RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical & Electronics Engineering, VI-Semester

Departmental Elective EX- 603 (A) Utilization of Electrical Engineering

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 lampspolar 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, electron 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, selection of Traction Motor, Different system of electric traction and their Advantages and disadvantages, 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

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.

UNIT-V

Introduction to Electric and Hybrid Vehicles

Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption.

REFERENCE BOOKS

1. Open Shaw ,Taylor, .Utilization of electrical energy., Orient Longmans, 1962.
2. H. Pratap, Art and Science of Utilization of Electrical Energy.
3. Gupta, J.B., Utilization of Elect. Energy ,Katariya and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect. Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect. Traction, New Age International.
6. Hancok N N, Electric Power Utilisation, Wheeler Pub.
7. Mehrdad,Ehsani,Yimin Gao,Sabastien.E. Gay,Ali Emadi, "Modern electric, hybrid electric and fuel cell vehicles", CRC Press

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Electrical & Electronics Engineering, VI-Semester

Departmental Elective EX- 603 (B) Energy Conservation & Management

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 housekeeping, 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. Payback period, Energy economics, Cost Benefit Risk analysis, Payback 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, Co-Generation, Energy conservation process, Industry Sugar, Textiles, Cement Industry etc Electrical Energy Conservation in building, heating and lighting. domestic gadgets

REFERENCE BOOKS

1. Energy Management – W.R. Murphy & G. Mckey Butler worths.
2. Energy Management Head Book- W.C. Turner, John Wiley
3. Energy Management Principles- Craig B. Smith, Pergamon Press
4. Energy Conservation- Paul O Callagan- Pergamon Press
5. Design & Management of energy conservation. Callaghan
6. Elect, Energy Utilization & Conservation- Dr. Tripathi S.C.,

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New Scheme Based On AICTE Flexible Curricula

Electrical & Electronics Engineering, VI-Semester

Departmental Elective EX- 603 (C) Electromagnetic Waves

UNIT-I
Transmission Lines
Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

UNIT-II
Maxwell's Equations
Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

UNIT-III
Uniform Plane Wave
Homogeneous unbound medium, Wave equation for time harmonic fields,Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

UNIT-IV
Plane Waves at Media Interface
Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

UNIT-V
Waveguides
Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

UNIT-VI
Antennas
Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

REFERENCE BOOKS
1.R. K. Shevgaonkar, **"**Electromagnetic Waves**"**, Tata McGraw Hill, 2005.
2. D. K. Cheng, "Field and Wave Electromagnetics**"**, Addison-Wesley, 1989.
3. M. N.O. Sadiku, "Elements of Electromagnetics**"**, Oxford University Press, 2007.
4. C. A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, 2012.
5. C. A. Balanis, "Antenna Theory: Analysis and Design**"**, John Wiley & Sons, 2005.

UNIT I: Transmission Lines

1. **Introduction to Transmission Lines**:

   - Definition and purpose of transmission lines in electrical engineering.

   - Types of transmission lines: balanced and unbalanced, lossless and lossy.

2. **Concept of Distributed Elements**:

   - Distributed parameter models: representation of transmission line parameters.

   - Derivation of distributed element equations: voltage, current, and impedance.

3. **Standing Waves and Impedance Transformation**:

   - Reflection and transmission coefficients, standing wave ratio (SWR).

   - Impedance matching techniques using transmission lines.

4. **Power Transfer on Transmission Lines**:

   - Concepts of forward and backward waves.

   - Maximum power transfer theorem and its application.

5. **Analysis of Transmission Lines**:

   - Transmission line equations in terms of admittances.

   - Smith chart and its applications in transmission line calculations.

6. **Applications and Impedance Matching**:

   - Practical applications of transmission lines: telecommunication, power distribution.

   - Techniques for impedance matching using transmission lines.

UNIT II: Maxwell's Equations

1. **Basic Quantities and Laws of Electromagnetics**:

   - Fundamental quantities: electric field, magnetic field, charge, current.

   - Gauss's law, Ampere's circuital law, Faraday's law of electromagnetic induction.

2. **Maxwell's Equations**:

   - Formulation of Maxwell's equations in integral and differential forms.

   - Concept of electric displacement current in Ampere's law.

3. **Surface Charge and Current**:

   - Boundary conditions for electric and magnetic fields at media interfaces.

   - Analysis of surface charge and surface current densities.

UNIT III: Uniform Plane Wave

1. **Homogeneous Unbound Medium**:

   - Introduction to homogeneous unbound media.

   - Wave equation for time-harmonic fields and its solutions.

2. **Uniform Plane Wave**:

   - Characteristics of uniform plane waves: amplitude, phase, frequency.

   - Wave polarization: linear, circular, elliptical polarization.

3. **Wave Propagation in Conducting Medium**:

   - Analysis of wave propagation in conductors.

- Calculation of phase velocity and power flow using Poynting vector.

UNIT IV: Plane Waves at Media Interface

1. **Plane Wave at Dielectric Interface**:

   - Reflection and refraction of plane waves at dielectric interfaces.

   - Total internal reflection and Brewster angle phenomenon.

2. **Wave Polarization at Media Interface**:

   - Effect of media interface on wave polarization.

   - Analysis of fields and power flow at media interfaces.

3. **Reflection from Conducting Boundary**:

   - Reflection characteristics from conducting boundaries.

   - Analysis of losses at media interfaces.

UNIT V: Waveguides

1. **Parallel Plane Waveguide**:

   - Introduction to waveguides and their classification.

   - Analysis of transverse electric (TE) and transverse magnetic (TM) modes.

2. **Cut-off Frequency and Dispersion**:

   - Definition of cut-off frequency and its significance in waveguides.

   - Phase velocity and dispersion characteristics in waveguides.

3. **Rectangular Waveguides**:

   - Analysis of wave propagation in rectangular waveguides.

   - Calculation of mode propagation constants and characteristic impedance.

UNIT VI: Antennas

1. **Radiation Parameters and Potential Functions**:

   - Characteristics of antennas: radiation pattern, directivity, gain.

   - Analysis of radiation from Hertz dipole antennas.

2. **Near and Far Fields**:

   - Differentiation between near and far fields in antenna radiation.

   - Calculation of total power radiated by a dipole antenna.

3. **Radiation Resistance and Pattern**:

   - Calculation of radiation resistance and radiation pattern of antennas.

   - Analysis of Hertz dipole antennas in receiving mode.
