AEEE223 - Circuit Analysis II

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<tr><td>Course Title</td><td colspan="5">Circuit Analysis II</td></tr>
<tr><td>Course Code</td><td colspan="5">AEEE223</td></tr>
<tr><td>Course Type</td><td colspan="5">Compulsory</td></tr>
<tr><td>Level</td><td colspan="5">BSc (1st Cycle)</td></tr>
<tr><td>Year / Semester</td><td colspan="5">2nd / 1</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Associate Prof Symeon Nikolaou</td></tr>
<tr><td>ECTS</td><td>5</td><td>Lectures / week</td><td>3</td><td>Laboratories/week</td><td>1</td></tr>
<tr><td>Course Purpose</td><td colspan="5">The aim of the course is to familiarize the students with the concepts and the principles of operation of R-L-C circuits under different excitation conditions, in order to identify and analyze their basic networks using fundamental circuit analysis theorems. The students should be in position to define and apply the preferred analysis method among time domain transient response, sinusoidal steady state and inverse Laplace transform.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">By the end of the course, students must be able to:
1. Study the basics of series and parallel combinations of inductors and capacitors and understand, analyze and derive the natural and step responses of RL and RC circuits.
2. Appreciate and study phasors and the phasor domain, develop competence in sinusoidal steady state analysis of RLC circuits, explain passive circuit elements and sources in the phasor domain, utilize Kirchhoff’s laws in the phasor domain, use source transformations to derive Thevenin-Norton equivalent circuits and use the node voltage method and the mesh-current method in the phasor domain.
3. Define the Laplace Transform and its properties, introduce the step and impulse functions, poles and zeros, analyze circuit elements in the s-domain, utilize Laplace transform in circuit analysis, analyze the impulse function in circuit analysis and the impulse response and transfer function of RLC circuits.
4. Appreciate resonance, analyze series and parallel resonant circuits, derive the quality factor, resonance frequency and bandwidth and plot the amplitude of the output versus frequency and relate these circuits to passive filtering.
5. Appreciate the representation of circuits as Two Port Networks, develop competence in the calculation of z-parameters, study series, parallel, T networks and symmetrical networks, calculate parameters using open-circuit and closed-circuit tests, represent and manipulate the parameters in matrix form.</td></tr>
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Prerequisites	AEEE222	Corequisites	None
Course Content	• **Response of First-Order RL and RC Circuits**: The Natural Response of an RL Circuit. The Natural Response of an RC Circuit. The Step Response of RL and RL Circuits. • **Natural and Step Responses of RLC circuits**: Natural Response of a parallel RLC Circuit. Forms of the Natural Response of a parallel RLC Circuit. Step Response of a Parallel RLC Circuit. Natural Response of a series RLC Circuit. Step Response of a Series RLC Circuit. • **Sinusoidal Steady-State Analysis**: The Sinusoidal Source. The Sinusoidal Response. The Phasor. The Passive Circuit Elements in the Frequency Domain. Kirchhoff's Laws in the Frequency Domain. Series, Parallel and Delta-to-Wye Simplifications. Source Transformations and Thevenin-Norton Equivalent Circuits. The Node-Voltage Method. The Mesh Current Method. • **Introduction to the Laplace Transform**: Definition of the Laplace Transform. The Step Function. The Impulse Function. Functional Transforms. Operational Transforms. Applying the Laplace Transform. Inverse Transforms. Poles and Zeros of F(s). Initial and Final Value Theorems. • **Laplace Transform in Circuit Analysis**: Circuit Elements in the s-Domain. Circuit Analysis in the s-Domain. Transfer Function. Transfer Function in Partial Fraction Expansions. Transfer Function and the Convolution Integral. Transfer Function and the Steady State Sinusoidal Response. The Impulse function in Circuit Analysis. • **Two Port Networks**: Representation of circuits as Two Port Networks in the s-domain. Calculation of z- parameters, Study of Π, series, parallel, and T-networks, Open circuit tests, Closed circuit tests • **Laboratory work:** Individual and small group experiments performed with the use of electronic boards, components, measuring instruments and simulation packages. Experiments include the design, construction on breadboards and analysis of the circuits and devices taught in theory. Testing is performed using signal measuring equipment such as digital multimeters (DMMs), DC and AC voltage sources.		
Teaching Methodology	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Topic notes are compiled by students, during the lecture can also be downloaded from the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours Laboratory experiments are carried out in small groups and lab reports are required two weeks after the laboratory class resulting in a cumulative mark. Students who fail the lab are marked as Incomplete and they are required to complete the laboratory work to pass the course.		

Bibliography	**(c) <u>Textbooks:</u>** • J. Nilsson, S. A. Riedel, Electric Circuits, Pearson International, 11th edition, 2019 **(d) <u>References:</u>** • Allan R. Hambley, Electrical Engineering Principles and Applications, 7th edition, Pearson, 2017. • R. C. Dorf, J. A. Suoboda, Introduction to Electric Circuits, 9th edition, John Wiley & Sons, 2014.
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted **40% and 60%**, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as mid-term written exam, quizzes, and laboratory assessment based on laboratory experiments and reports. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted continuous assessment of the course is shown below: • Assignments/Quizzes 10% • Mid-Term written exams 50% • Laboratory Work 40% Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constrains and revision timetable. The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems. The above criteria are weighted 20%, 60% and 20%, respectively. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	**English**