ECE 405 Electrical Engineering Principles
Course Outline

Credits:3
Contact Hours:3
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Textbook: G. Rizzoni, *Fundamentals of Electrical Engineering*, McGraw-Hill Companies, New York, 2009 , ISBN:9780073380377

Course Description: Provides non-electrical engineering students a basic understanding of the principles and analysis of electric circuits while exposing them to key electrical engineering applications.

Pre-Requisite: Phy 121

Specific Course Learning outcomes:
After successful completion of course a student should be able to:

1 Apply Ohm's Law to solve circuit problems.
2 Apply Kirchhoff's Current Law to solve circuit problems.
3 Apply Kirchhoff's Voltage Law to solve circuit problems.
4 Understand circuit elements and i-v characteristics.
5 Determine electrical power sources and sinks in a circuit and calculate the magnitude of the power.
6 Understand and use the Node Voltage method to solve circuits.
7 Understand and use the Mesh Current method to solve circuits.
8 Understand and use Norton and Thevenin equivalent circuits.
9 Understand and use Superposition to solve circuits.
10 Understand and use the idea of maximum power transfer.
11 Understand how to solve DC and AC circuits with inductors and capacitors.
12 Understand and use phasor and rectangular form for sinusoidal circuits.
13 Understand and use first-order differential equations for transient analysis of circuits containing a single capacitor or inductor.
14 Understand power in AC circuits and apply the concept of complex power.
15 Understand the use of transformers and solve circuits containing them.
16 Understand and use the ideal model of an operational amplifier in solving circuits.
17 Understand and solve circuits using diodes as rectifiers.
18 Understand the basic principles of rotating electric machines.

Relevant Student Outcome:

Student outcome	Relevant Course Outcome	Topics
a	1,2, 3,6,7,8,9	Analyze dc resistive circuits by various methods to calculate branch currents and voltages and calculate Power absorbed or delivered by the different elements
b	8	Able to reduce any given circuit to its Thevenin's OR Norton Equivalent
c	5	Write differential equation for circuits with R-C ,R-L or RLC combinations and calculate energy stored in energy storage elements.
d	12	Solve AC circuits using phasor techniques and find branch voltages and currents, and power absorbed by different elements.
e	11	Write first order differential equation for R-C or R-L circuit
f	14	Calculate Apparent power, Real power and reactive power delivered and absorbed in ac circuits.
g	15	Calculate voltages and currents in the circuits using transformer and calculate impedance reflection due to use of transformer.
h	17	Determine whether a diode is conducting or non-conducting in a given circuit configuration and calculate the branch voltages and currents for the circuit.
i	19	Identify the different configurations of DC machines and calculate power and losses at various stages of Generation
j	20	Understand the relationship between synchronous speed and supply frequency in ac machines and understand the working principle of induction machines
k	21	Calculate the frequency of voltage produced by Synchronous generators for given speed of rotation and vice-versa.

Course Schedule:

WEEK	Topics
1	Introduction, FE Exam, Definitions, Definitions, Ideal Sources, Kirchhoff's Laws, Electrical Power and Sign convention, Circuit Elements, i-v Characteristics, Resistance and Ohm's Law, Practical Voltage and Current Sources.
2	Network Analysis, Node Voltage Method, Mesh Current Method, Node and Mesh Analysis with controlled sources
3	Principle of Superposition , One Port Networks, Thevenin's Equivalent, Norton's Equivalent, Maximum Power Transfer, Non-Linear Circuit Elements
4	Energy Storage Circuit Elements, Time Dependent Signal Sources,
5	Solution of Circuits with Inductors and Capacitors, Phasor Solutions of Circuits with Sinusoidal Excitation
6	Transient Analysis: Writing Differential Equations for Circuits containing Inductors and Capacitors, DC Steady State Solution, Transient Response of First Order Circuits MIDTERM I
7	Solution of Circuits with Inductors and Capacitors, Phasor Solutions of Circuits with Sinusoidal Excitation
8	AC Power, Complex Power,
9	Transformers: Analyzing transformer as two port network, 3-ph Power
10	Electrical conduction in Semiconductor Devices ,The *p*-*n* Junction and Semiconductor Diodes, Circuit Models for Semiconductor Diodes, Rectifier Circuits
11	Midterm II
12	DC Generators
13	DC Motors
14	Induction and Synchronous Machines