

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

Programme Name/s : Electrical Engineering/ Electrical Power System
Programme Code : EE/ EP
Semester : Second
Course Title : FUNDAMENTAL OF ELECTRICAL ENGINEERING
Course Code : 312310

I. RATIONALE

Technologists in electrical engineering are expected to handle electrical machines, instruments, devices and equipment. The basic aim of this course is that, the student must understand the basic concepts, principles and laws of electric and magnetic circuits and practical thereof. The basic aim of this course is that the student must develop the basic concepts, fundamental laws of electric circuits, magnetic circuits, electromagnetic induction, Capacitors, Batteries and practical thereof. This course will enable the students to apply the fundamental concepts of electrical engineering to understanding of other higher level subjects in further study.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply basic principles of electrical engineering to solve the simple electrical engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Determine various parameters used in electric circuit.
- CO2 - Use basic laws of electrical engineering in D.C. Circuits.
- CO3 - Use capacitor and battery in electrical circuits.
- CO4 - Use principles of magnetism in Magnetic Circuits.
- CO5 - Apply Laws of electromagnetism in electrical circuit and systems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | Total Marks | |
|-------------|---------------------------------------|------|-------------------|--------------------------|----|----|-----|-----|---------|-------------------|-----------|-----|-------|-----|------------------|-----|-----|-----|-------------|----|-------------|--|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | | |
| | | | | CL | TL | LL | | | | | Practical | | FA-PR | | SA-PR | | SLA | | | | | |
| | | | | | | | Max | Min | | | Max | Min | Max | Min | Max | Min | Max | Min | | | | |
| 312310 | FUNDAMENTAL OF ELECTRICAL ENGINEERING | FEE | DSC | 4 | - | 4 | 2 | 10 | 5 | 3 | 30 | 70 | 100 | 40 | 25 | 10 | 25# | 10 | 25 | 10 | 175 | |

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310****Total IKS Hrs for Sem. : 0 Hrs**

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|--|--|
| 1 | <p>TLO 1.1 Interpret the given electric parameters.</p> <p>TLO 1.2 Explain the given terms of electric circuit.</p> <p>TLO 1.3 Explain the given effect of the electric current</p> <p>TLO 1.4 Calculate work, power and energy for the given circuit.</p> | <p>Unit - I Basic Electrical Parameters</p> <p>1.1 Direct Current (DC), Alternating Current (AC), Voltage Source and Current Source: Ideal and Practical.</p> <p>1.2 Electric Current, Electric Potential, Potential Difference(PD), Electro-Motive Force(EMF)</p> <p>1.3 Electrical Work, Power and Energy.</p> <p>1.4 Resistance, Resistivity, Conductivity, Effect of Temperature on Resistance</p> <p>1.5 Types of Resistor and their application</p> <p>1.6 Heating Effect, Magnetic Effect, Chemical Effect of Electric current</p> | <p>Chalk-Board Presentations</p> <p>Demonstration Model</p> <p>Demonstration Video</p> <p>Demonstrations</p> |
| 2 | <p>TLO 2.1 Apply Ohm's law to calculate internal resistance of the given circuit.</p> <p>TLO 2.2 Calculate equivalent resistance for the given circuit.</p> <p>TLO 2.3 Categorize the given type of network</p> <p>TLO 2.4 Apply the Kirchhoff's current law and Kirchhoff's voltage law to calculate the electrical quantities in the given circuit.</p> | <p>Unit - II D.C. Circuits</p> <p>2.1 Ohm's Law, Internal resistance of source, internal voltage drop, Terminal Voltage.</p> <p>2.2 Resistance in Series, Resistance in Parallel. (theory and numerical)</p> <p>2.3 Active, Passive, Linear, Non-linear Circuit, Unilateral Circuit and Bi-lateral Circuit, Passive and Active Network, Node, Branch, Loop, Mesh.</p> <p>2.4 Comparison of Kirchhoff's Current Law, Kirchhoff's Voltage Law (Simple numericals).</p> | <p>Chalk-Board Demonstration Video</p> <p>Demonstrations Presentations</p> |

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| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--|--|---|
| 3 | <p>TLO 3.1 Describe the construction of the given type of capacitor.</p> <p>TLO 3.2 Explain the working of the capacitor in the given circuit.</p> <p>TLO 3.3 Calculate equivalent capacitance in the given D.C. circuit.</p> <p>TLO 3.4 Define Battery and state its types and connections</p> <p>TLO 3.5 Plot charging and discharging curves for the given capacitor and battery.</p> | <p>Unit - III Capacitors and Battery</p> <p>3.1 Capacitor, its construction, Parallel Plate Capacitor</p> <p>3.2 Various connections of capacitor.</p> <p>3.3 Energy Stored in Capacitor.</p> <p>3.4 Charging and Discharging of Capacitor.</p> <p>3.5 Breakdown voltage and Di-electric strength.</p> <p>3.6 Applications of Capacitor</p> <p>3.7 Types of battery, Construction, series and parallel connection of Battery</p> <p>3.8 Charging and Discharging of Capacitor and battery</p> | <p>Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Presentations</p> <p>Model</p> <p>Demonstration</p> <p>Hands-on</p> |
| 4 | <p>TLO 4.1 Interpret the terms related to a magnetic circuit.</p> <p>TLO 4.2 Calculate various parameters of the given magnetic circuit.</p> <p>TLO 4.3 Compare the series and parallel magnetic circuit based on the given criteria.</p> <p>TLO 4.4 Plot B-H curve and hysteresis loop of the given magnetic materials.</p> | <p>Unit - IV Magnetic Circuits</p> <p>4.1 Magnetic lines of force, Flux, Flux density, Magnetic flux intensity.</p> <p>4.2 Magneto-Motive-Forces (MMF), Ampere Turns (AT), Reluctance, Permeance, Reluctivity.</p> <p>4.3 Electric and Magnetic circuit: Series Magnetic and Parallel Magnetic Circuit.</p> <p>4.4 Magnetization Curve (B-H Curve)</p> <p>4.5 Magnetic Hysteresis, Hysteresis Loop, Applications.</p> | <p>Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Demonstration</p> <p>Model</p> <p>Demonstration</p> <p>Presentations</p> |
| 5 | <p>TLO 5.1 Describe the use of Faraday's laws of electromagnetic induction in the given application.</p> <p>TLO 5.2 Distinguish between the given type of e.m.fs.</p> <p>TLO 5.3 Apply Faraday's laws to calculate induced e.m.f. in the given circuit.</p> <p>TLO 5.4 Calculate self-inductance and energy stored in the magnetic field of the given circuit.</p> | <p>Unit - V Electromagnetic Induction</p> <p>5.1 Development of Induced e.m.f. and Current, Faraday's Laws of Electromagnetic Induction.</p> <p>5.2 Static and dynamic emf, Lenz's Law, Fleming's Right hand rule</p> <p>5.3 Self Inductance, Coefficient of Self-inductance (L), Mutual inductance, Coefficient of Mutual inductance (M), self induced e.m.f. and mutually induced e.m.f, Coefficient of Coupling.</p> <p>5.4 Inductance in series</p> <p>5.5 Types of inductor, their application and Energy Stored in Magnetic Field</p> | <p>Chalk-Board</p> <p>Model</p> <p>Demonstration</p> <p>Video</p> <p>Demonstrations</p> <p>Presentations</p> |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|---|----------------|--------------|
| LLO 1.1 *Draw layout of Electrical Engineering laboratory. | 1 | Preparation of Layout of Electrical Engineering Laboratory. | 2 | CO1 |
| LLO 2.1 *Operate the fire extinguishers and prepare charts of the safety rules to be followed in the electrical lab | 2 | Operation of fire extinguisher and preparation of safety rules charts | 2 | CO1 |
| LLO 3.1 *Use relevant electric tools for various applications | 3 | Check lab supply system and make use of relevant electric tools for various applications. | 2 | CO1 |
| LLO 4.1 *Verify Ohm's Law | 4 | Verification of Ohm's Law | 2 | CO1 CO2 |
| LLO 5.1 *Able to connect and read multi range analog meters (Ammeter, Voltmeter) | 5 | Read analog meters for measurement of various electrical quantities in AC/DC circuits. | 2 | CO1 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|--------------|---|-----------------------|---------------------|
| LLO 6.1 *Operate Multimeter and Clip-On meter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit. | 6 | Use of Multimeter and Clip-On meter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit | 2 | CO1 CO2 |
| LLO 7.1 *Check frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO | 7 | Measurement of frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO. | 2 | CO1 CO2 |
| LLO 8.1 *Verify Kirchoff's Voltage Law | 8 | Verification of Kirchoff's Voltage Law | 2 | CO1 |
| LLO 9.1 *Verification of Kirchoff's Current Law. | 9 | Verification of Kirchoff's Current Voltage Law | 2 | CO1 CO2 |
| LLO 10.1 **Use rheostat as current regulator and potential divider. | 10 | Use of rheostat as current regulator and potential divider | 2 | CO1 CO2 |
| LLO 11.1 *Determine PD,EMF and internal resistance of DC source . | 11 | Determination of PD,EMF and internal resistance of DC source . | 2 | CO1 CO2 |
| LLO 12.1 *Verify the properties of circuit of series connected resistance. | 12 | Verification of parameters of two/three resistances connected in series connection. | 2 | CO1 CO2 |
| LLO 13.1 *Verify the properties of circuit of parallel connected resistance. | 13 | Verification of parameters of two/three resistances connected in parallel connection. | 2 | CO1 CO2 |
| LLO 14.1 Determine the time constant (RC) by plotting the charging curves of a capacitor(C) through resistor (R) | 14 | Plot the charging characteristics of capacitor and find the time constant (RC). | 2 | CO1 CO3 |
| LLO 15.1 Determine the time constant (RC) by plotting the discharging curves of a capacitor(C) through resistor (R) | 15 | Plot the discharging characteristics of capacitor and find the time constant (RC). | 2 | CO1 CO3 |
| LLO 16.1 * Find the equivalent capacitance in the series connected circuits | 16 | Verification of the equivalent capacitance in series connected circuits | 2 | CO1 CO3 |
| LLO 17.1 *Find equivalent capacitance of the parallel connected circuits | 17 | Verification of equivalent capacitance of the parallel connected circuits | 2 | CO1 CO3 |
| LLO 18.1 Determine the Rise characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit. | 18 | Plot the Rise characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit. | 2 | CO1 CO4 |
| LLO 19.1 Determine the Decay characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit. | 19 | Plot the decay characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit. | 2 | CO1 CO4 |
| LLO 20.1 *Find B-H curve for the given magnetic material | 20 | Plot B-H curve for the given magnetic material. | 2 | CO4 |
| LLO 21.1 *Obtain magnetization curve for magnetic material | 21 | Plot magnetization curve for magnetic core | 2 | CO4 |
| LLO 22.1 *Plot Hysteresis Loop for the given transformer coil | 22 | Study of Hysteresis loop for the given transformer coil | 2 | CO4 |
| LLO 23.1 *Verify Faraday's Law of Electromagnetic Induction (Statically Induced EMF) | 23 | Verification of Faraday's Law of Electromagnetic Induction (Statically Induced EMF) | 2 | CO4 CO5 |
| LLO 24.1 *Verify Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF) | 24 | Verification of Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF) | 2 | CO4 CO5 |
| LLO 25.1 Verify Fleming's Right Hand Rule | 25 | Verification of Fleming's Right Hand Rule | 2 | CO4 CO5 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|--------------|---|-----------------------|---------------------|
| LLO 26.1 Verify Fleming's Left Hand Rule | 26 | Verification of Fleming's Left Hand Rule | 2 | CO4 CO5 |
| LLO 27.1 *Determine Charging and discharging Curves of Battery. | 27 | Plot the Charging and discharging Curves of Battery | 2 | CO1 CO3 |

Note : Out of above suggestive LLOs -

- '*I' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)**Micro project**

- a. Types of Electrical equipment: Prepare chart showing real-life examples indicating various types of electrical equipment.
- b. Resistance: Collect samples of resistors and prepare models of simple series circuit and parallel circuit.
- c. Capacitance: Collect samples of capacitors and prepare models of simple series circuit and parallel circuit.
- d. Inductance: Collect samples of inductors and prepare models of simple series circuit and parallel circuit.
- e. Batteries : Collect samples and specifications of various batteries of different make and prepare chart of the same.
- f. EV-Batteries : Collect samples and specifications of various EV-batteries of different make and prepare chart of the same.
- g. Connect battery in series connection and measure voltage across each battery and total voltage .
- h. Connect battery in parallel connection and measure voltage across each battery and total voltage

Assignment

- a. Numerical based on Voltage and Current Source.
- b. Numerical based on Resistance, Resistivity, Effect of temperature on Resistance.
- c. Numerical based on Equivalent Resistance of Series and Parallel connection of Resistances in given D.C. Circuits.
- d. Numerical based on Equivalent Capacitance in given D.C. Circuits.
- e. Numerical based on calculation of various parameters of given magnetic circuit.
- f. Numerical based on calculation of self Inductance.
- g. Numerical based on Energy Stored in Magnetic Field.

Suggested Student Activity

- a. Illustrate situations wherein electrical energy is required.
- b. Prepare models in the form of mini-projects.
- c. Prepare power point presentation related to basics of electrical engineering.
- d. Prepare a chart of electric circuit elements and relevant industrial application.
- e. Prepare question bank referring old MSBTE question papers.

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- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|--|---------------------|
| 1 | Electrical Drawing of the Laboratory | 1 |
| 2 | 1.EMF source: Ampere:0-1A, Voltage:0-20V ,1 No. 2.Voltmeter Suitable voltage 1 No. 3.Ammeter: Suitable current 1 No. 4.Rheostat : Suitable load in ohm, 1 No. 5. Resistive Load, 1 No | 10 |
| 3 | 1.EMF source: Ampere=0-1A , Voltage=0-20V , 1 No. 2 Voltmeter: Suitable Voltage range, 2 No. 3 Ammeter: Suitable current range, 1 No 4 Series resistance: Suitable resistance in ohm, 2 No. | 12 |
| 4 | 1.EMF source: Ampere:0-1A , Voltage:0-20V , 1 No. 2 Voltmeter: Suitable Voltage range, 2 No. 3 Ammeter: Suitable current range, 1 No. 4 Parallel resistance: Suitable resistance in ohm, 2 No. | 13 |
| 5 | 1.EMF source: Ampere=0-1uA, Voltage=0-20V, 1 No. 2.Voltmeter: Suitable voltage, 1 No. 3. Ammeter: Suitable current, 1 No. 4.Capacitors: Suitable capacitor, 1 No. 5.Resistance: Suitable resistance , 1 No. 6.Stop watch: Suitable stop watch 1 No. | 14 |
| 6 | 1.EMF source: Ampere=0-1uA, Voltage=0-20V, 1 No. 2.Voltmeter: Suitable voltage, 1 No. 3. Ammeter: Suitable current, 1 No. 4.Capacitors: Suitable capacitor, 1 No. 5.Resistance: Suitable resistance , 1 No. 6.Stop watch: Suitable stop watch 1 No. | 15 |
| 7 | 1.EMF source: Ampere=0-1A, Voltage=0-20V : 1 No. 2.Voltmeter : Suitable Voltage, 1 No. 3.Ammeter : Suitable Current, 1 No. 4.Capacitor: Suitable Capacitor in Farad , 3 No. | 16 |
| 8 | 1.EMF source: Ampere=0-1A, Voltage=0-20V : 1 No. 2.Voltmeter : Suitable Voltage, 1 No. 3.Ammeter : Suitable Current, 1 No. 4.Capacitor: Suitable Capacitor in Farad , 3 No. | 17 |
| 9 | 1.Battery or D.C. Supply: Suitable Range 2. Single Pole Two Way Switch 3. Multi-meter 4. Stopwatch 5.A Choke Coil or a resistor in series with inductor | 18 |

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| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|--------------|---|----------------------------|
| 10 | 1.Battery or D.C. Supply: Suitable Range 2. Single Pole Two Way Switch 3. Multi-meter 4. Stopwatch 5.A Choke Coil or a resistor in series with inductor | 19 |
| 11 | Fire Extinguisher Kit | 2 |
| 12 | 1.EMF source: Ampere: 0-1A,Voltage:0-300V ,1 No. 2. Voltmeter: Suitable voltage:1 No. 3.Ammeter: Suitable current: 1 No. 4.Inductive coil: Suitable inductor,1 No. | 20 |
| 13 | 1.EMF source: Ampere: 0-1A,Voltage:0-300V ,1 No. 2. Voltmeter: Suitable voltage:1 No. 3.Ammeter: Suitable current: 1 No. 4.Inductive coil: Suitable inductor,1 No. | 21 |
| 14 | 1:EMF source: Ampere: 0-1A,Voltage:0-300V ,1 No. 2:Voltmeter:Suitable Voltage,1 No. 3:Ammeter: Suitable current,1 No. 4.Transformer :(0.5/1kVA)Suitable transformer,1 No. | 22 |
| 15 | 1.EMF source : Ampere:0-1A,Voltage:0-300V ,1 No. 2.Voltmeter : Suitable voltage,1 No. 3.Ammeter: Suitable current,1 No. 4.Inductive coil :Suitable Inductor 1 No. | 23 |
| 16 | 1.EMF source: Ampere=0-1A,Voltage:0-300V ,1 No. 2.Voltmeter:Suitable Voltage,1 No. 3.Ammeter :Suitable current,1 No. 4.Inductive coil: Suitable inductor,1 No. | 24 |
| 17 | 1.DC Generator: Suitable rating,1No | 25 |
| 18 | 1.DC motor: Suitable motor:1No | 26 |
| 19 | 1.EMF source: Ampere=0-1uA,Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No. 7. Suitable EV-Battery Data | 27 |
| 20 | Stripper, Hammer, Plier, Nose Plier, Multi-meter, tester ,Tachometer, Megger,Standard Wire Gauge crimping tool, wire gauge etc | 3 |
| 21 | Rheostat (0-90 Ohm,5A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact, DC Source, Milliammeter | 4 |
| 22 | Lugs, Wire crimping tool, Soldering Gun, Banana clips | 5 |
| 23 | Multi-meter, Clip -On Meter, Ammeter ,Voltmeter, Rheostat,etc | 6 |
| 24 | 1.CRO with probe,10Hz-30MHz,01No 2.Rheostat of suitable rating 3. Autotransformer of suitable rating | 7 |
| 25 | 1. D.C. Dual Power Supply, 1No 2.D.C. Voltmeter of Suitable Range,3No 3. Rheostat of Suitable Range,3No | 8 |
| 26 | 1.Rheostat of suitable range, 3 No 2.D.C. Dual Power Supply ,suitable range,1 No 3.D.C. milli-Ammeter, suitable range,3 No | 9 |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

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| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|-----------------------------|-------------|----------------|-----------|-----------|-----------|-------------|
| 1 | I | Basic Electrical Parameters | CO1 | 10 | 2 | 6 | 4 | 12 |
| 2 | II | D.C. Circuits | CO2 | 12 | 4 | 6 | 4 | 14 |
| 3 | III | Capacitors and Battery | CO3 | 12 | 4 | 6 | 4 | 14 |
| 4 | IV | Magnetic Circuits | CO4 | 12 | 4 | 4 | 6 | 14 |
| 5 | V | Electromagnetic Induction | CO5 | 14 | 4 | 4 | 8 | 16 |
| Grand Total | | | | 60 | 18 | 26 | 26 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Two unit tests of 30 marks will be conducted and average of two unit tests considered.
- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

Summative Assessment (Assessment of Learning)

- End semester summative assessment of 25 marks for laboratory learning.
- End semester assessment of 70 marks through offline mode of examination.

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|-----------------------|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | 1 | - | 1 | - | - | 2 | | | |
| CO2 | 3 | 1 | 1 | 1 | 1 | - | 2 | | | |
| CO3 | 3 | 1 | 1 | 2 | 2 | - | 2 | | | |
| CO4 | 3 | 1 | 1 | 2 | 2 | - | 2 | | | |
| CO5 | 3 | 1 | 1 | 2 | 2 | - | 2 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--|---|--|
| 1 | Theraja, B. L. Theraja, A. K. | A Text Book of Electrical Technology Vol-I | S.Chand and Co. New Delhi 2014 ISBN: 9788121924405 |
| 2 | Mittle, V. N. | Basic Electrical Engg. | Tata McGraw-Hill, New Delhi ISBN : 978-0-07-0088572-5 |
| 3 | Hughes, Edward | Electrical Technology | Pearson Education, New Delhi ISBN-13: 978-0582405196 |
| 4 | S. B. Lal Seksena and Kaustuv Dasgupta | Fundamentals of Electrical Engineering Part-1 | Cambridge University Press, New Delhi ISBN : 9781107464353 |

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| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--|--|---|
| 5 | Jegathesan V., Vinoth Kumar K., Saravanakumar R. | Basic Electrical and Electronics Engineering | Wiley India, New Delhi 2014 ISBN : 97881236529513 |
| 6 | Husain Ashfaq | Fundamentals of Electrical Engineering | Dhanpat Rai & Co. (p) Ltd-delhi, ISBN: 978-8177000436 |

XIII . LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|-----------------------------|
| 1 | https://www.electrical4u.com/electrical-engineering-articles/basic-electrical/ | Basic Electrical Parameters |
| 2 | https://en.wikipedia.org/wiki/Capacitor | Capacitor |
| 3 | https://www.corsi.univr.it/documenti/OccorrenzaIns/matdid/matdid441904.pdf | D.C. Circuits |
| 4 | https://www.slideshare.net/ChetanPatil396/basic-electrical-parameters-basic-electrical-engineering | Basic Electrical Parameters |
| 5 | https://www.britannica.com/science | Magnetic Circuits |
| 6 | https://en.wikipedia.org/wiki/Magnetic_circuit | Magnetic Circuits |
| 7 | https://en.wikipedia.org/wiki/Electromagnetic_induction | Electromagnetic Induction |
| 8 | https://youtu.be/XT-UmPviH64?si=MLIZBB5BgOA2SWBk | Electromagnetic Induction |
| 9 | https://youtu.be/M-QfX2fvpp4?si=xpZDAiX3-_7xrnr | Basics Magnetic Circuits |
| 10 | https://archive.nptel.ac.in/courses/117/106/117106108/ | Basic Electrical Circuits |
| 11 | https://en.wikipedia.org/wiki/Electric_battery | Battery |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students