JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. POWER ELECTRONICS/POWER ELECTRONICS AND ELECTRICAL DRIVES
EFFECTIVE FROM ACADEMIC YEAR 2019- 20 ADMITTED BATCH

R19 COURSE STRUCTURE AND SYLLABUS

I YEAR I SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core - I	Power Electronic Converters	3	0	0	3
Professional Core - II	Machine Modeling and Analysis	3	0	0	3
Professional Elective - I	1. Power Electronics for Renewable Energy Systems 2. Smart Grid Technologies 3.Dynamics of Electrical Machines 4. Modern Control Theory	3	0	0	3
Professional Elective - II	1. Power Semiconductor Devices and Modelling 2. Reactive Power Compensation and Management 3. High Frequency Magnetic Components 4. Hybrid Electric Vehicles	3	0	0	3
	Research Methodology and IPR	2	0	0	2
Lab - I	Machine Modelling and Analysis Lab	0	0	4	2
Lab - II	Power Electronic Converters Lab	0	0	4	2
Audit - I	Audit Course - I	2	0	0	0
	Total	**16**	**0**	**8**	**18**

I YEAR II SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core - III	Advanced Power Electronic Converters	3	0	0	3
Professional Core - IV	Electrical Drives	3	0	0	3
Professional Elective - III	1. Industrial Load Modelling and Control 2.Advanced Digital Signal Proceesing 3. SCADA Systems and Applications 4. PWM Converters and Applications	3	0	0	3
Professional Elective - IV	1.Advanced Microcontroller Based Systems 2.Distributed Generation 3. Power Quality 4. Integration of Energy Sources	3	0	0	3
	Mini Project with Seminar	0	0	4	2
Lab - III	Advanced Power Electronic Converters Lab	0	0	4	2
Lab - IV	Electrical Drives Lab	0	0	4	2
Audit - II	Audit Course - II	2	0	0	0
	Total	**14**	**0**	**12**	**18**

II YEAR I SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Elective - V	1. Reliability Engineering 2. Flexible AC Transmission Systems 3. HVDC Transmission 4. Energy Storage Technologies	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review - II	0	0	12	6
	Total	**6**	**0**	**12**	**12**

II YEAR II SEMESTER

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review - III	0	0	12	6
Dissertation	Dissertation Viva-Voce	0	0	28	14
	Total	**0**	**0**	**40**	**20**

***For Dissertation Work Review - I, Please refer 7.8 in R19 Academic Regulations.**

Audit Course I & II:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Mangement by Yoga
8. Personality Development through Life Enlightenment Skills

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

POWER ELECTRONIC CONVERTERS (Professional Core - I)

Prerequisite: Power Electronics

Course Objectives: to prepare the students to

- understand the principle of operation of modern power semiconductor devices.
- comprehend the concepts of different power converters and their applications
- analyze and design switched mode regulators for various industrial applications.

Course Outcomes: At the end of the course, the student is able to:

- Choose appropriate device for a particular converter topology.
- Use power electronic simulation packages for analyzing and designing power converters.

UNIT-I:
AC VOLTAGE CONTROLLERS
Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive-inductive-induced e.m.f. loads – ac voltage controllers with PWM Control – Effects of source and load inductances - Synchronous tap changers.
Three phase AC voltage controllers – Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads – Effects of source and load Inductances – Applications & Problems.

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

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

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

UNIT-V:
PULSE WIDTH MODULATED INVERTERS

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

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

TEXT BOOKS:

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

REFERENCES:

1. Milliman Shepherd and Lizang – “Power converters circuits” – Chapter 14 (Matrix converter) PP- 415-444,
2. M.H.Rashid - Power electronics hand book –
3. Marian P. Kaźmierkowski, Ramu Krishnan, Frede Blabjerg Edition:” Control in power electronics” illustrated Published by Academic Press, 2002.
4. NPTEL online course, Power Electronics, by Prof. B. G. Fernandez, https://www.youtube.com/playlist?list=PLA07ACBDE053A8229

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

MACHINE MODELING AND ANALYSIS (Professional Core - II)

Prerequisite: Electrical Machines

Course Objectives: to prepare the students to

- Identify the methods and assumptions in modeling of machines.
- Recognize the different frames for modeling of AC machines.
- Write voltage and torque equations in state space form for different machines.

Cousre Outcomes: At the end of the course, the student is able to:

- Develop the mathematical models of various AC and DC machines
- Analyze the developed models in various reference frames.

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

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

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

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

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

TEXT BOOKS:
1. Generalized Machine theory - P.S. Bimbhra, Khanna Publishers
2. Analysis of electric machinery and Drives systems - Paul C. Krause, Oleg wasynezuk, Scott D. Sudhoff.

REFERENCES:
1. Thyristor control of Electric Drives - Vedam Subranmanyam.
2. Power System Stability and Control – Prabha Kundur, EPRI.
3. Performance optimization of induction motors during Voltage-controlled soft starting, Article in IEEE Transactions On Energy Conversion, July 2004.

4. A Novel Method for Starting of Induction Motor with Improved Transient Torque Pulsations, Nithin K.S, Dr. Bos Mathew Jos, Muhammed Rafeek, Dr. Babu Paul. International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 8, February 2013.
5. NPTEL Course on "Modelling and Analysis of Electrical Machines", https://www.youtube.com/playlist?list=PLbMVogVj5nJQBG9363J1uq5Fnq4m1yGXL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS (Professional Elective - I)

Prerequisite: Power Electronics , Renewable Energy Systems

Course Objectives: to prepare students to

- Provide knowledge about the stand alone and grid connected renewable energy systems.
- equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems. To develop maximum power point tracking algorithms.

Course Outcomes: At the end of the course, the student is able to:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

UNIT-I:
INTRODUCTION
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNI-II:
ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION
Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT-III:
POWER CONVERTERS Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT-IV:
ANALYSIS OF WIND AND PV SYSTEMS Stand alone operation of fixed and variable speed wind energy conversion systems and solar systemGrid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT-V:
HYBRID RENEWABLE ENERGY SYSTEMS
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TEXT BOOKS:

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
5. Andrzej M. Trzynnadlowski, ‘Introduction to Modern Power Electronics’, Second edition, wiley India Pvt. Ltd, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

SMART GRID TECHNOLOGIES (Professional Elective - I)

Prerequisite: Power Systems, Electrical Measurements, Power Quality

Course Objectives:

- Understand concept of smart grid and its advantages over conventional grid
- Know smart metering techniques
- Learn wide area measurement techniques
- Understanding the problems associated with integration of distributed generation & its solution through smart grid.

Course Outcomes: At the end of the course, the student is able to:

- Appreciate the difference between smart grid & conventional grid
- Apply smart metering concepts to industrial and commercial installations
- Formulate solutions in the areas of smart substations,distributed generation and wide area measurements
- Come up with smart grid solutions using modern communication technologies

UNIT-I:
Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust & Self Healing Grid Present development & International policies in Smart Grid**.** 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, Smart Substations, Substation Automation, Feeder Automation .

UNIT-II:
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-III:
Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, 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-IV:
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

UNIT-V:
Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area,Network (NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols

TEXT BOOKS:

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE, 2011
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press , 2009

REFERENCES:

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, “Smart Grid: Technology and Applications”, Wiley 2012
2. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions “ CRC Press
3. A.G.Phadke, “Synchronized Phasor Measurement and their Applications”, Springer

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

DYNAMICS OF ELECTRICAL MACHINES (Professional Elective - I)

Prerequisite: Machine Modeling and Analysis

Course Objectives: to prepare the students to

- Understand generalized modeling of electrical machines
- analyze different electrical machines with dynamic modeling

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

- Understand the basic mathematical analysis of electrical machines and its characteristics.
- Understand behavior of electrical machines under steady state and transient state.
- Understand dynamic modeling of electrical machines.

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

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

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

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

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

TEXT BOOKS:

1. Sen Gupta D.P. and J.W **"** Electrical Machine Dynamics "Macmillan Press Ltd 1980.
2. Bimbhra P.S. "Generalized Theory of Electrical Machines " Khanna Publishers 2002.

REFERENCES:

1. Thyristor control of Electric Drives - Vedam Subranmanyam.
2. Performance optimization of induction motors during Voltage-controlled soft starting, Article in IEEE Transactions On Energy Conversion, July 2004.

3. NPTEL Course on “Modelling and Analysis of Electrical Machines”, https://www.youtube.com/playlist?list=PLbMVogVj5nJQBG9363J1uq5Fnq4m1yGXL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

MODERN CONTROL THEORY (Professional Elective - I)

Prerequisite: Control Systems

Course Objectives:

- To explain the concepts of basics and modern control system for the real time analysis and design of control systems.
- To explain the concepts of state variables analysis.
- To study and analyze non linear systems.
- To analyze the concept of stability for nonlinear systems and their categorization.
- To apply the comprehensive knowledge of optimal theory for Control Systems.

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

- Various terms of basic and modern control system for the real time analysis and design of control systems.
- To perform state variables analysis for any real time system.
- Apply the concept of optimal control to any system.
- Able to examine a system for its stability, controllability and observability.
- Implement basic principles and techniques in designing linear control systems.
- Formulate and solve deterministic optimal control problems in terms of performance indices.
- Apply knowledge of control theory for practical implementations in engineering and network analysis.

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

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

UNIT-III:
STATE FEEDBACK CONTROLLERS AND OBSERVERS
State feedback controller design through Pole Assignment, using Ackkermans formula– State observers: Full order and Reduced order observers.

UNIT-IV:
NON-LINEAR SYSTEMS
Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc; Linearization of nonlinear systems, Singular Points and its types– Describing

function–describing function of different types of nonlinear elements, – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Stability analysis of nonlinear systems based on phase-plane method.

UNIT-V:

STABILITY ANALYSIS

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

TEXT BOOKS:

1. M.Gopal, Modern Control System Theory, New Age International - 1984
2. Ogata. K, Modern Control Engineering, Prentice Hall - 1997

REFERENCES:

1. N K Sinha, Control Systems, New Age International – 3rd edition.
2. Donald E.Kirk, Optimal Control Theory an Introduction, Prentice - Hall Network series - First edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

POWER SEMICONDUCTOR DEVICES AND MODELLING (Professional Elective - II)

Prerequisite: Power Electronics

Cousre Objectives: to prepare the students to

- improve power semiconductor device structures for adjustable speed motor control applications.
- understand the static and dynamic characteristics of current controlled power semiconductor devices
- understand the static and dynamic characteristics of voltage controlled power semiconductor devices
- enable the students for the selection of devices for different power electronics applications
- understand the control and firing circuit for different devices.

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

- Know the operating charectertics of various basic semiconductor devices and switches
- Understand the advanced power semiconductor devices operation.
- Know the modeling of basic and advanced semiconductor devices and switches through simulation
- Analyze the applications of various power semiconductor switches

UNIT-I:

POWER DIODES: Basic structure and V-I characteristics, breakdown voltages and control, on-state losses, switching characteristics-turn-on transient, turn off transient and reverse recovery transient, Schottky diodes, snubber requirements for diodes, diode snubber, modelling and simulation of Power diodes. 5 Hrs. Power BJT'S: Basic structure and V-I characteristics, breakdown voltages and control, secondary breakdown and it's control- FBSOA and RBSOA curves - on state losses, switching characteristics, resistive switching specifications, clamped inductive switching specifications, turnon transient, turn-off transient, storage time, base drive requirements, switching losses.

UNIT-II:

POWER BJT'S: Device protection- snubber requirements for BJT'S and snubber design switching aids,modeling and simulation of power BJT'S.

SILICON CONTROLLED RECTIFIERS (THYRISTORS): Basic structure, V-I characteristics, turn-on process, on-state operation, turn -off process, switching characteristics, turn-on transient and di/dt limitations, turn-off transient, turnoff time and reapplied dv/dt limitations,gate drive requirements, ratings of thyristors,snubber requirements and snubber design, modelling and simulation of Thyristor.

TRIACS: Basic structure and operation-I characteristics, ratings, snubber requirements, modelling and simulation of triacs.

UNIT-III:

GATE TURNOFF THYRISTOR (GTO): Basic structure and operation, GTO switching characteristics, GTO turn-on transient, GTO turn -off transient, minimum on and off state times, gate drive requirements, maximum controllable anode current, over current protection of GTO'S, modelling and simulation of GTO'S.

POWER MOSFET'S: Basic structure, V-I characteristics, turn-on process, on state operation, turnoff process, switching characteristics, resistive switching specifications, clamped inductive switching specifications - turn-on transient and di/dt limitations, turn-off transient, turn off time, switching losses, effect of reverse recovery transients on switching stresses and losses - dv/dt limitations, gating

requirements, gate charge - ratings of MOSFET'S, FBSOA and RBSOA curves, device protection - snubber requirements, modeling and simulation of Power MOSFET'S.

UNIT-IV:

INSULATED GATE BIPOLAR TRANSISTORS (IGBT'S): Basic structure and operation, latch up IGBT, switching characteristics, resistive switching specifications, clamped inductive switching specification – IGBT turn-on transient, IGBT turn off transient- current tailing - gating requirements ,ratings of IGBT'S, FBSOA and RBSOA curves, switching losses – minimum on and off state times, switching frequency capability – overcurrent protection of IGBT'S, short circuit protection, snubber requirements and snubber design.

UNIT-V:

ADVANCED POWER SEMICONDUCTOR DEVICES: MOS gated thyristors, MOS controlled thyristors or MOS GTO'S, base resistance controlled thyristors, emitter switched thyristor, thermal design of power electronic equipment, modelling and simulation, heat transfer by conduction, transient thermal impedance, heat sinks, heat transfer by radiation and convection - heat sinkselection for power semiconductor devices.

TEXT BOOKS:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rd Edition. Wiley India Pvt Ltd, 2011.
2. G. Massobrio, P. Antognetti, "Semiconductor Device Modeling with Spice", McGrawHill, 2nd Edition, 2010.

REFERENCES:

1. B. Jayant Baliga, "Power Semiconductor Devices", 1st Edition, International Thompson Computer Press, 1995.
2. V. Benda, J. Gowar, and D. A. Grant, "Discrete and Integrated Power Semiconductor Devices: Theory and Applications", John Wiley & Sons,1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

REACTIVE POWER COMPENSATION AND MANAGEMENT (Professional Elective - II)

Prerequisite: 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
- To characterize distribution side and utility side reactive power management.

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

- Distinguish the importance of load compensation in symmetrical as well as un symmetrical loads
- Observe various compensation methods in transmission lines
- Construct model for reactive power coordination
- Distinguish demand side reactive power management & user side reactive power management

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 SYSTEM
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 – 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:
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 – retrofitting 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 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.

REFERENCES:

1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just “Reactive Power Compensation: A Practical Guide, April, 2012, Wiely publication.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

HIGH FREQUENCY MAGNETIC COMPONENTS (Professional Elective - II)

Prerequisite: None

Course Objectives: to prepare the students to

- Know about magnetic circuits
- Know about high frequency magnetic components

Course Outcomes: the student will be able to

- Design of magnetic components (i.e., inductor and transformer) in a converter.
- Perform steady-state analysis of switched mode power supply.
- Understand core loss in an electromagnetic device, recognize & describe its effect.
- Describe the engineering uses of electromagnetic waves, by frequency band, and the respective hazards associated with them

UNIT-I:

FUNDAMENTALS OF MAGNETIC DEVICES: Introduction, Magnetic Relationships, Magnetic Circuits, Magnetic Laws, Eddy Currents, Core Saturation, Volt-Second Balance, Inductance, Inductance Factor, Magnetic Energy, Self-Resonant Frequency, Classification of Power Losses in Magnetic Components, Non-inductive Coils.

MAGNETIC CORES: Introduction, Properties of Core Materials, Magnetic Dipoles, Magnetic Domains, Curie Temperature, Magnetization, Magnetic Materials, Hysteresis, Core Permeability, Core Geometries, Iron Alloy Cores, Amorphous Alloy Cores, Nickel–Iron and Cobalt–Iron Cores, Ferrite Cores, Powder Cores, Nano-crystalline Cores, Superconductors, Hysteresis Core Loss, Eddy-Current Core Loss, Total Core Loss, Complex Permeability.

UNIT-II:

SKIN EFFECT & PROXIMITY EFFECT: Introduction, Magnet Wire, Wire Insulation, Skin Depth, Ratio of AC-to-DC Winding Resistance, Skin Effect in Long Single Round Conductor, Current Density in Single Round Conductor, Impedance of Round Conductor, Magnetic Field Intensity for Round Wire, Other Methods of Determining the Round Wire Inductance, Power Density in Round Conductor, Skin Effect on Single Rectangular Plate. Proximity and Skin Effects in Two Parallel Plates, Anti-proximity and Skin Effects in Two Parallel Plates, Proximity Effect in Multiple-Layer Inductor, Appendix: Derivation of Proximity Power Loss.

WINDING RESISTANCE AT HIGH FREQUENCIES: Introduction, Winding Resistance, Square and Round Conductors, Winding Resistance of Rectangular Conductor, Winding Resistance of Square Wire, Winding Resistance of Round Wire, Leakage Inductance, Solution for Round Conductor Winding in Cylindrical Coordinates, Litz Wire, Winding Power Loss for Inductor Current with Harmonics, Effective Winding Resistance for Non-sinusoidal Inductor Current, Thermal Model of Inductors.

UNIT-III:

TRANSFORMERS: Introduction, Neumann's Formula for Mutual Inductance, Mutual Inductance, Energy Stored in Coupled Inductors, Magnetizing Inductance, Leakage Inductance, Measurement of Transformer Inductances, Stray Capacitance, High-Frequency Transformer Model, Non-interleaved Windings, Interleaved Windings, AC Current Transformers, Winding Power Losses with Harmonics, Thermal Model of Transformers.

DESIGN OF TRANSFORMERS: Introduction, Area Product Method, Optimum Flux Density, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in

DCM, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in DCM.

UNIT-IV:

INTEGRATED INDUCTORS: Introduction, Resistance of Rectangular Trace, Inductance of Straight Rectangular Trace, Construction of Integrated Inductors, Meander Inductors, Inductance of Straight Round Conductor, Inductance of Circular Round Wire Loop, Inductance of Two-Parallel Wire Loop, Inductance of Rectangle of Round Wire, Inductance of Polygon Round Wire Loop, Bond-wire Inductors, Single-Turn Planar Inductor, Inductance of Planar Square Loop, Planar Spiral Inductors, Multi-metal Spiral Inductors, Planar Transformers, MEMS Inductors, Inductance of Coaxial Cable, Inductance of Two-Wire Transmission Line, Eddy Currents in Integrated Inductors, Model of RF Integrated Inductors, PCB Inductors.

DESIGN OF INDUCTORS: Introduction, Restrictions on Inductors, Window Utilization Factor, Temperature Rise of Inductors, Mean Turn Length of Inductors, Area Product Method, AC Inductor Design, Inductor Design for Buck Converter in CCM, Inductor Design for Buck Converter in DCM method.

UNIT-V:

SELF-CAPACITANCE: Introduction, High-Frequency Inductor Model, Self-Capacitance Components, Capacitance of Parallel-Plate Capacitor, Self-Capacitance of Foil Winding Inductors, Capacitance of Two Parallel Round Conductors, Capacitance of Round Conductor and Conducting Plane, Self-Capacitance of Single-Layer Inductors, Self-Capacitance of Multi-layer Inductors, Capacitance of Coaxial Cable.

TEXT BOOKS:

1. Design of Magnetic Components for Switched Mode Power Converters, Umanand L., Bhat,S.R., ISBN:978-81-224-0339-8, Wiley Eastern Publication, 1992.
2. High-Frequency Magnetic Components, Marian K. Kazimierczuk, ISBN: 978-0-470- 71453-9 John Wiley & Sons, Inc.

REFERENCES:

1. G.C. Chryssis, High frequency switching power supplies, McGraw Hill, 1989 (2nd Edn.)
2. Eric Lowdon, Practical Transformer Design Handbook, Howard W. Sams & Co., Inc., 1980
3. “Thompson --- Electrodynamic Magnetic Suspension.pdf”
4. Witulski --- “Introduction to modeling of transformers and coupled inductors” Beattie ---“Inductance 101.pdf”
5. P. L. Dowell, "Effects of eddy currents in transformer windings.pdf"
6. Dixon--- “Eddy current losses in transformer windings.pdf”
7. J J Ding, J S Buckkeridge, “Design Considerations For A Sustainable Hybrid Energy System” IPENZ Transactions, 2000, Vol. 27, No. 1/EMCh.
8. Texas Instruments --- “Windings.pdf”
9. Texas Instruments --- “Magnetic core characteristics.pdf” Ferroxcube --- “3f3 ferrite datasheet.pdf” Ferroxcube --- “Ferrite selection guide.pdf” Magnetics, Inc., Ferrite Cores (www.mag-inc.com).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

HYBRID ELECTRIC VEHICLES (Professional Elective - II)

Prerequisite: Power Electronics, Power Semiconductor Drives, Advanced control of Electric Drives

Course Objectives:

- To understand upcoming technology of hybrid system
- To understand different aspects of drives application
- Learning the electric Traction

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

- Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
- To learn electric drive in vehicles / traction.

UNIT-I:
History of hybrid and electric vehicles, Social and environmental importance of hybrid and electric vehicles, Impact of modern drive-trains on energy supplies, Basics of vehicle performance, vehicle power source characterizationTransmission characteristics, Mathematical models to describe vehicle performance

UNIT-II:
Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies,Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

UNIT-III:
Introduction to electric components used in hybrid and electric Vehicles, Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives configuration and control of Permanent Magnet Motor drives Configuration and control of Switch Reluctance, Motor drives, drive system efficiency

UNIT-IV:
Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics Selecting the energy storage technology, Communications, supporting subsystems

UNIT-V:
Introduction to energy management and their strategies used in hybrid and electric vehicle, Classification of different energy management strategies Comparison of different energy management strategies Implementation issues of energy strategies

TEXT BOOKS

1. Sira -Ramirez, R. Silva Ortigoza, “Control Design Techniques in Power Electronics Devices” Springer.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, “Sliding mode control of switching Power Converters”

REFERENCES:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and

Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
4. Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

RESEARCH METHODOLOGY AND IPR

Prerequisite: --

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: At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- 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.
- 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.

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.

Effective literature studies approaches, analysis Plagiarism, Research ethics

UNIT-II:

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-III:

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-IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patentinformation and databases. Geographical Indications.

UNIT-V:

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. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCES:

1. Ranjit Kumar, 2nd Edition , “Research Methodology: A Step by Step Guide for beginners”
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
3. Mayall , “Industrial Design”, McGraw Hill, 1992.
4. Niebel , “Product Design”, McGraw Hill, 1974.
5. Asimov , “Introduction to Design”, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New
7. Technological Age”, 2016.
8. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

MACHINE MODELLING AND ANALYSIS LAB (Lab - 1)

Prerequisite: Electrical Machines, Machine Modelling Analysis

Course Objectives:

- Identifying the methods and assumptions in modeling of machines.
- Recognize the different frames for modeling of AC machines.
- To write voltage and torque equations in state space form for different machines.

Cousre Outcomes: At the end of the course, the student is able to:

- Develop the mathematical models of various machines like, induction motor and Synchronous machines ,permenant magnet synchronous motor,brushless DC motor using modeling equations.
- Analyze the developed models in various reference frames.

List of Experiments

1. Develop a dynamic model of open loop controlled dc motor
2. Develop a dynamic model of closed loop controlled dc motor
3. Convert ABC voltages into stationary frame
4. Convert ABC voltages into synchronous frames
5. Convert ABC voltages into rotor reference frames
6. Develop dynamic model of 3-phase Induction motor and generator
7. Develop a mathematical model for V/f controlled 3-phase Induction motor
8. Develop a mathematical model for 3-phase Synchronous motor
9. Develop a mathematical model for 3-phase Permanent Magnet Synchronous motor
10. Develop a mathematical model for Brushless DC Motor
11. Develop a dynamic model for closed loop control of Induction Motor
12. Develop a dynamic model for closed loop control of Synchronous motor

Note: Conduct any 10 experiments from the above using anysimulation tool

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – I SEM. (PE/PEED)

POWER ELECTRONIC CONVERTERS LAB (Lab - 2)

Prerequisite: Power Electronic Converters

Course Objectives: Upon successful completion of the lab students will be familiar with:

- Simulation of various AC-AC, AC-DC, DC-DC, DC-AC converter topologies

Course Outcomes: At the end of the course, the student should be able to:

- Simulate AC-AC Converters
- Simulate AC-DC Converters
- Simulate DC-DC Converters
- Simulate DC-AC Converters
- Analysis of various converter topologies developed

PART-A

1. Single phase full converter using RL and E loads.
2. Single phase semi converter using RL and E loads.
3. Three phase full converter using RL and E loads.
4. Three phase semi converter using RL and E loads.
5. Single phase AC Voltage controller using RL load.
6. Single phase Cyclo-converter using RL load.
7. Three phase six stepped inverter
8. Three-phase inverter with PWM controller.
9. BUCK ,BOOST and CUCK regulators
10. Space vector PWM converter

Note: Conduct any 5 hardware experiments from **PART-A**

PART-B:

1. Single phase full converter using RL and E loads.
2. Single phase semi converter using RL and E loads.
3. Three phase full converter using RL and E loads.
4. Three phase semi converter using RL and E loads.
5. Single phase AC Voltage controller using RL load.
6. Single phase Cyclo-converter using RL load.
7. Three phase six stepped inverter
8. Three-phase inverter with PWM controller.
9. BUCK ,BOOST and CUCK regulators
10. Space vector PWM converter

Note: Conduct any 5 experiments from **PART-B** using any simulation tool

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

ADVANCED POWER ELECTRONIC CONVERTERS (Professional Core - III)

Prerequisite: Power Electronics, Power Electronic Converters

Course Objectives: to prepare the students to

- understand various advanced power electronics devices.
- describe the operation of multi level inverters with switching strategies for high power applications.
- comprehend the design of resonant converters and switched mode power supplies.

Course Outcomes: student will be able to:

- Develop and analyze various converter topologies.
- Design AC or DC switched mode power supplies.

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

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

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

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

UNIT-V:

D.C & A.C POWER SUPPLIES

DC power supplies – classification - switched mode dc power supplies – fly back Converter – forward converter – push-pull converter – half bridge converter – Full bridge converter – Resonant d c power supplies – bidirectional power supplies – Applications.

AC power supplies – classification – switched mode ac power supplies – Resonant AC power supplies – bidirectional ac power supplies – multistage conversions – control circuits – applications. Introduction – power line disturbances – power conditioners – Uninterruptible Power supplies – applications.

TEXT BOOKS:

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

REFERENCES:

1. Milliman Shepherd and Lizang – "Power converters circuits" – Chapter 14 (Matrix converter) PP-415-444,
2. M.H.Rashid - Power electronics hand book –
3. Marian P. Kaźmierkowski, Ramu Krishnan, Frede Blabjerg Edition:" Control in power electronics" illustrated Published by Academic Press, 2002.
4. NPTEL online course, "Pulse width Modulation for Power Electronic Converters" Dr. , G. Narayanan, https://www.youtube.com/playlist?list=PLbMVogVj5nJQoZqyLxx-cg_dYE-Dt2UMH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

ELECTRICAL DRIVES (Professional Core - IV)

Prerequisite: Power Electronic Converters , Electrical Machines

Course Objectives: to prepare the students to

- understand principle of operation of scalar control of ac motor and corresponding speed-torque characteristics
- comprehend the vector control for ac motor drive (IM and SM)
- explain the static resistance control and Slip power recovery drive
- explain synchronous motor drive characteristics and its control strategies
- comprehend the brushless dc motor principle of operation.

Course Outcomes: student will be able to:

- Develop induction motor for variable speed operations using scalar and vector control techniques.
- Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
- Develop controllers for synchronous motor and variable reluctance motor.

UNIT–I:
RECTIFIER CONTROLLED DC MOTOR:
Separately excited DC motors and DC series motors with single phase semi converter and single phase full converter**-**Three-phase controlled converter, control circuit, control modeling of three phase converter – Steady state analysis of three phase converter control DC motor drive – Two quadrant, Three phase converter controlled DC motor drive – DC motor and load, converter.
CLOSED LOOP CONTROL OF DC DRIVE:
Current and speed controllers - Current and speed feedback – Design of controllers – Current and speed controllers – Motor equations – filter in the speed feedback loop speed controller – current reference generator – current controller and flow chart for simulation – Harmonics and associated problems – sixth harmonics torque.

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

UNIT–III:
CONTROL OF INDUCTION MOTOR:
Introduction to motor drives – Torque production – Equivalent circuit analysis – Speed – Torque Characteristics with variable voltage operation Variable frequency operation constant v/t operation – Variable stator current operation – Induction motor characteristics in constant torque and field weakening regions.
STATOR SIDE CONTROL:
Scalar control – Voltage fed inverter control – Open loop volts/Hz control – speed control slip regulation – speed control with torque and flux control – current controlled voltage fed inverter drive –

ROTOR SIDE CONTROL OF INDUCTION MOTOR DRIVES:

Slip power recovery drives – Static Kramer Drive – Phasor diagram – Torque expression – speed control of Kramer Drive – Static Scheribus Drive – modes of operation.

UNIT–IV:

VECTOR CONTROL OF INDUCTION MOTOR DRIVES:

Principles of Vector control – Vector control methods – Direct methods of vector control – Indirect methods of vector control – Adaptive control principles – Self tuning regulator Model referencing control – Direct torque control of AC motors.

UNIT–V:

CONTROL OF SYNCHRONOUS MOTOR DRIVES:

Synchronous motor and its characteristics – Control strategies – Constant torque angle control – Unity power factor control – Constant mutual flux linkage control – closed loop operation.

TEXT BOOKS:

1. Electric Motor Drives Pearson Modeling, Analysis and control – R. Krishnan – Publications – 1st edition – 2002.
2. Modern Power Electronics and AC Drives B K Bose – Pearson Publications 1st edition

REFERENCES:

1. Power Electronics and Control of AC Motors – MD Murthy and FG Turn Bull Pergman Press 1st edition
2. Power Electronics and AC Drives – BK Bose – Prentice Hall Eagle wood diffs New Jersey - 1st edition
3. Power Electronic circuits Deices and Applications – M H Rashid – PHI – 1995.
4. Fundamentals of Electrical Drives – G. K. Dubey – Narosa publications – 1995.
5. NPTEL online course on Electric Drives by Prof. Gopakumar, https://www.youtube.com/playlist?list=PL350C8304DD04538D
6. NPTEL course on Advanced Electric Drives by Dr. S.P. Das, https://www.youtube.com/playlist?list=PLA5CA7D35114BA425

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

INDUSTRIAL LOAD MODELLING AND CONTROL (Professional Elective - III)

Prerequisite: 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
- Study Reactive power management in Industries

Course Outcomes: After taking this course, student will be able to:

- Knowledge about load control techniques in industries and its application.
- Different types of industrial processes and optimize the process using tools like LINDO and LINGO.
- Apply load management to reduce demand of electricity during peak time.
- Apply different energy saving opportunities in industries.

UNIT-I:

Electric Energy Scenario-Demand Side Management-Industrial Load Management, Load Curves-Load Shaping Objectives-Methodologies, Barriers; Classification of Industrial Loads- Continuous and Batch processes -Load Modeling.

UNIT-II:

Electricity pricing – Dynamic and spot pricing –Models, Direct load control- Interruptible load control, Bottom up approach- scheduling- Formulation of loadmodels- Optimization and control algorithms - Case studies.

UNIT-III:

Reactive power management in industries-controls-power quality impactsapplication of filters Energy saving in industries.

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. C.O. Bjork “Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands,1989.
2. C.W. Gellings and S.N. Talukdar, “Load management concepts,” IEEE Press, New York, 1986, pp. 3-28.

REFERENCES:

1. Y. Manichaikul and F.C. Schweppe ," Physically based Industrial load", IEEE Trans. on PAS, April 1981.
2. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Interscience Publication, USA, 1989.
3. I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, New Delhi, 1995.
4. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planningin Industrial facilities", IEEE Inc, USA.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

ADVANCED DIGITAL SIGNAL PROCESSING (Professional Elective - III)

Prerequisite: Digital Signal Processing

Course Objectives: to prepare the students to

- understand the difference between discrete-time and continuous-time signals
- understand and apply Discrete Fourier Transforms (DFT)

Course Outcomes : the student will be able to:

- Know about the time domain and frequency domain representations as well analysis of discrete time signals and systems
- Study the design techniques for IIR and FIR filters and their realization structures.
- Acquire knowledge about the finite word length effects in implementation of digital filters.
- Know about the various linear signal models and estimation of power spectrum of stationary Random signals
- Design optimum FIR and IIR filters

UNIT-I:
Discrete time signals, Linear shift invariant systems-Stability and causality, Sampling of continuous time signals-Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform, Z transform-Properties of different transforms

UNIT-II:
Linear convolution using DFT, Computation of DFT Design of IIR digital filters from analog filters, Impulse invariance method, Bilinear transformation method

UNIT-III:
FIR filter design using window functions, Comparison of IIR and FIR digital filters, Basic IIR and FIR filter realization structures, Signal flow graph representations Quantization process and errors, Coefficient quantisation effects in IIR and FIR filters

UNIT-IV:
A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zeroInput limit cycles in IIR filters, Linear Signal Models

UNIT-V:
All pole, All zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals, Estimation of power spectrum of stationary random signals. Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters

TEXT BOOKS:

1. Sanjit K Mitra, “Digital Signal Processing: A computer-based approach “,TataMc Grow-Hill Edition 1998
2. Dimitris G .Manolakis, Vinay K. Ingle and Stephen M. Kogon, “Statistical and Adaptive Signal Processing”, Mc Grow Hill international editions .-2000

REFERENCES:

1. S Salivahanan. A. Vallavaraj C. Gnanapriya, Digital Signal Processing – TMH – 2nd reprint 2001.
2. Lourens R Rebinarand Bernold, Theory and Applications of Digital Signal Processing.

3. Auntoniam, Digital Filter Analysis and Design, TMH.
4. NPTEL online course, Advanced Digital Signal Processing-Wavelets and multirate by Prof. V. M. Gadre https://www.youtube.com/playlist?list=PLbMVogVj5nJRY7X-tMNDHPGdmfZyfHC7J

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

SCADA SYSTEMS AND APPLICATIONS (Professional Elective - III)

Prerequisite: None

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 taking this course, student will be able to:

- Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typicalapplications**.**
- Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
- Knowledge about single unified standard architecture IEC 61850.
- To learn about SCADA system components: remote terminal units, PLCs, intelligent electroni devices, HMI systems, SCADA server.
- Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

UNIT-I:
Introduction to SCADA: Data acquisition systems, Evolution of SCADA,Communication technologies. Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA

UNIT-II:
Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

UNIT-III:
SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture –IEC 61850.

UNIT-IV:
SCADA Communication: various industrial communication technologies-wired and wireless methods and fiber optics. open standard communication protocols.

UNIT-V:
SCADA Applications: Utility applications- Transmission and Distribution sector- operations, monitoring, analysis and improvement. Industries - oil, gas and water, Case studies, Implementation, Simulation Exercises

TEXT BOOKS:

1. Stuart A. Boyer: “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of AmericaPublications, USA,2004.
2. Gordon Clarke, Deon Reynders: “Practical Modern SCADA Protocols: DNP3, 60870.5 and RelatedSystems”, Newnes Publications, Oxford, UK,2004.

REFERENCES:

1. William T. Shaw, “Cybersecurity for SCADA systems”, PennWell Books, 2006.
2. David Bailey, Edwin Wright, “Practical SCADA for industry”, Newnes, 2003.
3. Wiebe, “A guide to utility automation: AMR, SCADA, and IT systems for electric power”,PennWell 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

PWM CONVERTERS AND APPLICATIONS (Professional Elective – III)

Prerequisite: Power Electronics

Course Objectives: to prepare the students to

- Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
- Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Course Outcomes: student will be able to:

- Knowledge concepts and basic operation of PWM converters, including basic circuit operation and design
- Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality
- Able to recognize and use the following concepts and ideas:Steady-State and transient modeling and analysis of power converters with various PWM techniques.

UNIT-I:
AC/DC and DC/AC power conversion, Overview of applications of voltage source converters and current source converters.

UNIT-II:
Pulse width modulation techniques for bridge converters, Bus clamping PWM.Space vector based PWM., Advanced PWM techniques.

UNIT-III:
Practical devices in converter, Calculation of switching and conduction power losses.

UNIT-IV:
Compensation for dead time and DC voltage regulation, Dynamic model of PWM converter.Multilevel converters, Constant V/F induction motor drives.

UNIT-V:
Estimation of current ripple and torque ripple in inverter fed drives, Line-side converters with power factor compensation. Active power filtering.Reactive power compensation, Harmonic current compensation, Selective harmonic elimination PWM technique for high power electric drives.

TEXT BOOKS:

1. Mohan, Undeland and Robbins, “Power Electronics: Converters, Applications and Design”, John’s Wiley and Sons.
2. Erickson RW, “Fundamentals of Power Electronics”, Chapman and Hall.

REFERENCES:

1. Vithyathil. J, “Power Electronics: Principles and Applications”, McGraw Hill.
2. NPTEL Online Course, Pulse width Modulation for Power Electronic Converters by Dr. G. Narayanan, https://www.youtube.com/playlist?list=PLbMVogVj5nJQoZqyLxx-cg_dYE-Dt2UMH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)
ADVANCED MICROCONTROLLER BASED SYSTEMS (Professional Elective - IV)

Prerequisite: Micrprocessors and Microcontrollers
Course Objectives: to prepare the students to

- understand the architecture of advance microcontrollers
- understand the applications of these controllers
- know about FPGA.

Course Outcomes: After taking this course, student will be able to:

- learn how to program a processor in assembly language and develop an advanced processor based system
- learn configuring and using different peripherals in a digital system
- compile and debug a Program
- generate an executable file and use it

UNIT-I:
Basic Computer Organization, Accumulator based processes-Architecture-Memory Organization-I/O Organization

UNIT-II:
Micro-Controllers-Intel 8051, Intel 8056- Registers, Memories, I/O Ports, Serial Communication. Timers, Interrupts, Programming.
Intel 8051 – Assembly language programming-Addressing-Operations-Stack & Subroutines,Interrupts-DMA.

UNIT-III:
PIC 16F877- Architecture Programming, Interfacing Memory/ I/O Devices, Serial I/Oand data communication

UNIT-IV:
Digital Signal Processor (DSP) - Architecture – Programming, Introduction to FPGA

UNIT-V:
Microcontroller development for motor control applications, Stepper motor control using micro controller.

TEXT BOOKS:

1. John.F.Wakerly: “Microcomputer Architecture and Programming”, John Wiley and Sons 1981.
2. Ramesh S.Gaonker: “Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publishing (India), 1994.

REFERENCES:

1. Raj Kamal: “The Concepts and Features of Microcontrollers”, Wheeler Publishing, 2005.
2. Kenneth J. Ayala, “The 8051 microcontroller”, Cengage Learning, 2004.
3. John Morton,” The PIC microcontroller: your personal introductory course”, Elsevier, 2005.
4. Dogan Ibrahim,” Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series”, Elsevier, 2008.
5. Microchip datasheets for PIC16F877.
6. NPTEL Course on "Microprocessors and Microcontrollers " by Prof. Ajit Pal, Dept of Computer Science & Engg., IIT Kharagpur, https://www.youtube.com/playlist?list=PL0E131A78ABFBFDD0

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

DISTRIBUTED GENERATION (Professional Elective - IV)

Prerequisite: Power Systems, Power Electronics

Course Objectives: to prepare the students to
- understand renewable energy sources.
- gain understanding of the working of off-grid and grid-connected renewable energy generation schemes.

Course Outcomes: student will be able to:
- understand the planning and operational issues related to Distributed Generation.
- Acquire Knowledge about Distributed Generation Learn Micro-Grids

UNIT-I:
Need for Distributed generation, Renewable sources in distributed generation and current scenario in Distributed Generation.

UNIT-II:
Planning of DGs, Sitting and sizing of DGs optimal placement of DG sources in distribution systems, Grid integration of DGs Different types of interfaces, Inverter based DGs and rotating machine based interfaces, Aggregation of multiple DG units.

UNIT-III:
Technical impacts of DGs, Transmission systems Distribution Systems De-regulation Impact of DGs upon protective relaying, Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis.

UNIT-IV:
Economic and control aspects of DGs Market facts, Issues and challenges Limitations of DGs, Voltage control techniques, Reactive power control, Harmonics Power quality issues, Reliability of DG based systems.

UNIT-V:
Introduction to micro-grids, Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids, Modeling & analysis of Micro-grids with multiple DGs, Micro-grids with power electronic interfacing units.
Transients in micro-grids, Protection of micro-grids, Case studies,Advanced topics.

TEXT BOOKS:
1. H. Lee Willis, Walter G. Scott, “Distributed Power Generation – Planning and Evaluation”, Marcel Decker Press.
2. M.GodoySimoes, Felix A.Farret, “Renewable Energy Systems – Design and Analysis with Induction Generators”, CRC press.

REFERENCES:
1. Stuart Borlase. “Smart Grid: Infrastructure Technology Solutions” CRC Press
2. NPTEL online course on “Power Electronics and Distributed Generation” by Dr. Vinod John,Department of Electrical Engineering,IISc Bangalore. https://www.youtube.com/playlist?list=PLbMVogVj5nJTAcW3-MnF47B7VuNzbsMzb

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

POWER QUALITY (Professional Elective – IV)

Prerequisite: Power Systems
Course Objectives:

- To Study the basics of power quality , power quality problems and power quality standards,
- To Study about the characteristics of non-linear loads
- To Study Voltage, Current, Power and Energy measurements and analysis methods of Laplace's, Fourier and Hartley and Wavelet Transforms
- To Study the analysis and conventional mitigation methods
- To Study about various devices used to enhance power quality.

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

- Know the different characteristics of electric power quality in power systems,
- Learn about the applications of non-linear loads,
- Know the applications of Hartley and Wavelet Transforms,
- Learn how to mitigate the power quality problems
- Learn about the application of FACTS device on DG side.

UNIT-I:
INTRODUCTION
Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT-II:
LONG & SHORT INTERRUPTIONS
Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.
SHORT INTERRUPTIONS: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT-III:
SINGLE AND THREE-PHASE VOLTAGE Sag CHARACTERIZATION
Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.
Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT- IV:
POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS
Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT-V:

MITIGATION OF INTERRUPTIONS & VOLTAGE SAGS

Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

POWER QUALITY AND EMC STANDARDS:

Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

TEXT BOOKS:

1. "Understanding Power Quality Problems" by Math H J Bollen. IEEE Press.
2. "Power Quality VAR Compensation in Power Systems", R. SastryVedam Mulukutla S. Sarma,CRC Press.

REFERENCES:

1. Power Quality, C. Sankaran, CRC Presss.
2. Electrical Power Systems Quality, Roger C. Dugan , Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Tata McGraw Hill Education Private Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

INTEGRATION OF ENERGY SOURCES (Professional Elective - IV)

Prerequisite: Power Electronics, Renewable Energy Systems

Course Objectives: to prepare the students to

- introduce the characteristics of various types of renewable energy sources and converters.
- explain the importance of storage and sizing of hybrid systems.
- introduce the control issues of isolated systems.
- explain the harmonics, power quality, voltage imperfections, power injection issues on the grid by integrating renewable energy sources.

Course Outcomes: the student should be able to:

- Identify the characteristics of renewable energy sources and converters.
- Analyze the importance of storage and sizing of hybrid systems.
- Realize the problems related to isolated systems.
- Analyze the challenges faced by the grid by integrating renewable energy sources.

UNIT- I:
REVIEW OF CHARACTERISTICS OF POWER SOURCES: Basic review of power generation from wind - Solar PV - Thermal - Small hydro - Biomass power strategies in each of these energy conversion systems - Review of maximum power point tracking techniques in solar PV and wind (perturb & observe, hill climbs, incremental conductance).

UNIT-II:
CONVERTER TOPOLOGIES: DC/DC converter (buck, boost, buck boost) - DC/AC inverters (sine, triangular, PWM techniques) - Phase locked loop for inverters.

UNIT-III:
HYBRID SYSTEMS: Advantages of hybrid power systems - Importance of storage in hybrid power systems - Design of hybrid power system based on load curve - Sizing of hybrid power systems.

UNIT-IV:
ISOLATED SYSTEMS: Control issues in isolated systems for voltage and frequency - Small signal stability in isolated power systems - Importance of storage and dump load in isolated systems.

UNIT-V:
ISSUES IN INTEGRATION OF RENEWABLE ENERGY SOURCES: Overview of challenges in integrating renewable sources to the grid - Impact of harmonics on power quality - Need to maintain voltage within a band and fluctuations in voltage because of renewable integration - Power inverter and converter technologies - Mechanism to synchronize power from renewable sources to the grid - Overview of challenges faced in designing power injection from offshore generation sources - Challenges in modeling intermittent nature of renewable power in a power system.

TEXT BOOKS:

1. Power Electronics, Converters, Applications and Design" by N. Mohan; T.M. Undeland; W.P. Robbins. 1995, John Wiley and Sons.
2. Renewable Energy Integration Challenges and Solutions Series: Green Energy and Technology **Hossain**, Jahangir, **Mahmud**, Apel (Eds.).

REFERENCES:

1. Integration of Alternative Sources of Energy Felix A. Farret, M. Godoy Simões, December 2005, Wiley-IEEE Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

ADVANCED POWER ELECTRONIC CONVERTERS LAB (Lab - III)

Prerequisite: Power Electronic Converters

Course Objectives:

- Speed control techniques of DC and AC drives
- Gate drive circuit configurations for converter circuits
- Advanced converter topologies
- Open loop and closed loop speed control analysis of AC and DC drives

Course Outcomes: At the end of the course, the student should be able to:

- Know the speed control strategies of AC and DC drives
- Design speed, current controllers for AC and DC drives
- Get the knowledge on multi-level inverter/converter topologies
- Perform the open loop and closed loop speed control analysis of AC and DC drives
- Design the gate driver circuits for converter topologies
- Know the complete study of advanced converter technologies

PART-A:

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

Note: Conduct any 5 hardware experiments from the above

PART-B:

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

Note: Conduct any 5 experiments using any simulation tool

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – I YEAR – II SEM. (PE/PEED)

ELECTRICAL DRIVES LAB (Lab - IV)

Prerequisite: Power Electronic Devices and Circuits and Electrical Machines

Course Objectives:

- To understand principle operation of scalar control of ac motor and corresponding speed-torque characteristics
- To comprehend the vector control for ac motor drive (IM and SM)
- To explain the static resistance control and Slip power recovery drive
- To explain synchronous motor drive characteristics and its control strategies
- To comprehend the brushless dc motor principle of operation.

Course Outcomes: After taking this course, student will be able to:

- Develop induction motor for variable speed operations using scalar and vector control techniques.
- Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
- Develop controllers for synchronous motor and variable reluctance motor.

List of Experiments:

1. Speed control of separately excited DC Motor Drive with 1 quadrant chopper
2. Speed control of separately excited DC Motor Drive with 4 quadrant chopper.
3. Speed control of BLDC Motor Drive.
4. Multi-level inverter based AC Induction Motor Drive control equipment.
5. Speed control of 3-phase wound rotor Induction Motor Drive.
6. Speed control of 3-phase doubly fed Induction Motor Drive.
7. Speed control of 5-phase Induction Motor Drive.
8. Speed control of 3-phase Induction Motor Drive using V/F control.
9. Speed control of 3-phase Induction Motor Drive using Vector Control technique.
10. Speed Measurement and closed loop control using PMDC Motor Drive.
11. Speed measurement and closed loop control of PMDC Motor Drive with thyristor circuit.
12. Matrix Converter
13. Speed measurement and closed loop control of IGBT used single 4 quadrant chopper for PMDC Motor Drive.
14. Isolated Gate Drive circuits for MOSFET / IGBT based circuits.

Note: Any ten experiments can be conducted.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – II YEAR – I SEM. (PE/PEED)

RELIABILITY ENGINEERING (Professional Elective - V)

Prerequisite: Mathematics

Course Objectives: to prepare students to

- comprehend the concept of Reliability and Unreliability
- Derive the expressions for probability of failure, Expected value and standard deviation of Binominal distribution, Poisson distribution, normal distribution and weibull distributions.
- formulate expressions for Reliability analysis of series-parallel and Non-series parallel systems
- derive expressions for Time dependent and Limiting State Probabilities using Markov models.

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

- Apply fundamental knowledge of Reliability to modeling and analysis of series-parallel and Non-series parallel systems.
- Solve some practical problems related
- Understand or become aware of various failures, causes of failures and remedies for failures in practical systems.

UNIT-I:
RELIABILITY AND PROBABILITY: Rules for combining probabilities of events, Definition of Reliability. Significance of the terms appearing in the definition. Probability distributions: Random variables, probability density and distribution functions. Mathematical expectation, Binominal distribution, Poisson distribution, normal distribution, exponential distribution weibull distribution.

UNIT-II:
HAZARD RATE: Derivation of the reliability function in terms of the hazard rate. Failures: Causes of failures, types of failures (early failures, chance failures and wear-out failures). Bath tub curve. Preventive and corrective maintenance. Modes of failure. Measures of reliability: mean time to failure and mean time between failures.

UNIT-III:
CLASSIFICATION OF ENGINEERING SYSTEMS: series, parallel and series-parallel systems-Expressions for the reliability of the basic configurations. Reliability evaluation of Non-series-parallel configurations: Decomposition, Path based and cutest based methods, Deduction of the Paths and cut-sets from Event tree.

UNIT-IV:
DISCRETE MARKOV CHAINS: General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation of one component repairable model. Absorbing states. Continuous Markov Processes: Modeling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating time dependent and limiting state Probabilities of one component repairable model. Evaluation of limiting state probabilities of two component repairable model.

UNIT-V:
FREQUENCY AND DURATION TECHNIQUES: Frequency and duration concepts, application to multi state problems, Frequency balance approach.
Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. “Reliability evaluation of Engineering systems”, Roy Billinton and Ronald N Allan, BS Publications.
2. “Reliability Engineering”, Elsayed A. Elsayed, Prentice Hall Publications.

REFERENCES:

1. “Reliability Engineering: Theory and Practice”, By Alessandro Birolini, Springer Publications.
2. “An Introduction to Reliability and Maintainability Engineering”, Charles Ebeling, TMH Publications.
3. “Reliability Engineering”, E. Balaguruswamy, TMH Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – II YEAR – I SEM. (PE/PEED)

FLEXIBLE AC TRANSMISSION SYSTEMS (Professional Elective - V)

Prerequisite: Power Electronics and Power Systems

Course Objectives:

- To develop the understanding of uncompensated lines and their behavior under heavy loading conditions.
- To understand the concept and importance controllable parameters of FACTS controllers.
- To emphasize the objectives of Shunt compensation, and basic operation of SVC and STATCOM.
- To analyze the functioning of series controllers like GCSC, TSSC and TCSC

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

- Choose proper controller for the specific application based on system requirements
- Understand various systems thoroughly and their requirements
- Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
- Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

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, mid-point 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 compensator control.

UNIT-V:
STATIC SERIES COMPENSATORS
Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of 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 BOOKS:

1. Hingorani H G and Gyugyi. L " Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems" New York, IEEE Press, 2000.
2. Padiyar.K.R, " FACTS Controllers in Power Transmission and Distribution" New Age Int. Publishers, 2007.

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – II YEAR – I SEM. (PE/PEED)

HVDC TRANSMISSION (Professional Elective – V)

Prerequisite: Power Electronics and Power Systems

Course Objectives:

- Understand state of the art HVDC technology.
- Learn the Methods to carry out modeling and analysis of HVDC system frontier-area power flow regulation.

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

- Expose the students to the state of the art HVDC technology.
- Knowledge of modelling and analysis of HVDC system for inter-area power flow regulation.
- Study of Neetishatakam will help in developing.

UNIT-I:

Development of HVDC Technology, DC versus AC Transmission,Selection of converter configuration. Rectifier and Inverter operation, Digital Simulation of converters, Control of HVDC converters and Systems.

UNIT-II:

Individual phase control, Equidistant firing controls, Higher level controls.Characteristics and non characteristics harmonics filter design. Fault development and protection.

UNIT-III:

Interaction between AC-DC power systems. Over voltages on AC/DC side, multi-terminal HVDC systems, control of MTDC systems..

UNIT-IV:

Modelling of HVDC systems, per unit system, Representation for power flow solution, representation for stability studies.

UNIT-V:

Introduction to relevant national and international standards, safe clearances for HV, Study regulations for HV tests, Digital techniques in HV measurements.

TEXT BOOKS:

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

REFERENCES:

1. E. W. Kimbark, “Direct Current Transmission”, Vol. I, Wiley Interscience, 1971.
2. Erich Uhlmann, “Power Transmission by Direct Current”, B.S. Publications, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH – II YEAR – I SEM. (PE/PEED)

ENERGY STORAGE TECHNOLOGIES (Professional Elective - V)

Course Objectives: to prepare the students to

- introduce generalized storage techniques
- analyze the different features of energy storage systems
- know the management and applications of energy storage technologies
- know about electrical energy storage market potential by different forecasting methods

Course Outcomes: the student will be able to:

- Understand the role of electrical energy storage technologies in electricity usage
- Know the behavior and features of electrical energy storage systems
- Analyze the applications of energy storage system
- Understand the hierarchy, demand for energy storage and valuation techniques.
- Get knowledge about energy storage forecasting methods

UNIT-I:

THE ROLES OF ELECTRICAL ENERGY STORAGE TECHNOLOGIES IN ELECTRICITY USE: Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable, Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT-II:

TYPES AND FEATURES OF ENERGY STORAGE SYSTEMS: Classification of EES systems, Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES), Electrochemical storage systems, Secondary batteries, Lead-Acid Batteries, Lithium-Ion Batteries, Flow batteries, Other Batteries in Development, Chemical energy storage, Hydrogen (H2), Synthetic natural gas (SNG), Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES),Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT-III:

APPLICATIONS OF EES: Present status of applications, Utility use (conventional power generation, grid operation & service), Consumer use (uninterruptable power supply for large consumers), EES installed capacity worldwide, New trends in applications, Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles,

UNIT-IV:

MANAGEMENT AND CONTROL HIERARCHY OF EES: Internal configuration of battery storage systems, External connection of EES systems, Aggregating EES systems and distributed generation (Virtual Power Plant), “Battery SCADA” – aggregation of many dispersed batteries.

DEMAND FOR ENERGY STORAGE: Growth in Variable Energy Resources, Relationship between balancing services and variable energy resources, Energy Storage Alternatives, Variable Generator Control, Demand Management, Market Mechanisms, and Longer Term Outlook.

VALUATION TECHNIQUES: Overview, Energy Storage Operational Optimization, Market Price Method, Power System Dispatch Model Method, Ancillary Service Representation, Energy Storage Representation, Survey of Valuation Results.

UNIT-V:

FORECAST OF EES MARKET POTENTIAL BY 2030: EES market potential for overall applications, EES market estimation by Sandia National Laboratory (SNL), EES market estimation by the Boston Consulting Group (BCG), EES market estimation for Li-ion batteries by the Panasonic Group, EES market potential estimation for broad introduction of renewable energies, EES market potential estimation for Germany by Fraunhofer, Storage of large amounts of energy in gas grids, EES market potential estimation for Europe by Siemens, EES market potential estimation by the IEA, Vehicle to grid concept, EES market potential in the future

TEXT BOOKS:

1. Power System Energy Storage Technologies, 1st Edition by Paul Breeze, Academic Press
2. Energy Storage: Systems and Components, by Alfred Rufer, CRC Press, 2017

REFERENCES:

1. Energy Storage Fundamentals, Materials and Applications, by Huggins and Robert, Springer.
2. www.ecofys.com/com/publications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)

Prerequisite: None

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I:
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:
skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

DISASTER MANAGEMENT (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I:
Introduction:
Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
Disaster Prone Areas in India:
Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:
Repercussions of Disasters and Hazards:
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:
Disaster Preparedness and Management:
Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:
Risk Assessment Disaster Risk:
Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-V:
Disaster Mitigation:
Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies”, Deep &Deep Publication Pvt. Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:
Alphabets in Sanskrit,

UNIT-II:
Past/Present/Future Tense, Simple Sentences

UNIT-III:
Order, Introduction of roots,

UNIT-IV:
Technical information about Sanskrit Literature

UNIT-V:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

VALUE EDUCATION (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:
Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT-II:
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT-III:
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:
Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT-V:
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOKS/ REFERENCES:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

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CONSTITUTION OF INDIA (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I:
History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble**,** Salient Features.

UNIT-II:
Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights**,** Right to Constitutional Remedies, Directive Principles of State Policy**,** Fundamental Duties.

UNIT-III:
Organs of Governance: Parliament**,** Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:
Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS/ REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

PEDAGOGY STUDIES (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I:
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II:
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:
Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV:
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT-V:
Research gaps and future directions: Research design**,** Contexts**,** Pedagogy**,** Teacher education**,** Curriculum and assessment**,** Dissemination and research impact.

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

STRESS MANAGEMENT BY YOGA (Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT-I:
Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:
Yam and Niyam.

UNIT-III:
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:
Asan and Pranayam

UNIT-V:
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PE/PEED)

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.