Course unit title:	Circuit Analysis II		
Course unit code:	AEEE223		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (2nd Cycle)		
Year of study:	2		
Semester when the unit is delivered:	4 (Spring)		
Number of ECTS credits allocated :	5		
Name of lecturer(s):	Dr. Antonis Papadakis		
Learning outcomes of the course unit:	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.		
Mode of delivery:	Face-to-face		
Prerequisites:	AEEE222	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	● **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.
Recommended and/or required reading:	
Textbooks:	J. W. Nilsson, S. A. Riedel, ***Electric Circuits***, 9th Edition, Pearson Education International, 2009.
References:	D. E. Johnson, J. R. Johnson, J. L. Hilburn, P. D. Scott, ***Electric Circuit Analysis****,* 3rd edition, Prentice Hall, 1997. R. C. Dorf, J. A. Suoboda, ***Introduction to Electric Circuits****,* 4th edition, John Wiley & Sons, 2000.
Planned learning activities and teaching methods:	Teaching is based on lectures and laboratory experiments. The course delivery will be based on theoretical lecturing, assignments and exercises solved in class. Exercises will be handed to students and their solutions shall be analysed at lecture periods. Additional tutorial time at the end of each lecture will be provided to students. Students are expected to demonstrate the necessary effort to become confident with the different concepts and topics of the course. Lectures are supplemented with laboratory work carried out on the following topics: Basics of L and C Components and Oscilloscope Measurements, DC Behavior of RLC Circuits, Sinusoidal Steady State of an RC Circuit, Sinusoidal Steady State of an RL Circuit, Step Response of an RLC Circuit, Transfer Function and Frequency Response of a LPF and a HPF, Series Resonant Circuit, Parallel Resonant Circuit.
Assessment methods and criteria:	• Assignments 5% • Tests: 30% • Laboratory Work: 15% • Final Exam 50%
Language of instruction:	English
Work placement(s):	No