Course Syllabus

1. Course number and name: 020ME1ES2 Electric Machines 1

2. Credits and contact hours: 6 credits, 3x1:15 course hours

3. Instructor's or course coordinator's name: Ragi GHOSN

4. Text book : Professor textbook and course material
    a. other supplemental materials: Slides

5. Specific course information
    a. brief description of the content of the course (catalog description)

        Construction and operation of rotating machines in steady-state. Electromechanical conversion, rotating magnetic field, dc machines, induction machines and synchronous machines operating as either a generator or a motor. Equivalent circuits, tests and determination of the parameters of the equivalents circuits. Use an equivalent circuit to predict the performance of a machine with reasonable accuracy. Electromagnetic torque and shaft torque. Torque-speed characteristics, efficiency, nameplate and rated values. Introduction to variable speed drives.
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    b. prerequisites or co-requisites: 020ETCES1 – Electrotechnics

    c. Required/Elective/Selected Elective: Required

6. Specific goals for the course
    a. specific outcomes of instruction,
        - Describe the construction of a dc machine, an induction machine and a synchronous machine.
        - Determine an equivalent circuit in steady-state for each one of the above mentioned machines and calculate the values of its parameters using standard experimental tests.
        - Calculate, where applicable, the values of the parameters of an equivalent circuit by using the manufacturer datasheet.
        - Use the equivalent circuits to predict the performance of a machine with reasonable accuracy.
        - Interpret correctly the data on a machine nameplate.

b. KPIs addressed by the course.

KPI	a1	a2	b2	b3	k2
Covered	x	x	x	x	x
Assessed	x	x	x	x	x
Give Feedback	x	x	x	x	

7. Brief list of topics to be covered and approximate lecture hours :
   - Course introduction: Mechanical loads, Mechanical force and emf production. 1 Lecture
   - DC Machine: Constructional features, windings, armature voltage, electromagnetic torque, magnetization curve, separately excited and series excited dc machines, motor and generator operations, torque-speed and voltage-current characteristics, nameplate, rated values and per unit values. Manufacturer data-sheet. 7 Lectures.
   - Problems on dc machines: 4 Lectures.
   - Electromechanical conversion and rotating magnetic field: 3 Lectures.
   - Induction Machines: Constructional features, squirrel-cage and wound-rotor inductions machines. Equivalent circuit models, no-load test, blocked-rotor test and equivalent circuit parameters, power flow in motor operation, torque-speed characteristic. Starting torque and current. Maximum torque. Nameplate, rated values and per unit values. Manufacturer data-sheet. Starting and introduction to speed control of an induction machine. 8 Lectures.
   - Problems on induction machines: 5 Lectures.
   - Synchronous Machines: Constructional features, non-salient and salient pole rotors. Equivalent circuit models of non-salient pole rotor unsaturated and saturated machine, synchronous reactance, phasor diagrams. Tests and equivalent circuit parameters, power flow in generator operation, motor operation, power and torque characteristics, power factor control. Nameplate, rated values and per unit values. Connection to an infinite bus, stability, independent generators. Manufacturer data-sheet. 7 Lectures.
   - Problems on synchronous machines: 4 Lectures.
   - Lab sessions on dc machine, induction machine and synchronous machine: Three sessions of 3 hours each, equivalent to 3 course lectures.