

# Flexible Scheme & Syllabus

2020-2021

## B.Tech.

in

# Electrical Engineering

(II Semester)



**Madhav Institute of Technology &  
Science**

Gwalior-474005

## **Electrical Engineering Materials: 130211**

### **Course Objectives:**

- The objective is to familiarize the students with different types of Engineering materials and their use in the field of Electrical Engineering.

Unit I. Conducting Materials: The conductivity of metals and alloys, General properties, Classification of conducting materials, Low resistivity and high resistivity materials, their properties and applications, Electrical and mechanical properties and applications of Cu, Al, Steel, ACSR conductor, AAC conductor, Tungsten, Molybdenum, Platinum, mercury, lead, manganese, metals and Alloys for fuses, superconductivity and its applications.

Unit II. Semiconductor Materials: Classification of materials based on atomic structure, conductors, insulators and semiconductors, Electron energy and energy band theory, Semiconductor materials, Intrinsic semiconductors, Extrinsic semiconductor, N type materials, P type materials, minority and majority carriers. Formation of PN junction by alloying, Merits of semiconductor materials for use in electrical Engg., Factors affecting semiconductors, application of semiconductor materials, Hall effect with mathematical treatment.

Unit III. Magnetic Materials: Different terms associated with magnetic materials. Classification of magnetic materials, Diamagnetic, Paramagnetic and ferromagnetic materials, Curie point, Magnetostriction, electromagnet and its uses, Magnetization curve, Hysteresis and eddy current loss, Soft and hard magnetic materials, their properties and applications, its advantage and disadvantages, requirements of magnetic materials for use in Electrical machines, Magnetic anisotropy, Spontaneous magnetization.

Unit IV. Dielectric materials: Behavior of dielectrics in static and alternating fields, polarization, Dielectric constant of mono atomic gases, ionic polarization, Dipolar polarization, internal fields in solids and liquids, Polarizability, Frequency dependence of electronic polarization, permittivity, dielectric losses, significance of the loss tangent dipolar relaxation, Ferroelectricity, piezoelectricity.

Unit V. Insulating materials: General electrical, mechanical, thermal and chemical properties of insulating materials, classification of insulating materials on the basis of temperature rise. Gaseous insulating materials properties and application of nitrogen, liquid insulating materials, their main features, Transformer oil, testing the dielectric strength of transformer oil. Ferrous metals and non ferrous metals.

Introduction to nano material.

### **Recommended Books:**

1. Science of Engineering Materials By C.M.Srivastava & C.Srinivasan, New Age International Publisher, 2010.
2. A Text Book Of Electrical Engineering Materials By P.L. Kapoor, Khanna Publication, 2016
3. Electrical Engineering Materials By A.J. Dekker, PHI, 2015
4. An Introduction To Electrical Engineering Materials By C.L. Indulkar, S. Thiravengadam, S. Chand & Co, 2006

**Course Outcomes**

After completing this course, the student will be able to:

**CO1: Describe** the properties and applications of conducting materials.

**CO2 : Explain** behavior of semiconductor materials, their classification and applications.

**CO3: Select** appropriate Magnetic materials for given applications.

**CO4 : Explain** dielectric materials, their behavior in different fields, polarization and dielectric losses

**CO5: Select** appropriate insulating material depending upon specific requirement

## **Basic Civil Engineering & Mechanics: 100020**

### **Course Objectives:**

1. To understand the utility, location, construction detail and suitability of various building elements.
2. To determine the location of object on ground surface.
3. To stabilize the position of various object.
4. To understand the effects of system of forces on rigid body in static conditions.
5. Analysis of determinate structure (beam & truss)

**Unit- I** Building Materials: Stones, bricks, cement, timber - types, properties, test & uses, Introduction of concrete properties & Laboratory tests on concrete, curing of concrete and mortar Materials.

**Unit- II** Surveying & Positioning: Introduction to surveying, Survey stations, Measurement of distances conventional and EDM methods, Measurement of directions by different methods, Measurement of elevations by different methods, reciprocal leveling.

**Unit- III** Mapping & Sensing: Mapping details and contouring, Plane tables and related devices. Introduction of theodolite. Measurement of areas and volumes, application of measurements in quantity computations, Introduction of remote sensing and its applications.

**Unit- IV** Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent coplanar forces, free body Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses, method of joints, method of Sections. Frictional force in equilibrium problems.

**Unit –V** Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment of Inertia of Composite section, Radius of Gyration, Introduction to product of Inertia and Principle Axes.

Support Reactions, Shear force and bending moment diagram for cantilever & simply supported

beam with concentrated, distributed load and Couple.

### **Text Books:**

1. Surveying, Vol. – 1, Punmia B.C., Laxmi Publications, 17th edition, 2016
2. Building Material, B. C. Punmia, Laxmi Publications, 2016
3. A textbook of Engineering Mechanics, D. S. Kumar, Katsons Publications, 2013

### **Reference Books:**

1. Basic Civil Engineering, S. Ramamrutam & R. Narayan, Dhanpat Rai Pub., 3rd edition, 2013
2. Applied Mechanics, Prasad I.B., Khanna Publication 17th edition, 1996
3. Surveying, Duggal, Tata McGraw Hill New Delhi, 4th edition, 2013
4. Applied Mechanics, R.K. Rajput, Laxmi Publications, 3rd edition, 2016

Course Outcomes:

Upon completion of the course, the students will be able to:

- CO 1.** Explain concepts and terminologies of building materials, surveying and mechanics.
- CO 2.** Apply various methods for surveying and mechanics.
- CO 3.** Determine the location, area and volume of objects on ground surface.
- CO 4.** Solve the problems of surveying and mechanics by using various methods.
- CO 5.** Analyse the effects of system of forces on rigid bodies in static conditions

## **Basic Mechanical Engineering: 100021**

### **Course Objectives:**

1. Develop the fundamentals of Engineering materials, measurement and reciprocating machines.
2. Develop an ability to understand the Thermodynamic laws, steam generator and reciprocating machines for solving engineering problems.
3. Demonstrate Engines and Boiler fundamentals using models.

### **Unit-I:**

Materials: Classification of engineering material, composition of cast iron and carbon steels on iron carbon diagram and their mechanical properties; Alloy steel and their applications; Stress Strain diagram,

Hooke's law and modulus of elasticity. Tensile, shear, hardness and fatigue testing of materials.

### **Unit-II:**

Measurement: Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set; introduction to lathe drilling, milling and shaping machines.

### **Unit-III**

Fluids: Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernoulli's equation for incompressible fluids, viscous and turbulent flow, working principle of fluid coupling, pumps, compressors, turbines, positive displacement machines and pneumatic machines.

Hydraulic power & pumped storage plants for peak load management as compared to base load plants.

### **Unit-IV**

Thermodynamics: Zeroth, First, second and third law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, classification and working of boilers, efficiency & performance analysis, natural and induced draught, calculation of chimney height. Refrigeration, vapour absorption and compression cycles, coefficient of performance (COP).

### **Unit-V**

Reciprocating Machines: Steam engines, hypothetical and actual indicator diagram; Carnot cycle and ideal efficiency; Otto and diesel cycles; working of two stroke & four stroke petrol and diesel IC engines.

**Text Books:**

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering;
5. Sawhney GS; Fundamentals of Mechanical Engineering; PHI
6. Nakra and Chaudhary; Instrumentation and Measurement; TMH
7. Nag PK; Engineering Thermodynamics; TMH
8. Ganesan; Combustion Engines; TMH

Course Outcomes: After successful completion of this course students will be able to:

- CO 1.** Define the essential concepts of thermal, design and production used in Mechanical Engineering.
- CO 2.** Summarize fundamental techniques and process used in power generating machines
- CO 3.** Solve the various problems based on basic concepts of Mechanical Engineering.
- CO 4.** Analyze the various gas, steam and air cycles
- CO 5.** Evaluate the problems of Steam Generator, Thermodynamics, Steam and I.C. engines
- CO 6.** Generate the skills to demonstrate steam Generator and reciprocating machine in depth.

**Lists of Experiments: 100021**

1. Study of simple vertical boilers.
2. Study of Locomotive boilers.
3. Study of Babcock and Wilcox boilers.
4. Study of Lancashire, Cornish and Cochran boilers.
5. Study of boiler mounting and accessories.
6. Study of 2 stroke diesel and petrol engines.
7. Study of 4 stroke diesel and petrol engines.
8. Study of simple steam engines.
9. Study of Lathe machine.
10. Study of Vernier and Micrometer.
11. Study of Internal Combustion Engine Parts.

## **Basic Electrical & Electronics Engineering: 100022**

### **Course Objectives:**

- To impart basic knowledge of the DC and AC circuits and their applications.
- To familiarize the students with the basic knowledge of magnetic circuits, transformer, and its terminology.
- To make familiarize the students about the working of rotating electrical machine, various electronic circuits and its importance.

### **Unit I - D.C. Circuits Analysis:**

Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

### **Unit II –Single-phase AC Circuits:**

Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor.

### **Unit III- Magnetic Circuits:**

Basic definitions, AC excitation in magnetic circuits, self-inductance and mutual inductance, Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F. Flux,MMF and their relation, analysis of magnetic circuits.

### **Unit IV- Single-phase Transformer &Rotating Electrical Machines:**

Single phase transformer, Basic concepts, construction and working principal, Ideal Transformer and its phasor diagram at No Load, Voltage, current and impedance transformation, Equivalent circuits and its Phasor diagram, voltage regulation, losses and efficiency, testing of transformers, Construction & working principle of DC and AC machine.

### **Unit V - Digital Electronics, Devices & Circuits:**

Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements, operation and conversion, Demorgan's theorem, Logic gates- symbolic representation and their truth table, Introduction to semiconductors, Diodes, V-I characteristic, Bipolar junction transistors and their working, Introduction to CB, CE & CC transistor configurations

### **Recommended Books:**

1. Basic Electrical and Electronics Engineering, D.P. Kothari & I.J. Nagrath-Tata McGraw Hill
2. Basic Electrical and Electronics Engineering, V N Mittle & Arvind Mittal -Tata McGraw Hill
3. Basic Electrical and Electronics Engineering, S. K Bhattacharya -Pearson
4. Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH
5. Principles of Electrical Engineering- Vincent Del Toro- Prentice Hall.
6. Basic Electrical Engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH
7. Integrated Electronics- Millmann & Halkias
8. Electronics Devices & circuits- Sanjeev Gupta, Dhanpat Rai Publication
9. Basic Electrical and Electronics Engineering, D.C Kulshreshtha-Tata McGraw Hill

### **Course Outcomes**

After the completion of the course, the student will be able to –

**CO 1. Solve** dc & ac circuits by applying fundamental laws & theorems

**CO 2. Compare** the behavior of electrical and magnetic circuits for given input

**CO 3. Explain** the working principle, construction, applications of rotating electrical machines

**CO 4. Explain** the working principle, constructional details, losses & applications of single phase transformer.

**CO 5. Select** the logic gates for various applications in digital electronic circuits.

**CO 6. Explain** characteristics of Diode and Transistor.



## **Basic Electrical & Electronics Engineering Lab**

### **LIST OF EXPERIMENT**

1. To verify Kirchoff's Current Law & Kirchoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter & measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

### **Course Outcomes:**

After the completion of the lab, the student will be able to –

- CO 1. **Verify** circuit theorems.
- CO 2. **Perform** tests on transformer for determination of losses, efficiency & polarity.
- CO 3. **Acquire** teamwork skills for working effectively in groups
- CO 4. **Prepare** an organized technical report on experiments conducted in the laboratory

## **Skill-Based Mini Project**

### **Basic Electrical & Electronics Engineering**

1. Enlist the different electrical loads available in your home and prepare their rating chart.
2. Design the residential house wiring using fuse, switch, and indicator, lamp and energy meter. Also apply the Thevenin's theorem for finding the current in a particular branch of the circuit.
3. If one FTL (Fluorescent Tube Light) is replaced by LED bulb.
  - A. Calculate the Monthly electrical energy saving?
  - B. Calculate the monthly savings in electricity bill?Note: LUX level of FTL and LED bulbs must be the same (follow BEE Guide lines). Consider electricity bill charges from MP Vidyut Vitran company website.
4. What is the use of condenser in a ceiling fan? Draw a wiring diagram for the testing of motor winding.
5. Find the different ways/ Methodologies/ Guidelines, by which energy can be conserved in domestic applications?
6. Design a working model for controlling one lamp by two 2-way switch.
7. Visit the electrical machine lab and enlist different types of AC and DC motors along with their ratings. Also mention their industrial applications.
8. Visit the panel room and identify the different safety practices followed by electrical engineer.
9. Enlist different measuring instruments available in electrical workshop lab. Also prepare a comparison chart for Analog and digital measuring instruments.

## **Manufacturing Practices: 130212**

### **LIST OF EXPERIMENTS**

1. To get familiarized with the testing bench
2. To identify and test different types of cables and connectors
3. To identify and use different types of Fuses, MCB, ELCB, MCCB, Insulators and relays with their ratings
4. To design basic electronic circuits using soldering and analyze their waveforms
5. To get familiarized with safety practices and maintenance techniques followed in Industries
6. To determine Realtime domestic and industrial electrical load
7. To understand and demonstrate process of electrical power generation, transmission and distribution in co-relation with real time power grid
8. To determine Lux for different applications as per illumination requirements (BEE Standards)
9. To measure phase and line parameters of a three phase AC circuit
10. To get familiarized with different types of earthing and earth resistance determination

### **Course Outcomes**

After the completion of the course, the student will be able to –

- CO 1. Identify** different types of electrical loads
- CO 2. Apply** illumination standards and safety practices for various applications
- CO 3. Select** cables, switches and protective devices for specific applications
- CO 4. Develop** teamwork skills for working effectively in groups
- CO 5. Prepare** the technical report on experiments conducted in the lab