REM master basic syllabus

Title:
TET4120 Electric Drives

Credit value:
7,5 ECTS

Mandatory/Optional:
Optional

Semester:
3 ?

Lecturer/s:
Prof. Roy Nilsen

University:
NTNU- Norwegian University of Science and Technology

Department:
Department of Electric Power Engineering

Rationale:
In spite the fact that a variable speed drive will require increased investment cost, this will in most cases very quickly be balanced by large energy savings compared to fixed speed drives. Approximately 97 % of all new motors are sold without a frequency converter. This means that a large potential market exists. In the Marine and Offshore industry several applications needs such type of drives. This can be offshore wind turbines, ship propulsions, anchor handlers, etc.

Objectives:
Part I gives an overview of different type of electrical motor drives, type of loads and the impact of using mechanical gears/transmissions. In part II simplified models of the most commonly used power electronic converters are presented. Modulation methods are presented. In part III measurement techniques used in a motor drives are presented. In addition, how to choose type of controller and tuning of controller parameters are covered in details. Part IV is devoted to DC drives. Mathematical modelling is performed, analysis of steady state characteristics aswell as choice and dimensioning of current- and speed controllers. In part V a general model of AC machines are presented. This includes introduction of space vectors, coordinate transformations and transformed mathematical models. In section VI the three most commonly used AC drives are analyzed; Induction Motor Drives, Permanent Magnet Synchronous Motor Drives and Synchronous Motor Drives. It will be focus on controllers operating in asynchronous rotating coordinate system, i.e. operating with DC-quantities in steady state.

Skills: *(according to the list of skills provided)*

Subject skills	**REM Master Skills**						
	L2.1	**L2.2**	**L2.3**	**L2.4**	**L2.5**	**L2.6**	**L2.7**
L3.1. Model and analyze electrical motor drives and their sub systems (converters, rotating machines and loads)	x		x				
L3.2. To be able to choose a suitable rotating machine for an electrical motor drive	x	x	x				
L3.3. To be able tochoose a suitable power electronic converter structure for an electrical motor drive	x		x				
L3.4 To be able to choose a suitable power electronic converter structure for an electrical motor drive	x	x	x				
L3.5. To be able to choose a suitable control structure, measurement method and calculate control parameters for an electrical motor	x		x				

Teaching and learning methods:

The course methodology includes various techniques, such as:

1. Lecture format with oral and audiovisual presentations.

2. Compulsory exercises and projects. Individual exercise. Projects in groups of 4-5 students.

3. Individual monitoring of the learning process is done through mentoring/guidance by the student assistants, research assistant, and the lecturers.

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Regular Lectures	48 hours	78 hours self preparation, exercises, etc.
Tutorials	12 hours	
Projects	30 hours	

-

Assessment:

Procedures for assessment of the course:

1. There will be a final exam counting 50% and 50% counting of project work
2. The student has to successfully complete mandatory exercises.

Assessment Matrix:

Subject skills	**Assessment method**				
	Exam	**Presentation**	**Project**	**…**	**…**
L3.1.	50%		50%		
L3.2.	50%		50%		
L3.3.	50%		50%		
L3.4.	50%		50%		
L3.5.	50%		50%		
L3.6.					

Programme:

Week nr.:	Chapter :	Topic:	Div.
2	1	Type of motors, devices, drives and simulation tools	
3	1	Loads, gear/transmission, choice of motors, thermal models and sensors	Ex. 1
4	2	Power Electronic Converters and simulation models	Ex. 2
5	3	Controllers and filtering	Ex. 3
6	3	Controllers and filtering	Ex. 4
7	4	Modelling & Control of DC-drives	Ex. 5
8	4	Project info, exercises, Control of DC-drives	Project start
9	5	AC machines and transformed models	Ex. 6
10	6	Induction Motor modelling	Ex. 7
11	6	Steady-state characteristics, Rotor flux oriented control	Ex. 8
12	6	Rotor flux oriented control	Ex. 9
13		*Easter*	
14	7	Modelling of PM motors	Ex. 10
15	7	Control of PM-motors	Project hand-in
16		Present project	

Resources:

Classrooms, Blackboard, laptop, projector, audio, security issues.

All the informationnecessary to follow the course is facilitated by teacher of the subject during the course development, through Black Board system

The resources used include A suitable classroom for regular lectures; blackboard; laptop with projector; photocopies;Back Board access.

Bibliography:

Basic textbooks:

[1] Nilsen Roy, Electric Drives, Lecture Notes, NTNU 2018

Further comments: