

## COURSE PROFILE

<b>Course Number : EE 222</b>	<b>Course Title : Circuit Theory II</b>
<b>Required / Elective : Required</b>	<b>Pre-requisite : EE 221 Circuit Theory I</b>
<b>Catalog Description:</b> Node and mesh analysis, state equations. Analysis of circuits using Laplace transform techniques. Transient and sinusoidal steady-state analysis. Network functions. Two-port networks.	<b>Textbook / Required Material :</b> J.W. Nilsson and S.A. Riedel, Electric Circuits, 8th edition, Prentice Hall.
<b>Course Structure / Schedule : (3+0+2) 4 / 7 ECTS</b>	
<b>Extended Description :</b> Introduction to sinusoidal steady state analysis: Sinusoidal sources, phasor concept. Phasor representation of circuit elements in frequency domain, impedance and reactance. Kirchoff's laws in the frequency domain. Application of circuit analysis techniques (node and mesh analysis methods, source transformations, Thevenin and Norton conversions, superposition) in the frequency domain. Analysis of transformer circuits using phasor methods. Power calculations for circuits with sinusoidal sources. Three-Phase circuits. Laplace transform, analysis of time varying circuits using Laplace transform, transient and sinusoidal steady-state response. Transfer function and impulse response. Convolution integral in circuit analysis. Frequency response and frequency selective circuits. Low-pass, high-pass, band-pass and band-stop filters using R, L and C elements. OPAMP based active filter circuits. Butterworth and Chebyshev filter characteristics. Two-Port circuit characterization and analysis of terminated two-port circuits.	
<b>Design content :</b> Design of frequency selective circuits. OPAMP based active filter design.	<b>Computer usage:</b> Circuit analysis, simulation and design using PSPICE and MATLAB
<b>Course Outcomes:</b> [relevant program outcomes in brackets]: At the conclusion of the course, students will develop an ability to: <ul style="list-style-type: none"> <li>a) Transform a circuit with a sinusoidal source into the frequency domain using phasor concepts and apply the circuit analysis techniques (node-voltages method, mesh-currents method, source transformations, Thevenin and Norton conversions, superposition etc.) to determine the sinusoidal steady state response of a linear circuit [2,6].</li> <li>b) Calculate the instantaneous power, average power, reactive power, complex power and power factor in a circuit [2,6].</li> <li>c) Calculate the loading requirements for a circuit for maximum power transfer [2,6,7].</li> <li>d) Analyze the balanced three-phase circuits [2,6].</li> <li>e) Apply the Laplace transform techniques to circuit analysis [2,6].</li> <li>f) Calculate the transfer function and impulse response of a circuit using s-domain techniques and know how to apply convolution to determine the response of the circuit[2,6].</li> <li>g) Obtain the frequency response of RL, RC and RLC circuits that act as filters [2,5,6].</li> <li>h) Design RL, RC and RLC filter circuits [2,5,6,7].</li> </ul>	

- i) Design active filters with OPAMPS that behave as low-pass and high-pass filters to meet specifications of cutoff frequency and passband gain [2,5,6,7].
- j) Calculate two-port parameters and analyze terminated two-port circuits [2,6].
- k) Use computer programs such as Pspice and Matlab for circuit analysis, simulation and design problems [9,11]

**Level of contribution of course to program outcomes:**

Strong: [2], [6]

Average: [5], [7]

Some:[9], [11]

**Recommended reading:**

Allan R.Hambley, Electrical Engineering Principles and Applications, 4rd ed, Prentice Hall

J.O. Attia, Electronics and Circuit Analysis Using MATLAB, 2nd edition, CRC Press (2004)

**Teaching Methods:**

Pre-readings, lectures, problem sessions/discussions, homework/quiz exercises.

**Assessment Methods:** [Related to course outcomes]

Quizzes, midterm exams, final exam [a,b,c,d,e,f,g,h,i]

Homework, project,[g,h,j]

Class survey (suggested)

**Student Workload:**

e.g. Preparatory reading	50 hrs
Lectures	40 hrs
Problem sessions, discussions	30 hrs
Midterm exams, Quizzes	7 hrs
Homeworks	30 hrs
Projects	15 hrs
Final Exam	3 hrs
<b>TOTAL .....</b>	<b>175 hrs ... to match 25 x 7 ECTS</b>

Prepared by : Assist.Prof. Hakan Gürkan  
Prof.Dr. Ahmet Aksen

Revision Date : 20.04.2010