



SARDAR PATEL UNIVERSITY, BALAGHAT (M.P.)

SCHOOL OF ENGINEERING AND TECHNOLOGY

SYLLABUS

COURSE – BACHELOR OF TECHNOLOGY BRANCH – ELECTRICAL ENGINEERING
SEMESTER – 7th ACADEMIC SESSION 2024-25

BEE071

POWER SYSTEM ANALYSIS & CONTROL

Course Outcomes :-The student will be able to

- CO1- Develop mathematical model of a given power system
- CO2- Perform power flow analysis using numerical techniques
- CO3- Analyze the behavior of the power system under faulted conditions
- CO4- Analyze the MVAR Voltage control Problem-
- CO5- Study the stability status of power system under transient condition.

Unit-I

Modern interconnected power Systems

General Problems associated with modern interconnected power Systems, deregulation, power systems restructuring, distributed generation, congestion, available transfer capacities, pricing of energy and transmission services.

Unit-II

Power flow studies

Power flow studies - 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-III

MW Frequency control-

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-IV

MVAR Voltage control Problem-

MVAR Voltage control Problem- 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.

Unit-V

Power System Stability –

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 Runge-Kutta method, methods of improving transient stability.



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BEE072

UTILIZATION OF ELECTRICAL ENERGY

Course Outcomes ; -The student will be able to

CO1- Get knowledge of principle of electric heating, welding and its applications and To design simple resistance furnaces.

CO2- Get Knowledge of electrochemical processes and applications of these in practical world, electrical circuits used in different appliances.

CO3- Design residential illumination schemes.

CO4- Understand technical information about Electric Traction and delivery of this technical information through presentations.

CO5- Calculate tractive effort, power, acceleration and velocity of traction

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, electro beam welding, and electrical equipment for them. Arc furnaces transformer and welding transformers. Review of electrolytic principles., laws of electrolysis, electroplating, anodizing- electro-cleaning, extraction of refinery metals, power supply for electrolytic process, current and energy efficiency.

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.



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BEE073

ELECTRICAL DRIVES

Course Outcomes ; -The student will be able to

CO1- Analyze the operation and performance of the converter, chopper fed dc drive.

CO2- Analyze the operation of both classical and modern induction motor drives.

CO3- Use Computer-aided techniques for the design of the current and speed controllers for a closed loop solid-state DC motor drive.

CO4- Design & understand Digital control of drives.

CO5- Able to Select the drives for any Industrial application

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



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Elective-I BEE0741

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

Course Outcomes ; -The student will be able to

CO-1 Understand General Concepts Of CAD & implement CAD for Electrical Equipment.

CO-2 Understand and implement CAD of synchronous machine.

CO-3 Understand and implement CAD of Three phase Induction Motor

CO-4 Understand and implement CAD of Single phase Induction Motor

CO-5 Understand and implement CAD of Electrical Equipments.

Unit-I

Design of Synchronous Machine :

Features of construction of low speed and medium speed Machine, design consideration of turbo and water wheel alternators, output coefficient and choice of main dimensions, design of stator winding, design of field systems, regulation, losses and efficiency, cooling systems.

Unit-II

Design of 3 Phase Induction Motor :

Design consideration of ac motors, calculation of main dimensions, design of stator winding, effect of air gap on performance. Rotor Design: Design of slip ring and squirrel cage rotor, components of leakage reactance, calculation of leakage reactance and its effect on the performance.

Unit-III

Design of single phase Induction motor:

Calculation of main dimensions of stator, complete design of stator with its punching details, design of main and auxiliary winding, design of rotor, performance calculation of designed rotor and performance by equivalent circuit approach.

Unit-IV

Design of Electrical Equipments:

Design of choke, DC motor starter, Lifting magnets and other electro magnetic devices.

Unit-V

Computer Aided Design:

Philosophy and economics of computer aided design, advantages limitations, analysis and synthesis methods, and selection of input data and design variables, flow charts for design of induction motor and synchronous machine. Optimization of design constrained and unconstrained optimization problem



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Elective-I BEE0743

SCADA SYSTEMS AND APPLICATIONS

Course Outcomes ; -The student will be able to

CO1- SCADA & PLC , Applications, Interfacing of PLC with SCADA.

CO2- SCADA system components i.e. Remote Terminal Unit, Communication Network, SCADA server

CO3- SCADA Architecture i.e. single unified standard architecture IEC 61850 SCADA / HMI Systems.

CO4- SCADA Communication technologies and fiber optics.

CO5- Operation and control of interconnected power system.

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, 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.



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Elective-II BEE0751

HIGH VOLTAGE ENGINEERING

Course Outcomes ; -The student will be able to

CO1- State the different breakdown theories applicable to gaseous, solid and liquid insulating materials.

CO2- Explain the causes of lightning and switching surges and the methods to control them.

CO3- Describe and design various methods of generation of high voltage ac, and impulse.

CO4- Explain the different measurement techniques used for high voltage ac, dc and impulse.

CO5- Carry out high voltage testing of isolators, circuit breakers, transformers, cables and surge arresters.

CO6-Design and plan layout of high voltage laboratory

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 and rod gap.

Unit - II

Breakdown in liquid and solids

Mechanisms of breakdown in liquids, suspended particle, suspended water, cavitation and tubule 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 (Mars circuit) circuit working, earthing and 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



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Elective-II BEE0753

GENERALISED THEORY OF ELECTRICAL MACHINES

Course Outcomes ; -The student will be able to

CO1 The role of magnetic energy in electromechanical energy conversion. Generalized equation of machines

CO2 Active and passive transformation. Linear transformation in circuits and machines

CO3 Electric machine dynamics. The torque expressions

CO4 Transient performance of various machines (motors and generators). Stability analysis using various stability criteria. Reference frames and applications.

CO5 Steady-state performance of induction machines. Steady-state performance of synchronous machines.

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- ϕ induction motor & synchronous 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 books:

1. P.C.Krause, Analysis of Electric Machinery, Wiley India.
2. B.Adkins, The General theory of Electrical Machines.
3. B.Adkins&R.G.Harley, The General theory of AC Machines.



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BEE076P

MAJOR PROJECT –I

Planning & Literature Survey

A literature survey of a project is a research of scholarly sources on a certain topic. It provides an overview of the existing knowledge to identify gaps, methods, and theories. A good literature survey of a project summarizes, evaluates, synthesizes, and analyzes sources to give a clear picture of the main concept. A literature survey in a challenge report represents the examine completed to help within the completion of a challenge. A literature survey additionally describes a survey of the earlier current materials on a subject of the report

- The Major Project Work provides students an opportunity to do something on their own and under the supervision of a guide.
- Each student shall work on an approved project, which may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas.
- The project work involves sufficient work so that students get acquainted with different aspects of manufacture, design or analysis. The students also have to keep in mind that in final semester they would be required to implement whatever has been planned in the Major Project in this semester.
- It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and also evaluated by an external examiner.
- At the end of semester, all students are required to submit a synopsis.

A Step-by-Step Guide to Conducting a Literature Survey for Your Project Report

Step 1: Define Your Research Question

Before delving into the literature, IT is essential to clearly define your research question. This will help narrow down your focus & identify the specific information you need to search for. A well-defined research question allows you to stay focused & save time during literature search.

Step 2: Identify Relevant Databases and Sources

To begin your literature survey, you need to identify the most relevant databases and sources in your field. These can include academic journals, conference proceedings, books, reputable websites, and specialized databases. Each field may have specific databases or sources that are commonly used, so IT is important to consult with your advisor or peers for recommendations.

Step 3: Develop Search Keywords

