JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. POWER ENGINEERING AND ENERGY SYSTEMS
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	Economic Operation of Power Systems	3	0	0	3
Professional Core - II	Renewable Energy Technologies	3	0	0	3
Professional Elective - I	1. Engineering Heat Transfer 2. Thermal Power Plant 3. Smart Grid Technologies 4. Modern Control Theory	3	0	0	3
Professional Elective - II	1. Electrical Power Distribution System 2. Reactive Power Compensation and Management 3. Mathematical Methods for Power Engineering 4. Hybrid Electric Vehicles	3	0	0	3
	Research Methodology and IPR	2	0	0	2
Lab - I	Power and Energy Systems Lab - I	0	0	4	2
Lab - II	Energy Computational 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	Digital Protection of Power System	3	0	0	3
Professional Core - IV	Energy Efficiency in Thermal Systems	3	0	0	3
Professional Elective - III	1. Restructured Power Systems 2. Nuclear Power Plants 3. Swarm Intelligence Techniques in Power Systems 4. Industrial Load Modelling and Control	3	0	0	3
Professional Elective - IV	1. AI Techniques in Power Systems 2. Wind Energy Conversion Systems 3. Optimization of Energy Systems 4. Power System Reliability and Planning	3	0	0	3
	Mini Project with Seminar	0	0	4	2
Lab - III	Power and Energy Systems Lab - II	0	0	4	2
Lab - IV	Power System Protection 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. Hydrogen Fuel Cells 2. Flexible AC Transmission Systems 3. Gas Insulated Systems 4. SCADA System and Applications	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. Constiotution 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. (PEES)
ECONOMIC OPERATION OF POWER SYSTEMS (Professional Core - I)

Prerequisite: Electrical Power Systems

Course Objectives: Students will be able to:

- formulate and derive the necessary conditions for economical load scheduling problem.
- understand various constraints, problem formulation and methods to solve the unit commitment problem.
- understand the constraints related to hydel power plants, problem formulation and solution techniques for hydro-thermal scheduling problem.
- understand the necessity, factors governing the frequency control and analyze the uncontrolled and controlled LFC system.
- understand the basic difference between ELS and OPF problem, formulation of the OPF problem and solution techniques.

Course Outcomes:

- Student can solve the economic load scheduling with and without network losses both in classical method and iterative methods.
- Student can solve the unit commitment problem using priority-list method and forward-dynamic method.
- should able to solve hydro-thermal scheduling problem for short-term and long-term range.
- should able to analyze the single area and two area systems for frequency deviation under sudden change in load.
- should able to solve the OPF problem using ac and dc load flow methods.

UNIT-I: ECONOMIC LOAD SCHEDULING
Characteristics of Steam Turbine, Variations in steam unit characteristics, Economic dispatch with piecewise linear cost functions, Lambda Iterative method, LP method, Economic dispatch under composite generation production cost function, Base point and Participation factors, Thermal system Dispatching with Network losses considered.

UNIT-II: UNIT COMMITMENT
Unit Commitment – Definition – Constraints in Unit Commitment–Unit Commitment solution methods – Priority–List Methods – Dynamic Programming Solution.

UNIT-III: HYDRO THERMAL SCHEDULING
Characteristics of Hydroelectric units, Introduction to Hydrothermal coordination, Long-Range and Short-Range Hydro-Scheduling, Hydroelectric plant models, Hydrothermal scheduling with storage limitations, Dynamic programming solution to hydrothermal scheduling.

UNIT-IV: LOAD FREQUENCY CONTROL
Control of generation – models of power system elements – single area and two area block diagrams – generation control with PID controllers – implementation of Automatic Generation control (AGC) – AGC features.

UNIT-V: OPTIMAL POWER FLOW
Introduction to Optimal power flow problem, OPF calculations combining economic dispatch and power flow, OPF using DC power flow, Algorithms for solution of the ACOPF, Optimal Reactive Power Dispatch.

TEXT BOOKS:

1. J.J. Grainger &W.D.Stevenson, “Power system analysis ”, McGraw Hill ,2003
2. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé-Power Generation, Operation and Control-Wiley-Interscience (2013)

REFERENCES:

1. Olle l. Elgerd, “Electric Energy Systems Theory an Introduction”, TMH, 2nd Edition, 1983.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

RENEWABLE ENERGY TECHNOLOGIES (Professional Core - II)

Course objectives:

- To explain the concepts of Non-renewable and renewable energy systems
- To outline utilization of renewable energy sources for both domestic and industrial applications
- To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes: Student have

- An understanding of renewable energy sources
- A knowledge of working principle of various energy systems
- A capability to carry out basic design of certain renewable energy systems

UNIT - I

Fundamentals of Energy: Energy consumption and standard of living, Oil crisis, Classification of energy resources, Consumption trend of primary energy resources, conventional energy sources and their distribution, Energy chain, common forms of energy, importance and salient features of non-conventional energy resources, environmental aspects of energy, Environment-economy-energy and sustainable development, Energy densities of various fuels, World energy status, Energy scenario in India.

UNIT - II

Solar energy: Solar energy basics, Sun-Earth relation spectrum, Terrestrial and extra-terrestrial radiation, spectral energy distribution of solar radiation, Depletion of solar radiation, measurement of solar radiation, solar radiation data, Solar time, Solar radiation geometry, Solar day length, Empirical equations for estimation of solar radiation on horizontal surfaces, Global, diffused and beam radiation, Solar radiation on inclined surface (Problems on energy availability on surfaces)

UNIT - III

Wind Energy: Wind origin, nature, types, Wind data and wind rose, wind speed variation, Wind siting Wind turbine classification and types of rotors, Wind turbine aerodynamics, power extraction from wind, Betz criteria, Axial thrust on the turbine, torque developed by the turbine, Dynamic matching, speed control strategies, Wind turbine operational characteristics, wind energy conversion systems, environmental aspect, Wind energy potential and installation in India (Problems on energy Conversion)

UNIT - IV

Biomass Energy: Biomass resources and their classification**,** Biomass conversion technologies: Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – operational parameters of biogas plants, Types of biogas Plants and biogas plant design – Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy program in India (Problems on biogas plant design)

UNIT - V

Ocean Energy: Origin and nature of tidal energy, Tidal range power, tidal energy conversion schemes - Principle of Ocean Thermal Energy Conversion (OTEC) - Ocean thermal power plants-wave energy, power in waves, wave energy technologies- Geothermal power plants - Various types.

Small Hydro Power Plant: Importance of small hydro power plants and their Elements - Types of turbines for small hydro - Estimation of primary and secondary power.

TEXT BOOKS:

1. Renewable Energy Sources, Twidell, J.W. and Weir, A., EFN Spon Ltd., 1986.
2. Renewable Energy Engineering and Technology, Kishore VVN, Teri Press, New Delhi, 2012
3. Renewable Energy Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K, 1996.

REFERENCE BOOKS:

1. Solar Energy - Principles of thermal collection and storage, S. P. Sukhatme
2. Solar Engineering of Thermal Processes, J. A. Duffie and W. A. Beckman
3. Principles of Solar Engineering, Kreith, F and Kreider, J. F., McGraw-Hill, 1978.
4. Renewable Energy, Bent Sorensen, Elsevier, Academic Press, 2011
5. Power Plant Technology, J Wakil
6. Non-Conventional Energy Sources, G.D Rai

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)
ENGINEERING HEAT TRANSFER (Professional Elective - I)

Course objective:

- To understand the fundamental laws of Heat transfer modes
- To develop the skills to correlate the Physics with applications

Course Outcomes: Student will be able to use the concepts of Heat Transfer and fluid flow in the field of energy applications.

UNIT - I

Conduction: Introduction – Modes of heat transfer – Basic Equations - Combined modes – Steady one-dimensional – Steady heat source system – Conduction Shape Factor - Unsteady heat conduction - Lumped heat capacity system - Infinite solid flat plate - cylinder (Heisler charts).
Types of fins – Analysis of fins of uniform cross section, effectiveness - Efficiency of fin. Applications**.**

UNIT- II:

Forced Convection: Flow with heat transfer - Flat Plate - Boundary layer - Laminar and Turbulent Flow - Forced convection over a flat plate – External Flow – Internal Flow - Empirical relations.
Free convection - Free convection from vertical and horizontal surfaces - Enclosed spaces. Applications to flat plate Collectors.

UNIT - III

Radiation: Overview of Mechanism – laws of radiation- Radiant heat exchange in gray - non-gray bodies – Furnaces – Performance terms and definitions – Furnace heat balance method – Factors affecting furnace performance

UNIT - IV

Boiling Heat Transfer: Regimes of pool boiling – Correlations – Boilers – Performance terms and definitions – Reference standards – Direct Method of Testing – Boiler Efficiency Calculation.
Condensation: Types - Film condensation on horizontal and vertical surfaces - Condensers.

UNIT - V

Heat Exchanger: Definition and classification – Heat Exchanger Types by flow design, construction and application - Concept of LMTD and overall heat transfer coefficient - Fouling factor- Derivation of LMTD and effectiveness for parallel and counter flow heat exchangers - NTU approach and design procedure. Purpose of the Performance Test - Performance terms and definitions – Industrial Heat Exchangers - Methodology of heat exchanger performance assessment.

TEXT BOOKS:

1. Heat transfer, Cengel and Ghajar, Tata McGraw Hill
2. Heat Transfer - A basic approach, Necati Ozisik, Mc Graw Hill

REFERENCE BOOKS:

1. Fundamentals of Heat and Mass transfer, Incropera and Dewit, Wiley
2. Heat Transfer, Ghoshdastidar, Oxford University Press
3. Convective Heat Transfer Analysis, Patrick H.Oosthuizen, David Naylor, Mc Graw Hill
4. Engineering heat and mass transfer, Mahesh M Rathore, Laxmi Publications
5. Energy Efficiency In Thermal Utilities (Book 2)
6. Energy Performance Assessment For Equipment And Utility Systems (Book 4)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)
THERMAL POWER PLANT (Professional Elective - I)

Course objective:

- To obtain knowledge on power generation techniques
- To suggest suitable methods to improve the performance of thermal power plants

Course Outcome: Students will be able to get exposure to different cycles and their working principle related to thermal power plants.

UNIT - I:

Fuels and Combustion: Types of fuels – Coal firing – Pulverization of solid fuels – Fuel handling systems – Coal cycle – Ash cycle – Types of Furnaces – Fluidized Bed Combustion (FBC) – Liquid and gaseous fuels – Byproducts of combustion (simple problems) – Heat of combustion – Combustion temperatures – Stack.

UNIT - II:

Steam Generators and Accessories: Steam generators – Classification – Types – High-pressure boilers – Super critical boilers – Steam piping Accessories - Super heaters – Re-heaters – Economizers – Air Preheaters - Pumps and Fans - Types of Condensers – Direct contact condensers - Surface condensers - Feed water heaters – Types – Boiler Makeup – Evaporators - Condensate circulation system – Cooling towers – Types – Wet and dry cooling towers.

UNIT - III

Steam Turbines: Classification – Steam Compounding - Advantages and disadvantages – Governing – Turbine losses – Turbine efficiencies – Turbine materials.

Gas turbines: Open and Closed Cycle gas turbines – Design for high temperature - Combined cycles with heat recovery boiler – Combined cycle for power plant – Combined cycle with multi pressure steam - Influence of component efficiencies on cycle performance – IGCC plant.

UNIT - IV

Power Plant Performance: General layout of modern thermal power plants – Components / Equipment in thermal power plant – Coal Mills – Boiler – Draft system – Water pumping system – LP and HP heaters – Turbine – Condenser -– Performance terms and definitions - Performance Evaluation.

UNIT - V

Environmental Aspects

Environmental aspects of thermal power plants - Constituents of the atmosphere – Ash and Dust handling - Oxides of Sulfur, Nitrogen and Carbon – Greenhouse effect – Acid precipitation – Particulate matter – Electrostatic precipitators – Thermal pollution.

TEXT BOOKS:

1. Power Plant Engineering, P.K.Nag / Tata McGraw Hill.
2. Energy Efficiency In Thermal Utilities (Book 2)
3. Energy Performance Assessment For Equipment And Utility Systems (Book 4)

REFERENCE BOOKS:

1. A course in Power Plant Engineering, Arora and Domkundwar, Dhanpat Rai.
2. Power Plant Technology, El Wakil/ Mc Graw Hill.
3. Power Plant Engineering, G.R. Nagpal/Khanna Publishers.
4. Power Plant Technology, Rajput

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

SMART GRID TECHNOLOGIES (Professional Elective - I)

Prerequisite: Power Systems

Course Objectives: Students will be able to

- 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: Students will be 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

UNIT- II

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- III

Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit(PMU)

UNIT- IV

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- V

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. Advanced Metering Infrastructure (AMI) and Various Communication means and 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. (PEES)

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. (PEES)

ELECTRICAL POWER DISTRIBUTION SYSTEM (Professional Elective - II)

Prerequisite: Power Systems

Course Objectives: Students will be able to

- Learning about power distribution system
- Learning of SCADA System
- Understanding Distribution Automation

Course Outcomes: Students will be able to

- Knowledge of power distribution system
- Study of Distribution automation and its application in practice
- To learn SCADA system

UNIT- I:
Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long-term, Power System Loading, Technological Forecasting.

UNIT- II:
Advantages of Distribution Management System (D.M.S.) Distribution Automation: Definition, Restoration / Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction

UNIT- III:
Interconnection of Distribution, Control & Communication Systems, Remote Metering, Automatic Meter Reading and its implementation. SCADA: Introduction, Block Diagram, SCADA Applied To Distribution Automation. Common Functions of SCADA, Advantages of Distribution Automation through SCADA

UNIT- IV:
Calculation of Optimum Number of Switches, Capacitors, Optimum Switching Device Placement in Radial, Distribution Systems, Sectionalizing Switches – Types, Benefits, Bellman's Optimality Principle, Remote Terminal Units, Energy efficiency in electrical distribution & Monitoring

UNIT- V:
Maintenance of Automated Distribution Systems, Difficulties in Implementing Distribution. Automation in Actual Practice, Urban/Rural Distribution, Energy Management, AI techniques applied to Distribution Automation

TEXT BOOKS:

1. A.S. Pabla, " Electric Power Distribution", Tata McGraw Hill Publishing Co. Ltd., Fourth Edition.
2. M.K. Khedkar, G.M. Dhole, "A Text Book of Electrical power Distribution Automation", University Science Press, New Delhi

REFERENCES:

1. Anthony J Panseni, "Electrical Distribution Engineering", CRC Press
2. James Momoh, "Electric Power Distribution, automation, protection & control", CRC Press

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

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 arc 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, Wiley publication.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

MATHEMATICAL METHODS FOR POWER ENGINEERING (Professional Elective - II)

Prerequisite: Mathamatices

Course Objectives: Students will be able to

- To understand the relevance of mathematical methods to solve engineering problems.
- To understand how to apply these methods for a given engineering problem.

Course Outcomes: Students will be able to

- Knowledge about vector spaces, linear transformation, eigenvalues and eigenvectors of linear operators
- To learn about linear programming problems and understanding the simplex method for solving linear programming problems in various fields of science and technology
- Acquire knowledge about nonlinear programming and various techniques used for solving constrained and unconstrained nonlinear programming problems
- Understanding the concept of random variables, functions of random variable and their probability distribution
- Understand stochastic processes and their classification

UNIT- I
Vector spaces, Linear transformations, Matrix representation of linear transformation, Eigen values and Eigen vectors of linear operator

UNIT- II
Linear Programming Problems, Simplex Method, Duality, Non Linear Programming problems

UNIT- III
Unconstrained Problems, Search methods, Constrained Problems

UNIT- IV
Lagrange method, Kuhn-Tucker conditions, Random Variables, Distributions

UNIT- V
Independent Random Variables, Marginal and Conditional distributions, Elements of stochastic processes

TEXT BOOKS:

1. Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2nd Edition, PHI, 1992
2. Erwin Kreyszig, “Introductory Functional Analysis with Applications”, John Wiley & Sons, 2004

REFERENCES:

1. Irwin Miller and Marylees Miller, John E. Freund’s “Mathematical Statistics”, 6th Edn, PHI, 2002
2. J. Medhi, “Stochastic Processes”, New Age International, New Delhi., 1994
3. A Papoulis, “Probability, Random Variables and Stochastic Processes”, 3rd Edition, McGraw Hill, 2002
4. John B Thomas, “An Introduction to Applied Probability and Random Processes”, John Wiley, 2000

5. Hillier F S and Liebermann G J, “Introduction to Operations Research”, 7th Edition, McGraw Hill, 2001
6. Simmons D M, “Non Linear Programming for Operations Research”, PHI, 1975

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

HYBRID ELECTRIC VEHICLES (Professional Elective - II)

Prerequisite: Power Systems, Electrical Machines and Power Electronics

Course Objectives: Students will be able to

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

Course Outcomes: Students 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. (PEES)

RESEARCH METHODOLOGY AND IPR

Prerequisite: None

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

UNIT-II:
Effective literature studies approaches, analysis, Plagiarism, Research ethics

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

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

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

TEXT BOOKS:

1. 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 Technological Age”, 2016.
7. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

POWER & ENERGY SYSTEMS LAB – I (Lab - I)

Prerequisites: Power System Analysis, Power System Reliability, Voltage Stability

Course Objectives:

- Develop Programs for Power System Analysis.
- Design models for Power Systems and Power Electronics.
- Develop Programs of Power System Reliability and Power Electronics.

Course outcomes: Upon the completion of the lab, the student will be able to Understand / Simulate / Analyze

- Power System Analysis using Software.
- Models of Power Systems and Power Electronics.
- Programs of Power System Reliability and Power Electronics.

List of Experiments

1. Develop Program for Y_{BUS} formation.
2. Develop Program for G-S Load Flow Analysis.
3. Develop Program for N-R Load Flow Analysis.
4. Develop Program for FDLF Load Flow Analysis.
5. Develop Program for Short Circuit Analysis.
6. Develop Program for Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
7. Develop Program for Generation System Reliability Analysis.
8. Develop Program for Distribution System Reliability Analysis.
9. Develop Simulation of RLC Circuit
10. Develop Simulation of Single Phase Full Converter with RLE Load
11. Develop Program model for Closed Loop Speed Control of Separately Excited D.C Motor.
12. Develop Program model for Sinusoidal Pulse Width Modulation.

Note: From the above list minimum 10 experiments are to be conducted using suitable software.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (PEES)

ENERGY COMPUTATIONAL LAB (Lab - II)

Course objective:

1. To expose to programming language, C / Fortran
2. To solve problems in renewable energy conversion technologies

Course Outcomes: Student get

1. Exposure to C programming
2. Expertise in developing programs in various applications.

List of Experiments:

1. Fundamentals of C Programming
2. Applications of C programming in the following areas:
   Problems related to Renewable Energy Sources: Solar and Wind
   Problems related to Heat transfer
   Problems related to Linear Control Systems
3. Use of Origin Lab – Data Analysis and Graphing Software

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

DIGITAL PROTECTION OF POWER SYSTEM (Professional Core - III)

Prerequisite: Power System Protection

Course Objectives: Students will be able to:

- Study of numerical relays.
- Developing mathematical approach towards protection.
- Study of algorithms for numerical protection.

Course Outcomes: Students will be able to:

- Learn the importance of Digital Relays.
- Apply Mathematical approach towards protection.
- Learn to develop various Protection algorithms.

UNIT-I: Mathematical Background to Digital Protection

Overview of static relays, Transmission line protection, Transformer protection, Need for Digital protection. Performance and operational characteristics of Digital protection, Basic structure of Digital relays, Finite difference techniques, Interpolation formulas, Numerical differentiation, Curve fitting and smoothing, Fourier analysis, Walsh function analysis,Relationship between Fourier and Walsh coefficients.

UNIT-II: Basic Elements of Digital Protection

Basic components of a digital relay, Signal conditioning subsystems, Conversion subsystem, Digital relay subsystem, The digital relay as a unit.

UNIT-III: Digital Relaying Algorithms-I

Sinusoidal-Wave-Based algorithms: Sample and first-derivative methods, First and second-derivative methods, Two-sample technique, Three-sample technique, An early relaying scheme.
Fourier analysis based algorithms: Full cycle window algorithm, Fractional-cycle window algorithms, Fourier-transform based algorithm.Walsh-function-based algorithms.

UNIT-IV: Digital Relaying Algorithms-II

Least squares based methods: Integral LSQ fit, Power series LSQ fit, Multi-variable series LSQ technique, Determination of measured impedance estimates.
Differential equation based techniques: Representation of transmission lines with capacitance neglected, Differential equation protection with selected limits, Simultaneous differential equation techniques.
Travelling-wave based protection: Fundamentals of Travelling-wave based protection, Bergeron's-equation based protection scheme, Ultra-high-speed polarity comparison scheme, Ultra-high-speed wave differential scheme, Discrimination function based scheme, Superimposed component trajectory based scheme.

UNIT-V: Digital protection of Transformers and Transmission lines

Principles of transformer protection, Digital protection of Transformer using: FIR filter based algorithm, Least squares curve fitting based algorithms, Fourier-based algorithm, Flux-restrained current differential relay.
Digital Line differential protection: Current-based differential schemes, Composite voltage- and current-based scheme.

TEXT BOOKS:

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

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)
ENERGY EFFICIENCY IN THERMAL SYSTEMS (Professional Core - IV)

Course objective:

- To understand the concepts of energy conversion in thermal utilities and estimate the performance.

Course Outcomes: Student will be able to

- Have knowledge of equipment used in thermal power plants.
- Estimate the conversion efficiency of the components.

UNIT - I

Fuels and Combustion: Properties of Solid, liquid and gaseous fuels – Combustion analysis – Draft – Combustion control.

Boilers – Performance Evaluation – Indirect Method - Boiler water Treatment – Energy Conservation Opportunities.

UNIT - II

Furnaces: Classification – Performance Evaluation – Indirect Method of Evaluation - Fuel Economy Measures (Air Preheater – Heat losses and Prevention).

Insulation and Refractories: Insulation – Types and Applications – Economic Thickness of Insulation – Heat Savings and Application Criteria – Refractories – Selection of Refractories

UNIT - III

FBC Boilers: Mechanism of Fluidized Bed – Advantages – Types of FBC Boilers – Operational Features – Saving Potential. Fans and Blowers: Performance evaluation – Efficient System Operation – Fan Performance Assessment. Energy Saving Opportunities.

UNIT - IV

Pumps and Pumping System: Classification of Pumps – System Characteristics – Factors affecting pump performance – Efficient pumping system operation – Flow Control Strategies – Energy Conservation Opportunities.

UNIT - V

Cogeneration: Definition – Basic Thermodynamic Cycles – Classification of Cogeneration Systems. Waste Heat Recovery Systems: General Classification – Benefits of Waste heat Recovery – Waste Heat Recovery Devices (Recuperator, Regenerators, Heat Wheels, Heat Pipe, Economizers, Heat Pump).

TEXT BOOKS:

1. T_5119_Energy_Efficiency_In_Thermal_Utilities Book 2.
2. T_5121_Energy_Performance_Assessment_For_Equipment_And_Utility_Systems_Book 4.

REFERENCE BOOKS:

1. Analysis of Engineering Cycles, R. W. Haywood, 4th Edition, Pergamon Press, Oxford, 1991.
2. Boiler Control Systems, D. Lindsay, Mcgraw Hill International, London, 1992.
3. Least Cost Electrical Utility / Planning, H. G. Stoll, John Wiley & Sons, 1989.
4. Short Term Forecasting: An introduction to the Box Jenkins Approach, T. M. O` Donovan, Wiley, Chichester, 1983.
5. Industrial Energy Management and Utilization, 1988, LC Wittie, P S Schmidt and D R Brown, Hemisphere Publishing Company.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

RESTRUCTURED POWER SYSTEMS (Professional Elective - III)

Prerequisite: Power Systems

Course Objectives: Students will be able to

- Understand what is meant by restructuring of the electricity market
- Understand the need behind requirement for deregulation of the electricity market
- Understand the money, power & information flow in a deregulated power system

Course Outcomes: Students will be able to

- Describe various types of regulations in power systems.
- Identify the need of regulation and deregulation.
- Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
- Identify and give examples of existing electricity markets.
- 5.Classify different market mechanisms and summarize the role of various entities in the market.

UNIT-I:
Fundamentals of restructured system, Market architecture, Load elasticity,Social welfare maximization

UNIT-II:
OPF: Role in vertically integrated systems and in restructured markets, congestion management

UNIT-III:
Optimal bidding, Risk assessment, Hedging,Transmission pricing,Tracing of power

UNIT-IV:
Ancillary services,Standard market design,Distributed generation in restructured markets

UNIT-V:
Developments in India, IT applications in restructured markets, Working of restructured power systems**,** PJM, Recent trends in Restructuring

TEXT BOOKS:

1. LorrinPhilipson, H. Lee Willis, “Understanding electric utilities and de-regulation”, Marcel Dekker Pub.,1998.
2. Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley and Sons, 2002.

REFERENCES:

1. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub., 2001.
2. Mohammad Shahidehpour, MuwaffaqAlomoush, “Restructured electrical power systems: operation, trading and volatility”, Marcel Dekker.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)
NUCLEAR POWER PLANTS (Professional Elective – III)

Course objective: to prepare students to

- understand the generation of nuclear power
- understand the concepts of pollution/pollutants and how to protect it from the environment.

Course Outcomes: Student will be able to

- Have knowledge of continual degradation of environment.
- Have an exposure to different types of pollutions control methods.

UNIT - I:

NUCLEAR FUEL AND REACTOR THEORY: Nuclear fuels-occurrence and extraction, fissile characteristics, enrichment, fission process - thermal and fast fission - energy released from fission - chain reaction - reaction control. Neutron balance - fast fission - resonance capture – thermalization - geometric effects - burn-up – introduction to reactor kinetics.

UNIT - II:

REACTOR COMPONENTS: General components of nuclear reactor - Fuel cladding - fuel assembly – moderators – coolants - control rods - Reactor safety - Neutron Population growth - assurance of safety - emergency core cooling and containment.

UNIT - III:

REACTOR TYPES: Different types of reactors - Pressurized Water Reactor - Boiling Water Reactor - Heavy Water-cooled Reactor -Gas cooled Reactor - Liquid metal cooled reactor - Organic moderated and cooled reactors - Fast Breeder Reactors – Fifth generation reactors.

UNIT - IV:

RADIOACTIVE WASTE MANAGEMENT: The nuclear fuel cycle - Waste classification - Spent fuel storage – Transportation – Reprocessing - High-Level waste disposal - low-level waste generation and treatment - Low-level waste disposal - Nuclear power plant decommissioning.

UNIT - V:

NUCLEAR POWER FOR PROPULSION AND ENERGY ECONOMICS: Reactors for naval propulsion - Space reactors - Space isotopic power generator - Energy economics -Components of electrical power – Cost forecast versus Reality - Challenges and opportunities - Technical and institutional improvements – Developments in nuclear reactor.

TEXT BOOK:

1. Principle of Energy Conversion, Archie W.Culp, McGraw Hill, Kogakusha Ltd., 1984.

REFERENCE BOOKS:

1. Nuclear Power Technology, W. Marshall, Vol. I &II, Clarendon press, Oxford, 1985.
2. Principle of Nuclear Reactor Engineering, Samual Glasstone, Van Nostrand Reinhold Co. Inc., New York, 1963.
3. A course in Power Plant Engineering, Arora and Domkundwar, Dhanpat Rai.
4. Power Plant Technology, El Wakil/ Mc Graw Hill.
5. Power Plant Engineering, G.R. Nagpal/Khanna Publishers.
6. Power Plant Technology, Rajput.
7. NPTEL online course, Energy Resouces and Technology, https://www.youtube.com/playlist?list=PLB8D62518BDBD6B9C

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

SWARM INTELLIGENCE TECHNIQUES IN POWER SYSTEMS (Professional Elective - III)

Prerequisite: Artificial Intellegence Techniques in Electrical Engineering

Course Objectives: Students will be able to:

- Understand Evolutionary algorithms like GA,PSO,ANT COLONY and BEE COLONY etc.
- Apply these Evolutionary algorithms to solve power systems problems
- Also able to understand solution of Multi-Objective optimization using these algorithms

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

- Discriminate the capabilities of bio-inspired system and conventional methods in solving optimization problems.
- Examine the importance of exploration and exploitation swarm intelligent system to attain near global optimal solution.
- Distinguish the functioning of various swarm intelligent systems.
- Employ various bio-inspired algorithms for power systems engineering applications.

UNIT- I
FUNDAMENTALS OF SOFT COMPUTING TECHNIQUES
Definition-classification of optimization problems-unconstrained and constrained optimization optimality conditions-Introduction to intelligent systems-soft computing techniques-conventional computing versus swarm computing-classification of meta-heuristic techniques-single solution based and population based algorithms-exploitation and exploration in population based algorithms-Properties of Swarm intelligent Systems-application domain-Discrete and continuous problems-single objective and multi-objective problems.

UNIT- II
GENETIC ALGORITHM AND PARTICLE SWARM OPTIMIZATION
Genetic algorithms-Genetic algorithm versus Conventional Optimization Techniques-Genetic representations and selection mechanisms: Genetic operators-different types of crossover and mutation operators-Bird flocking and Fish Schooling-anatomy of a particle-equations based on velocity and positions-PSO topologies-control parameters-GA and PSO algorithms for solving ELD problems.

UNIT- III
ANT COLONY OPTIMIZATION and ARTIFICIAL BEE COLONY ALGORITHMS
Biological ant colony system-Artificial ants and assumptions –Stigmergic communications-pheromone updating-local-global-pheromone evaporation-ant colony system-ACO models-Touring ant colony system-max min ant system-concept of elastic ants-Task partitioning in honey bees-Balancing foragers and receivers-Artificial bee colony (ABC) algorithms-binary ABC algorithms-ACO and ABC algorithms for solving Economic Dispatch of thermal units.

UNIT- IV
SHUFFLED FROG-LEAPING ALGORITHM and BAT OPTIMIZATION ALGORITHM
Bat algorithm-Echolocation of bats-Behaviour of micro bats-Acoustics of echolocation-Movement of Virtual bats-Loudness and pulse Emission-Shuffled frog algorithm-virtual population of frogs-comparison of memes and genes-memeplex formation-memeplex updation-BA and SFLA algorithms for solving ELD and optimal placement and sizing of the DG problem.

UNIT- V

MULTI OBJECTIVE OPTIMIZATION

Multi-Objective optimization introduction-concept of pareto optimality-Non-dominant sorting technique-pareto fronts-best compromise solution-min-max method-NSGA-II algorithm and applications to power systems

TEXT BOOKS:

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

REFERENCES:

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

REFERENCE PAPERS:

1. "Shuffled frog-leaping algorithm: a memetic meta-heuristic for discrete optimization" by Muzaffar eusuff, Kevin lansey and Fayzul pasha, Engineering Optimization, Taylor & Francis, Vol. 38, No. 2, pp.129-154, March 2006.
2. "A New Metaheuristic Bat-Inspired Algorithm" by Xin-She Yang, Nature Inspired Cooperative Strategies for Optimization (NISCO 2010) (Eds. J.R. Gonzalez et al.), Studies in Computational Intelligence, Springer Berlin, 284, Springer, 65-74 (2010).
3. "Firefly Algorithms for Multimodal Optimization" Xin-She Yang, O. Watanabe and T. Zeugmann (Eds.), Springer-Verlag Berlin Heidelberg, pp. 169-178, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

INDUSTRIAL LOAD MODELLING AND CONTROL (Professional Elective - III)

Prerequisite: Power Systems

Course Objectives: Students will be able to

- 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: Students 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

Direct load control- Interruptible load control. Bottom up approach- scheduling- Formulation of loadmodels- Optimization and control algorithms - Case studies. Reactive power management in industries-controls-power quality impacts, application of filters, Energy saving in industries.

UNIT- III

Cooling and heating loads- load profiling- Modeling. Cool storage-Types- Control strategies. Optimal operation-Problem formulation- Case studies.

UNIT- IV

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

UNIT-V:

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

TEXT BOOKS:

1. 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. (PEES)

AI TECHNIQUES IN POWER SYSTEMS (Professional Elective - IV)

Prerequisite: Artificial Intellegence Techniques in Electrical Engineering

Course Objectives: Students will be able to

- Understanding fuzzy logic, ANN
- Understanding GA & EP

Course Outcomes: Students will be able to

- Learn the concepts of biological foundations of artificial neural networks
- Learn Feedback networks and radial basis function networks and fuzzy logics
- Identifications of fuzzy and neural network
- Acquire the knowledge of GA

UNIT-I:
Biological foundations to intelligent Systems, Artificial Neural Networks, Single layer and Multilayer Feed Forward NN, LMS and Back Propagation Algorithm, Feedback networks and Radial Basis Function Networks.

UNIT-II:
Fuzzy Logic, Knowledge Representation and Inference Mechanism, Defuzzification Methods. Fuzzy Neural Networks and their learning methods

UNIT-III:
System Identification using Fuzzy and Neural Network.

UNIT-IV:
Genetic algorithm, Reproduction cross over, mutation, Introduction to evolutionary program.

UNIT-V:
Applications of above mentioned techniques to practical problems

TEXT BOOKS:

1. J M Zurada , “An Introduction to ANN”,Jaico Publishing House
2. Simon Haykins, “Neural Networks”, Prentice Hall

REFERENCES:

1. Timothy Ross, “Fuzzy Logic with Engg.Applications”, McGraw. Hill
2. Driankov, Dimitra, “An Introduction to Fuzzy Control”, Narosa Publication
3. Golding, “Genetic Algorithms”, Addison-Wesley Publishing Com

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

WIND ENERGY CONVERSION SYSTEMS (Professional Elective - IV)

Course objectives: to prepare the students to

- understand the fundamentals of wind energy and its conversion system
- learn gear coupled generator wind turbine components
- learn modern wind turbine control & monitoring.

Course Outcomes: Student will be able to:

- Know the energy conversion techniques in wind energy
- Learn about wind turbine components and their constructions.
- Understand the modern wind turbine control & monitoring.

UNIT - I:

Wind Energy Fundamentals & Wind Measurements: Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Turbulence. Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis.

UNIT - II:

Aerodynamics Theory & Wind Turbine Types: Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads; Sources of loads Vertical Axis Type, Horizontal Axis, Constant Speed Constant Frequency, Variable speed Variable Frequency, Up Wind, Down Wind, Stall Control, Pitch Control, Gear Coupled Generator type, Direct Generator Drive /PMG/Rotor Excited Sync Generator.

UNIT - III:

Gear Coupled Generator Wind Turbine Components And Their Construction: Electronics Sensors/Encoder/Resolvers, Wind Measurement : Anemometer & Wind Vane, Grid Synchronisation System, Soft Starter, Switchgear[ACB/VCB], Transformer, Cables and assembly, Compensation Panel, Programmable Logic Control, UPS, Yaw & Pitch System : AC Drives, Safety Chain Circuits, Generator Rotor Resistor controller (Flexi Slip), Differential Protection Relay for Generator, Battery/Super Capacitor Charger & Batteries/ Super Capacitor for Pitch System, Transient Suppressor/Lightning Arrestors, Oscillation & Vibration sensing.

UNIT - IV:

Direct Rotor Coupled Generator (Multipole) [Variable Speed Variable Freq.]: Excited Rotor Synch, Generator/PMG Generator, Control Rectifier, Capacitor Banks, Step Up/Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits

UNIT - V:

Modern Wind Turbine Control & Monitoring System: Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor & Blade), FACTS control & LVRT & New trends for new Grid Codes.

TEXT BOOKS:

1. Renewable Energy Sources, Twidell J.W. and Weir A., EFN Spon Ltd., 1983.

2. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle Oxford University Press, 1996.

REFERENCES BOOKS:

1. C-Wet: Wind Energy Resources Survey in India VI.
2. Solar Engineering of Thermal Processes, Duffie A. and Beckmann W. A., John Wiley, 1991.
3. Wind Energy Conversion Systems, Freris L.L., Prentice Hall, 1990.
4. Wind Energy Systems, John D Sorensen and Jens N Sorensen, Woodhead Publishing Ltd, 2011.
5. Stand – alone and Hybrid Wind Energy Systems, Kaldellis J.K., CRC Press, 2010.
6. Wind Energy Systems, Mario Garcia –Sanz, Constantine H. Houpis, CRC Press 2012.
7. Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering, Spera D.A., ASME Press, 1994.
8. NPTEL online course, Non-Conventional Wind Energy Systems, https://www.youtube.com/playlist?list=PL3QMEfkolRFbGhXveCE7RFDBgY0_gRxkh
9. NPTEL online course, Energy Resouces and Technology, https://www.youtube.com/playlist?list=PLB8D62518BDBD6B9C

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)
OPTIMIZATION OF ENERGY SYSTEMS (Professional Elective - IV)

Course objective: to prepare students to

- Know about optimisation of design parameters.
- Know about different design methodologies and simulation processes.

Course Outcomes: Students will be able to

- Perform Numerical calculations
- Understand Role of design parameters
- Run simulation models like genetic algorithms

UNIT - I:
Thermal Systems – Characteristics- formulation of design problem - Steps in the design process - Modeling of thermal systems – importance - Types of models - Mathematical Modeling

UNIT II:
Linear programming models – Formulation - Simplex method – Artificial variable technique – Big M method - Concept of Sensitive analysis.

UNIT - III:
Unconstrained Optimization: Single variable optimization – Fibonacci & Golden section method - Multi variable optimization – Gradient methods – Gradient of the function - Steepest descent – Flecher-Reeves method -Variable metric method - Constrained Non-linear Optimization Methods - Lagrangian multiplier – Application to thermal and electrical systems.

UNIT -IV:
Geometric programming – Polynomial – Arithmetic and Geometric inequalities – Unconstrained GP - Constrained GP with constraints of type less than or equal- Application to thermal and electrical systems- Dynamic Programming- Bellman's principle of optimality- Shortest route problems

UNIT -V:
Simulation - Definition- Types of Simulation models - Steps involved in simulation models - Application of simulation - Advantages and disadvantages – Introduction to Genetic algorithm – Applications in Genetic Algorithm - Similarities and dissimilarities with traditional methods - Genetic operators.

TEXT BOOKS:
1. Design and Optimization of Thermal Systems, Yogesh Jaluria, McGraw Hill.
2. Optimization theory and applications, S.S.Rao, New Age Publication.

REFERENCE BOOKS:
1. Design of Thermal System, W.F.Stoecker, McGraw Hill.
2. Operation Research, Panner Selvam, Prentice Hall.
3. Optimization Research, M.C.Joshi.
4. Simulation Modeling & Analysis, Law & Kelto.
5. Operation Research, S Prinsc Valle Kasur.
6. NPTEL online course, Introduction to Optimisation, https://www.youtube.com/playlist?list=PLA8E4E0900B672792

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)
POWER SYSTEM RELIABILITY AND PLANNING (Professional Elective - IV)

Prerequisite: Reliability Engineering
Course Objectives: At the end of the course the student will be able to:

- To describe the generation system model and recursive relation for capacitive model building
- To explain the equivalent transitional rates, cumulative probability and cumulative frequency
- To develop the understanding of risk, system and load point reliability indices
- To explain the basic and performance reliability indices

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

- Understand the importance of maintaining reliability of power system components.
- Apply the probabilistic methods for evaluating the reliability of generation and transmission systems.
- Assess the different models of system components in reliability studies.
- Assess the reliability of single area and multi area systems.

UNIT- I
Basic Reliability Concepts: The general reliability function. The exponential distribution – Mean time to failures – series and parallel systems. Markov process – continuous Markov process – Recursive techniques – Simple series and parallel system models.

UNIT- II
Generating Capacity – Basic Probability Methods: The generation system model – Loss of load indices – Capacity expansion analysis – scheduled outages. Load forecast uncertainty Loss of energy indices. The frequency and duration method.

UNIT- III
Transmission Systems Reliability Evaluation: Radial configuration – Conditional probability approach – Network configurations – State selection.

UNIT- IV
Generation Planning: Comparative economic assessment of individual generation projects – Investigation and simulation models – Heuristic and linear programming models – Probabilistic generator and load models.

UNIT- V
Transmission and Distribution Planning: Deterministic contingency analysis – Probabilistic transmission system – reliability analysis. Reliability calculations for single area and multi–area power systems. Network configuration design–consisting of schemes – security criteria configuration synthesis.

TEXT BOOKS:

1. Roy Billinton and Ronald Allan Pitam: Reliability Evaluation of Power Systems,1996.
2. R.L. Sullivan: Power System Planning, McGraw Hill International, 1977.

REFERENCES:

1. Wheel Wright and Makridakis: Forecasting methods and Applications, John Wiley, 1992.
2. J. Endremyl: Reliability Modelling in Electric Power Systems, John Wiley, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

POWER & ENERGY SYSTEMS LAB – II (Lab – III)

Prerequisites: Power System Analysis, Power System Protection

Course Objectives:

- To understand the Performance of Transformers and Synchronous Machines
- To select the Transmission Lines, UG Cables, String Insulators, CTs and PTs.
- To analyze the characteristics of OC, UV/OV, negative sequence relays.

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

- Test and evaluate the performance of Power Transformers and Synchronous Machines.
- Test and evaluate the performance of Transmission lines, UG Cables, Insulators and other Auxiliary Power Systems Equipment
- Test, Evaluate/Choose the various types of Relays (Electromagnetic, Static and Microprocessor based relays)

List of Experiments

1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Fault Analysis:
    i. Single Line to Ground fault (L-G).
    ii. Line to Line fault (L-L).
    iii. Double Line to Ground fault (L-L-G).
    iv. Triple Line to Ground fault (L-L-L-G).
4. Determination of Sub-transient reactance's of a Salient Pole Synchronous Machine.
5. Determination of Sequence Impedances of Three Phase Transformer
6. Characteristics of Over Current Relays
    i. IDMT Electromagnetic Relay (7051 A).
    ii. Microprocessor based Relay (7051 B)
7. Characteristics of Percentage biased Differential Relay.
    i. Electromagnetic Relay (7054 A).
    ii. Static Relay (7054 B).
8. Characteristics of Over Voltage Relay.
    I. Electromagnetic Relay (7053 A).
    II. Microprocessor based Relay (7053 B).
9. Characteristics of Under Voltage (UV) and Negative sequence Relays
    i. Uv Electromagnetic Relay (7052 A).
    ii. Uv Microprocessor Based Relay (7052 B).
    iii. Static Negative Sequence Relay (7055 B).
10. Performance and Testing of Generator Protection System.
11. Performance and Testing of Transformer Protection System.
12. Performance and Testing of Feeder Protection System.
13. Performance and Testing of Transmission Line Model.
14. Differential protection on Single Phase Transformer.

Note: From the above list minimum 10 experiments are to be conducted

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (PEES)

POWER SYSTEM PROTECTION LAB (Lab - IV)

Prerequisite: Power systems protection

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

- Different types of Faults occurring in power systems
- Characteristics of different types of relays
- Protection schemes

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

- Calculate various faults
- Analyze the various time-current characteristics of protective relays
- Know the Performance and Testing of various electrical models and systems

List of Experiments

1. Characteristics of Electromechanical Non-Directional over current relay
2. Characteristics of Electromechanical Directional Over Current Relay
3. Characteristics of Electromechanical differential protection relay
4. Characteristics of Numerical Distance relay
5. Characteristics of Integrated Numerical under Voltage Relay
6. Characteristics of Numerical over current Relay
7. Zones protection characteristics of distance Relay
8. Differential protection on Single Phase Transformer
9. Performance and Testing of Feeder Protection System
10. Performance and Testing of Generator Protection System.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. (PEES)

HYDROGEN FUEL CELLS (Professional Elective - V)

Course objective: to prepare students to

- Know about emerging technologies like production and storage of Hydrogen

Course Outcome: Students will be able to

- Gain exposure to different fuel cells in particularly Hydrogen fuel cells

UNIT - I:

Hydrogen Energy Economy: Hydrogen Energy Economy – Conception, Present status and a vision – Applications of Hydrogen - Transport application-cars, light trucks, buses - Stationary and Portable-Electronic gadgets.

UNIT - II:

Hydrogen and Production Techniques: Hydrogen – Physical and chemical properties, salient characteristics - Production of hydrogen – Steam reforming – Water electrolysis – Gasification and woody biomass conversion – Biological hydrogen production – Photo dissociation – Direct thermal or catalytic splitting of water.

UNIT - III:

Hydrogen Storage & Transport: Hydrogen storage options – Compressed gas – Liquid hydrogen – Hydride – Chemical Storage – Comparisons - Transport of Hydrogen - Pipelines, gaseous, liquid and compound materials.

UNIT - IV:

Fuel Cells: History – Principle - Working - Thermodynamics and kinetics of fuel cell process – Types of fuel cells – AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – Relative merits and demerits - Performance evaluation of fuel cell – Comparison of battery Vs fuel cell – Flow Battery.

UNIT - V:

Application Of Fuel Cell: Fuel cell usage for domestic power systems - Large scale power generation – Automobile - Space - Environmental analysis of usage of Hydrogen in Fuel cell - Future trends in fuel cells.

TEXT BOOKS:

1. Hydrogen and Fuel Cells: A Comprehensive Guide, Rebecca L. and Busby, Penn Well Corporation, Oklahoma (2005).
2. Fuel Cells – Principles and Applications, Viswanathan, B and M Aulice Scibioh, Universities Press (2006).

REFERENCE BOOKS:

1. Hydrogen and Fuel Cells: A Comprehensive Guide, Rebecca L. and Busby, Penn Well Corporation, Oklahoma (2005) **.**
2. Hydrogen and Fuel Cells: Emerging Technologies and Applications, Bent Sorensen (Sørensen), Elsevier, UK (2005) **.**
3. Fuel Cell and Their Applications, Kordesch, K and G.Simader, Wiley-Vch, Germany (1996).
4. Fuel Cells: Theory and Application, Hart, A.B and G.J.Womack, Prentice Hall, NewYork Ltd., London (1989).
5. The Hydrogen Economy, Jeremy Rifkin, Penguin Group, USA (2002).

6. Fuel Cells – Principles and Applications, Viswanathan, B and M Aulice Scibioh, Universities Press (2006).
7. Online lecture on Hydrogen Economy, https://www.youtube.com/watch?v=-yYrc1-thxQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. (PEES)

FLEXIBLE AC TRANSMISSION SYSTEMS (Professional Elective - V)

Prerequisite: Power Electronics and Power Systems

Course Objectives:

- To understand 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. (PEES)
GAS INSULATED SYSTEMS (Professional Elective - V)

Prerequisite: Switch Gear and Protection

Course objectives:

- To know the GIS concepts and principles
- To distinguish Air Insulated and Gas insulated Substations
- To demonstrate the design and constructional aspects of GIS
- To analyze transient phenomenon, problems and diagnostic methods in GIS

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

- Know the advantages of GIS systems over air insulated systems
- Observe constructional design features of GIS design
- Discriminate the problems and design diagnostic methods of GIS

UNIT–I
INTRODUCTION TO GIS AND PROPERTIES OF SF_6
Characteristics of GIS- Introduction to SF_6 - Physical properties-Chemical properties - Electrical properties-Specification of SF_6 gas for GIS application - Handling of SF_6 gas before use - Safe handling of Sf_6 gas in electrical equipment - Equipment for handling the SF_6 Gas - SF_6 and environment.

UNIT–II
LAYOUT OF GIS STATIONS
Advancement of GIS station - Comparison with Air Insulated Substation - Economics of GIS - User Requirements for GIS - Main Features for GIS - Planning and Installation components of a GIS station.

UNIT–III
DESIGN AND CONSTRUCTION OF GIS STATION
Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components - Insulation Design for Components - Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

UNIT-IV
FAST TRANSIENT PHENOMENA IN GIS
Introduction - Disconnector Switching in Relation to Very fast Transients-Origin of VFTO-Propagation and Mechanism of VFTO-VFTO Characteristics- Effects of VFTO-Testing of GIS for VFTO.

UNIT–V
SPECIAL PROBLEMS IN GIS AND GIS DIAGNOSTICS
Introduction - particles their effects and their control- Insulating Spacers and their Reliability - SF_6 Gas Decomposition - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

TEXT BOOKS:

1. M. S. Naidu," Gas Insulated Substations"- IK International Publishing House.

2. Hermann J. Koch, “Gas Insulated Substations”, June 2014, Wiley - IEEE Press.

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. (PEES)

SCADA SYSTEM AND APPLICATIONS (Professional Elective - V)

Prerequisite: None

Course Objectives: Students will be able to:

- To understand what is meant by SCADA and its functions.
- To know SCADA communication.
- To get an insight into its application**.**

Course Outcomes: Students will be able to:

- Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical Applications.
- 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 electronic 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 America Publications,USA,2004.
2. Gordon Clarke, Deon Reynders: “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, 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. Michael Wiebe, “A guide to utility automation: AMR, SCADA, and IT systems for electric power”, PennWell 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PEES)

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. (PEES)

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. (PEES)

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. (PEES)

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (PEES)

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. (PEES)

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. (PEES)

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. (PEES)

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.