**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**Electrical & Electronics Engineering, V-Semester**

**Open Elective EX- 504 (A) Industrial Electronics**

**Unit-I**

Power supply, rectifiers (half wave, full wave), performance parameters of power supplies, filters (capacitor,inductor, inductor-capacitor, pi filter), bleeder resistor, voltage multipliers .Regulated power supplies (series and shunt voltage regulators, fixed and adjustable voltage regulators,current regulator), switched regulator (SMPS), comparison of linear and switched power supply, switchmode converter (flyback, buck, boost, buk-boost, cuk converters).

**Unit-II**

Silicon controlled rectifies (SCR), constructional features, principle of operation, SCR terminology, turn-onmethods, turn-off methods, triggering methods of SCR circuits, types of commutation, comparison ofthyristors and transistors, thermal characteristics of SCR, causes of damage to SCR, SCR overvoltageprotection circuit, Line commutated converters (half wave rectifier withinductive and resistive load, single phase and three phase full wave rectifiers).

**Unit-III**

Other members of SCR familyTriacs, Diacs, Quadracs, recovery characteristics, fast recovery diodes, power diodes, power transistor,power MOSFET, Insulated gate bipolar transistor (IGBT), loss of power in semiconductor devices,comparison between power MOSFET, power transistor and power IGBT.

**Unit-IV**

Applications of OP-AMPBasics of OP-AMP, relaxation oscillator, window comparator, Op-comp as rectangular to triangular pulseconverter and vice- versa, Wien bridge oscillator, function generator, frequency response of OP-AMP,simplified circuit diagram of OP-AMP, power supplies using OP-AMP, filters (low-pass, high pass) using OP-AMP

**Unit-V**

Programmable Logic Controller (PLC)Functions, applications, advantages and disadvantages of PLC over conventional relay controllers,comparison of PLC with process control computer system, factors to be considered in selecting PLC,functional block diagram of PLC, microprocessor in PLC, memory, input and output modules (interfacecards), sequence of operations in a PLC, status of PLC, event driven device, ladder logic language, simpleprocess control applications of PLC, Programming examples..

**REFERENCE BOOKS**


1. Bishwanath Paul: Industrial Electronics and control, PHI Learning.
2. Rashid: Power Electronics- Circuits, devices and applications, Pearson Education.
3. Singh and Khanchandani: Power Electronics, TMH
4. Bhimbra: Power Electronics, Khanna Publishers.
5. Moorthi: Power Electronics, Oxford University Press.
6. Webb: Programmable Logic Controllers- Principles and Applications, PHI Learning.

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**Electrical & Electronics Engineering, V-Semester**

**Open Elective EX- 504 (B) Electromagnetic Theory**

## Unit I

Cartesian, cylindrical & spherical co-ordinate systems, scalar & vector fields, gradient, divergence & curl of a vector field, Divergence theorem & Stokes's theorem, concept of vectors.

Electrostatic Fields – Coulomb's law, electric field intensity due to different charge distribution viz. line charge, sheet charge, Field due to continuous volume – electric potential, properties of potential function, potential gradient equipotential surfaces, line of force, Gauss law, applications of Gauss law, Gauss law in point form, method of images.

## Unit II

Laplace's & Poisson's equations, solution of Laplace's equation, Electric dipole, dipole moment, potential & electric field intensity due to dipole, Behavior of conductors in an electric field. Conductor & insulator, electric field inside a dielectric, polarization, Boundary value conditions for electric Field, Capacitance & Capacitances of various types of capacitors, Energy stored and energy density in static electric field, Current density, conduction & convection current density ohms law in point form, equation of continuity.

## Unit III

Static Magnetic Field, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoidal current carrying wire, Relationship between magnetic flux, flux density & magnetic Field intensity; Ampere's circuital law and its applications, magnetic Field intensity due to infinite sheet and various other configurations, Ampere's circuital law in point form, Magnetic force, moving charge in a magnetic field, Lorentz Force on straight and long current carrying conductors in magnetic field, force between two long & parallel current carrying conductors. Magnetic dipole & dipole moment, a differential current loop as dipole, torque on a current carrying loop in magnetic field, Magnetic Boundary conditions.

## Unit IV

Scalar magnetic potential and its limitations, Vector magnetic potential and its properties, vector magnetic potential due to different simple configurations; Self and Mutual inductances, determination of self & mutual inductances, self inductance of solenoid, toroid

coils, mutual inductance between a straight long wire & a square loop. Energy stored in magnetic Field & energy density, Faraday's Law, transformer & motional EMFs, Displacement current, Maxwell's equations as Generalization of circuit equations, Maxwell's equation in free space, Maxwell's equation for harmonically varying Field, static and steady fields, Maxwell's equations in differential & integral form.

**Unit V**

Electro Magnetic Waves : Uniform plane wave in time domain in free space, Sinusoidally time varying uniform plane wave in free space, Wave equation and solution for material medium, Uniform plane wave in dielectrics and conductors, Pointing Vector theorem, instantaneous, average and complex poynting vector, power loss in a plane conductor, energy storage, Polarization of waves, Reflection by conductors and dielectric – Normal & Oblique incidence, Reflection at surface of a conducting medium, surface impedance, transmission line analogy.

**References:**

1. Mathew N.O Sadiku; Elements of Electromagnetic; Oxford.

2. P.V. Gupta; Electromagnetic Fields; Dhanpat Rai.

3. N.N. Rao; Element of Engineering Electromagnetic; PHI.

4. William H. Hayt; Engineering Electromagnetic; TMH.

5. John D. Kraus; Electromagnetic; TMH.

6. Jordan Balmian; Electromagnetic wave & Radiating System; PHI.

7. David K. Cheng; Fields and Wave Electromagnetic; Addison Wesley.

8. S.P. Seth; Electromagnetic Field ;Dhanpat Rai & Sons

Note: Field plotting of electromagnetic systems on a PC using standard softwares. Application for low and high frequency devices. Suggested softwares, GEMINI(Infolytica), ANSYS, ANSOFT, NISA.

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**New Scheme Based On AICTE Flexible Curricula**

**Electrical & Electronics Engineering, V-Semester**

**Open Elective EX- 504 (C) Electrical and Electronic Materials**

## COURSE OBJECTIVE

The primary objective of the course is to introduce concepts about the properties, characteristics, applications and limitations of Electrical & Electronics engineering materials.

**Course contents :**

**Unit I** : Crystal structure of materials, crystal systems, unit cells and space lattices and defects, Classes of Engineering Materials – Metals & alloys, ferrous and non-ferrous alloys, low alloy steels, aluminium alloys, copper alloys, stainless steels, cast iron, ceramics, organic polymers and composite material. Classification of solids from electrical engineering point of view. Conducting material – properties of conductors, characteristics of good conductor material, commonly used conducting materials, conductor materials for overhead lines, types of conductors, conductor for underground cables, conductor materials used in electrical machines, resistor materials, types of resistors, materials for bus bar.

**Unit II** : Dielectric Materials: Dielectric strength, factors affecting dielectric strength, dielectric loss, dissipation factor, factors affecting dielectric loss, permittivity & polarization, charging and discharging of dielectric, conduction through dielectric. Application of dielectric, different types of capacitors and materials used for them. Insulating materials, their– thermal and chemical, mechanical & electrical property. Insulating materials like ceramic, mica, glass, rubber, resins, wax varnishes, Class of insulator. Transformer oils & their testing. Piezoelectricity & Ferro electricity.

**Unit III** : Concept of energy band diagram for materials - conductors, semiconductors and insulators Applications of semi conductor materials: type of semi conductors, working and applications of semiconductors, Temperature sensitive elements, photoconductive cells, photo voltaic cells; Varistor, Hall effect generator, LCD, Light dependent resistors, LEDs, piezo – electric materials, semiconductor laser and its characteristics, photo conductors – photo diodes, avalanche photo diode, photo transistors.

**Unit IV** : Classification of magnetic materials: Dia-magnetism, Para magnetism, Ferro-magnetism, magnetization curve, hysteresis loop, Magnetostriction, Factors affecting permeability and hysteresis, Anti – ferromagnetism, Ferromagnetism, Magnetic resonance, B-H curve for different magnetic materials, loss of magnetism, impurities in ferromagnetic materials, soft and hard magnetic materials, ferrites

**Unit V**: Superconductivity & it's application. Materials of MHD generator, Thermoelectric generators, Thermionic conductors, Physical properties &Electrical properties of SF6, Specification of SF6 gas for GIS application, Advantages and Applications of SF6, Nanomaterials, Ultra Light materials and metallic foams.

**Course outcome :**

Student after successful completion of course is expected to possess an understanding of basic of Electrical & Electronics engineering materials.

**References:**


*1. A.J. Dekker; Electrical Engineering Materials; PHI.*

*2. William F Smith, JavadHashemi, Ravi Prakash 'Material science and engineering', McGraw Hill.*

*3. James F. Shackelford, Madanapalli K. Muralidhara 'Introduction to Materials Science for Engineers', Pearson*

*4. Ian P. Jones ' Materials Science for Electrical and Electronics Engineers' Oxford university press*

*5. C. S. Indulkar and S. Thruvengadem; Electrical Engineering Materials; S. Chand.*

*6. TTTI Madras; Electrical Engineering Materials; TMH.*

*7. John Allison; Electrical Engineering Material s & Devices; TMH.*

*8. Kasap; Electronic Materials and devices; TMH*

*9. V. Raghvan; Material Science & Engineering; PHI.*

*10. S.P. Seth & P.V. Gupta; Electrical Engineering Materials; Dhanpat Rai.*

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**Electrical & Electronics Engineering, V-Semester**

**EX506 MATLAB**

MATLAB

Basic simulation Mechanism and Simulation Tools, Starting and Ending MATLAB, MATLAB Desktop, Help Browser, Types of Files, Command Input Assistance, Operators and Special Characters, Variables and Arrays, Handling Arrays, Useful Built-in Functions, Control Structures, Input/Output Commands, File Handling

Introduction to Plotting

The plot command, Formatting and Labeling a Plot, Multiple Plots, Adding Legend, Sub Plots, Plotting Complex Data, 2-D and 3-D Plots, Plotting a Function, Plot Editor, Interactive Plotting using Plotting Tool

Programming in MATLAB

MATLAB Editor, MATLAB Programming, Debugging MATLAB Programs, MATLAB Debugger, Functions and Function Files, Differential Equation Solver, Symbolic Mathematics, Programming Examples

Basic Electrical and Networks Applications

Analysis of Electrical Networks – Experiments based on Solution of Series-Parallel Circuits, Solution of system with linear equations - Experiments based on mesh and nodal analysis, Experiments for Validation of Network Theorems, Solution of Network Problems.

**REFERENCE BOOKS**

1. “Modelling And Simulation Using Matlab- Simulink”,2011Dr Shailendra Jain, Willey India.
2. “MatlabProgramming”,Rudra prasad.