R22

M.Tech. (POWER SYSTEMS)

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 SYSTEMS)

M.TECH. (PS)

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: Demonstrate interdisciplinary skills and build hands on models for testing and research.

PEO-IV: Develop professional ethics, strong communication skills, knowledge of social impacts and leadership qualities

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

M.TECH. (PS)

PROGRAM OUTCOMES

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

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 area as per the specialization of the program.

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 assimilating power systems advancements.

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

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

(POWER SYSTEMS)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1PS01	Power System Analysis	3	0	0	3
Professional Core-II	22PC1PS02	Power System Dynamics	3	0	0	3
Professional Core-III	22PC1PS03	Power System Restructuring	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				
	22PE1PL03	Data Science Applications in Power Engineering				
Professional Elective-II	22PE1PS03	Electrical Power Distribution System	3	0	0	3
	22PE1PS04	SCADA Systems and Applications				
	22PE1PS05	Reactive Power Compensation and Management				
	22PE1PL05	Electric and Hybrid Vehicles				
	22PE1PL06	Machine Learning Applications				
Professional Core Lab-I	22PC2PL01	Python Programming Laboratory- An Application to Electrical	0	0	2	1
Professional Core Lab-II	22PC2PS01	Power System Analysis Laboratory	0	0	2	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing	0	0	2	1
Project	22PW4PS01	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 SYSTEMS)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1PS04	Digital Protection of Power System	3	0	0	3
Professional Core-V	22PC1PS05	Power Quality	3	0	0	3
Professional Core-VI	22PS1PC06	Flexible AC Transmission Systems	3	0	0	3
Professional Elective-III	22PE1PS06	Voltage Stability	3	0	0	3
	22PE1PS07	Power System Reliability				
	22PE1PS08	EHVAC Transmission				
	22PC1PL04	Advanced Power Electronic Converter				
	22PE1PS09	Evolutionary Algorithm in Power Engineering				
Professional Elective-IV	22PC1PL06	Advanced Control Systems	3	0	0	3
	22PE1PS10	Industrial Load Modelling and Control				
	22PE1PL09	Artificial Intelligence Techniques				
	22PE1PS11	Swarm Intelligence Techniques in Power Systems				
	22PE1PS12	Power System Transients				
Professional Core Lab-III	22PC2PS02	Power System Practice Laboratory	0	0	2	1
Professional Core Lab-IV	22PC2PS03	Power System Dynamics Laboratory	0	0	2	1
Industry Engagement	22SD5PS01	Industry Engagement	0	0	2	1
Project	22PW4PS02	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 SYSTEMS)

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
	22PE1PL14	Energy Conservation and Auditing				
	22PE1PL13	Energy Storage Technologies				
	22PE1PS13	Gas Insulated Substation				
	22PC1CP05	Internet of Things				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Entrepreneurship and Start-ups				
	22OE1AM02	Industrial Safety				
	22OE1AM03	Operations Research				
	22OE1PS01	Waste to Energy				
Project	22PW4PS03	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	22PW4PS04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1PS01) POWER SYSTEM ANALYSIS

TEACHING SCHEME		
L	T/P	C
3	0	3

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

COURSE PRE-REQUISITES: Fundamentals in Power Systems

COURSE OBJECTIVES:

- To evaluate the network matrices and study various methods of load flows and their advantages and disadvantages
- To analyze various types of faults in power system
- To understand power system security concepts and study the methods to rank the contingencies
- To understand need for power system state estimation and study various types of measurements used in state estimation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Calculate impedance and admittance matrices of a given power system network
CO-2: Evaluate state variables at various nodes in the power system network using different load flow techniques
CO-3: Calculate fault currents for various types of faults in power system and rank various contingencies according to their severity
CO-4: Estimate the bus voltage phasors at various nodes in the power system

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	-	-
CO-2	2	1	2	3	-	-
CO-3	3	1	3	3	2	3
CO-4	3	1	3	3	2	3

UNIT–I:
Admittance Model and Network Calculations: Branch and Node Admittances, Mutually Coupled Branches in Ybus, An Equivalent Admittance Network, Modification of Ybus, Network Incidence Matrix and Ybus, Method of Successive Elimination, Kron reduction, Triangular Factorization

UNIT–II:
Impedance Model and Network Calculations: Bus Admittance and Impedance Matrices, Thevenin's Theorem and Zbus , Modification of an existing Zbus, Calculation

of Zbus elements from Ybus, Power Invariant Transformations, Mutually Coupled Branches in Zbus

UNIT–III:
Load Flows: Gauss Seidel method, N-R Method, Decoupled method, Fast decoupled method, comparison between power flow solutions, DC load flow

UNIT-IV:
Fault Analysis: Fault calculations using Zbus, Fault calculations using Zbus equivalent circuits.
Symmetrical components, Sequence circuits of various components in power system (transmission lines, transformers and synchronous machines), Various types of unsymmetrical fault calculations-Single line to ground fault, line to line fault and double line to ground fault.

UNIT-V:
Security Analysis: Factors affecting power system security, Contingency analysis: Detection of network problems, Overview of security analysis, Linear sensitivity factors - Generator shift distribution factor and Line outage distribution factor, A.C power flow methods, Contingency selection using overload performance index and 1P1Q method.

TEXT BOOKS:
1. Power System Analysis, J. J. Grainger & W. D. Stevenson, McGraw Hill, 2003
2. Power Generation, Operation and Control, A. J. Wood, John Wiley, 1994

REFERENCES:
1. Power System Analysis, A. R. Bergen & Vijay Vital, Pearson, 2000
2. Computer Aided Power System Analysis, G. L. Kusic, Prentice Hall India, 1986

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1PS02) POWER SYSTEM DYNAMICS

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 Power Systems, Electrical Machines, Power System Analysis

COURSE OBJECTIVES:
- To study of system dynamics and its physical interpretation
- To develop mathematical models for synchronous machine
- To develop the excitation, PSS and load models
- To study small signal and transient power system stability

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the modelling of synchronous machine in detail
CO-2: Development of transient models of synchronous machine for stability studies
CO-3: Development of models for excitation systems and power system stabilizers (PSS)
CO-4: Understand the power system small signal and transient stability problem

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	1	2	1	1	1	-
CO-3	2	2	1	2	-	1
CO-4	1	1	1	2	1	-

UNIT-I:
Power System Stability: Swing Equation, Power-Angle Curve, Small signal stability, Stability analysis of SMIB system, Classical Model of a Single Machine System, Block Diagram of One Machine infinite bus system, System Response to Small Disturbances, Synchronizing and damping torques. Transient Stability, Swing curves for large disturbances for different cases: first swing stability, equal area criterion.

UNIT-II:
Synchronous Machine Modelling: Mathematical description of a synchronous machine, stator and rotor circuits of synchronous machine. Necessary assumptions for modelling, basic equations of synchronous, self-inductance and mutual inductances, stator and rotor flux linkage equations, stator and rotor voltage equations.

UNIT-III:

Park's Transformation and Equivalent Circuits: Park's Transformation, Flux Linkage Equations, Voltage Equations, Per Unit Conversion, Normalizing the Voltage and Torque Equations, Equivalent Circuit of a Synchronous Machine, DQ Equivalent Circuits:3-Ph SC on machine terminals– OCC, SCC and SCR. Simple sub transient, transient and steady state models.

UNIT- IV:

Modelling of Prime Movers and Excitation Systems: Modelling of turbines- hydraulic turbine-model of governors for hydraulic turbine-block diagram and steam turbine model. Modelling of Excitation Systems: Commonly used D.C and A.C excitation system block diagrams. IEEE type-I excitation system block diagram.

UNIT-V:

SMIB System:

SSS of SMIB System: State space representation of classical generator model, effect of field flux linkage variation on system stability. Phillips Heffron model, block diagram representation with exciter and AVR. Power System Stabilizer: structure and tuning of Power System Stabilizer (PSS), block diagram with AVR and PSS.

TEXT BOOKS:

1. Power System Stability and Control, P. Kundur, McGraw Hill, 1994
2. Power System Dynamics Stability and Control, K. R. Padiyar, B. S. Publications, 2006

REFERENCES:

1. Power System Dynamics and Stability, J. Machowski, J. Bialek & J. R. W. Bumby, John Wiley & Sons, 1997
2. Power System Stability Vol. I & III, E. W. Kimbark, John Wiley & Sons, 2002
3. Advanced Power System Analysis and Dynamics, L. P. Singh, New Age International, 2006
4. Power System Control and Stability, P. M. Anderson & A. A. Fouad, Galgotia, 1981

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1PS03) POWER SYSTEM RESTRUCTURING

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 Operation and Control, Power System Analysis

COURSE OBJECTIVES:

- To introduce the restructuring of power industry and market models
- To get knowledge on fundamental concepts of congestion management
- To analyse the concepts of Transmission pricing and LMP
- To illustrate about various power sectors in India and risk hedging functionalities

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the economic aspects and need of regulation and deregulation
CO-2: Describe the Technical issues and services provided in Deregulated Power Industry
CO-3: Explain existing electricity markets like PJM and OPF models
CO-4: Illustrate the ancillary services, Reform initiatives and open access issues

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	-	3	1
CO-2	2	-	3	1	1	2
CO-3	1	-	2	-	2	-
CO-4	1	-	1	-	1	-

UNIT-I:

Fundamentals of Restructuring: Introduction, Motivation – Benefits - Reasons – Structure - Restructuring process - Different entities - Role of ISO – PJM ISO - Models of Competition: Monopoly, purchasing agency, wholesale competition, Retail Competition - contractual restructuring models: Poolco, Bilateral and Hybrid - Power Exchange, Comparison of various market models - Issues involved in deregulation

UNIT-II:

Transmission Congestion Management:

Introduction: Definition of Congestion, reasons for transfer capability limitation, Effects of congestion management - features of congestion management – Classification of congestion management methods: Non – market methods – Market methods – OPF based Congestion management-- Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method - Congestion Pricing methods.

UNIT-III:

Calculation of ATC:

Structure of OASIS: Functions and Architecture – Implementation- Types of information available in OASIS and information requirements -Transfer Capability on OASIS - Definitions, Transfer Capability issues, ATC Calculation – TTC Calculation – TRM Calculation – CBM Calculation - methods of determination of ATC - ATC calculation considering the effect of contingency analysis.

UNIT-IV:

Ancillary Service Management: Introduction – Functions – Classification – Load generation balancing related services: Frequency regulation – Spinning reserve services – Voltage control and reactive power support devices - Sources of reactive power and their comparison - Issues – Black start capability service

UNIT-V:

Economics of Restructured Power System: Fundamentals of Economics: Modelling the Consumers, Modelling the producers, Market equilibrium – pareto efficiency. Demand response. Economic load dispatch-problem, conditions for optimum, recent developments.

TEXT BOOKS:

1. Restructured Electrical Power Systems: Operation, Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, 2001
2. Power System Restructuring and Deregulation, Loi Lei Lai, Wiley India
3. Fundamentals of Power System Economics, Daniel Kirschen and Goran Strbac, John Wiley & Sons, 2004

REFERENCES:

1. Operation of Restructured Power Systems, Kankar Bhattacharya, Jaap E. Daadler, Math H. J. Boolen, Kluwer Academic, 2001
2. Making Competition Work in Electricity, Sally Hunt, John Willey and Sons, 2002
3. Understanding Electric Utilities and De-Regulation, Lorrin Philipson and H. Lee Willis, CRC Press, 2006
4. NPTEL Course-Restructured Power Systems, A. R. Abhyankar, S. A. Khaparde, Available: http://nptel.iitm.ac.in/courses/108101005

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, 1985
3. Design of Photovoltaic Systems, Prof. 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
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, Pearson Education, 3rd Edition, 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, V. S. V. Prabhakar, I. K. International, 2009
3. VLSI Design, A. Albert Raj, Latha, PHI, 2008
4. Introduction to VLSI Design, Mead and Convey, B. S. 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, 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, 1989

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PS03) ELECTRICAL POWER DISTRIBUTION 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 Systems, Electrical Distribution Systems

COURSE OBJECTIVES:
- To learn about power distribution system
- To analyze the protective devices and coordination
- To know the functions and maintenance of Distribution Automation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge of power distribution system
CO-2: Study of Distribution automation and its application in practice
CO-3: Calculate voltage drop and loss
CO-4: Optimization and maintenance of EPDS

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	1	1	2
CO-2	3	2	3	3	3	2
CO-3	2	3	1	3	2	1
CO-4	1	2	2	2	2	3

UNIT–I:
Distribution Feeders and Substations: Introduction to distribution systems- Design considerations of distribution feeders: Radial and Loop types of primary feeders, voltage levels, feeder-loading. Design practices of the secondary distribution system. Location of substations: Rating of a distribution substation, service area with primary feeders. Benefits derived through optimal location of substations.

UNIT–II:
Distribution Automation: Distribution of Power, Power Loads, Short-term Load Forecasting, Long-term Load Forecasting. Definitions in Distribution Automation, Need for Distribution Automation, Objectives, functions and Benefits of Distribution Automation. Restoration / Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction, Advantages of Distribution Management System (DMS).

UNIT-III:

Capacitive Compensation for Power Factor Control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (fixed and switched) power factor correction, capacitor location. Economic justification. Procedure to determine the best capacitor location. Voltage Control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

UNIT-IV:

Protective Devices and Coordination: Objectives of distribution system protection, types of common faults and procedure for fault calculation. Protective Devices: Principle of operation of fuses, circuit reclosers, line sectionalizers and circuit breakers. Coordination of protective devices: General coordination procedure.

UNIT–V:

Maintenance of Distribution Systems: Maintenance of Automated Distribution Systems, Difficulties in Implementing Distribution Automation in actual practice, Urban/Rural Distribution, Need based Energy Management, AI techniques applied to Distribution Automation–Overview of General Techniques, GA and its implementation to Distribution Automation.

TEXT BOOKS:

1. Electric Power Distribution, A. S. Pabla, 4th Edition, Tata McGraw Hill
2. A Text Book of Electrical power Distribution Automation, M. K. Khedkar, G. M. Dhole, University Science Press
3. Electrical Power Distribution Engineering, Turan Gonen, 3rd Edition, CRC Press

REFERENCES:

1. Electrical Distribution Engineering, Anthony J. Panseni, CRC Press
2. Electric Power Distribution, Automation, James Momoh, Protection & Control, CRC Press

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1PS04) SCADA SYSTEMS AND 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: Basic Power Systems

COURSE OBJECTIVES:
- To understand what is meant by SCADA and its functions
- To know SCADA communication
- To get an insight into its application

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications
CO-2: Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system
CO-3: Comprehend about SCADA Protocols. IEC 60870, DNP3, ICCP etc
CO-4: Learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server
CO-5: Apply SCADA in transmission and distribution sector, industries etc.

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	1	1
CO-2	2	2	2	1	1	2
CO-3	1	1	1	-	1	1
CO-4	1	1	1	-	1	1
CO-5	3	1	2	2	1	1

UNIT-I:
Introduction to SCADA:
SCADA-SCADA Systems: Components of SCADA Systems & Applications in various industries, SCADA in Power Systems: Advantages, Basic functions& Application functions, Power System field, Types of data& signals in power system, Flow of data from field to SCADA control center, , Open System-Need and advantages, Building blocks of SCADA Systems.

UNIT-II:
SCADA RTU & IED Components: RTU- Block diagram, Sub systems- Communication, Logical, Termination, Power supply, HMI; Advanced RTU Functionalities of the logic subsystem.

IED- Functional block diagram, Hardware and software Architecture, Advanced functionalities, Communication subsystem; Data concentrators and merging units.

UNIT-III:

SCADA MS & HMI Components: MS- Major functions of basic SCADA software, Hardware components and their main functions, Block diagrams of small, medium, large Master Stations; Global Positioning Systems (GPS), MS performance.

HMI- Components, functionalities, HMI Intelligent alarm filtering and suppression techniques, Classification of SCADA Systems:-Single master- single remote, Single master-multiple RTU, Multiple master- multiple RTUs, Single master- multiple sub master-multiple remote.

UNIT-IV:

SCADA Communication: SCADA communication- Requirements, Topologies, Smart grid communication infrastructure; SCADA Data communication-Techniques, Components, Transmission of Digital Signals and their Modes, Error detection techniques, Media Access Control techniques.

UNIT-V:

SCADA Architecture & Protocols: SCADA Communication Protocol Architectures- OSI seven layer model, enhanced performance architecture (EPA) model, Transmission Control Protocol (TCP)/ Internet Protocol (IP) model.

SCADA And Smart Grid Protocols- Mod bus, International Electro Technical Commission (IEC 60870), Distributed Network Protocol 3 (DNP3), Inter-Control Center Protocol (ICCP), Ethernet, IEC 61850, IEEE C37.118 Synchrophasor standard, Zig bee & its devices, Wi-Fi, Guided(wired)& Unguided (wireless)media.SCADA Case Studies

TEXT BOOKS:

1. Power System SCADA and Smart Grids, Mini S. Thomas, John D. McDonald, CRC Press, Taylor and Francis, 2015
2. SCADA- Supervisory Control and Data Acquisition, Stuart A. Boyer, Instrumentation Systems and Automation Society

REFERENCES:

1. Practical SCADA for Industry, David Bailey, Edwin Wright, Newnes, 2003
2. Designing SCADA Application Software: A Practical Approach, Stuart G. McCrady

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 and Sons,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 EHV
- 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 EHVs 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, S2013

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

(22PC2PS01) POWER SYSTEM ANALYSIS 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 System Analysis

COURSE OBJECTIVES:

- To develop computer programs for evaluation of Ybus and Zbus matrices in a power system
- To develop computer programs to perform load flow studies of transmission and distribution systems
- To model faults and contingencies
- To plan the optimal scheduling of generators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine Ybus and Zbus matrices in a power system
CO-2: Evaluate node voltages in transmission and distribution systems
CO-3: Analyze various types of faults and contingencies in a power system
CO-4: Perform optimal scheduling of generators

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	1	2	2	2	1	1
CO-3	2	2	2	2	1	2
CO-4	2	1	2	2	1	1

LIST OF EXPERIMENTS:

1. Determination of Ybus using Inspection method.
2. Determination of Ybus using Singular matrix transformation.
3. Formation of Zbus using Z bus building algorithm
4. Load flow analysis using Gauss-Seidel method
5. Load flow analysis using Newton-Raphson method
6. Short circuit analysis in a power system
7. Contingency analysis
8. Economic load dispatch
9. Distribution system load flow analysis
10. Evaluation of distribution system realiability.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

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

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

(22PC1PS04) DIGITAL PROTECTION OF POWER 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 System Protection, Switch Gear Protection

COURSE OBJECTIVES:
- To study of numerical relays
- To developing mathematical approach towards protection
- To study of algorithms for numerical protection

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Learn the importance of digital relays
CO-2: Apply mathematical approach towards protection
CO-3: Learn to develop various Protection algorithms

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	3	-	2
CO-3	3	-	3	-	-	2

UNIT-I:
Basic Elements of Digital Protection: Introduction, Basic components of digital Protection: Signal conditioning sub system: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing error, sample and hold circuits, Digital multiplexing, Digital to Analog and Analog to Digital conversions, Digital relay sub system, Digital relay as a unit, Performance and characteristics of digital protection.

UNIT-II:
Mathematical Back Ground to Protection Algorithms: Finite difference techniques, Interpolation Formulae-Forward Interpolation, Backward Interpolation, Central difference interpolation Numerical differentiation, Curve fitting and smoothing-Least square method, smoothing Fourier analysis-Fourier series, Fourier Transform, Walsh function analysis, Relation between Fourier and Walsh Co-effecients, Sinusoidal wave: Derivative methods-sample and first, First and second, Sample Techniques-Two sample, Three sample

UNIT-III:

Least Squares, Differential Equation Based Techniques: Least Squares: Integral LSQ Fit, Power series LSQ Fit, Multi variable series LSQ Technique, Determination of measured impedance estimates

Differential Equation: Representation of transmission lines with capacitance neglected, Differential equation protection with selected limits, Simultaneous differential equation techniques.

UNIT-IV:

Travelling Wave Based Protection and Schemes: Travelling wave-based protection: Transmission line as a distributed component, super imposed quantities and their properties, Bergeron's equations, discriminate functions

Travelling wave-based protection Schemes: Bergeron's equation based, Ultra high speed polarity comparison, Ultra high speed wave differential, discriminate function based, Super imposed component trajectory based.

UNIT-V:

Digital Differential Protection and Schemes:

Digital Differential Protection of Power Transformer: Principles of transformer protection, FIR filter-based algorithms, Least squares curve fitting based algorithms, Fourier based algorithm, Flux restrained current differential relay, Basic hard ware of microprocessor-based transformer protection,

Digital Line differential Protection: current based differential schemes, composite voltage and current based protection scheme, Recent Advances in Digital Protection of Power Systems

TEXT BOOKS:

1. Digital Protection of Power Systems, A. T. Johns and S. K. Salman, IEEE Press,1999
2. Computer Relaying for Power Systems, A. G. Phadke and J. S. Thorp, Wiley/Research Studies Press, 2009

REFERENCES:

1. Digital Power System Protection, S. R. Bhide, PHI Learning, 2014
2. Numerical Distance Protection, Gerhard Zeigler, Siemens Publicis Corporate Publishing, 2006

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, 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

(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 and Sons, 1982
3. FACTS Controllers & Applications, K. S. Sureshkumar, S. Ashok, E-book Edition, Nalanda Digital Library, NIT Calicut, 2003

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(L,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 and 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

(22PE1PS07) POWER SYSTEM RELIABILITY

TEACHING SCHEME		
L	T/P	C
3	0	3

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

COURSE PRE-REQUISITES: Mathematics, Power Systems-II, Distribution systems, Power System Protection

COURSE OBJECTIVES:

- To identify the generation system model and recursive relation for capacitive model building
- To calculate the equivalent transitional rates, cumulative probability and cumulative frequency
- To classify the risk, system and load point reliability indices
- To evaluate the basic reliability indices

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

CO-1: Find loss of load and energy indices for generation systems model

CO-2: Describe merging of generation and load models

CO-3: Evaluate operating reserve and system and load point reliability indices

CO-4: Apply various indices for distribution 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	1	2	3	3	2	3
CO-2	2	2	1	2	2	3
CO-3	2	3	2	2	1	3
CO-4	3	2	2	3	2	2

UNIT-I:

Generating System Reliability Analysis – I: Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples.

UNIT-II:

Generating System Reliability Analysis – II: Frequency of encountering a state – Evaluation of equivalent transitional rates, cumulative probability and cumulative frequency of identical generating units using two component repairable model – 2-level daily load representation - merging of generation and load models – Examples.

UNIT-III:

Operating Reserve Evaluation: Basic concepts - risk indices – PJM methods — Modeling of rapid start and hot reserve units using STPM approach - security function approach.

Bulk Power System Reliability Evaluation: Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common Mode Failures in two component repairable System

UNIT-IV:

Inter Connected System Reliability Analysis: Probability array methods in two inter connected systems -Factors affecting the emergency assistance through the interconnections- Reliability evaluation in three interconnected systems.

UNIT-V:

Distribution System Reliability Analysis:

(Radial Configuration): Basic evaluation Techniques of Radial networks – Evaluation of Basic reliability indices and additional interruption indices– Examples.

(Parallel Configuration): Basic evaluation techniques –inclusion of bus bar failures, scheduled maintenance – temporary and transient failures – weather effects - inclusion of breaker failures.

TEXT BOOKS:

1. Reliability Evaluation of Power Systems, R. Billinton, R. N. Allan, B. S. Publications, 2007
2. Reliability Modeling in Electric Power Systems, J. Endrenyi, John Wiley and Sons, 1978

REFERENCES:

1. Reliability Engineering: Theory and Practice, Alessandro Birolini, Springer Publications
2. System Reliability Concepts, V. Sankar, Himalaya Publishing House, 2015
3. An Introduction to Reliability and Maintainability Engineering, Charles Ebeling, TMH
4. Reliability Engineering, E. Balaguruswamy, TMH
5. Reliability Engineering, Elsayed A. Elsayed, Prentice Hall

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PS08) EHVAC 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: High Voltage Engineering, Transmission Line Theory

COURSE OBJECTIVES:

- To identify the different aspects of extra high voltage AC and DC transmission design and analysis
- To understand the importance of modern developments of E.H.V and U.H.V transmission systems
- To demonstrate EHV AC transmission system components, protection and insulation level for over voltages

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

CO-1: List the necessity of EHV AC transmission, choice of voltage for transmission, line losses and power handling capability

CO-2: Estimate the Statistical procedures for line designs, scientific and engineering principles in power systems

CO-3: Construct commercial transmission system

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	3	1	1	1
CO-2	1	2	3	2	-	2
CO-3	1	2	3	2	2	3

UNIT-I:

Modeling of EHV Lines: E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitance of E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT- II:

Electrostatic Field and Voltage Gradients Estimation: Electrostatic field– calculations of electrostatic field of AC lines – 3 phase single circuit and double circuit lines and 6 phase AC lines effect of high electrostatic field on biological organisms and human beings –

Voltage Gradients: surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

UNIT- III:

Power Frequency Voltage Control: Calculation of Electrostatic induction in un-energized D/C lines – measurement of field for three phase double circuit un-energized lines.

Power Frequency Voltage control and over-voltages in EHV lines: No load voltage condition and charging current– cascade connection of components - shunt and series compensation – static VAR compensation.

UNIT - IV:

Corona & Electro Magnetic Interference: Corona in E.H.V. lines – Corona loss formulae-attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits.

Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT- V:

Design Aspects of EHV Lines: Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics

TEXT BOOKS:

1. EHVAC Transmission Engineering, R. D. Begamudre, 3rd Edition, New Age International
2. HVDC Power Transmission Systems, K. R. Padiyar, 2nd Revised Edition, New Age International, 2012

REFERENCES:

1. EHVAC and HVDC Transmission Engineering, S. Rao, Khanna Publishers
2. High Voltage Direct Current Transmission, Arrillaga J., 2nd Edition, Peter Peregrines, IEEE, 1998
3. FACTS Controllers in Power Transmission and Distribution, Padiyar K. R, New Age International, 2007
4. Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems, Hingorani H. G. and Gyugyi L., IEEE Press, 2000

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.
- To understand the design procedure of magnetic and electrostatic components of converters

COURSE OUTCOMES: After completion of the course, 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 – First Indian Reprint, Pearson Education, 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 & Sons
3. Elements of Power Electronics, Philip T. Krein, Oxford University Press
4. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson Education India, 2009
5. Switching Power Supply Design, Abraham I Pressman, McGraw Hill, 2001

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 Examine 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	2	2	1	1	1	-
CO-2	1	1	-	-	1	-
CO-3	2	2	2	1	2	-
CO-4	3	3	-	2	-	1

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, 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

(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	2	-	2	-	3	2
CO-2	1	-	2	1	3	2
CO-3	3	-	2	-	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. Advanced Control Systems, A. Nagoor Khani, 2nd Edition, RBA Publications, 2014
3. Process Dynamics and Control, Dale E. Seborg, Thomas F. Edgar, D. A. Mellichamp, F. J. Doyle III, 4th Edition, John Wiley & Sons, 2016
4. 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

(22PE1PS10) INDUSTRIAL LOAD MODELLING 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: Power Systems

COURSE OBJECTIVES:
- To understand the energy demand scenario
- To understand the modeling of load and its ease to study load demand industrially
- To know electricity pricing models
- To study reactive power management in Industries

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge about load control techniques in industries and its application
CO-2: Understand different types of industrial processes and optimize the process using tools like LINDO and LINGO
CO-3: Apply load management to reduced mand of electricity during peak time
CO-4: Apply different energy saving opportunities in industries

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	1	1	2	2	1	1
CO-3	2	2	2	1	1	1
CO-4	1	1	2	2	1	1

UNIT-I:
Electric Energy Scenario, Demand Side Management, Industrial Load Management. Load Curve, Load Shaping Objective, Methodologies.
Barriers: Classification of Industrial Loads, Continuous and Batch processes, Load Modeling

UNIT-II:
Direct load control, Interruptible load control. Bottom- up approach, Scheduling, Formulation of load models, Optimization and control algorithms, Case studies. Reactive power management in industry, Controls, Power quality impacts, Application of filters, Energy saving in industries.

UNIT-III:
Cooling and heating loads, Load profiling, Modeling. Cool storage, Types, Control strategies. Optimal operation, Problem formulation, Case studies.

UNIT-IV:
Captive power units, Operating and control strategies, Power Pooling, Operation models. Energy banking, Industrial Cogeneration.

UNIT-V:
Selection of Schemes, Optimal Operating Strategies. Peak load saving, Constraints, Problem formulation Case study. Integrated Load management for Industries.

TEXT BOOKS:

1. Industrial Load Management – Theory, Practice and Simulations, C. O. Bjork, Elsevier, 1989
2. Load Management Concepts, C. W. Gellings and S. N. Talukdar, IEEE Press, 1986

REFERENCES:

1. Physically Based Industrial Load, Y. Manichaikuland F. C. Schweppe, IEEE Transactions on PAS, 1981
2. Least Cost Electricity Utility Planning, H. G. Stoll, Wiley Interscience,1989
3. Modern Power System Engineering, I. J. Nagarath and D. P. Kothari, Tata McGraw Hill, 1995
4. IEEE Bronze Book, Recommended Practice for Energy Conservation and Cost-Effective Planning in Industrial Facilities, IEEE

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

(22PE1PS11) SWARM INTELLIGENCE TECHNIQUES IN POWER 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: Artificial Intelligence Techniques in Electrical Engineering

COURSE OBJECTIVES:

- To understand evolutionary algorithms like GA, PSO, Ant Colony and Bee Colony etc.
- To apply these evolutionary algorithms to solve power systems problems
- To also able to understand solution of multi-Objective optimization using these algorithms

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 swarm intelligent system to attain near global optimal solution

CO-3: Distinguish the functioning of various swarm intelligent systems

CO-4: Employ various bio-inspired algorithms for power systems 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	2	2	1	-	2	2
CO-2	3	2	2	-	3	2
CO-3	3	2	2	-	3	2
CO-4	3	2	2	-	3	2

UNIT-I:

Fundamentals of Soft Computing Techniques: Definition, Classification of optimization problems, Unconstrained and constrained optimization optimality condition, 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 intelligentSystems,Applicationdomain,Discreteandcontinuousproblems,Singleobjecti veandmulti-objectiveproblems.

UNIT-II:

Genetic Algorithm & Particle Swarm Optimization: Genetic algorithms, Genetic algorithm versus Conventional Optimization Techniques, Genetic representation sand 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 problems.

UNIT-III:

Ant Colony Optimization & Artificial Bee Colony Algorithms: Biological ant colony system, Artificial ants and assumptions, Stigmergic communications, Pheromone updating, Local – global – pheromone evaporation, Ant colony system, ACO models, Touring ant colony system, Max-min ant system, Concept of elasticants, Task partitioning in honeybees, Balancing for agers and receivers, Artificial bee colony (ABC) algorithms, Binary ABC algorithms, ACO and ABC algorithms for solving Economic Dispatch of thermal units.

UNIT-IV:

Shuffled Frog – Leaping Algorithm & Bat Optimization Algorithm: Bat algorithm, Echolocation of bats, Behavior of micro bats, 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 to power systems.

TEXT BOOKS:

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

REFERENCES:

1. Swarm Intelligence, James Kennedy and Russel Eeber Heart, The Morgan Kaufmann Series in Evolutionary Computation, 2001
2. Swarm Intelligence-From natural to Artificial Systems, Eric Bonabeau, Marco Dorigo and Guy Theraulaz, Oxford University Press, 1999
3. Genetic Algorithms in Search, David Goldberg, Optimization and Machine Learning, Pearson Education, 2007
4. Swarm Optimization and Intelligence: Advances and Applications, Konstantinos E. Parsopoulos and Michael N. Vrahatis, Particle Information Science Reference, IGI Global, 2010
5. Artificial Intelligence and Intelligent Systems, N. P. Padhy, Oxford University Press, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1PS12) POWER SYSTEM TRANSIENTS

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, High Voltage Engineering

COURSE OBJECTIVES:

- To learn the reasons for occurrence of transients in a power system
- To understand the change in parameters like voltage & frequency during transients
- To know about the lightning phenomenon and its effect on power system

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

CO-1: Get the knowledge of various transients that could occur in power system and their mathematical formulation

CO-2: Design various protective devices in power system for protecting equipment and personnel

CO-3: Coordinating the insulation of various equipment's in power system

CO-4: Model the power system for transient analysis

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	2	2	2
CO-2	1	1	-	1	1	1
CO-3	-	2	1	2	2	3
CO-4	3	2	1	2	-	3

UNIT-I:

Analysis of Electrical Transients: Review and importance of study of transients Fundamental circuit analysis of electrical transients, Laplace Transform method of solving simple Switching transients, Damping circuits-Abnormal switching transients, Three-phase circuits and transients, Computation of power system transients.

UNIT-II:

Over Voltages and Protection: Lightning, switching and temporary over voltages, Lightning, Physical phenomena of lightning, Protective devices, Protection of system against over voltages, lightning arresters, substation earthling

UNIT-III:

Transients in Power Systems: Interaction between lightning and power system, Influence of tower footing resistance and Earth Resistance - closing andre-closing of lines, line dropping, load rejection – over voltages induced by faults.

UNIT-IV:

Travelling Waves on Transmission Lines: Switching HVDC line, travelling waves on transmission line, Circuits with distributed Parameters Wave Equation, Reflection, Refraction, Behavior of Travelling waves at the line terminations, Lattice Diagrams – Attenuation and Distortion, Multi-conductor system, and Velocity wave.

UNIT-V:

Insulation Co-ordination & Computation of Power System Transients: Principle of insulation co-ordination in AirInsulated substation (AIS) and Gas Insulated Substation (GIS), Co-ordination between insulation and protection level, Statistical approach.
Principle of digital computation – Matrix method of solution, Modal analysis- Z transform- Computation using EMTP.

TEXT BOOKS:

1. Electrical Transients in Power System, Allan Greenwood, Wiley & Sons, 1991
2. Electromagnetic Transients in Power System, Pritindra Chowdhari, John Wiley & Sons, 1996
3. Transient in Power Systems, Harold A. Peterson, McGraw Hill, 1966

REFERENCES:

1. IEEE Guide for Safety in AC Substation Grounding, IEEE Standard 80, 2000
2. Working Group 33/13-09, Very Fast Transient Phenomena Associated with Gas Insulated System, CIGRE, 33-13, pp. 1-2, 1988
3. Extra High Voltage AC Transmission Engineering, Rakosh Das Begamudre, 2nd Edition, New Age International, 1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2PS02) POWER SYSTEM PRACTICE 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 System Analysis and Power System Protection

COURSE OBJECTIVES:
- To find equivalent circuit of 3-winding transformer
- To outline sub-transient reactance of a salient polo synchronous machine
- To test the characteristics of OC, UV/OV, negative sequence relays

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Draw the equivalent circuit of 3-winding transformer
CO-2: Review sequence impedances of salient pole synchronous machine and 3-ph transformer
CO-3: Analyze the characteristics of OC, UV/OV

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	3	1	2
CO-2	2	1	3	3	2	3
CO-3	3	3	1	3	3	2

LIST OF EXPERIMENTS:

1. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine
2. Determination of Equivalent circuit of a Three winding Transformer
3. Determination of Sequence Impedances of Three Phase Transformer
4. Characteristics of IDMT Electromagnetic Over Current Relay
5. Differential protection on Single Phase Transformer
6. Characteristics of Microprocessor based Over Voltage / Under Voltage Relay.
7. Determination of string efficiency of a suspension string insulator
8. Performance and Testing of Generator Protection System.
9. Performance and Testing of Transformer Protection System.
10. Performance and Testing of Transmission Line Model.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2PS03) POWER SYSTEM DYNAMICS 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 and Flexible AC Transmission Systems

COURSE OBJECTIVES:
- To study different types of compensators
- To develop various models of compensators
- To apply Power electronics to various systems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Analyze various types of variable Impedance type FACTS Controllers
CO-2: Analyze converter based FACTS Controllers
CO-3: Modelling and simulation of transmission lines and Controllers
CO-4: Transient stability and voltage stability Improvement of Power Systems using FACTS controllers

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	3	2	2	1	1

LIST OF EXPERIMENTS:

1. Modelling and simulation of medium and long transmission lines
2. Study and simulation of Thyristor Controlled Reactor with its waveform
3. Modelling and simulation of FC-TCR type SVC
4. Modelling and simulation of TSC-TCR type SVC
5. Simulation of PWM based VSC
6. Simulation of three level voltage sourced converter
7. Modelling and Simulation of TCSC Controllers
8. Load frequency control of two area power system using simulation
9. Steady state and Dynamic stability study of SMIB test system
10. Simulation of Phillips Heffron model with AVR and PSS.

Note: The above experiments are to be simulated using suitable simulation software

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4PS02) 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	3	3	2
CO-2	2	3	2	1	2	2
CO-3	3	3	2	2	3	3
CO-4	3	3	3	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 grid configuration, 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 & Sons, 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 & Sons, 2010

REFERENCES:

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

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, 1998

REFERENCES:

1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker, 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency, Booklet, 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

(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, 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

(22PE1PS13) GAS INSULATED SUBSTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

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

COURSE PRE-REQUISITES: Switch Gear and Protection

COURSE OBJECTIVES:
- To know the egis concepts and principles
- To distinguish air insulated and gas insulated substations
- To demonstrate the design and constructional aspects of GIS
- To analyze transient phenomenon, problems and diagnostic methods in GIS

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Know the advantages of GIS systems over air insulated systems
CO-2: Observe constructional design features of GIS design
CO-3: Discriminate the problems and design diagnostic methods of GIS

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	-	-	-
CO-2	2	2	3	3	-	1
CO-3	3	2	3	3	3	3

UNIT–I:
Introduction to GIS and Properties of SF6: Characteristics of GIS- Introduction to SF6, Physical properties, Chemical properties, Electrical properties, Specification of SF6gas for GIS application, Handling of SF6gas before use, Safe handling of Sf6gas in electrical equipment, Equipment for handling theSF6Gas, SF6and environment.

UNIT–II:
Layout of GIS Stations: Advancement of GIS station, Comparison with Air Insulated Substation, Economics of GIS, User Requirements for GIS, Main Features for GIS, Planning and Installation components of a GIS station.

UNIT–III:
Design and Construction of GIS Station: Introduction, Rating of GIS components, Design Features, Estimation of different types of Electrical Stresses, Design Aspects of GIS components, Insulation Design for Components, Insulation Design for GIS, Thermal Considerations in the Design of GIS, Effect of Very Fast Transient Over-voltages (VFTO) on the GIS design, Insulation Coordination systems, Gas handling and Monitoring System Design.

UNIT-IV:

Fast Transient Phenomena in GIS: Introduction, Disconnector Switching in Relation to Very fast Transients-Origin of VFTO, Propagation and Mechanism of VFTO, VFTO Characteristics, Effects of VFTO, Testing of GIS for VFTO.

UNIT–V:

Special Problems in GIS and GIS Diagnostics: Introduction, Particles their effects and their control, Insulating Spacers and their Reliability, SF6 Gas Decomposition, Characteristics of imperfections in insulation, Insulation Diagnostic methods, PD Measurement and UHF Method.

TEXT BOOKS:

1. Gas Insulated Substations, M. S. Naidu, IK International
2. Gas Insulated Substations, Hermann J. Koch, Wiley-IEEE Press, 2014

REFERENCES:

1. Dielectric materials and Electrostatics, Olivier Gallot-Lavellee, Wiley-IEEE Press
2. Dielectric Materials for Electrical Engineering, Jaun Martinez, Wiley-IEEE Press

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

CO4: Understanding the hardware and working principles of various sensors used for IoT,

CO5: Creating web application framework design using Raspberry PI plat form 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

(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
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 Publishers
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, 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

(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:

Introduction to Operations Research: Definitions of OR, Characteristics of OR, Scope of OR, Classification of Optimization Techniques, models in OR, General L.P Formulation, Graphical solution, Simplex Techniques.

Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II:

Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III:

Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT-IV:

Inventory Models: Deterministic inventory, models - Probabilistic inventory control models

UNIT-V:

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut
2. Engineering Optimization, S. S. Rao, New Age International, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, 2008

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

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, 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996