EE 801-Computer Applications to Power System

Unit I Power System Models- Models of power system components, network model using graph theory, formation of Z bus, transmission line models, regulating transformer, line loadability, capability curves of alternator.

Unit II Compensation- Control of load bus voltage using reactive power control variable, SVC & SVS, Regulated shunt compensation, series and shunt compensation, effect on loadability of transmission lines, Uniform series and shunt compensation.

Unit III Sensitivity Analysis-Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage.

Unit IV Power System Security– Security functions, Security level, contingency analysis, security control, economic dispatch using LP formulation, pre-contingency and post-contingency, corrective rescheduling.

Unit V Stability -Voltage stability, Difference between voltage and angle stability, PV Curve for voltage stability assessment, proximity and mechanism, modal analysis using reduced Jacobian, participation factor, effect of series and shunt compensation on voltage stability , effect of load models.

List of Experiments (Extendable): Matlab based:

1. Formation of bus admittance matrix using mat lab.
2. Z bus building algorithm using mat lab.
3. NEWTON RAPSON load flow analysis.
4. Fast de coupled load flow analysis.
5. Study of PV Curve for voltage stability.

References:

1. Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc.
2. 1984.
3. Computer methods in power systems analysis – by stage G.W. and E.L. Abiad A.H. Mc Graw Hill.

4. Computer Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.
5. Computer Modeling of Electrical Power Systems, Arrillaga J. Arnord C.P Harker B.J. John Wiley & Son
6. Computer Aided Power Systems Analysis Kusic G.L.- 2nd Edition, CRC Press
7. Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata Mc Graw Hill.
8. Power System Analysis Grainger J.J. & Stevnson W.D. Mc Graw Hill.
9. Power System Stability and control –P Kundur ,IEEE Press 1994.
10. Advance Power Systems Analysis and Dynamics Singh L.P. John Wiley.

EE 802 - Advance Electrical Drives

Control of D.C. Motors by Converters: Thyristor controlled drives, single phase semi and fully controlled converters and three semi and fully controlled converters connected to d.c. separately excited, output voltage and current waveforms, speed and torque expression, speed-torque characteristics.

Unit-II: Induction Motors Control:-Control of induction motor by ac voltage controllers-waveforms, speed torque characteristics, variable frequency control of induction motor by voltage source, current source inverters and cycloconverters, PWM control comparison of VSI & CSI operations, speed torque characteristics.

Unit-III: Control of Induction Motors from Rotor Side:-Static rotor resistance control, slip power recovery static scherbius drive, static kramer drive, their performance and speed torque characteristics advantages, application, problems.

Unit-IV: Synchronous Motor Control: - Separate control & self control of synchronous motors, operation of self controlled synchronous motors by VSI, CSI and cycloconverters. load commutated CSI fed Synchronous motor, operation, waveform, speed torque characteristics, application, advantage, numerical problems, closed loop operation.

Unit-V: Special Motors: Servo drives, AC & DC servomotor, stepper motor, microstepping , control techniques, energy efficient electric motors.

List of Experiments (Extendable)-Matlab based experiments:

1. Thyristor controlling of single phase semi and fully controlled converters.
2. Thyristor controlling of three semi and fully controlled converters connected to d.c. separately excited.
3. Analysis of speed and torque expression of DC motor.
4. Variable frequency control of induction motor by voltage source, current source inverters.
5. Transient analysis of DC motors.
6. Transient analysis of Induction motors.
7. Transient analysis of Synchronous motors.

References:

1. G.K. Dubey “Fundamentals of Electrical Drives”-. Narosa Publications
2. Gopal K. Dubey “Power semiconductor Controlled Drives”- PHI
3. S.B. Dewan, G.R. Slemon, A. Straughen “Power semiconductor Controlled Drives”
4. B.K. Bose “Power Electronic control of AC Drives”.
5. V. Subramanyam “Thyristor control of Electric Drive” Tata Mc Graw Hill Pub
6. N.K. De , P.K. Sen “Electric Drives” PHI
7. S.K. Pillai, “A first course of Electrical Drive” New age International.
8. S.K. Pillai. “Analysis of Thyristor Power conditioned Motors” University Press (India)Ltd. Longman
9. P.V. Rao, “Power semiconductor Drives”, BS Publications.

EE 803 (A)- EHV A.C. and D.C. Transmission

Unit- I Introduction: EHV A.C. and D.C. links, Kind of d.c. links, limitations 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, firing angle control, overlapping.

Unit- II **FACTS Devices**: Basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), seriesseries controller, combined series-shunt controller, unified power flow controller (UPFC), thyristor controlled phase shifting transformer(TCPST).

Unit- III Converters in EHV D.C: Components of EHV D.C. system, converter circuits, rectifier and inverter valves, reactive power requirements, harmonics generation, adverse effects, classification, remedial measures to suppress, filters, ground return. converter faults & protection harmonics misoperation, commutation failure, multiterminal d.c. lines.

Unit- IV Controlling: Control of EHV D.C. system desired features of control, control characteristics, constant current control, constant extinction angle control, ignition angle control. parallel operation of HVAC & DC system, problems & advantages.

Unit- V Transmission Systems: Travelling waves on transmission systems, 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 lighting and switching over voltages.

References:

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE londan pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, l. Gyugyi-"Undustanding of FACTS concept and technology", john willy & sons pub.
7. 7.P.Kundur- "H.V.D.C. Transmission" McGraw Hill

EE-803 (B) Renewable & Non Conventional Energy Systems

Unit – I Renewable Energy Systems: Energy sources, comparison of conventional and non-conventional, renewable and non-renewable sources, statistics of world resources and data on different sources globally and in indian context, significance of renewable sources and their exploitation, energy planning, energy efficiency and management.

Unit – II Wind Energy System: Wind Energy, wind mills, grid connected systems, system configuration, working principles, limitations, effects of wind speed and grid conditions. grid independent systems - wind-battery, wind diesel, wind-hydro biomass, wind operated pumps, controller for energy balance, small hydro system grid connected system, effect of hydro potential and grid condition, synchronous versus induction generator for stand alone systems, use of electronic load controllers and self excited induction generators, wave energy system: system configuration: grid connected and hybrid systems.

Unit – III Geothermal Energy Electric energy from gaseous cells, magneto-hydro generated energy, non hazardous energy from nuclear wastes, possibilities of other modern non-conventional energy sources.

Unit – IV Energy from oceans & Biomass Energy System: Ocean temperature difference, Principles of OTEC, plant operations, system configuration, biomass engine driven generators, feeding loads in stand-alone or hybrid modes, biomass energy and their characteristics.

Unit – V: Solar Energy: Extraterrestrial solar radiation, terrestrial solar radiation, solar thermal conversion, solar photo tonic system solar cell, solar cell materials, efficiency, characteristics of PV panels under varying insulation, PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels, electric energy conservation and audit.

References:

1. John Twidell & Toney Weir, Renewable Energy Resources, E & F N Spon.
2. El-Wakil, Power Plant Technology, McGraw Hill.
3. Rai G D, Non-conventional Energy Resources, Khanna.
4. F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application-II", Plenum Press, New York, USA.
5. Anna Mani, "Wind Energy Resource Survey **in** India-Ill", Allied Publishers Ltd., New Delhi,
6. S.P. Sukhatme: Solar Energy, TMH-4e,
7. Dr. A. Ramachandran, Prof B.V Sreekantan & M F.C. Kohli etc, "TERI Energy Data Directory & Year book 1994-95", Teri Tata Energy Research Institute, New Delhi,

EE 804(A)- Power System Analysis and Control

UNIT I Introduction to power system stability problem: Rotor angle stability, voltage stability and voltage collapse, mid term and long-term stability, classification of stability, states of operation, system security, system dynamic problems, problems associated with modern interconnected power systems, deregulation, power systems restructuring, distributed generation, congestion, pricing.

Unit-II Power System Stability - Steady state, dynamic and transients stability, swing equation , equal area criterion, solution of swing equation using step by step method modified Eulers method and Rnge-Kutta method, methods of improving transient stability.

Unit-III Power Flow Atudies - Formulation of static power flow equations and solutions using Gauss- Seidel, Newton Raphson and FDLF methods, comparison of these methods, Economic operation of power system - Economic dispatch, Emission dispatch, line loss, ITL, economic dispatch using lagrangian multiplier method.

Unit-IV MW Frequency Control- Coherency, control area, modeling of speed control mechanism, load damping, block diagrammatic representation of single and two area interconnected system, static and dynamic response, .optimum parameter adjustment.

Unit-V MVAR Voltage Control - Difference in control strategy over MW – f control, characteristics of an excitation system, DC AC and static excitation system, General block diagram representation of voltage regulators.

References:

1. K.R. Padiyar, Power system dynamics, stability and control, BS Pub. Hydbid
2. P Kunder, Power system stability and control, TMH.
3. P. W. Sauer & M A Pai: Power system dynamics and stability: Pearson.

EE804 (B)-Electrical Engineering Materials

Unit I Conducting Material and Their Properties: Classification, properties, high resistivity alloy: constant mangann,nichrome, electrochemical, properties of copper, aluminum, steel tungsten, molybdenum, platinum, tantalum, niobium, mercurry, nickel, titanum, carbon, lead, thermal, bitmetals, thermocouple, materials, specific resistance, conductance, super conductors, variation of resistance with temperature.

Unit II Semi Conductor Materials: Electrical conductivity, elements having semiconductor properties, general application, hall effect, energy levels, conduction in semiconductors, intrinsic conduction, impurity conduction, p and n type impurities, electrical change, neutrality, drift, mobility current flow in semi conductors p-n junction formation by alloying, elasing (forward and reverse) of p-n junction, reverse separation current, zener effect, junction, capacitance, hall defects and hall coeffiecient.

Unit III Magnetic Materials: B.H. curve, soft and hard magnetic materials, di-magnetic, para magnetic and ferromagnetic materials, electrical sheet steel, cast iron, permanent magnetic materials, dynamic and static hysteresis loop, hysterisis loss, eddy current loss, magnetisation, magnetic susceptibility, coercive force, rectangular hysteresia loop, magnet rest square loop core materials, iron silicon, iron alloys.

Unit IV Insulating Materials: Electrical, mechanical and chemical properties of insulating material, electrical characteristics, volume and surface resistivity, permitivity loss, and dielectric loss, polarisability**,** classification of dielectric.

Unit V Mechanical Properties: Classification of insulating materials on the basis of temperature rise, general properties of transformer oil, varnishes, solidifying insulating materials, resins, bituminous waxes, drying oils, fibrous insulating materials, wood, paper and cardboard, insulating textiles, varnished adhesive tapes, inorganic fibrous material and other insulating materials, such as mica, ceramic, bakelite, ebonite, glass, PVC, rubber, other plastic molded materials.

References:

1. TTTI Madras; Electrical Engineering Materials; TMH.
2. Electrical Engineering Material s & Devices; John Allison ;TMH
3. Electrical Engineering Materials: Indulkar and S. Thruvengadem;
4. Electrical Engineering Materials; S. Chand
5. Dekkor AK; Electrical Engineering Materials; PHI

EE805 Major Project -II

The aim of the final year project is to develop student's knowledge for solving technical problems through structure project research study in order to produce competent and sound engineers. It provides the students with the opportunity to design undertake or conduct an independent research or study related to their degree course.

Following are the compulsory objectives to be needed :

1. It should be from the approved area of the subject.
2. Students must submit a written report of the same.
3. Students must submit outline and action plan for the project execution
4. Each student is required to prepare a project report and present the same at the final examination with a ppt. demonstration.
5. The project should be authentic and must not be copied from anywhere and it should be working.

EE 806 Software Lab.-III

List of Experiments (Matlab Based):

1. Developing Simulation Models using STATCOM in power system transmission lines.
2. Developing Simulation Models using SVC in power system transmission lines.
3. Developing Simulation Models using TCSC in power system transmission lines.
4. Developing Simulation Models using SSSC in power system transmission lines.
5. Developing Simulation Models using IPFC in power system transmission lines.
6. Developing Simulation Models using UPFC in power system transmission lines.
7. Developing Simulation Models for single and three phase Rectifier for different load models.
8. Developing Simulation Models for single and three phase Inverter for different load models.
9. Developing Simulation Models for single and three phase Converter different load models.
10. To develop a program in Matlab for information of Y-bus matrix for N bus system.
11. Load flow solution for 3-bus system using Gauss- Seidel, Newton Raphson and FDLF
12. methods up to 3 iteration.
13. Load flow solution for IEEE 6-bus and 30-bus system in Matlab using Newton Raphson method.
14. Assessment of transient stability of a single machine system.
15. Effect of compensation on voltage profile of IEEE 6-bus system.