REM master basic syllabus

Title:
EE3016 Control Engineering I

Credit value:
5 ECTS

Mandatory/Optional:
Optional

Semester:
1

Lecturer/s:
Gordon Lightbody

University:
University College Cork

Department:
School of Engineering

Rationale:
To teach the fundamentals of Control Engineering

On successful completion of this module, students will have been introduced to continuous control with digital implementation developed in the laboratory using labview.

Classical Control: principles of control; stability using Routh-Hurwitz and Nyquist; relative stability; design of compensators in the frequency domain; Root Locus design; PID controllers and tuning techniques; Practical issues-cascade control; windup, etc; introduction to digital control.

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

Subject skills	L1.1	L1.2	L1.3	L1.4
L3.1. Design PID, phase-lead and phase-lag controllers in the frequency domain	X			
L3.2. Analyse the stability and performance of a closed-loop system from its Nyquist and Nichols plots	X			
L3.3. Predict the closed-loop performance of a process from its open-loop poles and zeros, using the root-locus method	X			
L3.4 Design PID, tacho-feedback and phase-lead compensators using the root-locus method	X			
L3.5 Design and simulate classical controllers using Matlab/Simulink	X	X	X	X

Teaching and learning methods:

Lectures.
Tutorials
On-line tutorial material
Matlab tutorials
Guided experimental work in laboratory
Matlab/Simulink design exercise – simulating, controlling and validating a realistic closed loop control system

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	24 hours	10 hours
Tutorials	10 hours	0 hours
Control design project	2 hours	20 hours
Control Laboratory	9 hours	8 hours
Private study		41 hours

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Assessment:

Laboratory report, control design report and final written exam test students' achievements of the learning outcomes.

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Class test**	**Control Design report**	**Laboratory Report**	**…**	**…**
All	60%	-	20%	20%		

Programme:

Lesson 1	***Introduction to control engineering*** *Distribution (2 h theory)*
Lesson 2	***Closed loop control concepts*** *Distribution (5 h theory)*
Lesson 3	***Stability of linear systems*** *Distribution (5 h theory)*
Lesson 4	***Frequency domain design*** *Distribution (6 h theory)*
Lesson 5	***Root locus design*** *Distribution (6 h theory)*
Lesson 6	***Overview of PID controllers*** *Self study notes (3 h)*
Lesson 7	**Lab1 : Digital PID control of a temperature process using Labview.** *Guided Experimental work in lab (3h)*

Lesson 8	**Lab2 : Speed Control of a Pneumatic motor** *Guided Experimental work in lab (3h)*
Lesson 9	**Lab3 : Control of the three tank system** *Guided Experimental work in lab (3h)*
Lesson 10	**Design Project in Matlab/Simulink** *2 h tutorial and 20 hours project work*

Resources:

A classroom, equipped with a blackboard and audio-visual resources (laptop/computer and Internet connection + projector), for the lectures.
For laboratory – use of the control laboratory (three groups of 3) based on three experimental workstations.
Matlab, Simulink, Control toolbox, computers on the Engineering network.

Bibliography:

Dutton, K., Thompson, S. and Barraclough, B. "The Art of Control Engineering", Addison-Wesley, ISBN 0-202-17545-2.

Dorf, R.C., Bishop, R.H. "Modern Control Systems", Pearson, Prentice-Hall, ISBN 0-13-127765-0.

Further comments: