RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VIII Semester

PTEX 801 Computer Application to Power system

Course Contents

Unit-I

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

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

Unit-III

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

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.

References:

1. Computer Modeling of Electrical Power Systems, Arrillaga J. watson N R Wiley India
2. A Chakrawarti Power System Analysis: Operation and Control PHI Learning 3rd edition
3. Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc. 1984.
4. Power Computer Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.
5. Computer Aided Power Systems Analysis Kusic G.L. 2nd Edition, CRC Press
6. Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata Mc Graw Hill.
7. Power System Analysis Grainger J.J. & Stevnson W.D. Mc Graw Hill
8. Power System Stability and control -P Kundur ,IEEE Press 1994
9. Advance Power Systems Analysis and Dynamics Singh L.P. John Wiley.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VIII Semester

Elective III PTEX-802 (A) High Voltage Engineering

Course Contents

Unit-I

Introduction:-Introduction to HV technology, advantages of transmitting electrical power at high voltages, need for generating high voltages in laboratory. Important applications of high voltage.

Unit-II

Breakdown phenomena:- Classification of HV insulating media, Properties of important HV insulating media. Gaseous dielectrics: Ionizations: primary and secondary ionization processes. Criteria for gaseous insulation breakdown based on Townsend's theory, Limitations of Townsend's theory. Streamer's theory breakdown in non uniform fields. Corona discharges. Paschen's law and its significance. Time lags of Breakdown. Breakdown in solid dielectrics: Intrinsic Breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown. Breakdown of liquids dielectric dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown.

Unit-III

Generation of HV AC DC and Impulse Voltage and current:- HV AC-HV transformer; Need for cascade connection and working of transformers units connected in cascade, Series resonant circuitprinciple of operation and advantages. Tesla coil. HV DC- voltage doubler circuit, cock croft- Walton type high voltage DC set, Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage, Multistage impulse generator Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Triggering gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse current.

Unit-IV

Measurement of high voltages:- Electrostatic voltmeter-principle, construction and limitation. Generating voltmeter- Principle, construction. Series resistance micro ammeter for HV DC measurements. Standard sphere gap measurements of HV AC, HV DC, and impulse voltages;Factors affecting the measurements. Potential dividers-resistance dividers capacitance dividers mixed RC potential dividers. Surge current measurement.

Unit-V

High voltage tests on electrical apparatus:-Definitions of technologies, tests on isolators, circuit breakers, cables insulators and transformers.

Reference Books:

1. E. Kuffel and W.S. Zaengl, “High voltage engineering fundamentals”, 2nd edition, Elsevier, press, 2005.
2. M.S.Naidu and Kamaraju, “High Voltage Engineering”, 3rd edition, THM, 2007.
3. L. L. Alston, “High Voltage technology”, BSB Publication, 2007.
4. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Easternlimited, 1987. 5. Transmission and distribution reference book-Westing House.C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VIII Semester

Elective III PTEX-802 (B) Scada System and Applications

Course Contents

Unit I Introduction to SCADA and PLC:SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

Unit II SCADA system components: Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

Unit III SCADA Architecture-Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

Unit IV SCADA Communication-Various industrial communication technologies- wired and wireless methods and fiber optics, open standard communication protocols.

Unit V Operation and control of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation. **Unit VI**: SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

Reference Books: 1. Stuart A Boyer: SCADA supervisory control and data acquisition.

2. Gordan Clark, Deem Reynders, Practical Modem SCADA Protocols.

3. Sunil S. Rao, Switchgear and Protections, Khanna Publication.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VIII Semester

Elective IV PTEX-803 (A) Energy Conservation and Management

Course Contents

Unit-I

General energy problem: Energy use patterns and scope for conservation. Energy audit: Energy monitoring, Energy accounting and analysis, Auditing and targeting. Energy conservation policy, Energy management & audit, Energy audit, Types of energy audit, energy management (audit), qualities and function of energy managers, language of an energy manager, Questionnaire, Check list for top management, Loss of energy in material flow, energy performance, Maximizing system efficiency, Optimizing, input energy requirements, Energy auditing instruments, Material load energy balance diagram.

Unit-II

Thermodynamics of Energy Conservation. Basic principle. Irreversibility and second law efficiency analysis of systems. Primary energy sources, optimum use of prime-movers, energy efficient house keeping, energy recovery in thermal systems, waste heat recovery techniques, thermal insulation. Thermal energy audit in heating, ventilation and air conditioning. Maintenance and Energy audit – friction, lubrication and tribo-logical innovations. Predictive and preventive maintenance.

Unit-III

Load curve analysis & load management DSM, Energy storage for power systems (Mechanical, Thermal, Electrical & Magnetic) Restructuring of electric tariff from energy conservation consideration, Economic analysis depreciation method, time value of money, Evaluation method of projects, replacement analysis, special problems inflation risk analysis. Pay back period, Energy economics, Cost Benefit Risk analysis, Pay back period.

Unit-IV

Energy efficient electric drives, Energy efficient motors V.S.D. power factor improvement in power system. Energy Conservation in transportation system especially in electric vehicle. Energy flow networks, Simulation & modeling, formulation & Objective & constraints, alternative option, Matrix chart.

Unit-V

Energy conservation task before industry, Energy conservation equipments, CoGeneration, Energy conservation process, Industry Sugar, Textiles, Cement Industry etc Electrical Energy Conservation in building, heating and lighting. domestic gadgets

References:

Energy Management – W.R. Murphy & G. Mckey Butler worths.

Energy Management Head Book- W.C. Turner, John Wiley

Energy Management Principles- Craig B. Smith, Pergamon Press

Energy Conservation- Paul O Callagan- Pergamon Press•

Design & Management of energy conservation.

Callaghan, Elect, Energy Utilization & Conservation. Dr. Tripathi S.C.,

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VIII Semester

Elective IV PTEX-803 (B) Advance Control System

Course Contents

UNIT-I

Review of Linear Control System: Modelling through differential equations and difference equations, State space method of description and its solution, Discretization of continuoustime state space model, Laplace and z-domain analyses of control systems, Controllability, Observability & Stability, Bode & Nyquist analysis, Root Loci, Effect of load disturbance upon control actions.

UNIT-II

Development of feedback control laws through state space technique, Modal control, Pole placement problem.

UNIT-III

Variable Structure Control and its applications. Examples on variable structure control.

UNIT-IV

Control of nonlinear dynamics: Lyapunov based control function, Phase plane technique, Lyapunov Stability analysis.

UNIT-V

Optimal Control: Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversality condition, Bolza problem, Pontyagin's maximum principle.

Reference: 1. Automatic Control System – B.C. Kuo, PHI, New York, 1975.

2. Modern Control Engineering: K. Ogata,PHI. New Delhi, 1992.

3. Digital Control Systems – B. C. Kuo, Oxford Pub.

4. Discrete-Time Control Systems – K. Ogata. PHI. New Delhi

5. Advanced Control Systems N Sarkar PHI Learning

6. Control System Engineering S NISE Wiley India

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Grading System

Electrical & Electronics Engineering, VIII Semester

PTEX 804 Major Project

Course Contents

GUIDELINES

The objectives of the course 'Major Project' are

To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.

To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.

To give students an opportunity to do something creative and to assimilate real life work situation in institution.

To adapt students for latest developments and to handle independently new situations. To develop good expressions power and presentation abilities in students.

The focus of the Major Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write-up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis, market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any).

The faculty and student should work according to following schedule:

i) Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff.

ii) The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

iii) At all the steps of the project, students must submit a written report of the same.