

B.TECH ELECTRICAL ENGINEERING SYLLABUS VII SEMESTER

POWER SYSTEM –II

Sub. Code: E-401

UNIT I

Faults in power systems, single line diagram, equivalent impedance diagram, per unit reactances. Analysis (using matrices) of power systems by symmetrical components under:

(a) Three phase short circuit (b) Line to line fault (c) Line to ground fault (d) Double line to ground fault.

Sequence networks and their inter connections for different types of faults, effects of fault impedance. Current Limiting Reactors: Applications, types, construction and location of current limiting reactors, short circuit calculation using reactors.

UNIT II

Introduction, Bus Admittance Matrix, Formation of Ybus & Zbus, Load flow equation & solution, iterative methods, Gauss-Seidel and Newton-Raphson methods, Jacobian Matrix, Fast Decoupled load flow.

UNIT III

Philosophy of protective relaying system, construction and realization of characteristics of different protective relays. Components of Protection System

Conventional and Static relays – advantages and limitations, static amplitude and phase comparators, level detectors, logic and training circuits, static over current, directional, distance relays. Numerical over current and distance protection.

UNIT IV

Types & detection of faults and their effects, alternator protection scheme (stator, rotor, reverse power protection etc.). Power transformer protection (external and internal faults protection), bus bar protection. Transmission line protection (current/time grading, distance, carrier aided protection).

UNIT V

Theory of current interruption- energy balance and recovery rate theory, arc quenching, recovery and restriking voltages. Types of circuit breakers. bulk oil and minimum oil, air break and air blast, sulphur hexa fluoride (SF₆) and vacuum circuit breakers. Rating selection and testing of circuit breakers/operating mechanisms. LT switchgear, HRC fuses, types construction and applications.

Reference Books :

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| - Electrical Power Systems | - C.L.Wadhwa |
| - Modern Power System Analysis | - Nagrath & Kothari |
| - Fundamentals of power system protection | - Y.G.Paithankar & S.R.Bhinde |
| - Power System Protection | - Badriram & Vishwakarma |
| - Power System Protection & Switchgear | - Ravindranath & Chander |

CONTROL SYSTEM –II

Sub. Code: E-402

UNIT-I INTRODUCTION TO STATE SPACE

State space representation of systems, solving time invariant state equation, State Transition Matrix, Zero input response, Zero state response, Decomposition, state equation, Relationship between state equation and transfer function, characteristic equation, eigen values, eigen vectors.

UNIT-II STATE SPACE ANALYSIS

Phase variable representation, canonical variable representation, diagonalisation, canonical variable representation, controllability and observability, pole placement design using state variable feed back.

UNIT-III NON LINEAR SYSTEMS & THEIR STABILITY

Non linear systems, common physical non linearities, phase plane method – basic concepts, construction of phase trajectories, singular points, describing function method – basic concepts, deviation of describing function, stability analysis by describing function method.

Concepts of stability, limit cycles, Liapunov stability criterion, method of constructing Liapunov function for non-linear systems, Popov's stability criterion.

UNIT-IV DIGITAL CONTROL SYSTEM

Introduction to discrete time system, z-transform, inverse z-transform. Pulse transfer function, Sampling Theorem, Data re-construction, zero order hold, first order hold, Time response of sampled data system.

UNIT-V DISCRETE SYSTEM ANALYSIS

Stability criterion, methods of stability analysis, bilinear transformation, stability analysis using Nyquist criterion and root locus, state space representation of discrete system, state transition matrix controllability and observability of discrete time system.

Reference Books:

1. Discrete control Engineering - Ogata
2. Automatic Control System – B.C. Kuo
3. Modern Control System – Nagarth & Gopal
4. Linear Control System - Prof. B.S.Manke
5. Discrete control System – M.Gopal

ELECTIVE-I: NON-CONVENTIONAL ENERGY SOURCES

Subject code: E 411

UNIT-I

Energy scenario in India, Renewable and Non-renewable Energy sources, Energy for sustainable development, Direct Energy conversion systems.

UNIT-II

Renewable Hydro – potential, flow, duration and storage, mini-micro hydro, small hydro power, types of turbines, generators & controls.

UNIT-III

Wind energy – potential, site selection, types of wind turbines, wind generation and control.

UNIT-IV

Solar energy – solar photovoltaics, solar thermal, applications of solar energy systems.

UNIT-V

Bio energy, wave & tidal energy, ocean thermal energy systems, MHD & fuel cells.

Reference Books:

1. Solar Energy – Padmashree S.P.Sukhatme
2. Solar Electricity – Tomas Markvart
3. Electrical Energy System Theory – O.I.Elgerd
4. Towards Clean Energy – B.Ghosh, Saha B., S.K.Basu, Sujay
5. Power System Engineering – I.J.Nagrath & D.P.Kothari

ELECTIVE-I: EMBEDDED SYSTEMS

Subject code: E 412

UNIT-I

Introduction embedded systems, their characteristics, modeling of systems, system specifications, specification languages, study of specification example.

UNIT –II

Specification translation, translation of various features such as state transition, message passing communication, concurrency, exception handling etc.

UNIT –III

System partitioning- Introduction, partitioning issues, partitioning algorithms, functional partitioning, hardware/software partitioning algorithms, functional partitioning for systems.

UNIT - IV

Design quality estimation- Quality metrics, hardware estimation, software estimation.

UNIT - V

Specification refinement- Refining variable grouping, channel refinement, resolving access conflict, refining incompatible interfaces, refining hardware/software interfaces. Study of a system design methodology and study of generic synthesis system.

Reference Books :

1. Specification and design of embedded systems, David D Gajski, Frank vahid, S. Narayan, J Garg
2. Embedded system design, Heath Steve and Newns 1997
3. Art of programming Embedded Systems, J. Gassle

ELECTIVE-II : COMPUTER APPLICATIONS IN POWER SYSTEM

Subject code: E 421

UNIT I

Introduction- Digital computers in power system simulations, System view point, Hierarchy of transmission and distribution system, nature and scope of power system studies, Electric supply industry structure under Deregulation, Regulatory and policy developments. Power system components, representation of transmission lines.

Transformers - Two winding and auto-transformers, tap changing transformer and loads.

UNIT II

Graph Theory- Oriented graph, reference direction, system graph for transmission network, concept of graph theory, loop matrix, cutset matrix, incidence matrix, Topological relations, multiport representation, Bus impedance and Bus admittance matrix formulation, bus impedance algorithm.

UNIT III

Load Flow Studies- Analytical formulation, methods of load flow solutions, Bus mismatch and convergence criteria, Gauss-Siedel method, Newton Raphson method, concept of decoupled methods.

UNIT IV

Optimal Load Flow Study of Power System- Thermal system, transmission losses, optimum scheduling of thermal plants taking losses into account, economic load scheduling of hydro-thermal plants.

UNIT V

Power system control and management – normal operation, abnormal operation contingency analysis and demand side management

Reference Books:

1. Electrical Energy Systems Theory -O.I.Elgerd
2. Computer Methods in Power system Analysis -A.H.El.Abiad
3. Understanding FACTS concept and Technology - Hingorani N.L.

ELECTIVE-II: POWER QUALITY

Subject code: E 422

UNIT-I

Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances

UNIT –II

Causes and effects of harmonics, converter configuration and their contribution to supply harmonics, other sources of harmonics

UNIT –III

Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters, high power factor pre-regulator, switching control circuit, transformer connections.

UNIT - IV

Elimination/suppression of harmonics using active power filters – topologies, and their control methods, PWM converter as a voltage source active filter, current source active filter.

UNIT - V

Electro-magnetic compatibility, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control.

References :

1. Power Quality - R.C. Duggan
2. Power system harmonics –A.J. Arrillga
3. Power electronic converter harmonics –Derek A. Paice

ELECTIVE-II : ARTIFICIAL INTELLEGENCE

Subject code : E 423

UNIT I

Meaning and definition of artificial intelligence, various types of production systems, characteristics of production systems, study and comparisons of breadth first search and depth first search techniques, other search techniques like hill climbing, best first search, A* algorithm AO* algorithm etc. And various types of control strategies

UNIT II

Knowledge representation, problems in representing knowledge, knowledge representation using proposition and predicate logic, comparisons of proposition and predicate logic, resolution refutation, deduction, theorem proving , inferencing , monotonic and non-monotonic reasoning.

UNIT III

Probabilistic reasoning, Bay's theorem, semantic networks, scripts schemes, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

UNIT IV

Game playing techniques like minimax procedure, alpha-beta cut- off etc., planning study of blocks world problem in robotics, understanding and natural language processing.

UNIT V

Introduction to learning, various techniques used in learning, neural networks, and applications of neural networks, common sense, reasoning and expert systems.

ELECTIVE-III: EHVAC & DC TRANSMISSION

Sub. Code: E 431

UNIT I

Constitution of EHV a.c. and d.c. links, kind of d.c. links, limitation and Advantages of a.c. and d.c. transmission, principal application of a.c. and d.c. transmission, trends in EHV a.c. and d.c. transmission power handling capacity.

UNIT II

Extra long distance lines, voltage profile of loaded and unloaded line along the line, compensation of lines, series and shunt compensation, shunt reactors, tuned power lines.

UNIT III

Traveling waves on transmission systems, their shape, attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over-voltages in transmission system: lightning, switching and temporary over-voltages: control of lightning and switching over-voltages.

UNIT IV

Converter theory and performance equations – Value characteristics, converter circuits, abnormal operation of converter circuits, harmonics and filters.

UNIT V

Control of HVDC systems – Basic principles of control, control implementation, converter firing control system, valve blocking and bypassing, starting, stopping and power flow reversal.

Reference Books:

1. EHV AC & DC Transmission - Begamudre
2. EHV AC & DC Transmission - S. Rao
3. H.V.D.C. Transmission – P.Kundur, McGraw Hill Pub.

ELECTIVE-III: ENERGY CONSERVATION & MANAGEMENT

Sub. Code: E 432

UNIT I

General energy problem. Global and national energy scenario, primary energy sources, energy use patterns, Basic Principles, laws of Thermo dynamics. Irreversibility, entropy enthalpy, heat engine, refrigeration cycle, thermal efficiency and thermal exchange ratio. Critical and economic thickness of insulation. Optimum use of prime movers for power generation, techniques cogeneration technology. Energy conservation methods in power plants, conservation of energy in energy intensive industries.

UNIT II

Maintenance engineering : friction, lubrication and tribological innovations, predictive and preventive maintenance, Energy audit, case studies.

UNIT III

- (i) Heating, lighting and Air conditioning of building and measures for conservation of electrical energy. Energy conservation in domestic gadgets.
- (ii) Industrial heating and energy conservation in electric and oil fired furnances.
- (iii) Measures for Reduction of losses in Transmission and distribution systems.

UNIT IV

Energy efficient electric drives, energy efficient motors, V.S.D. power factor improvement in power system. Energy conservation in transportation systems especially in electric vehicle.

UNIT V

Load curve analysis and load managements, DSM, Energy storage for power systems, (Mechanical, Thermal, electrical and Magnetic) Restructuring of electric tariff from energy conservation considerations, pay back period.

Reference Books:

1. Electrical Energy Utilization & Conservation - Dr. S.C.Tripathi
2. Energy Conservation and Audit - Thumman
3. Energy Audit and Conservation - TERI

ELECTIVE-III : DIGITAL SIGNAL PROCESSING

Sub. Code : E 433

UNIT-I INTRODUCTION TO DSP

Classification of signals, Multichannel and multi dimensional continuous v/s discrete time signals, continuous v/s discrete valued signals, continuous time sinusoidal signal, discrete time sinusoidal signals, sampling of analog signal, sampling theorem, quantification and coding of D/A conversion.

UNIT-II DISCRETE TIME SIGNAL AND SYSTEMS

Discrete time signal, systems, Z-transform & Inverse Z-transform, analysis of discrete time, linear time invariant systems, co-relation of discrete time systems.

UNIT-III FREQUENCY ANALYSIS OF SIGNALS

Frequency analysis of analog signals, frequency analysis of discrete time signals. Properties of Fourier Transform, Frequency Domain Characteristics, Time Frequency Dualities, Sampling of signals in time and frequency domain, DFT & FFT.

UNIT-IV DESIGN OF DIGITAL FILTERS

Design of linear phase FIR filter using window & frequency sampling method. Design of equiripple linear phase filters. Comparison of design methods for linear phase FIR filters. Design of IIR filters from analog filters. Direct Design Technique for digital IIR filters.

UNIT-V DSP APPLICATIONS

Introduction to digital signal processors chips, case study of different DSP applications. Application of filters to analog & digital signal processor, FET spectrum analyzer.

Reference Books:

1. Digital Signal Processing - W.D.Stanley
2. Analog & Digital Signal Processing – Ashok Ambardar