RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, VII-Semester

EE-701 Electrical Drives

Unit I

Basic Concepts of Electric Drives

Elements of drive systems, Requirement of electric drives, Rating & Selection of drives, groups and individual drives, Constant power and Constant torque drives. **Motor Mechanism dynamics**

Review of Characteristics of AC & DC motors, load characteristic, load-drive speed torque characteristics, quadrant speed torque characteristics. Mechanical Systems Stability of Electric drives, referred moment of inertia and torque of motor load combination, load equalization.

Unit II

DC Drives

Starting & Braking of conventional, Phase controlled and chopper controlled drives, Transient & Steady state analysis, Energy recovery systems.

Unit III

Induction Motor Drives

Conventional method of Starting braking and speed control, PWM, (VSI) Voltage source Inverter and Current Sources (CSI) fed IM drives, cyclo converter fed drive, Vector control drives.

Slip Controlled IM Drives

Review of Conventional methods & converter controlled-Crammers &Scherbius drives; rotor impedance control.

Unit IV

Synchronous Motors Drives

VSI and CSI fed; self-controlled-Brush less &. commutatorless dc & ac motor drives.

Unit V

Special Drives :Fundamentals of Switched reluctance motors, Stepper Motors, Permanent Magnet Motor Introduction to vector control; Digital control of drives. **Case Studies** Electric traction, steel & cements plants, textile & paper mills, machine tool drive and CNC, electric cars.

List ofExperiments:

1. Study the starting and running characteristics of converter fed DC traction motor.
2. To study the energy recovery systems and braking of a DCdrive.
3. To study the braking Methods of a three-phase inductionmotor.
4. TostudytheperformanceofVSIfedthree-phaseinductionmotorusingPWM technique.
5. TocontrolthespeedofathreephaseslipringInductionmotorusingrotor impedance control.
6. To study the performance of Vector Controlled three phase Induction motordrive.
7. To Study frequency Controlled Synchronous motordrive.
8. TostudythecontrolandperformanceCharacteristicsofswitchedReluctance motor.
9. To study the performance & control of a Steppermotor.
10. ToStudythePerformanceofapermanentmagnetBrushlessdcmotor drive.

References:

- PillaiS.K."Afirstcourseon ElectricalDrives",Secondedition,WileyEastern.
- Ned Mohan Electrical Machine Drive WILEYINDIA
- Dubey G. K., "Power Semiconductor Controlled Drives",PHI,
- DubeyG.K.,"FundamentalsofElectrical Drives".NarosaPublishingHouse.
- BoseB.K.,"PowerElectronicsandACDrives",PHILearning.
- Murphy M. D., and Tumbuli F., "Power Electronic Control of AC Motors",Pergamon Press, Oxford UniversityPress.

- P.V. Rao, "Power semiconductor Drives", BSPublications
- S.ShivaNagarajupower semiconductor drive PHIlearning

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New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, VII-Semester

Departmental Elective EE-702(A) High Voltage Engineering

Unit - I

Breakdown in gases

Mechanisms of breakdown in gases, various related ionization processes. Townsends and streamer theories. Paschen's law, Breakdown in Non-uniform fields. Effect of wave
shape of impressed voltage on the breakdown strength. Breakdown of sphere gap arid rod gap.

Unit - II

Breakdown in liquid and solids

Mechanisms of breakdown in liquids, suspended particle, suspended water, cavitation and tubble and electronic breakdown theories. Mechanisms of breakdown in solids; intrinsic electro-mechanical, erosion, surface, thermal and streamer, Relation between electric strength of solids and time, intrinsic breakdown strength.

Unit - III

Impulse Generator

Specifications of an impulse voltage Wave, standard impulse, reasons for adopting the particular shape, Analysis and control of simple circuit of impulse generator. Multistage impulse generator (Marks circuit) circuit working, earthing arid tripping. Techniques to observe wave front on C.R.O.

Generation of High Voltage

Methods of generation of power frequency high voltage cascade transformers and resonance methods, Generation of high voltage d.c., voltage stabilization. Tesla coil.

Unit - IV Measurement of High Voltage

Potential dividers-resistive, capacitive and mixed dividers for high voltage. Sphere gap; construction, mounting, effect of nearby earthed objects, humidity and atmospheric conditions, effect of irradiation and polarity, Electrostatic voltmeter; principle and classification, constructional details of an absolute electrostatic voltmeter. Oscilloscopes and their applications in high voltage measurement.

Unit - V

High Voltage Testing

Measurement of insulation resistance of cables. Wet and dry flashover test of insulators. Testing of insulators in simulated polluted conditions. Testing off transformers and rotating machines. Measurement of breakdown strength of oil. Basic techniques of non-destructive testing of insulators; measurement of loss angle, High Voltage Schering bridge, and partial discharge measurement techniques.

Over Voltage and Insulation Coordination

Lighting, Switching and temporary over voltages, BIL, SIL, methods of insulation coordination.

References:

- L. V. Bewley, "Traveling Waves on Transmission Systems", Wiley New York.M. S. Naidu and V. Kamaraju," High Voltage Engineering", Tata McGraw Hill.
- D.V. Razevig:" High Voltage Engineering", translated by Dr.M.P.Chourasia,
- KhannaPublisher
- Kuffel&Zingal, High VoltageEngg.
- Kuffel&Abdullah, High VoltageEngg.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, VII-Semester

Departmental Elective EE-702(B) Power Electronics Application to Power System

UNIT-I

Steady state and dynamic problems in AC systems: Flexible AC transmission systems (FACTS), Principles of series and shunt compensation, Description of static var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC),

UNIT-II

Modelling and Analysis of FACTS controllers: Control strategies to improve system stability, Power Quality problems in distribution systems

UNIT-III

Harmonics: Harmonics creating loads, modelling, harmonic propagation, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters, voltage sags & swells, voltage flicker, Mitigation of power quality problems using power electronic conditioners, IEEE standards, HVDC Converters and their characteristics, Control of the converters (CC and CEA), Parallel and series operation of converters.

UNIT-IV

Active Power Controllers: Dynamic static synchronous controllers, D – STATCOM, Dynamic static synchronous series controllers, dynamic voltage restorer, AC/AC voltage regulators.

UNIT-V

Energy Storage Systems: Introduction, structure of power storage devices, pumped – storage hydroelectricity, compressed air energy storage system, flywheels, battery storage, hydrogen storage, super conducting magnet energy storage, super capacitors, applications of energy storage devices.

REFERENCE BOOKS

1. N.G. Hingorani& Laszlo Gyugyi , Understanding FACTS , IEEE Press, 2000.
2. E. F. Fuchs & Mohammad A.S. Masoum, Power Quality in Power Systems and Electrical Machines, Elsevier Academic Press 2008.
3. K.R. Padiyar, FACTS controllers in power transmission and distribution, New Age International publishers, New Delhi, 2007.
4. K.R. Padiyar, HVDC Power Transmission Systems, New Age International publishers, New Delhi, 1999.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, VII-Semester

Departmental Elective EE-702(C) Generalized Theory of Electrical Machine

Unit-I

Review : Primitive machine, voltage and torque equation.

Concept of transformation change of variables & m/c variables and transform variables. Application to D.C. machine for steady state and transient analysis, and equation of cross field commutator machine.

Unit-II

Induction Machine : Voltage, torque equation for steady state operation, Equivalent circuit, Dynamic performance during sudden changes in load torque and three phase
fault at the machine terminals. Voltage & torque equation for steady state operation of 1- ö induction motor &scharge motor.

Unit-III

Synchronous Machine : Transformation equations for rotating three phase windings,

Voltage and power equation for salient and non salient alternator, their phasor diagrams, Simplified equations of a synchronous machine with two damper coils.

Unit-IV

Operational Impedances and Time Constants of Synchronous Machines: Park's equations in operational form, operational impedances and G(P) for a synchronous machine with four Rotor Windings, Standard synchronous machine Reactances, time constants, Derived synchronous machine time constants, parameters from short circuit characteristics.

Unit-V

Approximate Methods for Generator & System Analysis : The problem of power system analysis, Equivalent circuit & vector diagrams for approximate calculations, Analysis of line to line short circuit, Application of approximate method to power system analysis.

References:

- P.C.Krause, Analysis of Electric Machinery, WileyIndia.
- B.Adkins, The General theory of ElectricalMachines.
- B.Adkins&R.G.Harley, The General theory of ACMachines.
- P.S.Bhimbra, Generalised theory of Electricalm/c White & Woodson, Electro Mechanical EnergyConversion.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, VII-Semester

Open Elective EE-703(A) Utilization of Electrical Energy

UNIT I ILLUMINATION ENGINEERING

Nature of light, units, sensitivity of the eye, luminous efficiency, glare. Production of Light; Incandescent lamps, arc lamps gas discharge lamps- fluorescent lamps-polar curves, effect of voltage variation on efficiency and life of lamps, Distribution and control of light, lighting calculations, solid angle, inverse square and cosine laws, methods of calculations, factory lighting, flood lighting and street lighting, Direct diffused and mixed reflection & transmission factor, refractors, light fittings.

UNIT II
HEATING, WELDING AND ELECTROLYSIS

Electrical heating-advantages, methods and applications, resistance heating, design of heating elements, efficiency and losses control. Induction heating: core type furnaces, core less furnaces and high frequency eddy current heating, dielectric heating: principle and special applications, arc furnaces: direct arc furnaces, Indirect arc furnaces, electrodes, design of heating elements, power supply and control.
Different methods of electrical welding, resistance welding, arc welding, energy storage welding, laser welding, electrobeam welding, and electrical equipment for them.
Arc furnaces transformer and welding transformers.
Review of electrolytic principles., laws of electrolysis, electroplating, anodisisng- electro- cleaning, extraction of refinery metals, power supply for electrolytic process, current and energyefficiency.

UNIT III TRACTION

Special features of Traction motors, Different system of electric traction and their Advantages and disadvantages, diesel electric locomotives. Mechanics of train movement: simplified speed time curves for different services, average and schedule speed, tractive effort, specific energy consumption, factors affecting specific energy consumption, acceleration and braking retardation, adhesive weight and coefficient of adhesion.

UNIT IV
TRACTION MOTORS
DC motors, single phases and three phases motors, starting and control of traction
motors, braking of traction motors: plugging, rheostatic and regenerative braking, Modern 25 KV a.c.
single phase traction systems: advantages, equipment and layout of 25 KV, line and current selection,
single phase power frequency A.C. traction.

UNIT V
ELECTRIC DRIVES
Individual and collective drives- electrical braking, plugging, rheostatic and regenerative braking load equalization use of fly wheel criteria for selection of motors for various industrial drives, calculation of electrical loads for refrigeration and air-conditioning, intermittent loading and temperature rise curve.

References:

- Tailor, E.O., Utilization of Elect. Energy.
- H. Pratap, Art and Science of Utilization of ElectricalEnergy.
- Gupta, J.B., Utilization of Elect.Energy
- Garg, G.C., Utilization of Elect. Power and Elect.Traction.
- N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect. Traction, New AgeInternational.
- Hancok N N, Electric Power Utilisation, WheelerPub.

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Electrical Engineering, VII-Semester

Open Elective EE-703(B) Soft Computing Techniques & Application

UNIT-1
Review of probability theory: Random variable, distribution functions , function of random variable. generation of random digit, and random variants from various distribution function, Monte Carlo simulation, sampling distributions station evolution using MCS, confidence interval, coefficient ofvariation.

UNIT-2
Evolution of ANN, Artificial neurons activation functions general network structure g - rule, and back propagation rule of training, RBF and FLN network.

UNIT-3
Draw back of classical optimization techniques, genetic algorithm; binary and real parameter GA, constraints handling in GA.

UNIT-4
Evolution strategies(ES), two members non-recombinative ES, multi member ES, recombinative ES. Optimization based on swarm intelligence particle, swarm optimization and its variants .

UNIT-5
Application of soft computing techniques to problem of electrical engg. e.g. economic dispatch, reliable optimization, ANN training using evolutionary algorithms.

References:

1. R.Y.RubinsteinSimulationandtheMonte Carlo method,JohnWiley&sons1st Edition.
2. Paul.L.Mayer-Introducingprobabilityandstaticalapplication, AdditionWeslay.
3. Rajasekaran and pai- Neural Network, Fuzzy logic &Genetic Algorithms. PHI Learing
4. LiMin. Fu, Neural Networks in Computer Intelligence, 9thReprintTMH
5. Multi objective optimization using evolutionary algorithm- Kalyanmoy Deb John Wiley SonsLtd.
6. Probability and Random processes for Electrical Engineering , Alberto Leon Garcia IIndPearson.
7. Principlesofsoftcomputing-SNShivanandan,SNDeepaWileyIndia(P)Ltd,I edition2007.
8. Hand book of genetic algorithm- Rajaserkharans, vijayalaxmipai.
9. PSO Tutorial- KennedyEbuehart.
10. Sivanandam& Deepa- An Introduction to Neural Networks using Matlab6.0 1sted., TMH
11. M.Amirthavalli, Fuzzy logic and neural networks, Scitechpublications.

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Electrical Engineering, VII-Semester

Open Elective EE-703(C) ADVANCED CONTROL SYSTEM

UNIT-I

Review of Linear Control System: Modelling through differential equations and difference equations, State space method of description and its solution, Discretization of continuous-time 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

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Electrical Engineering, VII-Semester

EE-704 Electrical CAD Lab

LIST OF EXPERIMENT (PROGRAM)

1. Computer Program for Optimal Design of dc machine.
2. Computer Program in for Complete Design of core type power Transformer.
3. Computer Program for Complete Design of salient pole Alternator.
4. Computer Program for Optimal Design of cage rotor.
5. Computer Program for Optimal Design of slip ring induction motor.

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Electrical Engineering, VII-Semester

EE-705 Energy Audit

List of Experiments :-

1) To study the need of energy conservation and audit.

2) To study the uses and technical specification of all relevant energy auditing instruments.

3) To perform experiment to collect data of all energy auditing instruments with respect to their inputs and also analyze the collected data.

4) To perform experiment for comparative analysis of all luminaries (Incandescent lamp, Florescent lamp(FL), Compact FL and LED) using energy auditing instruments.

5) To study of different lighting systems, such as commercial, factory, flood and decorative etc.

6) To study applications of solar energy with respect to photovoltaic and thermal.

7) To study performance assessment of motors for energy conservation using auditing.

8) To study the different techniques for power factor improvement and its benefits.

9) To study the criteria and types of energy efficient motors.

10) To study the comparative analysis between standard and energy efficient motors.

11) Case study of net metering as a future technique to optimize electrical energy utilization.

12) Case study of energy audit of your departmental building.

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Electrical Engineering, VII-Semester

EE-706 Major Project-I

GUIDELINES

The objectives of the course 'Major Project-I' 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.