Course Syllabi: UEE101 Electrical Science (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE101; Electrical Science

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall (2008) 10thed.*
   - *Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).*
   - *Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, Tata McGraw Hill (2007).*
   - *Chakraborti, A., Basic Electrical Engineering, Tata McGraw–Hill (2008).*
   - *Del Toro, V., Electrical Engineering Fundamentals, Prentice–Hall of India Private Limited (2004).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Basic electrical quantities, Electric circuit sources and Circuit elements and their behavior (Active and Passive).

   Supply Systems: AC Supply System (Single Phase, Three Phase–Three Wire, Three Phase–Four Wire), DC Supply System, Their Specifications and Comparison. D.C. Networks: Mesh and Nodal Analysis, Star-Delta Transformation, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Millman's Theorem, Duality, Tellegen's Theorem.

   Sinusoidal Steady-State Response of Circuits: Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Series and Parallel circuits, Power and Power factors, Resonance in Series and Parallel circuits, Balanced 3-phase Voltage, Current and Power relations, Unbalanced 3-phase Circuits, 3-phase Power Measurement.

   Magnetic Circuits: Concept of Magnetic Circuits, Magnetic Field due to Steady Electric Current, Magnetic Flux, Flux Density and Magnetic Field Intensity, Interaction of Currents and Fields, B–H Curve, Calculation of Magnetic Circuits, Iron Losses, AC Excitation of Magnetic Circuit, Leakage Flux, Fringing and Stacking, Energy Stored in Magnetic Fields.

   Electromagnetic Induction: Faraday's Law, Self and Mutual Inductance, Dot Convention, Equivalent Inductance, Energy Stored in Electric Fields.

   Energy Conversion Principle: Concept of Co-Energy, Coupling-Field Reaction for Energy Conversion, Mechanical Work, Mechanical Forces and Torques in Singly and Doubly Excited Systems, Concepts of Reluctance and Electromagnetic Torques, Singly Excited Electric Field Systems.

   Single-Phase Transformers: Constructional Feature, EMF Equation, Ideal Transformer, Phasor Diagram, Definition of Voltage Regulation and Efficiency.

   Rotating Electrical Machines: Construction, Operating Principles and Applications of DC Generator, DC Motor, Three Phase Induction Motor and Single Phase Induction Motors.

   Electrical safety and Wiring: Electrical Safety and Standards, House Hold Wiring and Electric Appliances.

   Energy Management: Conservation efforts, Auditing.

Laboratory Work: Kirchhoff's Laws, Network Theorems, A.C. Series and Parallel Circuits, Resonant Circuit, Measurement of Power 3 Phase Circuits, Reactance Calculation of Variable Reactance Choke Coil, Identification and Testing of Devices (R, L, C, Diode), Use of Diode as Rectifier.

5. Specific goals for the course

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

- Compute reliably the performance of DC networks and distinguish various supply systems.
- Represent AC quantities through phasors and compute AC system behaviour during steady state.
- Comprehend magnetic circuits analysis and energy conversion principles for different electric systems.
- Realize the importance of transformer in AC systems and calculate the voltage regulation and efficiency of transformers.
- Compare the characteristics and operational aspects of various electric motors and shall choose as per the application.
- Observe and conform the electric safety aspect and conservation efforts.

6. Brief list of topics to be covered

- Supply systems
- Steady state response of circuits
- Magnetic circuits
- Energy conversion
- Single phase transformer
- Rotating electrical machines