Stellenbosch University Faculty of Engineering

Module Framework

This document should be read with the following documents: Stellenbosch University Calendar Parts 1 and 11, Faculty of Engineering Assessment Rules[1], Faculty of Engineering General Stipulations for Undergraduate Modules[1]

Module: 43915 **Energy Systems 344** 2015	Lecturer(s): **Dr PJ Randewijk** **Room: E313, pjrandew@sun.ac.za**	Approved by Programme Coordinator: Date:

1. Assessment Details

- Major assessment dates and venues are provided at firga.sun.ac.za and mymaties.com
- Note that awarding a pass mark is subject to meeting each the ECSA Exit Level Outcomes assessed in this module, as stated in Faculty of Engineering's Assessment Rules

Calculation of final marks (according to formulas in the Faculty of Engineering's Assessment Rules):

Assessment Method: Flexible: w_{SM} = 20%; w_{A1} = 30%; w_{A2} = 50%

SM=average(Tut tests and Task), A1=test during test week, A2=test in first examination period

Note that both A1 and A2 are compulsory.

2. Module Objectives

Aim: Mastering the basic aspects of electromechanical energy conversion and electrical machine systems.

A student who has successfully completed this module can:

- Derive mathematically from energy principles the electromechanical torque of a rotating electromechanical energy converter and apply this in the analysis of the different types of electrical machines.
- Understand and explain the basic working of the different types of electrical machines.
- Model the electrical machines in terms of electrical equivalent circuits.
- Determine from measurements the equivalent circuit parameters of an electrical machine.
- Understand the dq transformation and apply this in the analysis of synchronous machines.
- Understand and explain the torque and speed control of electrical machine systems.
- Understand and explain the basic working of power electronic converters that are used in electrical machine systems.

3. Module Content and Schedule

Prescribed textbook(s): SD Umans, Electric Machinery, 7th Edition, McGraw-Hill, 2013, ISBN: 978-007-132646-9

Week	Topic	Contact Session/Assignments
1	Magnetic circuits and electromechanical energy conversion	Tutorial
2	Electromechanical energy conversion	Tutorial
3	Introduction to rotating machines	Tutorial
4	Introduction to rotating machines	Tutorial
5	DC machine	Practical 1: DC machine
6	DC machine	Tutorial
	Test Week and Break	
7	Synchronous machine and dq transformation	Tutorial
8	Synchronous machine and control	Practical 2: Synchronous machine
9	3-phase Induction machine	Tutorial
10	3-phase Induction machine and control	Practical 3: Induction machine
11	Power electronic converters	Tutorial
12	Power electronic converters	Practical 4: Converters and machine control

[1] Available on SUNLearn for modules offered by Faculty of Engineering, in the block titled "General Programme Information" on the left-hand side

4. ECSA Knowledge Area Credits

Mathematical Science	Basic Science	Engineering Science	Design and Synthesis	Complementary Studies
0	0	15	0	0

Engineering Science:
Content: Science of electromagnetics from an engineering perspective.
Assessment: Assessed in tests.

5. ECSA Exit Level Outcomes

This module is not used to assess any ECSA Exit level Outcomes.

6. Other Module Specific Information

English/Afrikaans Terminology

air-core lugkern
airgap MMF lugspleet MMK
airgap power lugspleet drywing
apparent power skyndrywing [S in kVA]
armature anker
armature reaction ankerreaksie
armature reaction reactance ankerreaksie reaktansie
armature winding ankerwikkeling
back emf teen emk (elektromotoriese krag)
blocked-rotor test vashourotortoets
chorded winding verkorte spoelsteek wikkeling
coil spoel
coil pitch spoelsteek
commutation kommutasie
compensating winding kompensasie wikkeling
compound dubbelsluiting (by GS-machine)
- **cumulative compounding** versterkende dubbelsluiting
- **differential compounding** verswakkende dubbelsluiting
- **flat compounding** gelyk dubbelsluiting
- **over compounding** –
- **under compounding** –

core kern
core losses kernverliese
current density stroomdigtheid [J]
damper winding demper wikkeling
distribution factor verspreidingsfaktor
double-cage rotor dubbelkou rotor
double layer winding dubbellaag wikkeling
eddy currents werwelstrome
efficiency benuttingsgraad
exciting current opwekstroom
field control veldbeheer
field weakening veldverswakking
field winding veldwikkeling
flux density vloeddigtheid [B]
full-load vollas
full-pitch winding volsteek wikkeling
full-pitch coil volsteek spoel
hysteresis histerese
impedance impedansie
induced voltage ge¨ınduseerde spanning
induction machine Induksiemachine
interpoles tussenpole
iron core ysterkern
iron losses ysterverliese
lamination laminasie
lap winding luswikkeling
leakage inductance sprei-induktansie
leakage flux spreivloed
leakage reactance spreireaktansie
magnetic field strength magnetiese veldsterkte [H]
magnetic flux magnetiese vloed [λ]
magnetising current magnetiseerstroom
magnetising inductance magnetiserings-induktansie
magnetising reactance magnetiseringsreaktansie
magnetomotive force (MMF) magnetiese motoriese krag (MMK)
MMF distribution MMK verspreiding
mutual inductance wedersydse induktansie
no-load test nullastoets
open-circuit test oopbaantoets (nullastoets)
permeability permeabiliteit
per unit system per-eenheid stelsel
pole pitch poolsteek
power drywing
power factor arbeidsfaktor
power flow drywingsvloei
primary winding prim^ere wikkeling
pull-out torque uitval-draaimoment
rated value kenwaarde
reactance reaktansie [X in Ω]
synchronous reactance sinchroon reaktansie
reactive power reaktiewe drywing [Q in VAR]
real power werkdrywing [P in Watt]
reluctance reluktansie
reluctance torque reluktansie draaimoment

resistance weerstand (R in Ω)
root-mean-square (rms) wortel-van-die-gemiddeld-kwadrate (WGK of w.g.k.)
rotating magnetic field roterende magneetveld (draaiveld)
rotational losses roterende verliese (meestal ysterverliese plus wind-en-wrywing verliese)
salient pole speekpool
secondary winding sekondêre wikkeling
separately excited afsonderlik opgewek
series field winding serie veldwikkeling
shaft power asdrywing
short circuit test kortsluittoets
short-pitch verkorte spoelsteek
shunt dc machine newesluiting gs-machine
sinusoidal excitation sinusvormige opwekking
skin effect huid-effek
slip glip
slip frequency glipfrekwensie
slip rings sleepringe
squirrel-cage rotor kourotor
synchronous machine sinchroonmachine
synchronous impedance sinchroon impedansie
synchronous reactance sinchroon reaktansie
synchronous generator sinchroongenerator
torque draaimoment
transformer transformator
travelling wave loopgolf (draaiveld)
turn winding
voltage regulation spanningsregulasie
wave winding golfwikkeling
windage and friction losses wind-en-wrywing verliese
winding wikkeling
winding factor wikkelingsfaktor