AEEE351 - Power System Analysis

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<tr><td>Course Title</td><td colspan="6">Power System Analysis</td></tr>
<tr><td>Course Code</td><td colspan="6">AEEE351</td></tr>
<tr><td>Course Type</td><td colspan="6">Compulsory</td></tr>
<tr><td>Level</td><td colspan="6">BSc (Level 1)</td></tr>
<tr><td>Year / Semester</td><td colspan="6">3^{d} (Fall)</td></tr>
<tr><td>Teacher's Name</td><td colspan="6">Dr. Alexis Polycarpou</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>3</td><td colspan="2">Laboratories/week</td><td>1</td></tr>
<tr><td>Course Purpose</td><td colspan="6">The aim of the course is to familiarize students with various concepts and principles of power systems in order to implement their knowledge to analyze radial, symmetrically and unsymmetrically faulted, and interconnected power systems. Students should also carry out delta and star connected load analysis, and system stability assessment.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">By the end of the course, students must be able to:

1. Analyse Mathematically Delta and Star connected loads. Calculation of system voltages and currents
2. Apply symmetrical and asymmetrical fault analysis, calculate the parameters of sequence diagrams, perform fault current calculation, phase and line voltages calculation.
3. Evaluate Power factor effects on electricity consumption, analyse 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
4. Understand Network model formulation, Z and Ybus matrix, Gauss-Seidel method. Calculate the output of load flow methods in terms of bus voltages.
5. Use the swing equation and equal area criterion in order to assess the stability of a system.</td></tr>
<tr><td>Prerequisites</td><td colspan="2">AEEE349</td><td colspan="2">Corequisites</td><td colspan="2">None</td></tr>
<tr><td>Course Content</td><td colspan="6">Course contents:

• Revision of power system analysis principles.
• Mathematical analysis of three phase system parameters with star connected loads.</td></tr>
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	• Mathematical analysis of three phase system parameters with delta connected loads. • 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 for 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, Z and Ybus matrix , derivation of sequence network connections, calculation of fault current and phase quantities • Load Flow techniques, Gauss-Seidel implementation, Calculation of bus voltages. • The stability problem and implementation of the swing equation and equal area criterion for the assessment of power system stability. **Laboratory work:** Individual and small group experiments performed with the use of PSCAD simulation package as illustrated in the course consent. Simulated and the results are evaluated and compared with the experimental analysis.
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. PSCAD simulation laboratories are held for 1 hour per week. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the e-learning platform or 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.
Bibliography	**<u>Textbooks:</u>** • Power Systems Analysis, John Grainger, William Stevenson, Published by McGraw-Hill Education, United States , ISBN 10: 1259008355 ISBN 13: 9781259008351, 2016 . • Power system analysis & design, J Duncan Glover; Thomas J Overbye; Mulukutla S Sarma, 6th edition, 978-1-305-63213-4, 2017. **<u>References:</u>** • Elements of power system analysis, William D, Stevenson Jr, 4th ed. Mc Graw-Hill, 2002.
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, oral exam, quizzes, design assignments, and laboratory experiments. 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: • Mid-Term written exams 67% • Laboratory Test 33% Laboratory experiments are carried out for knowledge application and software familiarisation purposes, and the laboratory grade results from the lab final Test assessment. 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 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**