JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02801) PRINCIPLES OF POWER QUALITY

UNIT-I INTRODUCTION

What is power quality? Power quality – voltage quality, why are we concerned about power quality?, the power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

UNIT-II VOLTAGE SAGS AND INTERRUPTIONS

Sources of sagas and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags, utility system fault-clearing issues.

UNIT-III TRANSIENT OVER VOLTAGES

Sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

UNIT-IV FUNDAMENTALS OF HARMONICS

Harmonic Distortion, Voltage versus current distortion, Harmonics versus Transients, power system qualities under non sinusoidal conditions, Harmonic indices, Harmonic sources from commercial loads, Harmonic sources from Industrial loads

UNIT-V APPLIED HARMONICS

Effects of Harmonics, Harmonic distortion evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion

UNIT-VI LONG-DURATION VOLTAGE VARIATIONS

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation flicker.

UNIT-VII POWER QUALITY BENCH MARKING

Benchmarking process, RMS Voltage variation Indices, Harmonics indicesPower Quality Contracts

UNIT –VIII POWER QUALITY MONITORING

Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards

TEXT BOOKS:

1. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ptd.
2. Power quality by C. Sankaran, CRC Press

REFERENCE BOOKS:

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons
2. Understanding Power quality problems by Math H. J. Bollen IEEE Press

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02802) UTILIZATION OF ELECTRICAL ENERGY

Objective:

It deals with the illumination, Electrical heating, Welding, Electrolytic Process and Electric Traction.

UNIT – I ILLUMINATION

Definition – Laws of illumination – Polar curves – Calculation of MHCP and MSCP. Lamps: Incandescent lamp, Sodium Vapour lamp, Fluorescent lamp. Requirement of good lighting scheme – Types, Design and Calculation of illumination. Street lighting and Factory lighting – Numerical Problems.

UNIT – II ELECTRICAL HEATING

Advantages. Methods of Electric heating – Resistance, arc, Induction and dielectric heating.

UNIT – III ELECTRIC WELDING

Types – Resistance, Electric arc, gas welding. Ultrasonic, Welding electrodes of various metals, Defects in welding.

UNIT – IV ELECTROLYTIC PROCESS

Electrolysis - Faradays laws, Application of Electrolysis, Power supply for Electrolysis.

UNIT – V ELECTRIC DRIVES

Advantages, Types of D. C and A. C Motors and their Characteristics – Electric Breaking. Speed Control of D. C and A. C Motors – Temperature Rise and Load Equalization – Selection of Motors for particular Drive.

UNIT – VI ELECTRIC TRACTION – I

Introduction – Systems of Electric Traction. Comparison between A. C and D. C Traction – Special features of Traction Motors - Methods of Electric Braking – Plugging, Rheostatic and Regenarative types.

UNIT – VII ELECTRIC TRACTION – II

Mechanics of train movement. Speed-time curves of different services – trapezoidal and quadrilateral, speed-time curves – Numerical Problems.

UNIT – VIII ELECTRIC TRACTION-III

Calculations of tractive effort, Power, specific energy consumption - effect of varying acceleration and braking retardation, Adhesive weight and coefficient of adhesion – Problems.

TEXT BOOK:

1. Utilization of Electric Energy – by E. Openshaw Taylor and V. V. L. Rao, Universities Press.
2. Utilization of Electrical Power – by R. K. Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Co.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02803) MODERN CONTROL THEORY

(ELECTIVE – III)

Objective :

This subject deals with state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

UNIT – I STATE VARIABLE DESCRIPTION

Concept of State – State Equations for Linear Continuous time Models – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transmission matrix.

UNIT – II CONTROLLABILITY AND OBSERVABILITY

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms.

UNIT – III MODAL CONTROL

Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement. Full order observer and reduced order observer.

UNIT – IV DESCRIBING FUNCTION ANALYSIS

Introduction to nonlinear systems, Types of nonlinearities, Concepts of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance.

UNIT-V PHASE-PLANE ANALYSIS

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems.

UNIT-VI STABILITY ANALYSIS

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems.

UNIT –VII OPTIMAL CONTROL

Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Infinite time

Regulator, Output regulator problem. Tracking problem, Parameter Optimization.

UNIT-VIII CALCULUS OF VARIATIONS

Minimization of functionals of single function, Constrained minimization. Minimum principle. Control variable inequality constraints. Control and state variable inequality constraints.

TEXT BOOKS:

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996.
2. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.

REFERENCE BOOKS:

1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998.
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw-Hill Companies, 1997.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02804) SPECIAL ELECTRICAL MACHINES

(Elective – III)

UNIT –I SPECIAL TYPES OF D. C. MACHINES - I

Series booster – Shunt booster – Non – reversible booster – Reversible booster

UNIT –II SPECIAL TYPES OF D.C. MACHINES - II

Armature excited machines – Rosenberg generator – The Amplidyne and Metadyne - Rototrol and Regulex– Third brush generator – Three – wire generator - Dynamometer.

UNIT –III STEPPER MOTORS

Introduction – Synchronous Inductor (or Hybrid Stepper Motor), Hybrid Stepping Motor, Construction, Principle of Operation,

Energisation with two phase at a time – Essential conditions for the satisfactory Operation of a 2 – Phase Hybrid Step Motor –Very Slow-Speed Synchronous Motor for Servo Control – Different Configurations for Switching the Phase Windings – Control Circuits for Stepping Motors – An Open – Loop Controller for a 2-Phase Stepping Motor.

UNIT – IV VARIABLE RELUCTANCE STEPPING MOTORS

Variable Reluctance (VR) Stepping Motors, Single – Stack VR step motors, Multiple stack VR motors – Open – Loop Control of 3-Phase VR Step Motor – Closed – Loop Control of Step Motor, Discriminator (or rotor position sensor), Translator, Major loop – Characteristics of Step Motor in Open – Loop Drive – Comparison between Open-Loop Position Control with Step Motor and a Position Control Servo using a Conventional (dc or ac) Servo Motor – Suitability and Areas of Application of Stepping Motors – 5 – Phase Hybrid Stepping Motor – Single – Phase Stepping Motor, The Construction, Operating Principle, Torque developed in the Motor.

UNIT – V SWITCHED RELUCTANCE MOTOR

Introduction – Improvements in the Design of Conventional reluctance Motors – Some Distinctive Differences between SR and Conventional Reluctance Motors – principle of Operation of SRM – Some Design Aspects of Stator and Rotor Pole Arcs, Design of stator and Rotor and pole Arcs in SR Motor, Determination of $L(\theta)$ – θ Profile – Power Converter for SR Motor – A Numerical Example - Rotor Sensing Mechanism and Logic Control, Drive and Power Circuits, Position Sensing of rotor with Hall Problems – Derivation of Torque Expression, General, Linear Case.

UNIT –VI PERMANENT MAGNET MATERIALS AND MOTORS

Introduction, Hysteresis loops and recoil line – Stator Frames (Pole – and Yoke – Part) of Conventional PM dc Motors, Equivalent circuit of a PM – Development of Electronically Commutated DC Motor from Conventional DC Motor .

UNIT –VII BRUSHLESS DC MOTOR

Types of Construction – Principle of Operation of BLDM – Sensing and Switching Logic Scheme, Sensing, Logic Controller, Lockout Pulses – Drive and Power Circuits, Base Drive Circuit, Power Converter Circuit – Theoretical Analysis and Performance Prediction, Modeling and magnet circuit, d-q analysis of BLDM – Transient Analysis – Formulation in terms of Flux Linkages as State Variables –

Approximate Solutions for Current and Torque under Steady State – Theory of BLDM as Variable Speed Synchronous Motor (Assuming Sinusoidal Flux Distribution) – Methods of reducing Torque Pulsations, 180^0 Pole Arc and 120^0 current sheet.

UNIT –VIII LINEAR INDUCTION MOTOR

Development of a Double sided LIM from Rotary type IM – A Schematic of LIM Drive for Electric Traction – Development of one sided LIM with back Iron – Field Analysis of a DSLIM: Fundamental Assumptions.

TEXT BOOKS:

1. K. Venkataratnam, Special Electrical Machines, University Press.
2. R. K. Rajput, Electrical machines, 4th Edition, Laxmi Publications. [For Chapters I and II refer Chapter VIII of this book]
3. V. V. Athani, Stepper Motors: Fundamentals, Applications and Design, New Age International Pub.
4. N. Mohan, Undeland & Robbins, Power Electronics - Converters, Applications & Design, Wiley India, Student Edition.
5. Johan E. Gibson and F. B. Teuter, Control System Components, Mc Graw Hill Edition.
6. M. G. Say & E. O. Taylor, D. C. Machines, 2nd Edition, ELBS.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02805) PLC & DCS - ITS APPLICATIONS (ELECTIVE-III)

UNIT-I

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming Equipment, programming formats, construction of PLC ladder diagrams, Devices connected to I/O modules.

UNIT-II

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation.

UNIT-III

Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder Diagrams for process control: Ladder diagrams & sequence listings, ladder diagram construction and flowchart for spray process system.

UNIT-IV

PLC Registers: Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers.

UNIT-V

PLC Functions: Timer functions & Industrial applications, counter function & industrial applications, Arithmetic functions, Number comparison functions, number conversion functions

UNIT-VI

Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two-axis & three axis Robots with PLC, Matrix functions.

UNIT-VII

Distributed Control System (DCS) – Evolution – Different Architectures – Logical Control Unit – Operator Interface – Display – Engineering Interface.

UNIT-VIII

DCS Applications to Power Plant – Iron and Steel Plants – Chemical Industries – Paper and Pulp Industries.

Text Books:

1. Programmable Logic Controllers by W. Bolton, 5th Edition, Elsevier, 2010
2. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI
3. Distributed Control Systems by Michal P. Lucas, Van nostrand, Reinhold Co., 1986.

Reference Books:

1. Programmable Logic Controllers- Programming Method and Applications –JR. Hackworth &F.D Hackworth Jr. –Pearson, 2004.

2. Distributed Computer Control of Industrial Automation by Popovic D and Bhatkar V. P, Marcel Dekkar Inc., 1990.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02806) EMBEDDED SYSTEMS (Elective – IV)

UNIT- I OVERVIEW OF EMBEDDED SYSTEM

Embedded System, types of Embedded System, Requirements of Embedded System, Issues in Embedded software development, Applications.

UNIT-II PROCESSOR & MEMORY ORGANIZATION

Structural units in a processor, Processor selection, Memory devices, Memory selection, Memory Allocation & Map; Interfacing

UNIT-III DEVICES & BUSES FOR DEVICE NETWORKS

I/O devices, Timer & Counter devices, Serial Communication, Communication between devices using different buses.

UNIT-IV DEVICE DRIVERS AND INTERRUPT SERVICING MECHANISM

Device drives, Parallel and serial port device drives in a system, Interrupt servicing mechanism, context and periods for context switching, Deadline and Interrupt Latency.

UNIT V PROGRAM MODELING CONCEPTS

Program elements, Modeling Processes for Software Analysis, Programming Models, Modeling of Multiprocessor Systems.

UNIT VI SOFTWARE ENGINEERING PRACTICES

Software algorithm Concepts, design, implementation, testing, validating, debugging, Software Management and maintenance.

UNIT-VII HARDWARE AND SOFTWARE CO-DESIGN

Embedded system design and co design issues in software development, design cycle in development phase for Embedded System, Use of ICE

& Software tools for development of ES, Issues in embedded system design.

UNIT VIII RTOS

OS Services, I/O Sub Systems, Real Time and Embedded Systems OS, Interrupt routines in RTOS Environment, RTOS Task Scheduling Models.

TEXT BOOKS:

1. Embedded Systems : Architecture, Programming and Design – Rajkamal, TMH, 2003.
2. Programming for Embedded System: DreamTech Software Team-John Wiley -2002

REFERENCES:

1. Embedded Systems & Robots by Subrata Ghoshal, CENGAGE Learning.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02807) DESIGN OF ELECTRICAL SYSTEMS

(Elective – IV)

UNIT – I DESIGN ASPECTS OF ELECTRICAL SYSTEMS

Role of Statutes in Electrical System Design, Classification of Building Services, Design Aspects of Lighting, Design Aspects of Ventilation, Design Aspects of Climate Control, Design Aspects of Vertical Transportation, Design Aspects of Minor Building Services.

UNIT – II ELECTRICAL INSTALLATIONS IN DOMESTIC BUILDINGS

Classification, Estimation of Load Requirements, Selection of Type of Wiring, Special Features Applicable for High-Rise Apartment Buildings, Pre-commissioning Tests.

UNIT – III INDUSTRIAL INSTALLATIONS - I

Classification of Industrial Installation, General Characteristics, Selection of Distribution Architecture, Selection of Transformers and Sub Stations

UNIT – IV INDUSTRIAL INSTALLATIONS - II

Short Circuit Studies, Fault Current Calculations, Earthing Design, Selection of Switch Gears: Electrical Protection, Protection of Circuit Elements, Persons & Life stack, Equipment, Electrical Isolation, Switch Gear Control, Switching Devices, Uses, Selective Co-ordination, Circuit Breakers and Their Selection.

UNIT – V POWER FACTOR IMPROVEMENT

Nature of Reactive Energy, Power Factor, How to Improve Power Factor?, Economics of Power Factor Improvement, Location of Capacitors, Installation Precautions, Optimal Compensation, PF Correction of Induction Motors, Protection and Control, Voltage Transients, Switching Considerations.

UNIT – VI POWER SYSTEM EARTHING

Introduction, Earthing, Types of System Earthing, Reasons for Grounding/ Earthing, TN System, TT System, IT System, Protective Measures and Protective Devices in IT System, Main Characteristics of Earthing Systems, Selection Criteria for Earthing, Design Considerations of Earting, Measurement of Earth Resistance, Earth Leakage Protection, Neutral Earthing for Generators and Transformers.

UNIT – VII POER QUALITY ISSUES AND RESONANCE PROBLEMS IN SYSTEMS DESIGN

Power Quality Issues, Harmonics, Sources of Harmonics, Disturbances Caused by Harmonics, Methods to reduce the Impact of Harmonics, Design the Detuned Capacitor Bank, IEEE Standard 519-1992 and Limits.

UNIT – VIII ENERGY ECONOMICS IN SYSTEM DESIGN

Introduction, Time Value of Money, Single Payment Compound Amount Model (SPCA), Uniform Series Compound Amount Model (USCA), Uniform Series Present Worth Model (USPW), Depreciation, Tax Considerations, After Tax Analysis.

TEXT BOOK:

1. Electrical Systems Design – by M. K. Giridharan, I. K. International Publishing House Pvt. Ltd.

2. Design of Electrical Installations – by Er. V. K. Jain and Er. Amitabh Bajaj, University Science Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-II Sem. (E.E.E)

(9A02808) ENERGY AUDITING & DEMAND SIDE MANAGEMENT

(Elective – IV)

UNIT - I INTRODUCTION

Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation.

UNIT - II ENERGY AUDITING

Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Measurements in energy audits, presentation of energy audit results.

UNIT - III ENERGY EFFICIENT MOTORS

Energy efficient motors , factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT - IV POWER FACTOR IMPROVEMENT

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f. , p.f motor controllers.

UNIT – V LIGHTING AND ENERGY INSTRUMENTS

Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC’s

UNIT – VI ENERGY ECONOMIC ANALYSIS

The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems.

UNIT – VII DEMAND SIDE MANAGEMENT - I

Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning.

UNIT – VIII DEMAND SIDE MANAGEMENT - II

Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and Organization of Energy Conservation awareness Programs.

TEXT BOOK:

1. Industrial Energy Management Systems, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York.
2. Fundamentals of Energy Engineering - Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.
3. Electrical Power distribution, A S. Pabla, TMH, 5th edition, 2004
4. Demand Side Management, Jyothi Prakash, TMH Publishers.

REFERENCES:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
4. Energy management hand book by W.C.Turner, John wiley and sons
5. Energy management and good lighting practice : fuel efficiency-booklet12-EEO

6. Recent Advances in Control and Management of Energy Systems, D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
7. Energy Demand – Analysis, Management and Conservation, Ashok V. Desai, Wiley Eastern, 2005.
8. Hand book on energy auditing - TERI (Tata Energy Research Institute)