Course unit title:	Power System Analysis		
Course unit code:	AEEE351		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	3		
Semester when the unit is delivered:	5 (Fall)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Alexis Polycarpou		
Learning outcomes of the course unit:	1. Per unit analysis. Calculation of parameters and potential difference for any section of a radial system. Understand how the per unit system analysis method is used to analyze a multy node multy voltage level system, and evaluate the per-unit and actual voltages and currents at the various system buses 2. Introduction to symmetrical component theory for three phase system analysis, The A operator matrix. 3. Describe mathematically how the 'A' operator matrix is derived as well as the inverse matrix, and calculate the symmetrical phasors of the currents or voltages of an unbalanced system with the use of symmetrical components 4. Symmetrical and asymmetrical faults, sequence diagrams, fault current calculation, phase and line voltages calculation. 5. Power factor effects on electricity consumption, Ways of improving/controlling the power factor of a load. Describe how the insertion of reactive power compensation devices leads to the improvement of the power factor in a system, evaluate the amount of Capacitance required for power factor correction under heavily inductive loading cases 6. Calculate Network model formulation, ybus matrix, gauss-seidel method. Calculate the output of load flow methods in terms of bus voltages..		
Mode of delivery:	Face-to-face		
Prerequisites:	AEEE350	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• Revision of power system analysis principles • Active, reactive and apparent power calculations for radial systems • Losses on short and medium model transmission lines • Delta and star connected loads line to line and phase quantities • Per unit system formulation, definitions and base quantities for various parameters. Parameter calculation and mathematical identification of per unit voltage and current quantities at various points of a radial system. • Sequence component theory, derivation of formulation through sequence diagrams. • A operator matrix and calculations of phase voltages and currentsInverse A operator matrix and calculation of symmetrical components from phase currents • Resistive inductive and capacitive load effect on power factor angle. Calculation of power factor for series and parallel networks.		

	• Calculation of mitigation capacitor values for power factor improvement • Examples Precision improvement of the power factor through sizing the reactive compensation with the use of capacitor banks • Symmetrical faults theory, examples, calculation of three phase fault distance on wires. • Asymmetrical faults , derivation of sequence network connections, calculation of fault current and phase quantities • Load Flow techniques • Y bus matrix • Gauss-Seidel implementation • Calculation of bus voltages • LAB 1: PSCAD environment compiler introduction • LAB 2: Introduction to circuit design Voltage divider circuit illustration. • LAB 3: Radial circuit , voltage and current comparison. • LAB 4: Load switching and circuit breaker operation • LAB 6: Motor load switching in the system, steady state and transient demand. • LAB 5: Active and reactive power measurement and calculation • LAB 7: Transformer operation and implementation • LAB 8: Capacitor switching for power factor improvement • LAB 9: Integration of symmetrical and asymmetrical faults • LAB 10: Symmetrical and Asymmetrical faults • LAB 11: Introduction to transmission model operation • LAB 12: Integration of transmission line models • LAB 13: final exam of LAB
Recommended and/or required reading:	Notes provided by the instructor.
Textbooks:	J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, Power System Analysis And Design, Fifth Edition , 2012
References:	Elements of power system analysis, William D, Stevenson Jr, 4th ed. Mc Graw-Hill, 2002 Electrical technology, E. Hughes, Longman, 1995
Planned learning activities and teaching methods:	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. One hour of lab provides the student with the ability to learn basic skills and simulate systems in PSCAD. Topic notes are compiled by students, during the lecture. 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. Assessment consists of tests and Laboratory reports.
Assessment methods and criteria:	• Tests: 25% • Laboratory 15% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No