NRI INSTITUTE OF TECHNOLOGY

POTHAVARAPPADU (V), (VIA) NUNNA, AGIRIPALLI (M), PIN – 521 212

POWER ELECTRONICS AND DRIVES

COURSE STRUTURE AND SYLLABUS FOR FIRST YEAR PG PROGRAMME

I SEMESTER

Sl. No.	Course Code	Title of the Course	L	P	Total	Internal Marks	External Marks	Total Marks	No. of Credits
1	18EEPE101	Electrical Machine Modeling and Analysis	4	--	4	40	60	100	4
2	18EEPE102	Analysis of Power Electronic Converters	4	--	4	40	60	100	4
3	18EEPE103	Power Electronic Control of DC Drives	4	--	4	40	60	100	4
4	18EEPE104	Flexible AC Transmission Systems	4	--	4	40	60	100	4
5	18EEPE105A 18EEPE105B 18EEPE105C	**Elective – I** i. Modern Control Theory ii. Power Quality iii. Optimization Techniques	4	--	4	40	60	100	4
6	18EEPE106A 18EEPE106B 18EEPE106C	**Elective – II** i. Energy Auditing, Conservation and Management ii. Artificial Intelligence Techniques iii. HVDC Transmission	4	--	4	40	60	100	4
7	18EEPE161	Simulation - Lab	--	3	3	40	60	100	2
Total			**24**	**3**	**27**	**280**	**420**	**700**	**20**

II SEMESTER

Sl. No.	Course Code	Title of the Course	L	P	Total	Internal Marks	External Marks	Total Marks	No. of Credits
1	18EEPE201	Switched Mode Power Conversion	4	--	4	40	60	100	4
2	18EEPE202	Power Electronic Control of AC Drives	4	--	4	40	60	100	4
3	18EEPE203	Digital Controllers	4	--	4	40	60	100	4
4	18EEPE204	Custom Power devices	4	--	4	40	60	100	4
5	18EEPE205A 18EEPE205B 18EEPE205C	**Elective – III** i. Renewable Energy Systems ii. Reactive Power Compensation & Management iii. Electrical Distribution Systems	4	--	4	40	60	100	4
6	18EEPE206A 18EEPE206B 18EEPE206C	**Elective – IV** i. Smart Grid Technologies ii. Special Machines iii. Programmable Logic Controllers & Applications	4	--	4	40	60	100	4
7	18EEPE261	Power Converters & Drives Laboratory	--	3	--	40	60	100	2
Total			**24**	**3**	**27**	**280**	**420**	**700**	**20**

L - LECTURE T – TUTORIAL P - PRACTICLE S - SELF STUDY

18EEPE101 - ELECTRICAL MACHINE MODELING AND ANALYSIS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Basic concepts of Modeling

Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine voltage, current and Torque equations.

UNIT II

DC Machine Modeling

Mathematical model of separately excited D.C motor – Steady State analysis-Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor-Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations

UNIT III

Reference frame theory & Modeling of single phase Induction Machines:

Linear transformation-Phase transformation - three phase to two phase transformation (abc to αβ0) and two phase to three phase transformation αβ0 to abc - -Power equivalence- Mathematical modeling of single phase induction machines.

UNIT IV

Modeling of three phase Induction Machine

Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-state space model with flux linkages as variables

UNIT V

Modeling of Synchronous Machine& Special machines

Synchronous machine inductances –voltage equations in the rotor's dq0 reference frame electromagnetic torque-current in terms of flux linkages-three synchronous machine model modeling of PM Synchronous motor, modeling of BLDC motor, modeling of Switched Reluctance motor

TEXT BOOKS:

1. P.S.Bimbra, "Generalized Theory of Electrical Machines", Khanna Publications, 5th edition,1995 (Units - I, II,).

2. P.C.Krause, Oleg Wasynczuk, and Scott D.Sudhoff, "Analysis of Electrical Machinery and Drive Systems", IEEE Press, Third Edition, 2013 (Units - IV, V).

REFERENCE BOOKS:

1. R.Krishnan, "Electric Motor Drives - Modeling, Analysis & control", Pearson Publications, First Edition, 2002 (Units - II, IV, V).

2. Chee Mun Ong, "Dynamic simulation of Electric machinery using Matlab / Simulink",Prentice Hall Publications,1998 (Units-II, IV, V).

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE102 - ANALYSIS OF POWER ELECTRONIC CONVERTERS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

AC voltage Controllers

Single Phase AC Voltage Controllers with PWM control only –synchronous tap changers – Three Phase AC Voltage Controllers-Analysis of Controllers with star and delta connected resistive, resistive –inductive loads-Effects of source and load inductances–Application- numerical problems.

UNIT II

AC-DC converters

Single phase full and half Converters with inductive load– Power factor improvements: Extinction angle control-symmetrical angle control - single phase sinusoidal PWM-Single phase series converters- numerical problems - Three Phase full and half Converter with inductive load– harmonic analysis -Power factor improvements-three phase PWM-twelve pulse converters numerical problems

UNIT III

Power Factor Correction Converters

Single-phase single stage boost power factor corrected rectifier, power circuit principle of Operation, and steady state- analysis, Three phase boost PFC converter.

UNIT IV

PWM Inverters

single phase full bridge inverters - sinusoidal PWM – modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and delta modulation – numerical problems - Three-Phase Inverters- Sinusoidal PWM- 60_0 PWM- Third Harmonic PWM- Space Vector Modulation- Comparison of PWM Techniques-current source inverters-Variable dc link inverter - numerical problems.

UNIT V

Multi-level inverters

Multilevel Concept, Types of Multilevel Inverters- Diode-Clamped Multilevel Inverter, Features of Diode-Clamped Inverter, Improved Diode-Clamped Inverter- Flying-Capacitors Multilevel Inverter- Features of Flying-Capacitors Inverter- Cascaded Multilevel Inverter- Principle of Operation- Features of Cascaded Inverter- Switching Device Currents-DC-Link Capacitor Voltage Balancing- Features of Multilevel Inverters- Comparisons of Multilevel Converters

TEXT BOOKS

1. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint- 2008

2. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley& Sons -2nd Edition.

3.Power Electronics – Lander –Ed.2009

REFERENCE BOOKS

1. Modern power Electronics and AC Drives – B.K.Bose

2. Power Converter Circuits – William Shepherd & Li Zhang-Yes Dee Publishing PvtLtd

E-RESOURCES

1. http://nptel.ac.in/course.php

2. http://jntuk-coeerd.in/

18EEPE103 - POWER ELECTRONIC CONTROL OF DC DRIVES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Introduction on single phase convertor fed DC motor drive:
Basic power electronic drive system, components, stability of power electronic drive, single Phase full-convertor and half-convertor fed dc drives for continuous and discontinuous mode of operation. Four quadrant operation of drive using dual convertor.

UNIT II

Three phase AC-DC convertor fed DC motor drive:
Three phase full-convertor and half-convertor fed dc drives for continuous and discontinuous mode of operation. Four quadrant operation of drive using three phase dual convertor. Pulsating torque

UNIT III

Modeling of AC-DC convertor fed DC drive components & design of controller:
Transfer function of Dc motor and load, convertor, current and speed controllers, current and speed feedback elements. Design of current controller and speed controller. Closed loop two quadrant DC motor drive, closed loop four quadrant DC motor drive, introduction to simulation of DC motor drive.

UNIT IV

DC-DC convertor fed DC motor drive:
Four quadrant DC-DC convertor fed dc motor drive, steady state analysis of DC-DC convertor dc motor drive, pulsating torques.

UNIT V

Closed loop operation of DC-DC convertor fed dc motor drive:
Design of current controller, design of speed controller, modeling of current and speed controller, introduction to simulation of speed-controlled dc motor drive.

TEXT BOOKS

1. Electrical Motor Drives Modeling, Analysis and Control – R. Krishna, Prentice Hall India.

2. Power Semiconductor Controlled Drives – G.K. Dubey.Prentice Hall India.

REFERENCE BOOKS

1. Power Electronics and Motor control – Shepherd, Hulley, Liang-II Edition, Cambridge University Press.

2. Power electronic circuits, devices and applications – M.H.Rashid – PHI.

E-RESOURCES

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE104 - FLEXIBLE AC TRANSMISSION SYSTEMS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

FACTS concepts, Transmission interconnections, power flow in an AC System, Loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

UNIT II

Basic concept of voltage and current source converters, comparison of current source converters with voltage source converters. Static shunt compensation: Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable var generation, variable impedance type static var generators, switching converter type var generators, hybrid var generators.

UNIT III

SVC and STATCOM: The regulation and slope transfer function and dynamic Performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

UNIT IV

Static series compensators: Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor-controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.

UNIT V

Unified Power Flow Controller: Basic operating principle, conventional transmission control capabilities, independent real and reactive power flow control, comparison of the UPFC to series compensators and phase angle regulators

TEXT BOOKS

1. "Understanding FACTS Devices" N.G.Hingorani and L.Guygi, IEEE Press. Indian Edition is available:--Standard Publications

REFERENCE BOOKS

1. Sang.Y.Hand John.A.T, "Flexible AC Transmission systems" IEEE Press (2006).
2. HVDC & FACTS Controllers: applications of static converters in power systems- Vijay K.Sood-Springer publishers

E-RESOURCES

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE105(A) - MODERN CONTROL THEORY

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

State Variable Analysis

The concept of state – State Equations for Dynamic systems – State diagram - Linear Continuous time model for physical systems – Existence and Uniqueness of Solutions to Continuous – Time State Equations – Solutions – Linear Time Invariant Continuous – Time State Equations – State transition matrix and it's properties

UNIT II

State Variable Techniques

General concept of Controllability - General concept of Observability Controllability tests for Continuous &Time Invariant systems - Observability tests for Continuous &Time Invariant systems - Controllability and Observability of state model in Jordan Canonical form - Controllability and Observability Canonical forms of State model – State feedback controller ,design through pole assignment.

UNIT III

Non Linear Systems – I

Introduction – Non Linear Systems – Types of Non – Linearities – Saturation – Dead – Zone – Backlash – Jump Phenomenon etc; - Singular Points – Introduction to Linearization of nonlinear systems, properties of Non Linear Systems – Describing function – describing function analysis of nonlinear systems- Stability analysis of Non – Linear systems through describing functions.

UNIT IV

Non-Linear Systems – II

Introduction to phase – plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase – plane analysis of nonlinear control systems.

UNIT V

Stability Analysis

Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems – Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method

TEXT BOOKS:

1. Modern Control System Theory by M. Gopal – New Age International – 1984

2. Modern Control Engineering by Ogata. K – Prentice Hall – 1997

REFERENCE BOOKS:

1. Nonlinear systems, Hassan K. Klalil, Prentice Hall, 1996

2. Modern control systems, Richard C. Dorf and Robert H. Bishop, 11th Edition, Pearson Edu, India, 2009

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE105(B) - POWER QUALITY

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Introduction

Overview of Power Quality - Concern about the Power Quality - General Classes of Power Quality Problems – Transients -Long-Duration Voltage Variations - Short-Duration Voltage Variations - Voltage Unbalance - Waveform Distortion - Voltage fluctuation - Power Frequency Variations - Power Quality Terms - Voltage Sags and Interruptions - Sources of Sags and Interruptions – Nonlinear loads.

UNIT II

Transient Over Voltages

Source of Transient Over Voltages - Principles of Over Voltage Protection - Devices for Over Voltage Protection - Utility Capacitor Switching Transients - Utility Lightning Protection – Load Switching Transient Problems - Computer Tools for Transient Analysis

UNIT III

Harmonic Distortion and solutions

Voltage vs. Current Distortion - Harmonics vs. Transients - Power System Quantities under Non sinusoidal Conditions - Harmonic Indices – Sources of harmonics - Locating Sources of Harmonics – System Response Characteristics - Effects of Harmonic Distortion – Inter harmonics - Harmonic Solutions Harmonic Distortion Evaluation - Devices for Controlling Harmonic Distortion - Harmonic Filter Design - Standards on Harmonics

UNIT IV

Long Duration Voltage Variations:

Principles of Regulating the Voltage - Device for Voltage Regulation - Utility Voltage Regulator Application - Capacitor for Voltage Regulation - End-user Capacitor Application – Regulating Utility Voltage with Distributed Resources – Flicker

UNIT V

Distributed Generation and Power Quality:

Resurgence of Distributed Generation - DG Technologies - Interface to the Utility System - Power Quality Issues - Operating Conflicts - DG on Low Voltage Distribution Networks - Interconnection standards - Wiring and Grounding - Typical Wiring and Grounding Problems - Solution to Wiring and grounding Problems

TEXT BOOKS:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw-Hill, 2002.

2. Power Quality Primer, Kennedy B W, First Edition, McGraw-Hill, 2000.

3. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M H J, First Edition, IEEE Press; 2000.

REFERENCE BOOKS:

1. Power Quality c.shankaran, CRC Press, 2001

2. Harmonics and Power Systems –Franciso C.DE LA Rosa-CRC Press (Taylor & Francis)

3. Power Quality in Power systems and Electrical Machines-EwaldF.fuchs, Mohammad A.S. Masoum-Elsevier

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE105(C) - OPTIMIZATION TECHNIQUES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

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

UNIT II

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

UNIT III

Nonlinear Programming: Unconstrained cases **-** One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method – Uni variate method, Powell's method and steepest descent method.

Constrained cases - Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT IV

Introduction to Evolutionary Methods: Evolutionary programming methods - Introduction to Genetic Algorithms (GA)– Control parameters –Number of generation, population size, selection, reproduction, crossover and mutation – Operator selection criteria – Simple mapping of objective function to fitness function – constraints – Genetic algorithm steps – Stopping criteria –Simple examples.

UNIT V

Introduction to Swarm Intelligence Systems: Swarm intelligence programming methods - Basic Partial Swarm Optimization – Method – Characteristic features of PSO procedure of the global version – Parameters of PSO (Simple PSO algorithm – Operators selection criteria – Fitness function constraints) – Comparison with other evolutionary techniques – Engineering applications of PSO.

TEXT BOOKS:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Soft Computing with Matlab Programming by N.P.Padhy&S.P.Simson, Oxford University Press – 2015

REFERENCE BOOKS:

1. "Optimization methods in operations Research and Systems Analysis" by K.V.Mital and C.Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.

2. Genetic Algorithms in search, optimization, and Machine Learning by David .Goldberg, ISBN:978-81-7758-829-3, Pearsonby Dorling Kindersley (India) Pvt. Ltd.

3. "Operations Research: An Introduction" by H.A.Taha, PHI pvt. Ltd., 6th edition.

4. Linear Programming by G.Hadley.,Narosa Publishers.

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE106(A) - ENERGY AUDITING, CONSERVATION AND MANAGEMENT

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

UNIT I: Basic Principles of Energy Audit

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

UNIT II

UNIT II: Energy Management –I

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

UNIT III

UNIT III: Energy Efficient Motors and Lighting

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. Good lighting system design and practice, lighting control, lighting energy audit

UNIT IV

Power Factor Improvement and energy instruments

Power factor – methods of improvement , location of capacitors , Power factor with non-linear loads, effect of harmonics on p.f. , p.f motor controllers – Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tong testers ,application of PLC's

UNIT V

Economic Aspects and their computation

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

TEXT BOOKS:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.

2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-

3. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998

REFERENCE BOOKS:

1. Energy management hand book by W.C.Turner, John wiley and sons

2. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE106(B) - ARTIFICIAL INTELLIGENCE TECHNIQUES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Introduction to Neural Networks

Introduction, Humans and Computers, Biological Neural Networks, Historical development of neural network, Terminology and Topology, Biological and artificial neuron models, Basic learning laws.

UNIT II

Feed Forward Neural Networks

Introduction, Perceptron models: Discrete, continuous and multi-category, Training algorithms: Discrete and Continuous Perceptron Networks, Perceptron convergence theorem, Limitations and applications of the Perceptron model, Generalized delta learning rule, Feedforward recall and error back propagation training-Radial basis function algorithms-Hope field networks

UNIT III

Genetic algorithms &Modelling-introduction-encoding-fitness function-reproduction operators-genetic operators-cross over and mutation-generational cycle-convergence of genetic algorithm

UNIT IV

Classical and Fuzzy Sets

Introduction to classical sets - properties, operations and relations; Fuzzy sets, membership, Uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components-Fuzzification, Membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, defuzzification methods.

UNIT V

Application of AI Techniques: Design of PI controller for speed control of DC motor using neural networks and fuzzy logic-PWM Controllers -Selected harmonic elimination PWM Space vector PWM using neural network.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan andPai – PHI Publication.

2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

REFERENCE BOOKS:

1. Modern Power Electronics and AC Drives –B.K.Bose-Pearson Publications

2. Genetic Algorithms- David E Goldberg. Pearson publications.

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE106(C) - HVDC TRANSMISSION

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Limitation of EHV AC Transmission, Advantages of HVDC Technical economical reliability aspects. HVDC Transmission: General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration. Types of HVDC links- Apparatus and its purpose.

UNIT II

Static Power Converters: 6-pulse bridge circuit and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers. Comparison of the perform of diametrical connection with 6-pulse bridge circuit

UNIT III

Control of HVDC Converters and systems: constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control. Factors responsible for generation of Harmonics voltage and current harmonics effect of variation of α and μ. Filters Harmonic elimination.

UNIT IV

Interaction between HV AC and DC systems – Voltage interaction, Harmonic instability problems and DC power modulation. Development of DC circuit Breakers, Multi terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

UNIT V

Transient over voltages in HV DC systems: Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults. Converter faults and protection in HVDC Systems: Converter faults, over current protection - valve group, and DC line protection, circuit breakers. Over voltage protection of converters, surge arresters

TEXT BOOKS:

1. S Kamakshaih and V Kamaraju:HVDC Transmission- MG hill.
2. K.R. Padiyar : High Voltage Direct current Transmission, Wiley Eastern Ltd., New Delhi – 1992.
3. E.W. Kimbark : Direct current Transmission, Wiley Inter Science – New York.

REFERENCE BOOKS:

1. J. Arillaga : H.V.D.C. Transmission Peter Peregrinus ltd., London UK 1983
2. Vijay K Sood: HVDC and FACTS controllers: Applications of static converters in power systems by, Kluwer Academic Press.

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE161 - SIMULATION LABORATORY

Practice:	3	**Internal Marks:**	40
Credits:	2	**External Marks:**	60

List of Experiments:

1. Switching characteristics simulation analysis of Thyristor, MOSFET, IGBT.
2. Simulation analysis of single phase full converter using R-L load, R-L-E load with and without LC Filter.
3. Simulation analysis of three phase full converter using R-L-E Load.
4. Simulation analysis of single phase AC Voltage controller with PWM control for RL load.
5. Simulation analysis of three phase AC Voltage controller using RL load.
6. Simulation analysis of single phase inverter with sinusoidal PWM control for R & RL – loads.
7. Simulation analysis of three phase inverter with Sinusoidal PWM control for R & RL - Loads.
8. Simulation analysis of Buck, Boost& Buck-Boost DC-DC converters.
9. Simulation analysis of three phase converter fed DC motor.
10. Development of mathematical model and simulation analysis of induction machines under
11. balanced and symmetrical conditions for the following
    a. dq model in synchronous reference frame
    b. dq model in stator reference frame
    c. dq model in rotor reference frame
12. Simulation analysis of Volts/Hz closed-loop speed control of an induction motor drive.
13. Simulation analysis of Open-loop Volts/Hz control of a synchronous motor drive.
14. Simulation analysis of Speed control of a permanent magnet synchronous motor.
15. Simulation analysis of Capacitor-start capacitor-run single-phase induction motor.

EQUIPMENT REQUIRED:

REFERENCE BOOKS:

1. Rashid, Muhammad H. *Spice for power electronics and electric power*. CRC Press, 2012.

2. Shaffer, Randall. *Fundamentals of power electronics with MATLAB*. Firewall Media, 2013.

3.Robert W. Erickson &Dragon Maksimovic, " Fundamentals of Power Electronics" Second Edition, 2001 Springer science and Business media.

4. Ned Mohan, T. M. Udeland and W.P Robbin, "Power Electronics converters, Application and design" John Wiley and sons. Wiley India edition, 2006.

5. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hal India, New Delhi, 1995

E-RESOURCES:

1.

2.

VIRTUAL LABS:

1.

2.

3.

18D1252401 - SWITCHING MODE POWER CONVERSION

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Non-isolated switch mode converters:
Control of DC-DC converters, Buck converters, Boost converters, Buck-Boost converter, CUK Converter, Converter realization with nonideal components.

UNIT II

Resonant converters:
Basic resonant circuit concepts, series resonant circuits, parallel resonant circuits, zero current switching Quasi-resonant buck converter, zero current switching Quasi-resonant boost converter, zero voltage switching Quasi-resonant buck converter, zero voltage switching Quasi-resonant boost converter

UNIT III

Isolated switch-mode converters:
Forwarded converter, fly back converter, Push-pull converter, half-bridge converter, full ridge Converter

UNIT IV

Control schemes of switching converters:
Voltage-mode control, Current-mode control, control scheme for resonant converters, proportional integral controller. Magnetic design consideration: Transformers design, DC inductor and capacitor design

UNIT V

Modeling& Control design based on linearization:
Formulation of averaged models for buck and boost converters average circuits models, small – signal analysis and linearization. Control design based on linearization: Transfer function of converters, control design, large signal issues in voltage-mode & current-mode control.

TEXT BOOKS:

1. Power Electronics – IssaBataresh, Jhonwilley publications,2004
2.Power switching converters-simonang, alejandro olive, CRC Press (Taylor &franicsgroup).

REFERENCE BOOKS:

1. Elements of Power Electronics – Philip T. Krein, Oxford University press.
2.Power Electronics: converters Applications & Design – Mohan, Undeland, Robbins-Wiley publications

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18D1252402 - POWER ELECTRONIC CONTROL OF AC DRIVES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

3-phase induction motor drives – Part 1

Analysis of IM fed from non-sinusoidal supply, harmonic equivalent circuit, transient analysis – starting and plugging; variable frequency control, torque-slip relation, starting torque and braking torque, closed-loop VSI fed IM drive. Slip-ring IM controls, closed-loop speed control with static rotor resistance, closed-loop speed control by using slip power recovery scheme.

UNIT II

3-phase induction motor drives – Part 2

Concept of space vector, vector control of IM: direct or feed-back vector control, flux vector estimation, indirect or feed forward vector control, vector control of line side PWM converter, stator flux-oriented vector control, vector control of converter fed inverter drive.

UNIT III

Synchronous motor and BLDC motor drives

Variable frequency control of synchronous motor, closed-loop control of inverter fed synchronous motor drive. Permanent magnet synchronous motor drive. BLDC motor drives, VSI fed BLDC motor drives, back emf, phase current and torque waveforms, control of BLDC motors with sensors, sensor-less control of BLDC motors

UNIT IV

Traction drives

Motors employed in railway traction and road-vehicles, control of railway traction dc motors using ac-dc converters, control of railway traction ac motors using ac-dc and dc-ac converters, power electronic control circuits of electric vehicles and hybrid electric vehicles

UNIT V

Switched reluctance and stepper motor drives

Switched reluctance motor operation and control: modes of operation, converter circuits closed loop speed control. Stepper motor characteristics drive circuits for uni-polar and bipolar stepper motors.

TEXT BOOKS:

1. Electric motor drives, modeling, analysis and control", R. Krishnan, PHI Publishers

2. "Control of electric drives", W. Leonhard, Springer Verilog

3. "Vector control of AC machines", ArindamGhosh, Gerard Ledwich

4. "Power Electronics: Converters,Application and design" ,Mohan, Undeland and Robbins, Wiley Publications.

5. "Urban transport and hybrid electric vehicles", Edited by SerefSoylu, Published online, 18 Aug 2010. Available:http://www.intechopen.com/books/urban-transport-and-……..

REFERENCE BOOKS:

1. "Power control of AC motors", J.M.D. Murphy and F. G. Turnbul

2. "Power semiconductor drives", G. K. Dubey, Printice Hall International

3. "Fundamentals of electric drives", G. K. Dubey, Narosa Publishing House

E-RESOURCES:

1. http://nptel.ac.in/course.php

2. http://jntuk-coeerd.in/

18D1252403 - DIGITAL CONTROLLERS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

PIC MICROCONTROLLERS

PIC Microcontrollers: Overview and Features, PIC 16C6X/7X, FSR(File Selection Register) [Indirect Data Memory Address Pointer], PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organizations, PIC PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC)

UNIT II

INTRODUCTION TO DSP

Introduction to the C2xx DSP core and code generation, The components of the C2xx DSP core, Mapping external devices to the C2xx core , peripherals and Peripheral Interface , System configuration registers , Memory , Types of Physical Memory , memory Addressing Modes , Assembly Programming using C2xx DSP, Instruction Set, Software Tools.

UNIT III

I/O & CONTROL REGISTERS

Pin Multiplexing (MUX) and General Purpose I/O Overview, Multiplexing and General Purpose I/O Control Registers. Introduction to Interrupts, Interrupt Hierarchy, Interrupt Control Registers, Initializing and Servicing Interrupts in Software.

UNIT IV

ADC & EVENT MANAGER

ADC Overview , Operation of the ADC in the DSP , Overview of the Event manager (EV) , Event Manager Interrupts , General Purpose (GP) Timers , Compare UNITs, Capture UNITS And Quadrature Enclosed Pulse (QEP) Circuitry , General Event Manager Information

UNIT V

FPGA

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA , Xilinx XC3000 series , Configurable logic Blocks (CLB), Input/Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming – overview of Spartan 3E and Virtex II pro FPGA boards- case study.

TEXT BOOKS:

1. Microcontrollers-Theory and Applications by Ajay V Deshmukh, McGraw Hills

2. Microcontrollers by Kennith J ayala, Thomson publishers

3. Microprocessor and Microcontrollers by Prof C.R.Sarma.

4. Hamid.A.Toliyat and Steven G.Campbell"DSP Based Electro Mechanical Motion Control " CRC Press New York , 2004.

REFERENCE BOOKS:

1. XC 3000 series datasheets (version 3.1). Xilinx,Inc.,USA, 1998.

2. Wayne Wolf," FPGA based system design ", Prentice hall, 2004

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18D1252404 - CUSTOM POWER DEVICES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Introduction

Custom Power and Custom Power Devices - power quality variations in distribution circuits – Voltage Sags, Swells, and Interruptions - System Faults – Over voltages and Under voltages - Voltage Flicker - Harmonic Distortion - Voltage Notching - Transient Disturbances - Characteristics of Voltage Sags.

UNIT II

Overview of Custom Power Devices

Reactive Power and Harmonic Compensation Devices - Compensation Devices for Voltage Sags and Momentary Interruptions - Backup Energy Supply Devices - Battery UPS – Super Conducting Magnetic Energy Storage systems - Flywheel – Voltage Source Converter – Multilevel converters.

UNIT III

Reactive Power and Harmonic Compensation Devices

Var control devices - Static Var Compensator – Topologies - Direct Connected Static Var Compensation for Distribution Systems – Static Series Compensator - Static Shunt ompensator (DSTATCOM) - Interaction with Distribution Equipment and System – Installation Considerations.

UNIT IV

High-Speed Source Transfer Switches, Solid State Limiting, And Breaking Devices:

Source Transfer Switch - Static Source Transfer Switch (SSTS),- Hybrid source transfer switch High-speed mechanical source transfer switch - Solid state current limiter - Solid state breaker. Application of Custom Power Devices in Power Systems

UNIT V

Application of Custom Power Devices in Power Systems

P-Q theory – Control of P and Q – Dynamic Voltage Restorer (DVR) – Operation and control – Interline Power Flow Controller (IPFC) – Operation and control – Unified Power Quality Conditioner (UPQC) – Operation and control. Recent custom power devices.

TEXT BOOKS:

1. Guidebook on Custom Power Devices, Technical Report, Published by EPRI, Nov 2000

2. Power Quality Enhancement Using Custom Power Devices – Power Electronics and Power Systems, Gerard Ledwich, ArindamGhosh, Kluwer Academic Publishers, 2002.

REFERENCE BOOKS:

1. Power Quality, C. Shankaran, CRC Press, 2001

2. Instantaneous power theory and application to power conditioning, H. Akagiet.al., IEEE Press, 2007.

3. Custom Power Devices - An Introduction, ArindamGhosh and Gerard Ledwich, Springer, 2002

4. A Review of Compensating Type Custom Power Devices for Power Quality Improvement, Yash Pal et.al., Joint International Conference on Power System Technology and IEEE Power India Conference, 2008. POWERCON 2008.

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE205A - RENEWABLE ENERGY SYSTEMS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Solar Energy - Availability - Solar radiation data and measurement - Estimation of average solar radiation - Solar water heater types - Heat balance – Flat plate collector efficiency – Efficiency of heat removal - Thermo siphon flow calculation - Forced circulation calculation – Evacuated collectors - Basics of solar concentrators Solar Energy Applications - Solar air heaters – Solar Chimney - Crop driers - Passive solar system - Active solar systems - Water desalination - Output from solar still – Principle of solar ponds.

UNIT II

Wind Energy – Nature of wind – Characteristics – Variation with height and time – Power in wind – Aerodynamics of Wind turbine – Momentum theory – Basics of aerodynamics – Aero foils and their characteristics – HAWT – Blade element theory – Prandtl's lifting line theory (prescribed wake analysis) VAWT aerodynamics – Wind turbine loads – Aerodynamic loads in
steady operation – Yawed operation and tower shadow. Wind Energy Conversion System – Siting – Rotor selection – Annual energy output – Horizontal axis wind turbine (HAWT) – Vertical axis wind turbine (VAWT) – Rotor design considerations – Number of blades – Solidity
- Blade profile – Upwind/Downwind – Yaw system – Tower – Braking system – Synchronous and asynchronous generators and loads – Integration of wind energy converters to electrical networks – Inverters – Control system – Requirement and strategies – Noise Applications of wind energy

UNIT III

Biomass energy - Bio fuel classification – Examples of thermo chemical, Pyrolysis, biochemical
and agrochemical systems – Energy farming – Direct combustion for heat – Process heat and electricity – Ethanol production and use – Anaerobic digestion for biogas – Different digesters – Digester sizing – Applications of Biogas - Operation with I.C. Engine

UNIT IV

Ocean Energy - OTEC Principle - Lambert's law of absorption - Open cycle and closed cycle - heat exchanger calculations – Major problems and operational experience. Tidal Power - Principles of power generation - components of power plant – Single and two basin systems –
Turbines for tidal power - Estimation of energy – Maximum and minimum power ranges - tidal Power house. Wave Energy – Concept of energy and power from waves – Wave characteristics – period and wave velocities - Different wave energy conservation devices (Saltor duck, oscillating water column and dolphin types) – operational experience.

UNIT V

Geothermal Energy - Classification- Fundamentals of geophysics - Dry rock and hot aquifer energy analysis - Estimation of thermal power - Extraction techniques - Prime movers.

TEXT BOOKS:

1. Renewable Energy Resources Basic Principles and Applications / G.N.Tiwari and M.K.Ghosal / Narosa
2. Solar Energy - Principles of thermal collection and storage/ S.P. Sukhatme / TMH
3. Wind Energy Handbook / Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi / Wiley Wind Electrical Systems / S.N.Bhadra, D.Kastha and S.Banerjee / Oxford
4. Biogas Technology - A Practical Hand Book / K.Khendelwal& S.S. Mahdi / McGraw-Hill.

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE205B - REACTIVE POWER COMPENSATION & MANAGEMENT

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

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

Reactive power compensation in transmission system:

Steady state -Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples Transient state - Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples

UNIT III

Reactive power coordination:

Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences

UNIT IV

Distribution side Reactive power Management:

System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks

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

UNIT V

Reactive power management in electric traction systems and are furnaces:

Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace

TEXT BOOKS:

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982

2. Reactive power Management by D.M.Tagare,Tata McGraw Hill,2004

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18D1252513 - ELECTRICAL DISTRIBUTION SYSTEMS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

(Residential, Commercial, Agricultural and Industrial) and their characteristics

UNIT II

Distribution Feeders and Substations: Design consideration of Distribution feeders: Radial and loop types of primary feeders, voltage levels, feeder-loading. Design practice of the secondary distribution system. Location of Substations: Rating of a Distribution Substation, service area with 'n' primary feeders. Benefits derived through optimal location of substations.

UNIT III

System analysis : Voltage drop and power loss calculations : Derivation for volt-drop and power loss in lines, manual methods of solution for radial networks, three-phase balanced primary lines, non-three-phase primary lines.

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 sectionalizer and circuit breakers. Coordination of protective devices: General coordination procedure.

UNIT V

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.

TEXT BOOKS:

1. "Electric Power Distribution System Engineering " byTuranGonen, Mc.Graw-Hill Book Company,1986.

2. Electric Power Distribution-by A.S.Pabla, Tata McGraw-Hill Publishing Company, 4th edition, 1997.

REFERENCE BOOKS:

1. Electrical Distribution V.Kamaraju-McGraw Hill

2. Handbook of Electrical Power Distribution – Gorti Ramamurthy-Universities press

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE206A - SMART GRID TECHNOLOGIES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient &Self Healing Grid, Present Development & International policies on Smart Grid. Case study of Smart Grid

UNIT II

Smart Grid Technologies: Part 1: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

UNIT III

Smart Grid Technologies: Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit (PMU).

UNIT IV

Microgrids and Distributed Energy Resources: Concept of micro grid, need & applications of micro grid, formation of microgrid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources.

UNIT V

Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

TEXT BOOKS:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley

2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama,"Smart Grid: Technology and Applications", Wiley

3. Jean Claude Sabonnadière, NouredineHadjsaïd, "Smart Grids", Wiley Blackwell 19

4**.** S. Chowdhury, S. P. Chowdhury, P. Crossley, "Microgrids and Active Distribution Networks." Institution of Engineering and Technology, 30 Jun 2009

REFERENCE BOOKS:

1. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power DrivingSustainability: 1", Artech House Publishers July 2011

2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press

3. MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18D1252522 - SPECIAL MACHINES

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

Stepper Motors

Constructional features, Principle of operation, Modes of excitation torque production in Variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor.

UNIT II

Permanent Magnet Synchronous Motors (PMSM) and Switched Reluctance Motors (SRM)

PMSM: Power electronic controllers, Torque speed characteristics, Self control, Vector control, Current control - SRM: Constructional features, Principle of operation. Torque equation, Characteristics, Control Techniques, Drive concept.

UNIT III

Permanent Magnet Brushless DC Motors

Concept of electronic commutation, Hall sensors, Optical sensors, back emf detection, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Speed control by microcontroller.

UNIT IV

Servomotors and AC Tachometers

Servomotor – Types – Constructional features – Principle of Operation – Characteristics - Control – Microprocessor based applications.

AC Tachometers: Permanent magnet ac tachometer, AC induction tachometer, Schematic diagrams, Operating principle.

UNIT V

Linear Motors

Linear Motors: Linear Induction Motor (LIM) Classification – Construction – Principle of operation – Concept of Current sheet –Goodness factor – DC Linear Motor (DCLM) types – Circuit equation – DCLM control-applications.

TEXT BOOKS:

1. Miller, T.J.E. “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon ,Press, Oxford, 1989.

2. Kenjo, T, “Stepping Motors and their Microprocessor control”, Clarendon Press, Oxford, 1989.

3. Naser A and Boldea I, “Linear Electric Motors: Theory, Design and Practical Application”, Prentice Hall Inc., New Jersey,1987

4. Special Electrical Machines-K.Venkataratnam- University press

REFERENCE BOOKS:

1. Floyd E Saner,”Servo Motor Applications”, Pittman USA, 1993.

2. Kenjo, T and Naganori, S “Permanent Magnet and brushless DC motors”, Clarendon Press, Oxford, 1989.

3. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5th edition- 1995

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE206C - PROGAMMABLE LOGIC CONTROLLERS & APPLICATIONS

Lecture – Tutorial:	4-0	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOKS:

1. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI

2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.

REFERENCE BOOKS:

1. Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.

2. Programmable Logic Controllers –W.Bolton-Elsevier publisher.

E-RESOURCES:

1. http://nptel.ac.in/course.php
2. http://jntuk-coeerd.in/

18EEPE261- POWER CONVERTERS AND DRIVES LAB

Practice:	3	**Internal Marks:**	40
Credits:	2	**External Marks:**	60

List of Experiments:

1. Analysis and speed control of DC motor drive using 3-phase full Converter.
2. Analysis of a four quadrant Chopper feeding DC motor.
3. Analysis of a 3-phase A.C. Voltage controller fed to R & RL - load.
4. Analysis of Buck, Boost, Buck-Boost DC-DC converters.
5. Analysis of Single Phase IGBT based PWM Inverter connected to R & R-L load.
6. Analysis of 3-phase IGBT based PWM Inverter feeding R & R-L load.
7. Analysis and speed control of 3 phase slip ring Induction motor by Static Rotor Resistance controller.
8. Analysis of three phase SVPWM Pulse generation using PIC Micro controller/DSP processor.
9. Analysis of DSP based V/F Control of 3 phase Induction motor.
10. Analysis of vector control-based speed control of three phase Induction Motor drive.

EQUIPMENT REQUIRED:

REFERENCE BOOKS:

1. Robert W. Erickson &Dragon Maksimovic" Fundamentals of Power Electronics" Second Edition, 2001 Springer science and Business media
2. Ned Mohan,T.MUndeland and W.P Robbin, "Power Electronics converters, Applicationand design" John Wiley and sons.Wiley India edition, 2006.
3. Fundamentals of Power Electronics With MATLAB Randall Sbaffer.
4. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", PrenticeHal India,New Delhi, 1995.

E-RESOURCES:

1.
2.
3.
4.

VIRTUAL LABS:

1.
2.
3.