Electrical Circuits and Measurements

1.1 Course Number: EEV201

1.2 Contact Hours: 3-1-0 Credits: 11

1.3 Semester-offered: 2nd Year-Odd

1.4 Prerequisite: Nil

1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Vijay Kumar Singh, Dr. Saptarshi Ghosh, Dr. Saurabh Pandey.

2. Objective: To introduce the students to the basics of theoretical and practical aspects of a broader area of Electrical Engineering.

3. Course Content: Unit-wise distribution of content and number of lectures

Circuit Concepts and Transient Response: Series and Parallel combinations of Capacitors and Inductors, its applications; First Order Circuits: The Source-free RC and RL Circuits, Step Response of an RC and RL Circuits. Second Order Circuits: Source-free Second Order Circuits, Step Response of a Series RLC and parallel RLC Circuits and applications.

Sinusoids and Phasors: Phase Difference, Lagging, Leading and In-Phase Quantities and Phasor Representation, Sinusoidal Steady State Analysis; A.C. Power Analysis: Instantaneous and Average Power, Maximum Average Power Transfer, Effective or RMS Value, Apparent Power and Power Factor, Complex Power, Conservation of A.C. Power, Power Factor Correction; Network theorems for AC circuits.

Polyphase A.C. Circuits: Concept of three-phase supply and phase sequence. Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. Power relations, Analysis of balanced and unbalanced 3-phase circuits, three phase power measurements.

Electromagnetism: concepts of magnetic circuit, analogy between electric and magnetic circuit, magnetic circuits with D.C. and A.C. excitation, magnetic leakage, BH curve, hysteresis and eddy current losses, Series & Parallel magnetic circuits, concepts of self-inductance, mutual-inductance and coefficient of coupling, DOT convention.

Introductory instrumentation system: Units and standards, calibration methods, Standards of measurement, classification of errors, error analysis, static characteristics – Accuracy, precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effect etc., dynamic characteristics.

Electrical Instruments and measurements: Sensitivity of D.C. bridge, measurement of low and high resistances, D.C. potentiometer, principles of A.C. bridges for measurement of Inductance and Capacitance; Instrument transformer: CT and PT, D' Arsonval Galvanometers, moving coil meters, dynamometer type wattmeter and induction type energy meter, Range extension of instruments, Hall effect sensor.

4. Readings

4.1 Textbook:

i. *Charles K. Alexander, Matthew N.O. Sadiku, Fundamentals of electrical circuits, McGraw-Hill, 5th Edition 2013.*
ii. *Nagrath & Kothari. Basic Electrical Engineering,*
iii. *Basic Electrical Engineering, S. N. Singh.*
iv. *Sawhney A. K.: A course in Electrical and Electronic Measurements and Instrumentation, Dhanapat Rai and Sons, New Delhi, 1995.*

4.2 Reference books:

i. *Engineering Circuit Analysis: Hayt, Kemmerly, and Durbin.*
ii. *M.B. Stout, Basic Electrical Measurements, Prentice Hall.*

5. Outcome of the Course:

The student will learn about fundamentals of Electrical Engineering. Also, they will understand analysis and working Principal of measuring instrument for measuring Voltage, current, power, resistance and other electrical parameters.