COURSE PROFILE

Course Number : EE 221	**Course Title : Circuit Theory I**
Required / Elective : Required	**Pre-requisite :** None
Catalog Description: Lumped circuit elements. Kirchoff's laws. Introduction to time-invariant circuits. Analysis of first-order and second-order circuits. Coupling elements and circuits	**Textbook / Required Material :** J. M. Nilsson and S. A. Riedel. *Electric Circuits, 8th Edition*, Pearson Prentice Hall, 2008.
Course Structure / Schedule : (3+0+1) 3 / 6 ECTS	
Extended Description: Circuit Theory I is a sophomore level introduction to the fundamentals of electric circuits, and more generally to the broader area of electrical engineering. The concepts and techniques that are developed in this course will constitute a foundation for many disciplines in electrical engineering. The course focuses on the electrical behavior of circuits, namely, on the relationships between voltages and currents at device terminals, rather than the interior mechanics of the devices themselves. The emphasis is on idealized models for circuits consisting of basic circuit elements such as voltage and current sources, resistors, capacitors, inductors, as well as operational amplifiers, diodes and other resistive elements.	
Design content : Problems focusing on the design of basic electric circuits, via selection of circuit components to satisfy practical requirements, such as maximum power transfer.	**Computer usage:** DC and transient analysis of circuits using PSPICE.

Course Outcomes:

a. Ability to describe the concepts of electric voltage, current, power and energy, and comprehend and employ Kirchoff's laws that govern them, to solve the general electrical behavior of circuits. [2,6]

   Relevant Content: Kirchoff's current and voltage laws. Concept of reference directions, active and passive elements. Directed graph representation of circuits. Computation / conservation of power and energy.

b. Ability to identify and model basic circuit elements, and descibe their terminal behavior. [2,6]

   Relevant Content: Resistors, dependent and independent voltage/current sources, diodes, and power storage elements. Voltage-curent characteristics across device

terminals.

c. Ability to derive, comprehend, and apply techniques of circuit analysis in resistive, op-amp, RL, RC and RLC circuits, and to identify the best technique for the analysis of a given circuit. [2,6,7]

   Relevant Content: Interconnection of circuit elements. Analysis of simple resistive, RL, RC, RLC and op-amp circuits. Use of circuit analysis techniques such as mesh current, node voltage, source transformation, Thevenin and Norton equivalents, to solve for the unknown voltage, current, power and energy characteristics.

d. Ability to obtain equivalent representations, and simplified models of circuits. [2,6]

   Relevant Content: Thevenin and Norton equivalents, source transformations, delta to wye transformations, maximum power transfer.

e. Ability to design and simulate circuits that meet certain requirements or perform simple tasks, using basic tools of circuit analysis. [5,6,7,11]

   Relevant Content: Analysis of resistive, op-amp, RL, RC, and RLC circuits. Formulating necessary circuit equations and solving for the unknown component values. Verifying techniques of circuit analysis, i.e. node-voltage and mesh-current method, source transformation; computation of voltage, current, power and energy characteristics for resistive elements, op-amps, power storage elements and DC sources; natural and step responses of RL, RC and RLC circuits through the use of SPICE simulations..

f. Ability to analyze circuits with DC sources, describe them using a system of equations, and solve them using linear algebra and differential equations [2,6]

   Relevant Content: Solution of linear equations with multiple unknowns; solution of first order and second order differential equations; voltage-current characteristics of ideal circuit elements; computation of power and energy.

The contribution of this course to the program outcomes can be rated as follows:

Outcomes 2,6 : SIGNIFICANT

Outcomes 7 : MODERATE

Outcomes 5, 11: SOME

Recommended reading:
L. O. Chua, C. A. Desoer, E. S. Kuh. Linear and Nonlinear Circuits. McGraw Hill, 1987.

Teaching Methods:

Pre-readings encouraged by reading quizzes, weekly homework encouraged by homework quizzes, lecture and problem/discussion sessions.

Assessment Methods:

- Exams (written) [Course outcomes a,b,c,d,e,f].

- Pop-quizzes (reading and homework quizzes) [a,b,c,d,f].
- Class surveys, exit surveys [c,e,f].

Student Workload:

Preparatory reading	42 hrs
Lectures,workshop, discussions	70 hrs
Homework and self study	45 hrs
Computer Assignments	15 hrs
Final Exam	3 hrs
TOTAL ……	**175 hrs to match 25 x 7 ECTS**

Prepared by : Onur Kaya	Revision Date : 03/02/2010