Marco Villani

<table>
<tr><td colspan="3">Programme of “Macchine Elettriche”
“Electrical Machines”</td></tr>
<tr><td colspan="3">Number of ECTS credits: 9 (workload is 90 hours; 1 credit = 10 hours)</td></tr>
<tr><td colspan="3">CODE: I0634
• TYPE OF COURSE UNIT: COMPULSORY
• LEVEL OF COURSE UNIT (E.G. FIRST, SECOND OR THIRD CYCLE; SUB-LEVEL IF APPLICABLE): FIRST CYCLE
• YEAR OF STUDY (IF APPLICABLE):, SEMESTER: 3rd year , 2nd semester
Teacher: Marco Villani</td></tr>
<tr><td>1</td><td>Course objectives and Learning outcomes</td><td>The aim of this course is to provide students in electrical engineering with an adequate basic knowledge of electrical machines, for an understanding of their operating principles. The student should be able, also through mathematical tools, to evaluate problems related to the use of electric transformers, motors and generators and to correctly evaluate the supply and load limit conditions.
The course of Electrical Machines is preparatory for the following courses:
Electrical Drives and Electrical Machines Design.</td></tr>
<tr><td>2</td><td>Dublin descriptors</td><td>Topics of the module include: classification of the electrical machines, electromechanical energy conversion. TRANSFORMERS. Basic operation principle and construction aspects. Theory of single-phase transformer, equivalent circuit, vector diagram, parameters and tests, parallel operation. Theory of 3-phase transformer, winding connections, groups of 3-phase transformers, parameters and tests. Losses and efficiency, Autotransformer. ROTATING MACHINE: Air gap m.m.f. distribution, rotating field, harmonic contents, vector-space theory, A.C. windings. INDUCTION MACHINE: Basic operation principle and construction aspects. Equivalent circuit, vector diagram, parameters and tests, mechanical characteristics, circular diagram. Induction motor for variable speed. Single-phase induction motor. Linear induction motor. SINCHRONOUS MACHINE: Basic operation principle and construction aspects. Isotropic and anisotropic machine, d-q axes theory. Behn-Eschenburg and Potier equivalent circuits. Electrical equations. Synchronous reactance. Vector diagram. Active and reactive power regulation. Static and dynamic stability. Circular diagram. PM synchronous motor, reluctance synchronous motor. Measurement and tests. COMMUTATOR MACHINE: Basic operation principle and construction aspects. Armature reaction. Commutation. Mechanical characteristic of DC machines, torque and speed regulation. Dynamic behavior of DC motor. Losses and efficiency. Universal motor.
NUMERICAL PRACTICES and LABORATORY TESTS.</td></tr>
<tr><td>3</td><td>Prerequisites and learning activities</td><td>The student must know the basic notions of Circuits theory and Electromagnetism.</td></tr>
<tr><td>4</td><td>Teaching methods and language</td><td>Lectures and exercises. Language: Italian / English
Ref. Text books
- E.CHIRICOZZI, A.OMETTO “LEZIONI DI MACCHINE ELETTRICHE” LECTURE NOTES (IN ITALIAN);
- A.E.FITZGERALD, C.KINGSLEY JR., A.KUSKO “MACCHINE ELETTRICHE” 7A ED. FRANCO ANGELI, 2006 (IN ITALIAN);
- D.P.KOTHARI, I.J.NAGRATH ELECTRIC MACHINES” 3A ED. MCGRAW HILL, 2007;
- I.BOLDEA, L.TUTELEA, “ELECTRIC MACHINES: STEADY STATE, TRANSIENTS, AND DESIGN WITH MATLAB”, CRC PRESS, TAYLOR&FRANCIS GROUP, NEW YORK, U.S.A., 2010;
- TURAN GŐNEN, “ELECTRICAL MACHINES WITH MATLAB”, 2A ED., CRC PRESS, TAYLOR&FRANCIS GROUP, NEW YORK, U.S.A., 2012;
- J.B.GUPTA, “THEORY AND PERFORMANCE OF ELECTRICAL MACHINES”, S.K. KATARIA&SONS PUBLISHER, REPRINT 2012;
- S.N.VUKOSAVIC, “ELECTRICAL MACHINES”, SPRINGER, 2013.</td></tr>
<tr><td>5</td><td>Assessment methods</td><td>Oral exam.</td></tr>
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