Albert Raj, Latha, PHI, 2008
4. Introduction to VLSI Design, Mead and Convey, BS Publications, 2010
5. VLSI Design, M. Michal Vai, CRC Press, 2009

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PS02) SMART GRIDS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basics in Power Systems

COURSE OBJECTIVES:

- To understand the concept of smart grid, Architecture and its advantages over conventional grid
- To know tools & techniques for smart grids
- To understand the problems associated with integration of distributed generation and learn wide area measurement techniques
- To understand the communication technologies

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the features of smart grid
CO-2: Assess the role of automation and digitization in Transmission and Distribution
CO-3: Analyse smart grids and distributed energy resources (DER) with evolutionary algorithms
CO-4: Investigate operation and the importance of data acquisition devices and their location for Voltage and Frequency control

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	-	1	2	1
CO-2	2	2	1	1	1	2
CO-3	2	1	-	3	2	2
CO-4	1	-	-	2	1	1

UNIT-I:

Introduction to Smart Grid: Basics of power systems, definition of smart grid, need for smart grid, smart grid domain, enablers of smart grid, smart grid priority areas, regulatory challenges, smart-grid activities in India.

UNIT-II:

Smart Grid Architecture: Smart grid architecture, standards-policies, smart-grid control layer and elements, network architectures, IP-based systems, power line communications, supervisory control and data acquisition system, advanced metering infrastructure. The fundamental components of Smart Grid designs, Transmission Automation, Distribution
Automation, Renewable Integration

UNIT-III:

Tools and Techniques for Smart Grid: Computational Techniques – Static and Dynamic Optimization Techniques for power applications such as Economic load dispatch – Computational Intelligence Techniques – Evolutionary Algorithms in power system – Artificial Intelligence techniques and applications in power system.

UNIT-IV:

Distribution Generation Technologies: Introduction to Distribution Energy Sources, Renewable Energy Technologies – Microgrids – Storage Technologies –Electric Vehicles and plug – in hybrids – Environmental impact and Climate Change – Economic Issues.

UNIT-V:

Communication Technologies in Smart Grid: Introduction to Communication Technology, Two Way Digital Communications Paradigm, Synchro- Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS)- Introduction to Internet of things (IoT)-Applications of IoT in Smart Grid.

TEXT BOOKS:

1. Smart Grids, Infrastructure, Technology and Solutions, S. Borlase, 1st Edition, CRC Press, 2013,
2. Renewable and Efficient Electric Power System, G. Masters, 2nd Edition, Wiley–IEEE Press, 2013,

REFERENCES:

1. Synchronized Phasor Measurements and their Applications, A. G. Phadke and J. S. Thorp, 2nd Edition, Springer, 2017
2. Wind Power in Power Systems, T. Ackermann, Hoboken, 2nd Edition, John Wiley, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PL02) DATA SCIENCE APPLICATIONS IN POWER ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To provide necessary knowledge in data science
- To understand the process of data collection and storage, descriptive and predictive analysis
- To gain understanding Statistical tools for descriptive analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the data science process
CO-2: Understand tools for data collection and statistical analysis
CO-3: Basic machine learning algorithms and deep learning architecture
CO-4: Apply data science knowledge in electrical power applications

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	1	2	1
CO-2	3	1	3	1	3	2
CO-3	2	1	2	1	3	2
CO-4	3	1	3	1	3	2
CO-5	3	-	3	1	2	1

UNIT-I:

Data Science Introduction: Introduction, Terminology, data science process, Types of data, Example applications.

Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

UNIT-II:

Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes

UNIT-III:

Data Visualization: Introduction, Types of data visualization,

Data for Visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

UNIT-IV:

Deep Learning: Deep Architectures – Convolutional Neural Networks–Convolutional Layer–Pooling Layer–Normalization Layer - Fully Connected Layer–Deep belief Networks

UNIT-V:

Applications of Data Science: Descriptive and predictive data analysis for electrical applications. Short term and long term load predictions, analyzing power plant data and performing descriptive and predictive analysis

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline, Cathy O'Neil, Rachel Schutt, O'Reilly, 2013
2. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, 1st Edition, Manning Publications, 2016
3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, 1st Edition, Springer, 2013

REFERENCES:

1. Neural Networks: A Comprehensive Foundations Simon Haykin, Pearson, 2003
2. Fuzzy Sets, Uncertainty and Information, G. J. Klir and T. A. Folger, PHI,1994
3. Neural Network & Fuzzy System, Bart Kosko, Prentice Hall, 1992
4. Neural Computing Theory & Practice, P. D. Wasserman, Van Nostrand Reinhold, New York, 1989

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PL03) PREDICTIVE CONTROL OF POWER CONVERTERS AND DRIVES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Control Systems & Power Electronics

COURSE OBJECTIVES:
- To learn the mathematical models of predictive control for power converters and drives
- To study the concepts predictive controller schemes
- To learn the cost function through analysis Optimally
- To understand the concepts predictive control schemes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop the mathematical models of predictive control for power converters and drives
CO-2: Design the predictive controller scheme for power converters and drives
CO-3: Optimize the cost function through analysis and simulation of power converters and drives
CO-4: Implement model predictive control schemes for electric drive systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	2	2	2
CO-2	3	1	3	1	2	2
CO-3	2	1	2	1	2	2
CO-4	3	1	3	2	2	2

UNIT-I:
Introduction and Classical Control Methods for Power Converters and Drives: Power converter control in the past, power converter control today, control requirements and challenges, digital control platforms, why predictive control is particularly suited for power electronics.
Design and Implementation Issues of Model Predictive Control: Cost function selection, weighting factor design, cost function classification, weighting factors adjustment and examples.

UNIT-II:
Model Predictive Control: Predictive control methods for power converters and drives, basic principles of model predictive control, model predictive control for power electronics and drives, controller design, implementation, general control scheme.

UNIT-III:

Predictive Control of a Three-Phase Inverter: Introduction, predictive current control, cost function converter model, load model, discrete-time model for prediction, working principle, implementation of the predictive control strategy, comparison to a classical control scheme, predictive control simulation of three-phase inverter

UNIT-IV:

Control of an Active Front-End Rectifier: Introduction, rectifier model, space vector model, discrete-time model, predictive current control in an active front-end, cost function, predictive power control, cost function and control scheme, predictive control of an ac – dc – ac, control of theinverter side, control of the rectifier side, control scheme.

UNIT-V:

Predictive Control of Induction Machines: Introduction, dynamic model of an induction machine, predictive torque control of an induction machine fed by a voltage source inverter, comparison to a classical control scheme, predictive control simulation – torque control of an induction machine fed by a two-level voltage source inverter.

TEXT BOOKS:

1. Predictive Control of Power Converters and Electrical Drives, Jose Rodriguez and Patricio Cortes, 1st Edition, Wiley-IEEE Press, 2012
2. Model Predictive Control of High Power Converters and Industrial Drives, Tobias Geyer, 1st Edition, Wiley, 2016

REFERENCES:

1. Advanced Control Systems for Electric Drives, Adel Merabet, MDPI AG, 2020
2. Predictive Control: Fundamentals and Developments, Yugeng Xi and Dewei Li, 1st Edition, Wiley, 2019

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PL04) DIGITAL SIGNAL PROCESSING FOR POWER AND CONTROL

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Network Analysis, Advanced Calculus, Linear and Digital IC applications

COURSE OBJECTIVES:
- To understand characteristics of discrete time signals and systems
- To analyze and process signals using various transform techniques
- To understand various factors involved in design of digital filters
- To understand the applications of DSP to Active power filtering

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze and process signals in the discrete domain
CO-2: Design filters to suit specific requirements for specific applications
CO-3: Perform statistical analysis and inferences on various types of signals
CO-4: Apply digital filters to active power filters.

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	2	3	2
CO-2	3	1	3	3	2	2
CO-3	3	1	2	3	2	1
CO-4	3	1	3	2	1	1

UNIT-I:
Introduction: Classification of continuous time Signals & Systems. Linear shift invariant systems, stability and causality, Sampling of Continuous signals- Sampling process- Sampling theorem. Classification of discrete time signals and sequences

UNIT-II:
Fourier Analysis: Introduction to Discrete Fourier series, Discrete Fourier Transform: Properties of Discrete Fourier Transform, linear convolution and circular convolution of sequences using DFT, Computation of DFT, Relation between DFT and Z-Transform.

UNIT-III:
Z-Transform: Introduction to Z-transform, Properties of Z- Transform, Inverse Z- Transform, Application of Z- Transforms for Linear constant coefficient difference equations, Realization of Digital filters, system function – stability criterion.

UNIT-IV:

IIR FILTERS & FIR FILTERS: Analog filter approximations- Design of Butterworth filter-Design of IIR digital filter from analog filter using- impulse invariant and bilinear transformation techniques, realization of IIR filters-direct, canonic, cascade, and parallel forms. DFT Filter bank-Sliding- Sliding Goertzel -Moving DFT algorithms

Characteristics of FIR Digital Filters, Frequency response, Design of FIR filters using – Rectangular, Hamming, Bartlett- windows, frequency sampling technique, comparison of FIR and IIR filters

UNIT-V:

Active Power Filters Control Algorithms: Introduction to Active power Filter (APF) - Control circuit of Shunt Active Power Filter, APF control using first harmonic detection-Various control circuits using 4th order Butterworth Filter-5th order Butter worth- Sliding-Sliding Goertzel - Moving DFT Algorithms, P-Q theory control algorithm for shunt APF.

TEXT BOOKS:

1. Digital Signal Processing: Principles, Algorithms And Applications, John G. Proakis, G. Manolakis, 3rd Edition, PHI, 2007
2. Discrete Time Signal Processing, A. V. Oppenheim and R. W. Schaffer, PHI, 2009
3. Digital Signal Processing in Power Electronics Control Circuits, Krzysztof Sozan´ski, Springer, 2013

REFERENCES:

1. Digital Signal Processing-Fundamentals and Applications, Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLAB, Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing, S. Salivahanan, A. Vallavaraj, C. Gnanapriya, TMH, 2009
4. Discrete Systems and Digital Signal Processing with MATLAB, TaanS El Ali, CRC Press, 2009
5. Digital Signal Processor; Architecture, Programming & Application, P. Venkata Ramani, M. Bhaskar, Tata McGraw Hill, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PS05) REACTIVE POWER COMPENSATION AND MANAGEMENT

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Systems

COURSE OBJECTIVES:
- To identify the necessity of reactive power compensation
- To describe load compensation
- To select various types of reactive power compensation in transmission systems
- To illustrate reactive power coordination system
- Tocharacterizedistributionsideandutilitysidereactivepowermanagement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish the importance of load compensation in symmetrical as well as unsymmetrical loads
CO-2: Work out on various compensation methods in transmission lines
CO-3: Construct models for reactive power coordination
CO-4: Distinguish demand side reactive power management & user side reactive power management

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	-	-	-	1
CO-2	2	2	-	1	-	2
CO-3	2	2	-	2	2	2
CO-4	-	1	-	1	2	1

UNIT-I:
Load Compensation: Objectives and specifications, Reactive power characteristics, Inductive and capacitive approximate biasing, Load compensator as a voltage regulator, Phase balancing and power factor correction of unsymmetrical loads, Examples.

UNIT-II:
Steady–State Reactive Power Compensation in Transmission Systems: Uncompensated line, Types of compensation, Passive shunt and series and dynamic shunt compensation, Examples.
Transient State Reactive Power Compensation in Transmission Systems: Characteristic time periods, Passives hunt compensation, Static compensation, Series capacitor compensation, Compensation using synchronous condenser, Examples.

UNIT-III:

Reactive Power Coordination: Objective, Mathematical modeling, Operation planning, Transmission benefits, Basic concepts of quality of power supply, Disturbances, Steady–state variations, Effect of under-voltages, Frequency, Harmonics, Radio frequency and electromagnetic interference.

UNIT-IV:

Demand Side Management: Load patterns, Basic methods load shaping, Power tariffs, KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels.

Distribution Side Reactive Power Management: System losses, Loss reduction methods, Examples, Reactive power planning, Objectives, Economics Planning capacitor placement, Retro fitting of capacitor banks.

UNIT-V:

User Side Reactive Power Management: KVAR requirements for domestic appliances, Purpose of using capacitors, Selection of capacitors, Deciding factors, Types of available capacitor, Characteristics and Limitations.

Reactive Power Management in Electric Traction Systems and Arc Furnaces: Typical layout of traction systems, Reactive power control requirements, Distribution transformers, Electric arc furnaces, Basic operation, Furnaces transformer, Filter requirements, Remedial measures, Power factoro fan arcfurnace.

TEXT BOOKS:

1. Reactive Power Control in Electric Power Systems, T. J. E. Miller, John Wiley,1982
2. Reactive Power Management, D. M. Tagare, Tata McGraw Hill, 2004

REFERENCES:

1. Reactive Power Compensation: A Practical Guide, Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just, Wiley, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PL05) ELECTRIC AND HYBRID VEHICLES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Electrical Machines

COURSE OBJECTIVES:
- To study the different drive train configurations of electric vehicles
- To propose the various propulsion and energy storage systems for EHVs
- To know the sizing of propulsion motors and other systems involved in EH vehicles
- To carry out different design case studies of EHV and BEVs

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess the performance, societal and environmental impact of EEHVs having known their past history
CO-2: Implements various drive train topologies and control strategies in Electric and Hybrid vehicles
CO-3: Recommend, design/size and control different electric propulsion units and other components of EHVs and BEVs
CO-4: Appropriately select the energy storage system and strategize its management in EHVs

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	2	2	2	2
CO-2	2	1	3	3	3	2
CO-3	3	1	3	3	3	2
CO-4	2	1	2	2	2	2

UNIT-I:
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

UNIT-II:
Hybrid Electric Drive-Trains: Basic architecture and concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT-III:

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Synchronous Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-IV:

Sizing the Drive System: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, Sizing the power electronics based on Switch Technology - Switching Frequency and Ripple capacitor design, selecting the energy storage technology, Communications, supporting subsystems

UNIT-V:

Energy Storage and Energy Management Strategies: Energy Storage Requirements in Hybrid and Electric Vehicles, Batteries, Fuel Cell and Super Conductor and Flywheel based Energy storage, Introduction to Energy Management Strategies used in Hybrid and Electric vehicles, Classification and Comparison of Energy Management Strategies, Battery Management System (BMS) principle, General architecture of BMS, Battery equivalent circuit models, Open Circuit Voltage, State of Charge (SOC) dependance.

Case Study: Design of a Hybrid Electric Vehicle (HEV)

TEXT BOOKS:

1. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Hussein, CRC Press, 2010
2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2009
3. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley, 2003

REFERENCES:

1. Hybrid Vehicle Propulsion, Jefferson C. M., Barnard and R. H., WIT Press, 2002
2. Electric and Fuel Cell Vehicles, Jack Erjavec and Jeff Arias, Cengage Learning, 2012
3. Electric Vehicles - The Benefits and Barriers, Seref Soylu, InTech Publishers, 2011
4. Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles, Jack Erjavec and Jeff Arias, Cengage Learning, 2007
5. Build Your Own Electric Vehicle, Seth Leitman, McGraw Hill, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PL06) MACHINE LEARNING AND APPLICATIONS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To learn basic concepts of machine learning techniques
- To understand various learning methods
- To apply machine learning for various problem solving applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic concepts of Machine Learning Techniques
CO-2: Distinguish between supervised learning, unsupervised learning and reinforced learning
CO-3: Develop the skills in using machine learning software for solving practical problems
CO-4: Apply Machine Learning Algorithms for Electrical Engineering problems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	1	2	2
CO-2	3	1	2	1	2	2
CO-3	3	1	3	2	2	2
CO-4	3	1	3	3	2	2

UNIT-I:
Neural Networks: Introduction to Neural Networks, Models of Neuron Network, Architectures – Knowledge representation, Artificial Intelligence and Neural Networks – Learning Process, Error Correction Learning, Multi-layer perceptron using Back Propagation Algorithm (BPA)

UNIT-II:
Learning Theory:
Introduction to Machine Learning: What is Learning – Learning Objectives – Data needed – Bayesian inference and Learning – Bayes theorem – inference – naïve Bayes – Regularization – Bias-Variance Decomposition and Trade-off – Concentration Inequalities – Generalization and Uniform Convergence – VC –dimension- Types of Learning- Supervised Learning – Unsupervised Learning and Reinforcement Learning.

UNIT-III:
Supervised Learning: Simple linear Regression – Multiple Linear Regression- Logistic Regression – Exponential Family and Generalized Linear Models- Generative Models:

Gaussian Discriminate Analysis, Naïve Bayes – Kernal Method: Support Vector Machine (SVM) – Kernal function – Kernal SVM - Gaussian Process – Tree Ensembles: Decision Trees- Random Forests – Boosting and Gradient Boosting

UNIT-IV:

Unsupervised Learning (Clustering): K –means Clustering Algorithm – Gaussian Mixture Model (GMM) – Expectation Maximization (EM) – Variational Auto Encoder (VAE) – Factor Analysis – Principle Components Analysis (PCA) – Independent Component Analysis (ICA)

UNIT-V:

Reinforcement Learning & Applications of ML: Markov Decision Processes (MDP) – Bellman's Equations- Value Iteration and Policy Iteration - Value Function Approximation – Q – Learning.

Load Forecasting – Energy Market forecasting – Fault identification and localization – Renewable Uncertainty estimation

TEXT BOOKS:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2011
2. Machine Learning, E. Alpaydin, MIT Press

REFERENCES:

1. Machine Learning, Tom M. Mitchell, McGraw Hill International Edition, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2PL01) PYTHON FOR ELECTRICAL SYSTEMS AND APPLICATIONS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Problem Solving using C, Control systems, All core subjects

COURSE OBJECTIVES:

- To introduce core programming basics and program design with functions using Python programming language for electrical systems
- To study the use of procedural statements like assignments, conditional statements, loops and function calls for Electrical systems
- To describe the need for Object-oriented programming concepts in Python for Electrical and other related applications
- To apply python for Real Time Systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine the Electrical/ Electronic and Magnetic network parameters and Analysis using Python
CO-2: Illustrate Decision Making statements and Functions for Network and control solutions
CO-3: Develop programs for Power electronic applications
CO-4: Evaluate the electrostatic field parameters using Python
CO-5: Perform Sensor based Control applications for Real Time Systems

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	2	1	2	1
CO-2	3	-	2	1	2	2
CO-3	2	-	2	2	2	1
CO-4	2	-	2	1	2	1
CO-5	2	-	2	1	2	2

LIST OF EXPERIMENTS:

1. Numbers in Python, Basic & Built-in Math functions, Number Formats, Strings, Quotes, print () Function, Assigning Values to Names & Changing Data Through Names, Copying Data.
2. Dictionaries - Groupings of Data Indexed by Name, Special String Substitution Using Dictionaries, Arrays, Treating a String Like a List, Special Types, Ranges of Sequences, Working with Sets, Arrays.

3. Decision Making and Functions: Theory: If statement, if-elif-else, Repetition using while loop, for loop, break statement.
4. Functions-Grouping Code under a Name, defining a Function, function in the function, Checking & Setting Your Parameters.
5. Calling Functions from within Other Functions, Functions Inside of Functions, Layers of Functions – Dynamic Equation solutions.
6. Calculation of ripple factor for a given rectifier: Half-wave/Full-wave/Bridge circuit using Python program.
7. Modelling and Response of second and higher order electrical circuit using Python program(Time-response, Root locus, Bode plot).
8. Generate Continuous and Discrete time signals for elementary functions.
9. Calculation of the equivalent circuit parameters and efficiency of a Transformer at differentloads using Python commands.
10. Plotting and performing various operations on Discrete Time Signals in Python.
11. Exploration of Advanced Python Libraries I : Introduction to Objects and Functions of a. Numpy - core library for scientific computing b. Pandas - fast, powerful, flexible and easy to use open source data analysis and manipulation tool.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2PL02) MODELING AND SIMULATION OF ELECTRICAL DRIVES LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: MATLAB & Electrical Machines

COURSE OBJECTIVES:

- To find torque and assess the DC machines through State space models
- To identify different reference frame for applying transformations
- To study and control different drives using power electronic converters
- To apply different simulation packages for studying different machines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To assess the performance of dc machines through state space models
CO-2: To study different braking operations of DC machines through simulations
CO-3: To obtain and study the machine equations to different reference frames
CO-4: To study the control of different drives by power electronic converters through simulations

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	3	3	3
CO-2	2	1	2	2	2	2
CO-3	3	1	3	3	3	3
CO-4	3	1	2	2	3	3

LIST OF EXPERIMENTS:

1. Determination of DC Shunt Machine Constants and Parameters used for its Mathematical Modelling.
2. Torque vs Armature Current characteristic of a Separately Excited DC Motor using its Mathematical Model.
3. Torque vs Speed Characteristic of a Separately Excited DC Motor using its Mathematical Model.
4. Variation of Mutual and Self Inductances in a three-phase induction motor.
5. MMF Distribution in air gap with Sinusoidal Winding Distribution.
6. Mathematical Model of a Three Phase Induction Motor to a,b,c reference frame.
7. Mathematical Model of a Three Phase Induction Motor to synchronously rotating d,q,0 reference frame.
8. Mathematical Model of a Three Phase Induction Motor to statord,q,0 reference frame.

9. Study of Regenerative/Dynamic braking operation of DC Motor through simulation.
10. Study of V/F Control operation by VSIFed Induction Motor Drive through simulation.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22SD5HS01) COMMUNICATION SKILLS FOR ACADEMIC AND RESEARCH WRITING

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To equip the students with an understanding of the mechanics and conventions of academic and research writing including cohesion and coherence to produce texts that demonstrate precision and clarity
- To enable students to present focused, logical arguments that support a thesis
- To empower the students to find, analyze, evaluate, summarize and synthesize appropriate source material for literature review
- To enable students to use appropriate language to analyze and interpret the data, and prepare an outline
- To enable students to become adept in the requirements and specifications of standard writing to produce academic and research papers

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of academic language features, and text structure and ensure cohesion and coherence as connected to various text types

CO-2: Demonstrate the use of writing process strategies through outlining, reviewing, composing, and revising

CO-3: Evaluate sources and use summary, analysis, synthesis, and integration to construct a literature review on a topic chosen by the student

CO-4: Prepare an outline for Research Articles and Thesis

CO-5: Apply standard documentation style to produce academic and research papers that meet the demands of specific genres, purposes, and audiences

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	1	1	-	1
CO-2	3	3	3	1	-	1
CO-3	1	3	2	2	-	1
CO-4	3	3	2	1	-	1
CO-5	3	3	3	1	-	1

UNIT-I:

a) Factors Influencing Effective Writing: Mechanics of Writing, Purpose of Writing, Audience/reader, Organisation- Cohesion, and Coherence

b) Features of Academic Writing: Introduction, Complexity, Formality, Precision, Objectivity, Explicitness, Accuracy and Appropriacy, Relevance, Hedging

UNIT-II:

1. Academic Writing Forms:

a) Analysing arguments; Building an argument
b) Making a Counter Argument- Managing tone, and tenor

2. Types of Research: Primary and Secondary Research;
3. Research Design: Statement of the Problem, Survey of relevant literature, Writing Hypotheses, Developing Objectives; Research Tools

UNIT-III:

a) Criteria of Good Research- Avoiding Plagiarism
b) Data Interpretation
c) Preparing an outline for Research Articles & Research Reports

UNIT-IV:

a) Reference Skills -Paraphrasing (Change of parts of speech, word order, synonyms, using the passive form), -Summarizing (Steps in summarising)
b) Documentation Format: APA style
c) Documentation Format: MLA style

UNIT-V:

a) Writing Article Reviews
b) Report Writing: a) Writing Technical Reports b) Writing Proposals

TEXT BOOKS:

1. A Course in Academic Writing, Gupta R., Orient Black Swan, 2010
2. Academic Writing: Exploring Processes and Strategies, Leki I., CUP, 1998
3. Writing-up Research: Experimental Research Report Writing for Students of English, Weissberg R., & Buker S., Englewood Cliffs, Prentice Hall, 1990

REFERENCES:

1. English Academic Writing for Students and Researchers. Yakhontova T., 2003
2. Inside Track: Successful Academic Writing, Gillett A., Hammond A., Martala M., Pearson Education, 2009
3. English for Academic Research: Writing Exercises, Wallwork, Springer, 2013
4. The MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association
5. Academic Writing for Graduate Students: A Course for Non-native Speakers of English, Swales J. M., & Feak C. B., University of Michigan Press, 1994

ONLINE RESOURCES:

1. https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/support-for-students/academic-writing-resources/
2. https://www.biz-e-training.com/resources-for-learners/academic-writing-online-resources/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22MN6HS01) REASEARCH METHODOLOGY AND IPR

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand research problem formulation

CO-2: Analyze research related information & Follow research ethics

CO-3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO-4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to 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

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	1	1	3	2
CO-2	3	2	1	3	2	1
CO-3	3	2	2	2	1	3
CO-4	3	3	3	1	3	3
CO-5	3	3	3	2	3	3

UNIT – I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT – II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT – III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT – IV:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System.
New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS:

1. Research Methodology: An Introduction for Science & Engineering Students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition

REFERENCES:

1. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd., 2007
2. Industrial Design, Mayall, McGraw Hill, 1992
3. Product Design, Niebel, McGraw Hill, 1974
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
5. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1PL04) ADVANCED POWER ELECTRONIC CONVERTERS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics, Power Electronic Converters

COURSE OBJECTIVES:

- To describe the operation of multi level inverters with switching strategies for high power applications.
- To comprehend the design of resonant converters and switched mode power supplies.
- Understand the design procedure of magnetic and electrostatic components of converters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop and analyze various converter topologies
CO-2: Analyse dynamics of DC DC converters
CO-3: Describe multilevel Inverter topologies for various applications of electrical engineering
CO-4: Design the components for switched mode power supplies

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	3	2	2	3
CO-2	2	-	3	3	2	3
CO-3	-	-	3	2	3	2
CO-4	2	-	3	3	2	2

UNIT-I:
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 ;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-II:
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-III:

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-IV:

Power Supply Applications: Isolated Switch mode dc power supplies – fly back Converter – forward converter – push-pull converter – half bridge converter – Full bridge converter – Resonant d c power supplies – bidirectional power supplies – Applications; power line disturbances – power conditioners – Uninterruptible Power Supplies.

UNIT-V:

DC-DC Converter Dynamics Design: Pulse Width Modulated Converter-Dynamic and Output Equations of the Converter; Averaged Model of the Converter- Steady State Solution-Small Signal Model of The Converter-Transfer Functions of the converter with examples; Generalized State Space Model of the Converter –Generalized model – linear small signal model-dynamic functions of the converter-circuit averaged model quantities; some examples.

Design of magnetic components-design of transformer - Design of Inductor and current transformer - Selection of filter capacitors - Selection of ratings for devices - input filter design

TEXT BOOKS:

1. Power Electronics, Mohammed H. Rashid, 3rd Edition, Pearson, 2004
2. Power Electronics, Ned Mohan, Tore M. Undeland and William P. Robbins, 2nd Edition, John Wiley & Sons
3. Course Material on Switched Mode Power Conversion V. Ramanarayanan, 1st Edition, 2005

REFERENCES:

1. Fundamentals of Power Electronics, Robert W. Erickson and Dragan Maksimovic, Springer
2. Pulse-width Modulated DC-DC Power Converters, Marian K. Kazimierczuk, John Wiley
3. Elements of Power Electronics, Philip T. Krein, Oxford University Press
4. Power Electronics: Circuits, Devices, and Applications, Muhammad H. Rashid, Pearson Education, 2009
5. Switching Power Supply Design, Abraham I. Pressman, McGraw Hill, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1PL05) DIGITAL CONTROLLERS IN POWER ELECTRONIC APPLICATIONS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics

COURSE OBJECTIVES:
- To understand the architecture of Texas Instruments's MSP 430 processor
- To understand PWM generation using MSP 430 Processor
- To understand the architecture of Texas Instruments' LF 2xx processor
- To appreciate digital control of power electronic converters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the architecture and addressing modes of MSP 430, LF 2xx Processor
CO-2: Formulate programs for PWM generation using MSP 430 Processor
CO-3: Understand the digital control application in power electronic converters

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	-	3	1
CO-2	3	2	-	3	3	2
CO-3	3	1	-	3	3	3

UNIT-I:
MSP430 Architecture: Introduction – Where does the MSP430 fit, The outside view, The inside view-Functional block diagram, Memory, Central Processing Unit, Memory Mapped Input and Output, Clock Generator, & Clock System Exceptions: Interrupts and Resets, MSP430 family.

UNIT-II:
Addressing Modes & Instruction Set- Addressing Modes, Instruction set, Constant Generator and Emulated Instructions, Program Examples.

UNIT-III:
Interrupts and Timmer Operating Modes- Interrupts, What happens when an interrupted is requested, Interrupt Service Routines, Low Power Modes of Operation, Watchdog Timer, Basic Timer1, Timer-A: Timer Block, Capture/Compare Channels, Analog/Digital Input-Output and PWM - ADC10, Sigma-Delta ADC, DAC, Simple PWM, Design of PWM.LCD interfacing.

UNIT-IV:

Introduction to DSP Processor: Introduction to the C2xx DSP core and code generation. The components of the C2xx DSP core, Mapping external devices to the C2xx core , peripherals and Peripheral Interface, System configuration registers, Memory , Types of Physical Memory , memory Addressing Modes , Code Composer Studio for C2xx DSP.

UNIT-V:

Design of Controller in Power Electronics: Typical applications: DSP Implementation of DC-DC buck-boost converter- DSP-based control of permanent magnet brushless DC machines- DSP-based Implementation of clarkes's and park's transformations- DSP-Based implementation of SPWM, SVPWM inverter pulse generation.

TEXT BOOKS:

1. MSP430 Microcontroller Basics, John H. Davies, Elsevier
2. DSP Based Electro Mechanical Motion Control, Hamid A. Toliyat and Steven G. Campbell, CRC Press, 2004

REFERENCES:

1. Introduction to Embedded Systems Using Microcontrollers and the MSP430, Jiménez Manuel, Palomera Rogelio, Couvertier Isidoro

2. 2833x Digital Signal Controller (DSC) Data Manual

a. TMS320C28x CPU and Instruction Set Reference Guide - SPRU430

b. TMS320x28xx, 28xxx Peripheral Reference Guide - SPRU566

c. TMS320x2833x System Control and Interrupts Reference Guide - SPRUFB0

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1PL06) ADVANCED CONTROL SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Control Systems, Linear Algebra

COURSE OBJECTIVES:

- To cater the knowledge of basic and modern control system for the real time analysis and design of control systems
- To provide adequate knowledge of state space representation and system analysis using state space
- To equip student with the know-how of estimation and controller design techniques
- To provide comprehensive knowledge of optimal control and modern control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyse and design controllers for multivariable systems
CO-2: Apply state space techniques for linear system analysis
CO-3: Design estimators and controllers for systems using state space models

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	3
CO-2	3	1	3	2	3	3
CO-3	3	1	3	1	3	2

UNIT-I:

Multivariable Systems & State Space Representation: Introduction to multivariable systems, SISO, MIMO Systems. Process interactions and control loop interactions. Pairing of controlled and manipulated Variables. Relative gain array, structure selection. Decoupler. PID controller design for MIMO systems.

State Space Representation of physical systems, Transfer function to state space representation, Phase variable form, Canonical Forms – Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form, State space to Transfer function State diagram Representation.

UNIT-II:

State Transition Matrix, Controllability and Observability: Stability analysis through state space Solution of State Equation, State Transition Matrix; Tests for controllability and observability for continuous time systems – Time varying case, time invariant case, Principle of Duality, Controllability and observability form and other canonical forms.

UNIT-III:

State Feedback Control: Need for state feedback. Design of state feedback control through pole placement. State regulator problem. Dynamic programming, Ricati equations and the discrete time linear quadratic regulator (LQR). Output regulator problem. State and output tracking problem.

UNIT-IV:

State Estimation: Separation principle. Design of full order observer and reduced order observer. Least squares estimation, weighted Least squares estimation, recursive least square estimation. Discrete time Kalman filter. Applications of Kalman filtering. Linear quadratic gaussian (LQG).

UNIT-V:

Model Predictive Control: Formulation of Minimum time, Minimum energy and minimum fuel optimal control problems. Prediction horizon, Model predictive control - formulation and implementation. Selection of Design and Tuning Parameters. Constrained model predictive control.

TEXT BOOKS:

1. Modern Control System Theory, M. Gopal, 2nd Edition, New Age International, 1996
2. Process Dynamics and Control, Dale E. Seborg, Thomas F. Edgar, D. A. Mellichamp, F. J. Doyle III, 4th Edition, John Wiley & Sons, 2016
3. Optimal State Estimation: Kalman, H Infinity, and Nonlinear Approaches, Simon Dan, John Wiley & Sons, 2006

REFERENCES:

1. Modern Control Engineering, K. Ogata, 3rd Edition, Prentice Hall of India, 1998
2. Digital Control and State Variable Methods, M. Gopal, Tata McGraw-Hill, 1997

ONLINE RESOURCES:

1. https://in.mathworks.com/videos/series/understanding-model-predictive-control.html
2. https://in.mathworks.com/videos/series/understanding-kalman-filters.html

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PS06) VOLTAGE STABILITY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power System Analysis, Power System Operation

COURSE OBJECTIVES:

- To analyze the concepts of power system stability, security and assessment methods
- To understand the reactive power control in generation/transmission interconnected networks
- To assess the methods for voltage stability indices(I, VCPI) and graphical methods p-v q-v curves-analysis
- To improve the controlling and compensation methods of voltage stability

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the significance of Q-control, PS load model, angle stability and voltage stability
CO-2: Analyze the graphical methods of evaluating voltage stability
CO-3: Analyze voltage stability indices (L-Index and VCPI)
CO-4: Understand the preventive methods of voltage collapse

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	2	1	1
CO-2	2	2	2	2	1	2
CO-3	2	2	2	2	2	1
CO-4	2	3	3	2	1	2

UNIT–I:
Reactive Power Control: Concepts of power in A.C transmission systems, reactive loss characteristics, operation of transmission lines under NL and heavy load conditions. Voltage regulation relations with reactive power line – line loadability – governing effects on reactive power flow – system MVAr mismatch – constraints effects and practical aspects of reactive power flow problem.

UNIT–II:
Introduction To Voltage Stability:
Definitions: Voltage Stability, Voltage Collapse, Voltage Security; Classification of Voltage Stability, different expressions and scenarios between reactive power and

system stability.; Factors affecting Voltage collapse and instability; Previous cases of voltage collapse incidences.

UNIT–III:

Graphical Analysis of Voltage Stability: Comparison of Voltage and angular stability of the system; Graphical Methods describing voltage collapse phenomenon: P-V and Q-V curves; detailed description of voltage collapse phenomenon with the help of Q-V curves.

UNIT–IV:

Power System Loads:

Loads that Influences Voltage Stability: Discharge lights, Induction Motor, Air-conditioning, heat pumps, electronic power supplies, OH lines and cables.

Reactive Power Compensation: Generation and Absorption of reactive power- Series and Shunt compensation- Synchronous condensers- SVCs- OLTCs - Booster Transformers.

UNIT–V:

Analysis of Voltage Stability on SMLB System: Analytical treatment and analysis.

Voltage Stability Indices: L-Index and its expression, Voltage collapse proximity indicator - Determinant of Jacobin as proximity indicators- Voltage stability margin.

Stability Margin: Compensated and un-compensated systems.

Voltage Security: Definition; Voltage security; Online monitoring of Voltage Stability; Methods to improve voltage stability and its practical aspects.

TEXT BOOKS:

1. Power System Voltage Stability, C.W. Taylor, McGraw Hill, 1994
2. Performance, Operation And Control of EHV Power Transmission System, A. Chakrabarthy, D. P. Kotari, A. K. Mukopadyay, 1st Edition, A. H. Wheeler Publishing, 1995

REFERENCES:

1. Power System Dynamics: Stability and Control, K. R. Padiyar, 2nd Edition, B.S. Publications
2. Voltage Stability of Electric Power Systems, Thierry Van Cutsem, Costas Varnas, Springer-Verlag

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ES18) EMBEDDED SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES:C Programming, Micro-processor and Micro-controllers

COURSE OBJECTIVES:

- To understand the basics of real time operating and embedded systems
- To understand the architecture and programming of AVR micro-controller
- To interface AVR micro-controller with different Peripherals.
- To understand the practical applications of AVR micro-controller

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Program AVR micro-controllers for different applications
CO-2: Apply the knowledge of AVR micro-controller for real time applications
CO-3: Design an embedded system using AVR micro-controller
CO-4: Interface AVR micro-controller with different Peripherals

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	2	-	2	2
CO-2	3	1	3	-	3	2
CO-3	3	1	2	-	2	2
CO-4	3	1	2	-	2	2

UNIT-I:
Introduction to Embedded System: An Embedded system, Processor, hardware unit, soft ware embedded into a system, Example of an embedded system, Real time and embedded OS. Structural UNIT-In a Processor, processor selection for embedded systems.

UNIT-II:
Introduction to AVR Micro-controller: AVR system –AVR family processors, Architecture, Addressing modes, Instruction overview, Branch, call, and Time delay loop, AVR I/O Port Programming.

UNIT-III:
Programming with AVR Micro-controller: Assembly level programming, Higher level language programming, AVR programming in C, Timer programming, Interrupt programming.

UNIT-IV:

Interfacing of I/O Device With AVR Micro-controller: AVR LCD and Keyboard interfacing, ADC, DAC, and different sensor interfacing, relay, Opt isolated interface.

UNIT-V:

Motor Control With AVR Micro-controller: Stepper motor interfacing, Servo motor interfacing, PWM Programming, RTC, PC interface, Data Acquisition system.
Real time Embedded systems using AVR micro controller.
Case studies
DC Motor control, Induction motor control (VSI and CSI fed), UPS Applications, Special machine control (PMBLDC).

TEXT BOOKS:

1. AVR Micro Controller and Embedded Systems: Using Assembly, M. A. Mazidi, S. Naimi
2. Embedded System Architecture: Programming and Design, Rajkamal, TMH, 2007
3. JW Valvano Embedded Micro Computer System: Real Time Interfacing, 1st Edition, Cengage, 2000

REFERENCES:

1. Real Time Systems, Jane W. S. Liu, Prentice Hall, 2000
2. An Embedded Software Primer, David E. Simon, Pearson Education, 1999

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1PS05) POWER QUALITY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Complete knowledge of Power Systems, Power Electronics and Electrical Drives

COURSE OBJECTIVES:

- To get the knowledge on power quality problems and standards
- To get the knowledge on PQ effects on system equipment and loads
- To get awareness on devices introducing harmonics and mitigation methods
- To get the Knowledge of PQ improvement methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on power quality issues and standards and know the severity of PQ problems
CO-2: Analyze the PQ Issues and effects on system equipment and loads
CO-3: Analyze the Harmonics and its mitigation methods
CO-4: Understand the PQ Improvement Methods

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	1	1	1
CO-2	2	2	2	2	1	2
CO-3	2	2	2	2	1	1
CO-4	2	3	3	2	2	2

UNIT- I:
Introduction to Power Quality: Overview of power quality phenomena-classification of power quality Issues- Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients and Interruptions. Power quality measures and Standards Power acceptability curves- IEEE guidelines, EMC standards and recommended practices.

UNIT–II:
Voltage Sags and PQ in Industrial Power Systems: Voltage Sag – Characterization - Single Phase: Voltage sag – definition, causes of voltage sag, voltage sag magnitude, monitoring. Voltage sag calculation in non-radial systems, meshed systems- voltage sag duration. Three Phase: Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags. Modelling of networks and components under non-sinusoidal conditions-transmission and distribution systems-

shunt capacitors- transformers-electric machines -loads that cause power quality problems.

UNIT–III:

Interruptions and PQ Issues in Drives: Short interruptions – definition, origin of short interruptions and monitoring of short interruptions. Long Interruptions– Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions.

Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of PQ problems in AC Drives, adjustable speed DC drives.

UNIT-IV:

Harmonics: Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage vs Current distortion – Harmonics vs Transients – Sources and effects of harmonic distortion – System response characteristics – total harmonic distortion- RMS value of a harmonic waveform, Principles of controlling harmonics – Standards and limitation – important harmonic introducing devices-SMPS-Three phase power converters-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.Passive compensation and passive filters, active filtering – shunt, series and hybrid Filters and their control and d-q domain control of three phase shunt active filters

UNIT–V:

PQ Improvement and Custom Power Devices: Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. Voltage source converter, series voltage controller: Dynamic Voltage Restorer, shunt controller: DSTATCOM, combined shunt and series controller: UPQC.

TEXT BOOKS:

1. Understanding Power Quality Problems, Math H. J. Bollen, IEEE Press
2. Electrical Power Systems Quality, Roger C. Durgan, Mark F. McGranaghan and H. Wayne Beaty, 2nd Edition, Tata McGraw-Hill, 2008
3. Power Quality – Problems and Mitigation Techniques, Bhim Singh, Ambarish Chandra, Kamal Al-Haddad, Wiley Publication

REFERENCES:

1. Power Quality in Electrical Systems, Alexander Kusko and Mark M. Thompson, McGraw Hill
2. Power Quality, Sankaran C., CRC Press, 2002
3. Distribution Reliability and Power Quality, T. A. Sort, Taylor & Francis
4. Electric Power Quality, G. T. Heydt, 2nd Edition, West Lafayette, IN, Stars in a Circle Publication, 1994
5. Power Quality Enhancement Using Custom Power Devices, A. Ghosh, G. Ledwich, Kluwer Academic, 2002

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PS09) EVOLUTIONARY ALGORITHM APPLICATIONS IN POWER ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To get the capabilities of bio-inspired system and conventional methods in solving optimization problems
- To describe the importance of exploration and exploitation of evolutionary algorithm to attain near global optimal solution
- To describe the functioning of various evolutionary algorithms
- To get the various bio-inspired algorithms for Power engineering applications

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Discriminate the capabilities of bio-inspired system and conventional methods in solving optimization problems

CO-2: Examine the importance of exploration and exploitation of evolutionary algorithm to attain near global optimal solution

CO-3: Distinguish the functioning of various evolutionary algorithms

CO-4: Employ various bio-inspired algorithms for Power engineering applications

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	2	2	2
CO-2	3	1	2	1	2	3
CO-3	3	1	2	1	2	3
CO-4	3	1	2	2	2	3

UNIT-I:

Fundamentals of Soft Computing Techniques: Definition-Classification of optimization problems- Unconstrained and Constrained optimization Optimality conditions- Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Single solution based and population based algorithms – Exploitation and exploration in population based algorithms - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi- objective problems.

UNIT-II:

Genetic Algorithm and Particle Swarm Optimization: Genetic algorithms- Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and

mutation operators -Bird flocking and Fish Schooling – anatomy of a particle-equations based on velocity and positions -PSO topologies - control parameters– GA and PSO algorithms for solving ELD problem.

UNIT-III:

Artificial Bee Colony Algorithm and Differential Evolution: Artificial bee colony (ABC) algorithms-binary ABC algorithms – ACO and ABC algorithms for solving Economic Dispatch of thermal units. The Motivation for Differential Evolution (DE), Introduction to Parameter Optimization, Single-Point, Derivative-Based Optimization, Local Versus Global Optimization, Differential Mutation, Recombination, Selection, Benchmarking Differential Evolution, DE Versus Other Optimizers, DE on Parallel Processors

UNIT-IV:

Shuffled Frog-Leaping Algorithm and Bat Optimization Algorithm: Bat Algorithm-Echolocation of bats- Behavior of microbats- Acoustics of Echolocation- Movement of Virtual Bats- Loudness and Pulse Emission- Shuffled frog algorithm-virtual population of frogs-comparison of memes and genes -memeplex formation- memeplex updation - BA and SFLA algorithms for solving ELD and optimal placement and sizing of the DG problem.

UNIT-V:

Multi Objective Optimization: Multi-Objective optimization Introduction- Concept of Pareto optimality - Non-dominant sorting technique-Pareto fronts-best compromise solution-min-max method-NSGA-II algorithm and applications.

TEXT BOOKS:

1. Recent Advances in Swarm Intelligence an Evolutionary Computation, Xin-She Yang, 1st Edition, Springer International, 2015
2. Multi-Objective Optimization using Evolutionary Algorithms, Kalyanmoy Deb, 1st Edition, John Wiley & Sons, 2001

REFERENCES:

1. Swarm Intelligence-From natural to Artificial Systems, Eric Bonabeau, Marco Dorigo and Guy Theraulaz, Oxford University Press, 1999
2. Swarm Intelligence, James Kennedy and Russel E. Eberheart, The Morgan Kaufmann Series in Evolutionary Computation, 2001
3. Artificial Intelligence and Intelligent Systems, N. P. Padhy, Oxford University Press, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PL07) ADVANCED CONTROL TECHNIQUES FOR POWER ELECTRONICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To get the understanding of different types of converter model and its usage
- To get the fractional version and resonant controller for converters
- To get the understanding of fractional version and resonant controller for converters
- To apply fuzzy logic and AI techniques for converters and drives

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand and analyze the different types of converter model and its usage

CO-2: Design the advanced PID controller with its fractional version and resonant controller for converters

CO-3: Design the robust controller for converter using the loop-shaping methods and the Sliding mode control

CO-4: Apply fuzzy logic and AI techniques based controllers for drives

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	1	1
CO-2	3	1	3	3	1	2
CO-3	3	1	3	2	2	2
CO-4	3	1	3	2	3	3

UNIT-I:

Modeling of Power Converters: Types of Models- Linearized Averaged models- Large signal and Small signal models- Switched models- Relation between various model types- Control goals in converter operation- Review of classical control methods.

UNIT-II:

Advanced PID Controller: PID controller-Tuning methods of PID controller- Set point weighting- Integrator Windup- Controller degrees of freedom- Model based Design methods: Direct Synthesis (DS) method, Internal Model Control (IMC) method- Fractional Control System (FOS) -Design of Fractional PID controller- Case Study: PID controller design for DC-DC boost converter.

UNIT-III:

Resonant Controller: Necessity of resonant controller- Principle of Proportional Resonant (PR) control- Design methods of PR controller- Example of PR controller design for DC-DC boost converter.

UNIT-IV:

Loop-Shaping Design: Concept of Loop shaping- Robust controller design using the loop shaping methods: H∞ Control, Quantitative feedback theory (QFT)- Case Study: Loop shaping methods to design the robust controller for DC-DC converter.

UNIT–V:

Sliding Mode Controller (SMC): Nonlinear control preliminaries-Types of Uncertainty-Sliding surface design- Stability of SMC- Equivalent control concept- Integral Sliding Mode Control (ISMC) design-

Case Study: Application of SMC to design the robust controller for DC-DC converter.

Fuzzy logic control and artificial Intelligence (AI) techniques: Introduction to fuzzy logic and AI techniques, application of fuzzy logic to power converters and electric drives, hardware system description, application of AI techniques to electric machines and drives.

TEXT BOOKS:

1. Power Electronic Converters Modeling and Control with Case Studies, S. Bacha, I. Munteanu, A. I. Bratcu, 1st Edition, Springer-Verlag, 2014
2. PID and Predictive Control of Electrical Drives and Power Converters using MATLAB/Simulink, L. Wang, S. Chai, D. Yoo, L. Gan, K. Ng, 1st Edition, Wiley Press, 2015
3. Robust Linear Control of DC-DC Converters: A Practical Approach to the Synthesis of Robust Controllers, C. Olalla, Ramon Leyva, I. Queinnec, 1st Edition, VDM Verlag-Dr. Muller, 2010

REFERENCES:

1. Sliding Mode Control of Switching Power Converters: Techniques and Implementation, S. C. Tan, Y. M. Lai, C. K. Tse, 1st Edition CRC Press, 2012
2. Control Design Techniques in Power Electronic Devices, Hebertt Sira-Ramirez, Ramon Silva- Ortigoza, 1st Edition, Springer- Verlag London, 2006
3. Control of Power Electronic Converters and Systems, Freede Blaabjerg, 1st Edition, Academic Press, 2018
4. Control of Power Inverters in Renewable Energy and Smart Grid Integration, Q. C. Zhong, T. Hornik, 1st Edition, Wiley Press, 2013
5. Sliding Mode controllers for Power Electronic Converters, A. Mehta, B. Naik, Springer Nature, 2019

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PL08) ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics

COURSE OBJECTIVES:
- To enumerate sources of electromagnetic interferences
- To design EMI filter for insertion loss and for switch mode power supplies
- To understand concept of Faraday screens for EMI Prevention

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Recognize the sources of conducted and radiated EMI in power electronic Converters and consumer appliances and suggest remedial measures tomitigate the problems
CO-2: Assess the insertion loss and design EMI filters to reduce the loss
CO-3: Design EMI filters, common-mode chokes and RC-snubber circuits measures to keep the interference within tolerable limits

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	2	2	2
CO-2	3	-	3	1	2	3
CO-3	3	1	3	1	3	3

UNIT-I:
Introduction: Sources of conducted and radiated EMI, EMC standardization and description, measuring instruments, conducted EMI references, EMI in power electronic equipment: EMI from power semiconductors circuits.

UNIT-II:
Noise Suppression in Relay Systems: AC switching relays, shielded transformers, capacitor filters, EMI generation and reduction at source, influence of layout and control of parasites.

UNIT-III:
EMI Filter Elements: Capacitors, choke coils, resistors, EMI filter circuits. Ferrite breeds, feed through filters, bifilar wound choke filter, EMI filters at source, EMI filter at output.
EMI Filter Design for Insertion Loss: Worst case insertion loss, design method for mismatched impedance condition and EMI filters with common mode choke-coils, IEC standards on EMI.

UNIT-IV:

EMI in Switch Mode Power Supplies: EMI propagation modes, power line conducted-mode inference, safety regulations (ground return currents), Power line filters, suppressing EMI at sources, Line impedance stabilization network (LISN), line filter design, common-mode line filter inductors- design& example, series –mode inductors and problems, EMI measurements.

UNIT-V:

Faraday Screens for EMI Prevention: As applied to switching devices, transformers faraday screen and safety screens, faraday screens on output components, reducing radiated EMI on gapped transformer cores, metal screens, electrostatic screens in transformers.

TEXT BOOKS:

1. Electromagnetic Compatibility in Power Electronics, Laszlo Tihanyi, IEEE Press
2. EMI Filter Design Pullen, Timotty M., Ozenbaugh N., Richard Lee, CRC Press, Taylor & Francis
3. Practical Design for Electromagnetic Compatibility, R. F. Ficchi, Hayden Book Co.

REFERENCES:

1. Handbook on Switch-Mode Power Supplies, Keith H. Billings, McGraw-Hill, 1989

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PL09) ARTIFICIAL INTELLIGENCE TECHNIQUES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Control Systems, Power Systems, Electrical Drives

COURSE OBJECTIVES:

- To locate soft commanding methodologies, such as artificial neural networks, fuzzy logic and genetic algorithms
- To observe the concepts of feed forward neural networks and about feedback neural networks
- To practice the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy control
- To analyze genetic algorithm, genetic operations and genetic mutations

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Quote feed forward neural networks and learning and understanding of feedback neural networks
CO-2: Generalize fuzziness involved in various systems and fuzzy set theory
CO-3: Examine genetic algorithm and applications in electrical engineering
CO-4: Understand concept of hybrid AI techniques

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	1	-	2	1
CO-2	2	1	1	-	2	1
CO-3	2	1	1	-	2	1
CO-4	3	1	2	-	2	1

UNIT-I:
Artificial Neural Networks: Introduction to AI, biological foundation to intelligent systems. Artificial Neural Network: architecture, learning process, learning rules. **Training Algorithms:** LMS algorithm, Back-propagation algorithm. Radial basis network-covers theorem, generalized radial basis function networks, estimation of regularization parameter.

UNIT-II:
Fuzzy Logic: Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets –Operations on Fuzzy relations – Min Max operations - Fuzzification, Membership value assignment, development of rule base and decision making system, De-fuzzification to crisp sets, De-fuzzification methods.

UNIT-III:

Genetic Algorithm: 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 - Problems on optimization-Algorithm.

UNIT-IV:

Neuro-Fuzzy Systems: Fuzzy associative memories; Fuzzy rule generation using neural net approaches, Fuzzy neural networks; adaptive neuro-fuzzy inference systems (ANFIS); neuro-fuzzy control.

System/process identification using neural networks, system identification using fuzzy models: Mamdani Model, Takagi-Sugeno model

UNIT-V:

Applications of AI Techniques: Control and Process Monitoring, fault diagnosis and load forecasting, Function Approximation, – Load flow studies – Economic load dispatch – Load frequency control –Single area system and two area system – Position and speed control of DC and AC Motors.

TEXT BOOKS:

1. An Introduction to ANN, J. M. Zurada, Jaico Publishing House
2. Neural Networks, Simon Haykins, Prentice Hall
3. Neural Networks, Fuzzy Logic & Genetic Algorithms, S. Rajasekaran and G. A. V. Pai, PHI, 2003

REFERENCES:

1. Neural Network & Fuzzy System, Bart Kosko, Prentice Hall, 1992
2. Neural Computing Theory & Practice, P. D. Wasserman, Van Nostrand, Reinhold, 1989
3. Fuzzy Sets, Uncertainty and Information, G. J. Klir and T. A. Folger, PHI, 1994
4. Genetic Algorithms, D. E. Goldberg, Addison Wesley 1999
5. Neural Networks, Satish Kumar, Tata McGraw Hill

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PL10) POWER CONVERTERS AND CONTROL TECHNIQUES FOR MICROGRIDS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the microgrid architectures and their standards
- To model the power electronic converters in microgrid applications
- To develop power converters and control techniques for micro grid applications
- To evaluate dynamics and stability of microgrids

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Compare types of microgrid architectures and their standards
CO-2: Modeling of power electronic converters in microgrid applications
CO-3: Develop power converters and control techniques for micro grid applications
CO-4: Evaluate dynamics and stability of microgrids

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	1	3	2	3
CO-2	3	2	1	3	2	3
CO-3	3	1	1	1	2	1
CO-4	1	2	1	3	2	2

UNIT-I:

Micro-Grid: Power system resilience, The concept of micro-grids, Types of micro-grids, Autonomous and non- autonomous grids, Sizing of micro-grids, Microgrid Modeling &Analysis, Micro-grids with multiple DGs. Standards and regulation issues associated with AC&DC microgrids, Comparison between AC and DC Microgrids.

UNIT-II:

Micro-Grid Control: Centralized control, Hierarchical principle: Primary, secondary and tertiary control – Distributed control, Protection issues and Communication based techniques.

UNIT-III:

Modeling of Power Electronic Converters in Micro-Grid Application: Modeling of voltage source PWM rectifier, modeling of voltage source inverter in current controlled mode and voltage controlled mode, modelling of boost DC-DC converter and its control, modeling of isolated bidirectional DC-DC converter and its control.

UNIT-IV:

Micro-Grid Dynamics: Modeling of AC & DC microgrid and its dynamic studies.

Control of grid connected inverter in AC Microgrid: Basics of Voltage-frequency control and P-Q control in AC microgrid, control of grid-forming inverter, control of grid-feeding inverter, control of grid- supporting power inverter, synchronization of inverters in ac microgrids.

UNIT-V:

Control of DC-DC Converter in DC Micro-Grid: Voltage control and power control in DC microgrid, control of parallel DC-DC converters in a DC microgrid.

Linear and Nonlinear Stability System in AC & DC Micro-Grid System: Models and stability analysis of AC&DC Microgrid, stabilization strategies-impedance and admittance stability criteria, stabilization using nonlinear techniques-feedback linearization and sliding mode control, intelligent control of microgrids-fuzzy logic control and ANN control. Future Perspectives.

TEXT BOOKS:

1. Microgrid Technology and Engineering Application, Fusheng Li, Ruisheng Li, Fengquan Zhou, Elsevier, 2015
2. Microgrids and Active Distribution Networks, S. Chowdhury, P. Crossley, Institution of Engineering and Technology, 2009
3. Microgrids Architectures and Control, Nikos Hatziargyriou, John Wiley, 2014
4. Microgrid Dynamics and Control, Hassan Bevrani, Bruno François, Toshifumi Ise, John Wiley, 2017

REFERENCES:

1. Intelligent Control and Power Flow Optimization, Manuela Sechilariu, Fabrice Locment, Urban DC Microgrid, Butterworth-Heinemann, 2016
2. Distributed Generation Systems: Design, Operation and Grid Integration, Gevork B., Gharehpetian S., Mohammad Mousavi Agah, Butterworth Heinemann, 2017
3. IEEE Transactions

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1PS06) FLEXIBLE AC TRANSMISSION SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics, Power Systems, Reactive Power Control

COURSE OBJECTIVES:
- To learn the active and reactive power flow control in power system
- To understand the need for static compensators
- To develop the different control strategies used for compensation
- To understand the need of custom power devices and applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge of reactive power control and objectives of FACTS Controller in power systems
CO-2: Understand the working and control of shunt Controllers
CO-3: Access the working and control of series controllers
CO-4: Analyze the modelling of FACTS device and understand the functioning of Hybrid devices

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	2	1	1
CO-2	2	3	3	2	2	2
CO-3	2	3	3	2	2	2
CO-4	1	2	2	2	1	1

UNIT- I:
Introduction to Facts Controllers: Transmission inter connections, power and Reactive power flow control in AC transmission system, loading capability limits, constraints of maximum transmission loading and dynamic stability considerations. Uncompensated and compensated lines, relative importance of controllable parameters. Classification of FACTS controller based on type of connection, relative importance of different types of controllers and benefits of FACTS technology.

UNIT-II:
Objectives of Static Compensation: Objectives of Shunt compensation – midpoint voltage regulation, voltage instability precaution – importance of Transient Stability – Power Oscillation damping. Objectives of series compensation – Improvement of Transient Stability and Voltage Stability – Power Oscillation Damping – Methods of

controllable var generation – variable impedance type static var generations, switching converter type var generations and hybrid var generations.

UNIT-III:

SVC and STATCOM: Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM - Operation and control of TCR, TSC, FC-TCR and TSC-TCR type SVCs and STATCOM - Compensator control. Comparison between SVC and STATCOM.

UNIT-IV:

Static Series Compensators: Variable impendence type FACTS controllers - GCSC, TSSC and TCSC and their control schemes. Switching converter type FACTS controllers: SSSC and its control. Static voltage and phase angle regulators – TCVR and TCPAR Operation and Control –Applications.

UNIT-V:

UPFC, IPFC & Modelling: Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPFC.

Basic Principle of P and Q control- Independent real and reactive power flow control- Applications. Introduction to interline power flow controller: basic operation and characteristics. Transfer function and dynamic response of SVG, implementation of regulation slope for SVG, Control circuit implementations for transient stability, power oscillation damping and var reserve control for SVG.

TEXT BOOKS:

1. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, N. G. Hingorani, L. Gyugyi, IEEE Press Book, Standard Publishers and Distributors, 2001
2. FACTS Controllers in Power Transmission and Distribution, K. R. Padiyar, New Age International, 2007

REFERENCES:

1. Flexible AC Transmission Systems-Modeling and Control, X. P. Zhang, C. Rehtanz, B. Pal, Springer Verlag, 2006
2. Static Reactive Power Compensation, T. J. E. Miller, John Wiley, New York, 1982
3. FACTS Controllers & Applications, K. S. Suresh Kumar, S. Ashok, E-book Edition, Nalanda Digital Library, NIT Calicut, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PL11) DESIGN OF POWER ELECTRONIC CONVERTERS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To apply numerical methods to develop simulation software for power electronic systems
- To carry out transient simulation for power electronic systems
- To apply switching functions to describe switching states of power converters
- To develop effective models for power electronic converters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply numerical methods to develop simulation software for power electronic systems
CO-2: Carry out transient simulation for power electronic systems
CO-3: Apply switching functions to describe switching states of power converters
CO-4: Develop effective models for power electronic converters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	3
CO-2	3	1	3	3	1	2
CO-3	3	1	3	3	1	2
CO-4	3	1	3	3	1	3

UNIT-I:

Introduction: Computation challenges - Simulation process - mechanics of simulation, Solution techniques for time domain analysis -Equation solvers, circuit-oriented simulators.

UNIT-II:

Simulation of Power Electronic Converters: MNA and ST Approaches- Nodal Analysis, Modified Nodal Analysis, Spare Tableau Approach, Nonlinear Circuits - Newton-Raphson Method, Computation Time, Convergence Issues, Nonlinear Circuit Equations.

UNIT-III:

Transient Simulation: Introduction, Discretization of Time, Transient Analysis, Accuracy and Stability, Explicit and Implicit Schemes, Methods for Transient Simulation - FE, BE and TRZ, Transient Analysis in Circuit Simulation, Equivalent Circuit Approach: RC Circuit, Buck Converter; Some Practical Aspects: Undamped Oscillations, Ringing,

Global Error in Switching Circuits, Round-off Error, Assessment of Accuracy, Singular Matrix Problem, Trapezoidal integration, M & N method for simulating power electronic converters (with buck converter as a representative example).

UNIT-IV:

Switching Function: Introduction, Application of the switching function technique, Properties of the switching function, Voltage-Current relations in switched circuits - Single Switch, Parallel Switch. Pulse Width Modulation Modeling- Unipolar, PWM Signal of a composite function, bipolar square wave modulation, Mathematical Modeling of Buck Converter, Modeling using switching function-buck converter, Rectifier, 3-phase VSI inverter, matrix converter, m-phase rectifier. PWM rectifier topologies

UNIT-V:

Modeling of power electronic converters - PWM rectifier in different frames- abc, alpha-beta and d-q using switching function, Inverters.

TEXT BOOKS:

1. Simulation of Power Electronic Converters, M. B. Patil, V. Ramnarayanan, V. T. Ranganathan, 1st Edition, Narosa Publishers, 2010
2. State Variables For Engineers, De Russo, P. M., Roy, R. J., Close, C. M., Desrochers, A., 2nd Edition John Wiley, 1998

REFERENCES:

1. Power Electronics: Converters, Applications, N. Mohan, T. M. Undeland, W. P. Robbins,3rd Edition, John Wiley, 2009
2. Mathematical modeling and digital simulation for engineers and scientists, Smith, J. M, John Wiley, New York, 1987, 2nd Edition

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/108/108108034/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2PL03) ADVANCED POWER ELECTRONIC CONVERTERS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Power Electronic Converters

COURSE OBJECTIVES:

- To implement multilevel converter topologies
- To perform closed loop control of DC DC converters
- To implement various isolated and non isolated power electronic converters
- To perform soft switching of power electronic converters
- To compare behaviour of PV systems at different conditions

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Demonstrate multi-level inverter/converter topologies in simulation environment

CO-2: Design the Closed loop controller for DC DC converters in simulation environment

CO-3: Implement various resonant power electronic converters in simulation environment

CO-4: Identify maximum power point of PV system in simulation environment

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	1	1	1	3
CO-2	2	1	2	3	1	3
CO-3	3	1	1	3	1	3
CO-4	1	1	3	1	1	3

LIST OF EXPERIMENTS:

1. Single phase diode clamped Multilevel inverter.
2. Single phase flying capacitor Multilevel inverter
3. Single phase cascaded Multilevel inverter
4. Push pull converter
5. Fly back converter
6. Forward converter
7. Series resonant converter
8. Parallel resonant converter
9. Zero voltage switching resonant converters
10. Zero current switching resonant converters

11. Closed loop implementation of buck and boost dc-dc converters. (a) Design of various elements such as inductor, capacitor for continuous current operation. (b) Small signal state space modeling. (c) Dynamic response with change in load.
12. Characteristics of solar PV Systems, Maximum Power Point Tracking Charge Controllers

Note: Conduct the above experiments using any simulation tool

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2PL04) POWER ELECTRONIC CONVERTER AND APPLICATIONS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Power Electronics

COURSE OBJECTIVES:
- To perform digital control of DC and AC machines
- To implement PWM generation using digital controllers
- To identify the Maximum power point of PV systems at different conditions
- To perform digital control of power electronic converters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Implement closed loop control of DC machines
CO-2: Execute digital control of AC machines
CO-3: Demonstrate Maximum power point tracking of PV systems at different conditions
CO-4: Demonstrate PWM generation using digital controllers for power electronic Converters

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	3	1	2
CO-2	1	-	2	3	2	1
CO-3	2	-	1	3	1	3
CO-4	2	-	1	3	1	3

LIST OF EXPERIMENTS:

1. To study single phase (i) fully controlled (ii) halfcontrolled bridge rectifiers with resistive and inductive loads.
2. To Study the operation of IGBT /MOSFET Based DC-DC Converters. (Buck Converter & Boost Converter)
3. To study single phase cyclo-converter.
4. To study MOSFET / IGBT based Three-phase bridge inverters.
5. Thyristorised drive for PMDC Motor with speed measurement and closed Loop control.
6. Thyristorised drive for 1Hp DC motor with closed loop control.
7. 3-Phase input IGBT, 4 quadrant chopper drive for DC motor with closed Loop control equipment.
8. Characteristics of solar PV panel

9. PWM signal generation using digital controller
10. Speed control of Three Phase induction Motor

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4PL02) MINI-PROJECT

TEACHING SCHEME

L	T/P	C
0	4	2

CIE	SEE	TOTAL
40	60	100

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the formulated industry / technical / societal problems
CO-2: Analyze and / or develop models for providing solution to industry / technical / societal problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo a mini-project during II semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the project work, submit it to the department in a prescribed report form and shall make an oral presentation before the departmental Project Review Committee.
- Evaluation of the mini-project shall consist of CIE and SEE and shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- CIE shall be carried out for 40 marks on the basis of review presentation as per the calendar dates and evaluation format.
- SEE shall be carried out at the end of semester fpr 60 marks on the basis of oral presentation and submission of mini-project report.
- Prior to the submission of mini-project report to the PRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The mini-project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22MN6HS02) ANCIENT WISDOM

TEACHING SCHEME

L	T/P	C
2	0	0

EVALUATION SCHEME

SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology
- To trace, identify and develop the ancient knowledge systems
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Familiarize learners with major sequential development in Indian science, engineering and technology

CO-2: Understand eco-friendly, robust and scientific planning and architecture system of ancient India

CO-3: Trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge

CO-4: Understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within

UNIT-I:

Indian Science & Technology: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)

Ancient Architecture:

Scientific Achievements though Ancient Architect: Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79oE 41'54, Veerbhadra temple with 70 hanging pillars

UNIT-II:

Foundation Concept for Science and Technology: The Introduction to Ancient Mathematics & Astronomy Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, 22 bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system,

Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System

UNIT-III:

Humanities & Social Sciences: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

UNIT-IV:

Aspiration and Purpose of Individual and Human Society: Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha.

Individual Level:

Program for Ensuring Human Purpose:

Fundamental Concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul).

The True Constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana

Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. the six cleansing procedures of Yoga, understanding of Indian psychological concept, consciousness, tridosha & triguna.

UNIT-V:

Five Important Slokas for Enlightenment

Gayatri Mantram, Santi Mantram: Asatoma Sadgamaya, Geeta (Yada Yadahi Dharmasya, Glanirbhavati Bharata), Amanitwam Adambitwam.., Karmanyevadikarastu… Maa phaleshukadachana

TEXT BOOKS:

1. Textbook on Indian Knowledge Systems, Prof. B Mahadevan, IIM Bengaluru
2. Indian Knowledge Systems, Kapur K. and Singh A. K., 2005

REFERENCES:

1. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
2. Value and Distribution System in India, B. L. Gupta, Gyan Publication House
3. Ancient Indian Culture and Civilization, Reshmi Ramdhoni, Star Publication, 2018
4. Ancient Indian Society, Maharaj Swami Chidatmanjee, Anmol Publication
5. Ancient Indian Classical Music, Lalita Ramkrishna, Shubhi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1PL12) CONTROL AND INTEGRATION OF RENEWABLE ENERGY SOURCES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To get the Knowledge on dynamic and static energy conversion technologies
- To control and integration on renewable energy systems with grid

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand different renewable energy sources and storage devices
CO-2: Model and simulate renewable energy sources
CO-3: Analyze and simulate control strategies for grid connected and off-grid systems
CO-4: Develop converters to comply with grid standards to obtain grid integration

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	1	3	2
CO-2	3	2	2	3	1	3
CO-3	1	2	3	3	3	2
CO-4	3	2	1	2	3	2

UNIT-I:

Introduction: Electric grid, Utility ideal features, Supply guarantee, power quality, Stability and cost; Importance & Effects of Renewable Energy penetration into the grid, Boundaries of the actual gridconfiguration, Consumption models and patterns.

UNIT-II:

Dynamic Energy Conversion Technologies: Introduction, types of conventional and nonconventional dynamic generation technologies, principle of operation and analysis of reciprocating engines, gas and micro turbines, hydro and wind-based generation technologies.

UNIT-III:

Static Energy Conversion Technologies: Introduction, types of conventional and nonconventional static generation technologies; Principle of operation and analysis of fuel cell, photovoltaic systems and wind generation technologies; MPPT techniques and its classifications, principle of operation and partial shading effects; Storage Technologies - batteries, fly wheels, super capacitors and ultra-capacitors.

UNIT-IV:

Control Issues and Challenges: Linear and nonlinear controllers, predictive controllers and adaptive controllers, Load frequency and Voltage Control, PLL, Modulation Techniques, Control of Diesel, PV, wind and fuel cell based generators, Dimensioning of filters, Fault-ride through Capabilities.

UNIT-V:

Integration of Energy Conversion Technologies: Introduction & importance, sizing, Optimized integrated systems, Interfacing requirements, Distributed versus Centralized Control, Grid connected Photovoltaic systems –classifications, operation, merits & demerits; Islanding Operations, stability and protection issues, load sharing, operation & control of hybrid energy systems, Solar Photovoltaic applications. IEEE & IEC codes and standards for renewable energy grid integrations.

TEXT BOOKS:

1. Renewable and Efficient Electric Power Systems, G. Masters, , 2nd Edition, IEEE-John Wiley, 2013
2. Microgrids and Active Distribution Networks, S. Chowdhury, S. P. Chowdhury, P. Crossley, IET Power Electronics Series, 2012
3. Integration and Control of Renewable Energy in Electric Power System, Ali Keyhani Mohammad Marwali and Min Dai, 2nd Edition, John Wiley, 2010

REFERENCES:

1. Fundamentals, Technologies & Applications, Chetan Singh Solanki, Solar Photovoltaic, 3rd Edition, PHI, 2019
2. Control of Power Inverters in Renewable Energy and Smart Grid Integration, Quing Chang Zhong, 1st Edition, IEEE-John Wiley, 2013
3. Power Conversion and Control of Wind Energy Systems, Bin Wu, Yongqiang Lang, Navid Zargari, 1st Edition, IEEE-John Wiley, 2011
4. Report on Large Scale Grid Integration of Renewable Energy Sources - Way Forward Central Electricity Authority, GoI

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PC1CP05) INTERNET OF THINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce the terminology, technology, concept of M2M (machine to machine) and its applications
- To introduce the Python scripting language which issued in many IoT devices
- To introduce the IOT in different domains, system management with NETCONF-YANG
- To introduce the hardware and working principles of various sensors used for IoT
- To introduce the Raspberry PI platform, design and implementation of web application frame work used in IoT applications

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understanding the physical and logical design of the Internet of Things, IoT & M2M

CO-2: Analyzing various applications of Internet of Things in various domain, NETCONF-YANG

CO-3: Creating Logical Design of IoT systems using Python

CO-4: Understanding the hardware and working principles of various sensors used for IoT,

CO-5: Creating web application framework design using Raspberry PI platform and restful web API

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	2	2	3
CO-2	3	1	2	2	3	3
CO-3	1	1	2	2	2	3
CO-4	2	2	2	2	2	2
CO-5	1	2	3	3	2	2

UNIT–I:

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT –IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies –Wireless Sensor Networks, Cloud Computing, Bigdata analytics, Communication protocols, Embedded Systems, IoT Levels and Templates.

IOT and M2M: Introduction, M2M, Difference between IOT and M2M, SDN and NFV for IOT

UNIT–II:

Domain Specific IoTs: Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

System Management with NETCONF-YANG: Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG

UNIT–III:

Introduction To Python: Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages -JSON,XML, HTTPLib, URLLib, SMTPLib

UNIT-IV:

IoT Physical Devices and Endpoints: Introduction to Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), and Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework designing a RESTful web API

UNIT-V:

Controlling Hardware: Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, Using unipolar and bipolar Stepper motors

Digital input- Sensing push switch, pull-up and pull-down resistors, Rotary encoder, Using keypad, Using RTC Sensors: Light sensor, temperature sensor with thermistor, voltage sensor, ADC and ADC, Temperature and Humidity Sensor DHT11, Read Switch, Distance Measurement with ultrasound sensor

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014
3. Raspberry Pi Cookbook, Software and Hardware Problems and Solutions, Simon Monk, O'Reilly (SPD), 2016

REFERENCES:

1. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, Wiley, 2014
2. The Internet of Things, Samuel Greengard, MIT Press, Cambridge, 2015
3. Internet of Things: Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufman, 2016

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1PL13) ENERGY STORAGE TECHNOLOGIES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand non electrical storage technologies available
- To understand electro-chemical secondary batteries characteristics
- To understand efficiency improvement techniques in storage systems
- To appreciate various applications of storage systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Learn mechanical, magnetic and electrostatic storage systems
CO-2: Enumerate merits and demerits of various secondary batteries
CO-3: Study characteristics of Lead acid batteries
CO-4: Improve the efficiency of storage systems
CO-5: Apply knowledge on storage technologies in EV and Power systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	3	1	3	1
CO-2	2	2	2	1	1	1
CO-3	1	2	1	3	1	2
CO-4	1	1	1	2	3	3
CO-5	3	3	3	3	3	3

UNIT-I:

Non Electrical Storage Systems: Flywheel, Energy Relations, Flywheel System Components, Benefits of Flywheel over Battery, Superconducting Magnet Energy Storage, Compressed Air Energy storage, Overview Thermal Energy Storage. Capacitor bank storage, Comparison of storage Technologies.

Electro Chemical Storage: History, General battery concepts- Types of Batteries- Primary, seconday- Battery Vs Cell, Nickel-Cadmium -Nickel-Metal Hydride, Nickel hydrogen, Lithium-Ion- Lithium-Polymer, Fuel cells.

UNIT-II:

Charging Technologies and Testing: Discharge Characteristics, Charging-Importance-characteristics-charge acceptance-over charging, Types of charging- Constant voltage charging- Constant current charging- Taper charging-special charging-Charging power sources, storage, Testing, safety.

UNIT –III:

Specifications and Characteristics: Domains of applications of Energy storage- Starter-Traction-stationary-mobile or nomadic, Review of storage requirements, Definitions of characteristics, Terminology of States, Battery Design, Battery Charging, Charge Regulators, Battery Management, General Equivalent Electrical Circuit, Performance Characteristics.

UNIT –IV:

Efficiency Improvement Methods: Hybrid Electrical Energy storage– Design Considerations- Architecture- Charge management- components Modeling of Power Conversion, Reconfigurable EES Array Architecture, Cycle Efficiency and Capacity Utilization of EES Bank, General Bank Reconfiguration Architecture, Dynamic Reconfiguration Algorithm, Cycle Efficiency and Capacity Utilization Improvement.

UNIT–V:

Storage Applications: Electric Vehicle application- Regenerative Brake- PV module assistance-Storage bank reconfiguration- Overall cost analysis, Energy storage in Transient regimes of Power system-Problem formulation-modeling- steady tate stability analysis with storage-storage Parameters to ensure transient stability, Battery rating calculations for standalone system.

TEXT BOOKS:

1. Energy Storage for Power Systems, A. Ter-Gazarian, Peter Peregrinus Ltd., 1994
2. Design and Management of Energy-Efficient Hybrid Electrical Energy Storage Systems, Younghyun Kim, Naehyuck Chang, Springer, 2014
3. Rechargeable Batteries Applications Handbook, EDN Series for Design Engineers, Elsevier

REFERENCES:

1. Lithium Batteries and Other Electrochemical Storage Systems, Christian Glaize, Sylvie Geniès
2. Wind and Solar Power Systems, Mukund R. Patel, 2nd Edition, CRC Press, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1PL14) ENERGY CONSERVATION AND AUDITING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Energy Systems and Power Systems

COURSE OBJECTIVES:

- To have acquaintance with Energy Conservation act and to understand energy management principles
- To use energy efficient technologies like energy efficient motors and transformers
- To understand the methods of energy audits
- To know the operation of energy audit equipment

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the current energy scenario and importance of energy conservation

CO-2: Implement different energy management strategies

CO-3: Apply various electrical energy efficient technologies

CO-4: Carry out energy audits in industrial and lighting sectors

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	2	-	2	1	1
CO-2	2	3	1	3	2	2
CO-3	1	3	2	3	2	2
CO-4	2	2	-	3	2	2

UNIT–I:

Energy Scenario and Energy Management: Energy Conservation and its importance, long term energy scenario, energy pricing, reforms in energy sector, energy security, salient features of Energy Conservation Act-2001.

Principles of Energy management, Qualities and Functions of energy manager, checklist for top management, questionnaire

UNIT–II:

Principles of Energy Audit: Energy audit- concept and definitions, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy, conservation schemes- Energy audit of process industries and thermal power station- energy saving potential, calculation of simple payback method, net present worth method

UNIT–III:

Energy Efficiency in Electrical Systems: Electricity billing/tariff, electrical Load management, Maximum Demand Control, Power factor improvement, its benefits, selection and location of capacitors, Automatic Power Factor controllers

UNIT–IV:

Electrical Energy Efficient Technologies: 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

Soft starters with energy saver-comparison with conventional starters, variable speed drives, energy efficient transformers, use of amorphous core, electronic ballast, use of low frequency induction motors

UNIT–V:

Energy Audit in Illumination and Energy Audit Instruments: Design and practice of good lighting system, energy efficient lighting control, light energy audit, use of CFL,

Energy audit instruments: watt-meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers

Case Studies: Energy audit in Transmission and Distribution Systems

TEXT BOOKS:

1. Energy Management, W. R. Murphy & G. Mckay, Butterworth-Heinemann
2. Energy Management, Paul O' Callaghan, 1st Edition, McGraw Hill Book, 1998

REFERENCES:

1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker, 1995
2. Energy Management Handbook, W. C. Turner, John Wiley
3. Energy Management and Good Lighting Practice: Fuel Efficiency, Booklet12, EEO
4. Guide Books for National Certification Examination for Energy Manager, Energy Auditor Books 1 and 3
5. Utilization of Electrical Energy and Conservation, S. C. Thripathy, McGraw Hill, 1991

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1PL15) HVDC TRANSMISSION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Power Electronics, Power Systems

COURSE OBJECTIVES:

- To comprehend the conversion principles of HVDC transmission
- To do analysis of 3, 6, 12 pulse converters, rectifier and inverter operations of HVDC converters
- To identify the different types of Harmonics and reduction by using filters
- To comprehend interaction between HVAC and DC systems in various aspects
- To appreciate the reliable MTDC systems and protection of HVDC system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Expose the students to the state of the art HVDC technology
CO-2: Knowledge of modeling and analysis of HVDC system for inter-area power flow regulation
CO-3: Appreciate the reliable Multi terminal HVDC system
CO-4: Have knowledge on the Protection of HVDC systems against transient over voltages and over currents

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	3	1	2
CO-2	1	1	3	3	1	2
CO-3	2	2	2	1	2	3
CO-4	2	2	1	2	3	1

UNIT-I:
HVDC Technology: Historical development in DC Transmission, Advantages & Disadvantages of DC Transmission over Ac Transmission, DC Transmission Systems: Mono-polar, bi-polar and homo-polar lines, back-to-back HVDC systems, Components of HDVC Transmission System, Main applications of DC Transmission.

UNIT-II:
Analysis HVDC Converters: Rectifier and Inverter operation, analysis of 6 and 12 pulse converters, Characteristics and non-characteristics harmonics filter design.
HVDC System Control: choice of converter configuration any pulse number, Constant current control, constant excitation angle control, VDCOL, constant ignition angle

control, Individual phase control and equidistant pulse control; Fault development and protection.

UNIT-III:

MTDC Systems: Introduction-Potential applications of MTDC systems, Types of MTDC systems-Comparison, multi-terminal HVDC systems, control and protection of MTDC systems.

UNIT-IV:

Power Flow Analysis in HVDC Systems: Introduction, DC system model, Basic model of the converter, converter equations, per unit system for DC quantities, DC Network equations, DC control equations.

UNIT-V:

Standards for Testing & Measurements in HVDC Systems: Introduction to relevant national and international standards-IEC, IEEE, CIGRE, safe clearances for HV, Study regulations for HV tests, Digital techniques in HV measurements.

TEXT BOOKS:

1. High Voltage Direct Transmission, J. Arrillaga, Peter Peregrinus, 1983
2. HVDC Power Transmission Systems, K. R. Padiyar, Wiley Eastern, 1990

REFERENCES:

1. Direct Current Transmission, E. W. Kimbark, Vol. I, Wiley Interscience, 1971
2. Power Transmission, Erich Uhlmann, Direct Current, B. S. Publications, 2004
3. EHVAC and HVDC Transmission Engineering Practice, Theory, Practice and Solved Problems, Felix A. Farret, M. S. Rao, Khanna Publishers, 1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1CN01) BUSINESS ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the role of business analytics within an organization and to analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making and to become familiar with processes needed to develop, report, and analyze business data
- To use decision-making tools/Operations research techniques and to manage business process using analytical and management tools
- To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of data analytics

CO-2: Think critically in making decisions based on data and deep analytics

CO-3: Use technical skills in predicative and prescriptive modeling to support business decision-making

CO-4: Translate data into clear, actionable insights

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	1	-	1	1
CO-2	3	-	2	-	1	2
CO-3	2	1	1	-	1	1
CO-4	1	2	1	-	1	1

UNIT-I:

Business Analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data Business Analytics Technology.

UNIT-III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V:

Decision Analysis: Formulating Decision Problems, Decision Strategies without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business Analytics-Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press
2. Business Analytics, James Evans, Pearson Education
3. Business Analytics, Purba Halady Rao, PHI, 2013

REFERENCES:

1. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen, Jesper Thorlund, 2nd Edition, Wiley Publications
2. Business Analytics: Data Analysis & Decision Making, S. Christian Albright, Wayne L. Winston, 5th Edition, 2015
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman Elsevier, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM01) INDUSTRIAL SAFETY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Elements of Mechanical, Civil, Electrical and Industrial Engineering

COURSE OBJECTIVES:

- To achieve an understanding of principles, various functions and activities of safety management
- To communicate effectively information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities
- To anticipate, recognize, and evaluate hazardous conditions and practices affecting people, property and the environment, develop and evaluate appropriate strategies designed to mitigate risk
- To develop professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards

CO-2: Communicate effectively on health and safety matters among the employees and with society at large

CO-3: Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations

CO-4: Interpret and apply legislative / legal requirements, industry standards, and best practices in accident prevention programmes in a variety of workplaces

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	1
CO-2	-	-	-	-	2	3
CO-3	3	1	2	1	-	-
CO-4	-	2	-	1	-	2

UNIT-I:

Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit -

performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:

Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.

Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publisher's, Trivandrum
3. Managing Emergencies in Industries, Proceedings, Loss Prevention of India Ltd., 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw Hill Education, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM02) OPERATIONS RESEARCH

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze linear programming models in practical and their practical use
- To apply the transportation, assignment and sequencing models and their solution methodology for solving problems
- To apply inventory and queuing, inventory models and their solution methodology for solving problems
- To evaluate the simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate the problems using linear programming
CO-2: Analyze assignment, transportation problems
CO-3: Apply inventory and queuing problems for real time problems
CO-4: Model the real-world problem and simulate it

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	3	2	-	-
CO-2	1	3	3	3	-	-
CO-3	1	3	3	3	-	-
CO-4	1	3	3	3	-	-

UNIT-I:
Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit - performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:
Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.
Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, New Delhi, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publisher's, Trivandrum
3. Managing Emergencies in Industries, Loss Prevention of India Ltd., Proceedings, 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, New Delhi, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw-Hill, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM03) ENTREPRENEURSHIP AND START-UPS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To understand different Theories of Entrepreneurship and their Classification
- To create Feasibility Reports, Business, Project Plans and resolve Operational problems
- To understand the roles of Family, non-family entrepreneurs and learning about Startups' Opportunities, Corporate Legal and Intellectual Property related issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the role of an entrepreneur in the economic development and discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Learn different Theories of entrepreneurship, the role of Family and Non-Family entrepreneurs and problem-solving skills

CO-3: Create Marketing, Financial Plans and evaluate Structural, Financial and Managerial Problems

CO-4: Apply lean methodology to startup ideas using Business Model Canvas and be able to create Business Plans through establishing business incubators. Understand Corporate Legal and Intellectual Property related matters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	3
CO-2	1	-	-	-	-	2
CO-3	1	-	-	-	-	2
CO-4	-	-	-	1	-	-

UNIT-I:

Entrepreneurship: Definition of Entrepreneur, Entrepreneurial motivation and barriers; Internal and external factors; Types of entrepreneurs, Personality and Skill Set of an Entrepreneur, Entrepreneurship as a career for engineers, scientists, and technologists.

UNIT-II:

Theories of Entrepreneurship: Classification of entrepreneurship. Creativity and Innovation: Creative Problems Solving, Creative Thinking, Lateral Thinking, Views of De Bono, Khandwala and others, Creative Performance in terms of motivation and skills.

Family and Non-Family Entrepreneurs: Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Sick industries, Reasons for Sickness, Remedies for Sickness, Role of BIFR in revival, Bank Syndications.

UNIT-III:

Creativity and Entrepreneurial Plan: Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning, Evaluation, Monitoring and Control, segmentation, Targeting and positioning of Product, Role of SIDBI in Project Management.

UNIT-IV:

Operation Problems: Incubation and Take-off, Problems encountered Structural, Financial and Managerial Problems, Types of Uncertainty. Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT-V:

Startups' Opportunity Assessment, Business Models, Entrepreneur talk, Clinical/ Regulatory, Sector Specific Group Briefing by Advisory Committee, Corporate Legal and Intellectual Property, Pitching, Payers and Reimbursement, Pitch practice, Investors, Mistakes I Won't Repeat, Business Development and Exits, Finance, Budgeting, Team Building, Opportunities in Telangana State and India – incubators, schemes, accelerators.

TEXT BOOKS:

1. Understanding Enterprise: Entrepreneurship and Small Business, Bridge S. et al., Palgrave, 2003
2. Holt- Entrepreneurship: New Venture Creation, Prentice-Hall, 1998
3. Entrepreneurship Development, Robert D. Hisrich, Michael P. Peters, Tata McGraw Hill Edition

REFERENCES:

1. New Venture Creation: An Innovator's Guide to Entrepreneurship, Marc H. Meyer and Frederick G. Crane, 2nd Edition, Sage Publications
2. Technology Ventures: From Idea to Enterprise, Byers, Dorf, Nelson
3. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist - Feld, Mendelson, Costolo
4. Breakthrough Entrepreneurship, Burgstone and Murphy
5. Business Model Generation, Alexander Osterwalder

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1PL01) WASTE TO ENERGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To create awareness in students of energy conservation
- To identify the use of different types of Bio waste energy resources
- To understand different types of bio waste energy conservations
- To detect different waste conversion into different forms of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find different types of energy from waste to produce electrical power
CO-2: Estimate the use of bio waste to produce electrical energy
CO-3: Understanding different types of bio waste and its energy conversions
CO-4: Analyze the bio waste utilization and to avoid the environmental pollution

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	1	2	1
CO-2	3	3	3	3	2	3
CO-3	3	2	3	2	2	3
CO-4	3	3	3	3	2	3

UNIT-I:
Introduction to Energy From Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW (Municipal solid waste) – Conversion devices – Incinerators, Gasifiers, Digestors. Urban waste to energy conversion, Biomass energy Programme in India.

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion.

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. Biogas Technology-Transfer and Diffusion, M. M. EL-Halwagi, Elsevier Applied Science Publisher, 1984
2. Introduction to Biomass Energy Conversions, Sergio Capareda

REFERENCES:

1. Non-Conventional Energy, Desai Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill, 1983
3. Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing Co. Pvt. Ltd., 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996