

# PHYS H4007: Control System Design

Module Title:			Control System Design		
Language of Instruction:		1:	English		
Credits:		5			
NFQ Level:		8			
Module Deli	vered In		1 programme(s)		
Module Aim:			To analyse the behaviour and control of dynamic systems. To design control strategies to modify the responses of dynamic systems.		
Learning Ou	itcomes				
On successf	ul completion	n of th	nis module the learner should be able to:		
LO1	Define the performance characteristics of a control system.				
LO2	Design a control strategy in order to achieve the required system specifications.				
LO3	Demonstrate open-loop systems and select and tune appropriate closed-loop, P, PI and PID controllers modelled in Matlab.				
LO4	Analyse the operation and performance of a feedback control system.				
Pre-requisit	e learning				
Module Recommendations This is prior learning (or a practical skill) that is recommended before enrolment in this module.					
No recommendations listed					
Incompatible Modules These are modules which have learning outcomes that are too similar to the learning outcomes of this module.					
No incompatible modules listed					
Co-requisite Modules					
No Co-requisite modules listed					
<b>Requirements</b> This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.					
No requirements listed					



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## **Module Content & Assessment**

## Indicative Content

#### **Review of control systems**

Applications of feedback control Reasons for using feedback The design process

### System modelling

Experimental methods Mathematical modelling -Use of differential equations -Use of Laplace Transforms -Poles and zeros Block diagrams -Block diagram reduction -Disturbance inputs -Transfer functions Signal flow graphs

#### Time response

Transient and steady state responses -First and higher order responses -Time delay -Specifications

## Frequency response

Introduction Frequency response specifications -System gain in dB -Bandwidth -Effect of system order -Resonance Frequency response diagrams -Bode diagrams. First & higher order systems. Time delay. -Closed loop

System stability The Bode Stability Criterion -Gain & phase margins Nyquist Analysis Transfer functions and pole-zero plots -Closed loop response The Routh-Hurwitz Criterion

Sensitivity Open and closed loop systems Parameter variations

#### Servo Systems

Components of a servo control system -Specifications -Responses System responses to standard inputs Design examples and component selection Application areas - Robot systems

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	30.00%
End of Module Formal Examination	60.00%

Continuous Assessment					
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date	
Short Answer Questions	n/a	1,4	10.00	Week 4	

### No Project

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Practical					
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date	
Practical/Skills Evaluation	Matlab Practicals	1,2,3,4	30.00	Every Week	

End of Module Formal Examination					
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date	
Formal Exam	n/a	1,2,4	60.00	End-of-Semester	

SETU Carlow Campus reserves the right to alter the nature and timings of assessment



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# Module Workload

Workload: Full Time		
Workload Type	Frequency	Average Weekly Learner Workload
Lecture	12 Weeks per Stage	3.00
Lab/Lecture	12 Weeks per Stage	2.00
Independent Learning	15 Weeks per Stage	5.13
	Total Hours	137.00

Module Delivered In				
Programme Code	Programme	Semester	Delivery	
CW_EMMEC_B	Bachelor of Engineering (Honours) in Mechanical Engineering	7	Mandatory	