### COURSE STRUCTURE - M.TECH (POWER ELECTRONICS)
#### 2014 - 2015

#### I-YEAR - I SEMESTER

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
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<tr>
<td>1</td>
<td>PGEE1T01</td>
<td>Electrical Machine Modeling &amp; Analysis</td>
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<td>Analysis of Power Electronic Converters</td>
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<td>Electric Drives-I</td>
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<td>Modern Control Theory</td>
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<td>PGEE1T06</td>
<td>Power Quality</td>
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<td>HVDC Transmission</td>
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<td>PGEE1P11</td>
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ELECTRICAL MACHINE MODELING & ANALYSIS

I Year – I Sem

SYLLABUS

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

UNIT – III
Reference frame theory & Modeling of single phase Induction Machines Linear transformation-Phase transformation - three phase to two phase transformation (abc to áâ0) and two phase to three phase transformation áâ0 to abc - Power equivalence- Mathematical modeling of single phase induction machines

UNIT – IV

UNIT – V

REFERENCE BOOKS

ANALYSIS OF POWER ELECTRONIC CONVERTERS

I Year – I Sem

SYLLABUS

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

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

UNIT –V

TEXTBOOKS
UNIT-I
Introduction and 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 drive 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.

REFERENCE BOOKS:
4. Power electronic circuits, devices and applications – M.H.Rashid – PHI.
FLEXIBLE AC TRANSMISSION SYSTEMS

I Year – I Sem

SYLLABUS

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
Voltage source converters: Single phase, three phase, full wave bridge converters, transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source converters, and comparison of current source converters with voltage source converters.

UNIT-III
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-IV
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.

TEXT BOOK :

3. HVDC & FACTS Controllers: applications of static converters in power systems- Vijay K.Sood- Springer publishers
SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN::BHIMAVARAM
(Autonomous)
Department of Electrical and Electronic Engineering
M. Tech (POWER ELECTRONICS) 2014-15
(ELECTIVE-I)
MODERN CONTROL THEORY

I Year – I Sem

SYLLABUS

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 – 1 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 – 11 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
– Krasoovski’s method.

TEXTS BOOKS:

1. Modern Control System Theory by M. Gopal – New Age International – 1984
   Edu, India, 2009
UNIT –I

UNIT –II

UNIT –III

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

TEXT BOOKS:

REFERENCE BOOKS:
6. Power Quality in Power systems and Electrical Machines-Ewald F.fuchs, Mohammad A.S. Masoum-Elsevier

(ELECTIVE I)
I Year – I Sem

SYLLABUS

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

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

UNIT – III
Unconstrained Nonlinear Programming: One – dimensional minimization methods:
Classification, Fibonacci method and Quadratic interpolation method. Univariate method,
Powell’s method and steepest descent method.

UNIT – IV
Constrained Nonlinear Programming: 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 – V
Dynamic Programming: Dynamic programming multistage decision processes – types – concept
of sub optimization and the principle of 34 2013-14 optimality – computational procedure in
dynamic programming – examples illustrating the calculus method of solution - examples
illustrating the tabular method of solution.

TEXT BOOKS:

REFERENCE BOOKS:
4. Linear Programming–by G.Hadley.
SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN::BHIMAVARAM
(Autonomous)
Department of Electrical and Electronic Engineering
M. Tech (POWER ELECTRONICS) 2014-15
(ELECTIVE II)
ENERGY AUDITING, CONSERVATION & MANAGEMENT
I Year – I Sem

SYLLABUS

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

UNIT -II
Energy Management –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
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, tongue 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, lifecycle 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.

REFERENCE BOOKS
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
5. Energy management and good lighting practice : fuel efficiency-booklet12-EEO
SYLLABUS

UNIT - I
Introduction to artificial Intelligence systems, concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Multilayer Perceptron. Learning and Training the neural network.

UNIT - II

UNIT - III
Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters, solution of typical control problems using genetic algorithm, Particle swarm optimization.

UNIT - IV

UNIT - V

TEXT BOOKS
5. Artificial Intelligent based Electrical Machines and Drives- Peter Vas, Oxford University Press

REFERENCES
2. Fundamental of neural networks architectures, algorithms and applications- Laurene Faussett-pearson publications
I Year – I Sem

SYLLABUS

UNIT –I

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 $\alpha$ and $\mu$. 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.

REFERENCE BOOKS:
5. HVDC Transmission-S Kamakshaih and V Kamaraju MG hill.
Any 10 of the following experiments are to be conducted.

List of experiments:

1. Switching characteristics of Thyristor, MOSFET, IGBT using PSPICE Simulation
2. PSPICE Simulation of Single phase full converter using R-L load, R-L-E load with and without LC Filter.
3. PSPICE Simulation of Three phase full converter using R-L-E Load.
4. PSPICE Simulation of single phase AC Voltage controller with PWM control for RL load.
5. PSPICE Simulation of three phase AC Voltage controller using RL load.
6. PSPICE Simulation of single phase inverter with sinusoidal PWM control for R-load
7. PSPICE Simulation of Three phase inverter with Sinusoidal PWM control for R-Load.
8. PSPICE Simulation of dc-dc Boost converter.
9. Three phase converter fed DC motor using Matlab/Simulink
10. Development and Simulation of 3-phase PWM Inverter with sinusoidal pulse-width modulation using Matlab/Simulink
11. Characteristics of induction machines under balanced and symmetrical conditions for the following using Matlab/Simulink
   a) dq model in synchronous reference frame
   b) dq model in stator reference frame
   c) dq model in rotor reference frame
17. Three phase IGBT based ac voltage controller with PWM control using Matlab-Simpower blockset