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| Course Title | Electromechanical Energy Conversion | | | | |
| Course Code | ECE345 | | | | |
| Course Type | Compulsory | | | | |
| Level | Bachelor (1st Cycle) | | | | |
| Year / Semester | 3rd Year / 6th Semester | | | | |
| Teacher's Name | TBA | | | | |
| ECTS | 6 | Lectures / week | 3 hours / 14 weeks | Laboratories / week | N/A |
| Course Purpose and Objectives | The objective of this course is to provide participants an overview of fundamental concepts of electric and magnetic field theory. The basic laws of electromagnetism are thoroughly described and applied to elementary problems involving steady and alternating fields and currents. Students are also presented to the nature and application of electromagnetic fields in engineering. | | | | |
| Learning Outcomes | Upon successful completion of this course, students should be able to:<br>• Demonstrate electromagnetic theory applied to simple practical situations<br>• Explain the meaning of Energy Conversion in the context of Electrical and Electronic Engineering.<br>• Apply Maxwell's equations to problems involving simple configurations<br>• Interpret electromagnetic solutions<br>• Explain the operation of simple electromagnetic devices<br>• Apply mathematical methods and vector algebra to practical problems | | | | |
| Prerequisites | ECE325 | Co-requisites | None | | |
| Course Content | Introduction: Why Energy Conversion? Power System, Electromechanical Energy Conversion. Basic electromechanical energy conversion principles. Basic principles and methodology required in electrical and electronic engineering, to enable appreciation of its scientific and engineering context. Past, current, and future developments and technologies.<br><br>Magnetic Circuits:<br>Magnetic Circuits, Flux Linkage, Inductance & Energy, Magnetic Materials, AC Excitation & Losses, Permanent Magnets, Basic ideas behind AC and DC machines (brushed and brushless), actuators.<br><br>Transformers<br>Ideal Transformer, Equivalent Circuits, Power & Variable Frequency Transformers, Short-circuit & Open-circuit Tests, Auto-transformers & Multi-circuit Transformers, Transformers in Three-phase Circuits, Per-unit System, Electrical Safety | | | | |

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| | Thermal Issues:<br>Diodes and transistors – estimating power loss, heatsinking, power amplifiers, classes, B (efficiency, maximum power dissipation and working out of PDISS) and D (outline of components of class D system), advantages and disadvantages.<br><br>Conversions<br>Forces & Torques in Magnetic Field Systems, Energy Balance, Singly-excited Systems, Determination of Magnetic Force (torque), Multiply-excited systems, Permanent Magnet Systems, Dynamic Equations & Analytical Techniques, Energy supply system – overview of organisation, generation, protection, tariffs, Energy sources, renewables, efficiency<br><br>DC Machines<br>Introduction: Principle of Operation, Commutation Action, Induced EMF, Electric-Magnetic Circuit Aspects, DC Generators,<br>DC Motors, Armature Reaction, Speed Control of DC Motors |
| Teaching Methodology | Face- to- face |
| Bibliography | Gieras, J. F., Electrical Machines: Fundamentals of Electromechanical Energy Conversion, CRC Press<br><br>Lyshevski S. E., Electromechanical Systems, Electric Machines, and Applied Mechatronics, CRC Press<br><br>Fitzgerald, Kingsley and Umans*, Electric Machinery*, McGraw-Hill<br><br>Guru and Hızıroğlu, *Electric Machinery & Transformers, Electric Machinery and Transformers*, The Oxford Series in Electrical and Computer Engineering<br><br>Brown D. and Hamilton E.P., Electromechanical Energy Conversion, Macmillan |
| Assessment | Examinations 70%<br>Assignments/Lab 20%<br>Class Participation and Attendance 10%<br>100% |
| Language | English |