Course Name: Electric Circuit II

Description of the lesson (as much as one paragraph):

Electric Circuit II is a second course on electric circuits and it is a continuation of Electric Circuits I. This course is intended to both enhance the knowledge of students with regard to electric circuits and develop skills in analysis. Three phase systems are studied in detail including power calculations and power factor corrections. The solutions of linear circuits by Laplace transforms are developed. The concepts of convolution and impulse response for linear time invariant systems are studied. The state space modeling of circuits along with theory of graph are introduced and it is shown how they can be used to solve electric circuits. Two port networks including hybrid parameters are studied in depth. The concept of sensitivity is introduced and it is shown how one can calculate and minimize sensitivity of a given circuit with respect to a particular parameter. Prerequisite: Electric Circuit I.

Course Syllabuss:

1. 3-Phase Systems
    - What are 3-phase systems and why they are used?
    - Balanced 3-phase voltages, currents, sources and loads
    - Analysis of Y-Y, Y-Δ, Δ-Δ, Δ-Y circuits
    - Example of an unbalanced 3-phase system
    - Power calculations and measurements in a 3-phase system
2. Laplace Transform
    - Definition of Laplace transform
    - Properties of Laplace transform and Laplace table
    - Solving linear electric circuits using one sided Laplace transform
    - Initial and final value theorems
    - Transfer function and block diagrams
3. Convolution
    - Definition of convolution integral
    - Graphical representation of convolution integral
    - Impulse response and convolution
    - LTI system response using convolution integral
4. Solving Electric Circuits Using Graph
    - Definition of graph and components of a graph
    - Definition and derivation of Incidence matrix of an electric circuit

- Definition and derivation of loop matrix of an electric circuit
- Definition and derivation of cut set matrix of an electric circuit
- Definition and derivation of mesh matrix of an electric circuit
- Solving electric circuits using graph

5. State Space
    - What is a state?
    - Order of a circuit/ poles and zeros
    - Zero input/ zero state response
    - Transient and steady state response
    - State variable definition and selection for an electric circuit
    - Solving state equations
    - Solving n^{th} order linear differential equations using state variables
6. Two-Port Networks
    - What are two port networks and why are they needed
    - Different types of two-port networks
    - Properties of two-port networks
    - Conversion of two-port networks from one type to another
    - Solving two-port networks
7. Sensitivity
    - Definition of sensitivity
    - Normalized sensitivity
    - How to obtain sensitivity
    - Minimizing sensitivity