AEEE525 - Electromagnetic Energy Conversion

Course Title	Electromagnetic Energy Conversion				
Course Code	AEEE525				
Course Type	Technical Elective				
Level	MSc (Level 2)				
Year / Semester	1 or 2				
Teacher's Name	Dr Nicholas Christofides				
ECTS	8	Lectures / week	3	Laboratories/week	-
Course Purpose	To distinguish the performance, applications and design of electrical machines such as generators and motors. Furthermore, to recognize the characteristics to apply circuit theory to model synchronous generators and induction motors. Analyse the operating conditions and limitations of the synchronous generator and induction motor.				
Learning Outcomes	By the end of the course, students must be able to: 1. Describe the fundamental principles of electromagnetic energy conversion. 2. Analyse the performance and calculate parameters related to the loading capability of synchronous generators. 3. Analyse the performance of induction machines 4. Analyse the performance of dc motors				
Prerequisites	none		Co-requisites		none
Course Content	• **Introduction:** Magnetic field intensity and flux density, B-H curves, electromagnetic induction, voltage induced in a conductor, force on a conductor, direction of force, torque and mechanical work, power, power of a motor, efficiency of machines, energy transformation, speed of motor/load, power flow in mechanically coupled systems. • **Synchronous generators:** features of stator and rotor, field excitation and exciters, brushless excitation, generator under load, synchronization and parallel operation, efficiency, power and size of electrical machines. • **Induction machines:** principle of operation and characteristics, properties, motor under load, slip and slip speed, starting characteristics, estimation of electrical parameters, doubly-fed induction machine, selection and application of induction machines, equivalent circuit. • **Direct current motors:** armature/field connections, use dc machine as a generator or motor, speed characteristics of dc motors, torque characteristics of dc motors, speed control of dc motors, power electronic controllers, operation and characteristics				

	The Department, through its Research Policy acknowledges the importance of the synergies between research and teaching. As a result, students can be assigned to investigate further on a topic in order to better interpret something or identify current/new methods and practices. Through such activities, students can enter in the research culture and environment with the overall aim being to make them aware and to trigger ideas for the senior project and future postgraduate studies. Where just and fit, students are encouraged to participate in research projects that could complement their senior project requirements.
Teaching Methodology	The course is taught through lectures (3 hours per week) in classrooms or lectures theatres supported by the whiteboard and the overhead projector. Examples on subject delivered during the lectures are solved and open-ended discussion is encouraged. Further exercises can be assigned for practise or as homework. The lecture presentations are available on the e-learning platform for students to download along with other peripheral material such as past tests and exams, links and guides. Students are expected to take in-class hand-written notes. Students are also advised to use the subject's main textbook or reference books for further reading and practice in solving related exercises. Further literature research is encouraged by assigning to students a specific problem related to some issue and they are expected to gather relevant scientific information about how others have addressed the problem and report this information in written or orally.
Bibliography	• Power System Analysis, Grainger J., Stevenson, W.D., Chang G.W., McGraw Hill, 2nd edition, 2016 • Hughes Electrical and Electronic Technology, 12th edition, Edward Hughes, John Hiley, et all, Pearson, 2016 • Electrical Engineering Principles And Application, 6th edition, Hambley AR, Pearson, 2016 • Electric Machinery Fundamentals, Stephen Chapman, McGraw Hill, 5th edition, 2011 • Electrical Machines, Drives and Power Systems, Theodore Wildi, Pearson, 6th edition, 2013 • Electric Machinery, E. Fitzgerald, Charles Kingsley, Jr., Stephen Umans, McGraw Hill, 6th edition, 2005
Assessment	The assessment is continuously via mid-term tests and mini-assignments with the respective assessment weight, date and time being set at the beginning of the semester via the course outline or aurally discussed. Students are prepared for the final exam by revision and recapitulation and by solving exercises. The final assessment of the students is formative and summative and is in line with the subject's expected learning outcomes and course level. 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 tests, oral presentations, quizzes, design assignments and design projects. An indicative weighted continuous assessment of the course is shown below: • Assignment 10-15% • Homework 10% • Mid-Term written exams 60-70% • Mini design project 15-20% • Presentation 10-15% 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.
Language	**English**