



Institiúid Teicneolaíochta Chorcaí
Cork Institute of Technology

INTR8006: Control Engineering

Module Details

Short Title:	Control Engineering	APPROVED
Full Title:	Control Engineering	
Module Id:	2017	

Official Code:	INTR8006	NFQ Level:	8	ECTS Credits:	5
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Coordinator:	JOSEPH CONNELL
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Description:	The module aim is to develop the key engineering skills of team-work, critical thinking, communication and problem solving in a control engineering context. In this module, participants will work in teams to design, implement and evaluate a controller for a specified laboratory-scale piece of equipment. Learning is achieved through a collaborative project-based learning environment that is supported by formal lectures and workshops. In addition to the key skills this module aims to promote a deep understanding of the subject matter by offering participants the opportunity to investigate, design, implement, evaluate and reflect on the underlying theory.
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Learning Outcomes:

On successful completion of this module the learner will be able to...

1. LO1: Utilise available resources to develop a linear model for a physical system that is sufficiently accurate for controller design purposes.
2. LO2: Use available resources to synthesise and implement a controller for the selected system that achieves pre-specified performance criteria.
3. LO3: Work effectively as a team member, in a variety of roles, on an engineering project.
4. LO4: Critically reflect on, and evaluate the relative success of their engineering project.
5. LO5: Use CAD tools in the design and evaluation of the engineering project and ICT tools to communicate results to the engineering community.

Pre-requisite learning

Module Recommendations

This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named CIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).

Control and Simulation (Module ID 2021) and Engineering Mathematics 222 (Module ID 2674) and Engineering Mathematics 321 (Module ID 2677) or equivalent

Incompatible Modules

These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.

No incompatible modules listed

Module Requirements

This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.

No requirements listed



Module Content & Assessment

Indicative Content

Modeling

Modeling from first principles; modeling from time-domain data; modeling from frequency domain data; design of system identification tests; least-squares and parameter estimation; model validation; state-space representation

Controller Design

Principles of feedback; PID controller design; internal model control; pole-placement control; cascade control; controller evaluation; industrial case studies

Non-linear systems

Linear versus non-linear dynamics; non-linear dynamics; linearisation via small signal analysis; relay tuning

Group work

Group dynamics; positive and negative group behaviours; team work and communication skills; project planning; leadership;

ICT

Workshop on MATLAB; Workshop on real-time controller development environment; workshop on system identification toolbox; workshop on portfolio preparation; workshop on poster preparation and presentation

Assessment Breakdown

	%
Course Work	100%
End of Semester Formal Examination	0%

Coursework Breakdown

Type	Description	Outcome addressed	% of total	Assessment Date
Written Report	Students are required to complete a short team-work assignment	3	10	Week 4
Written Report	Students are required to summarise the work completed on modeling the process	1	10	Week 7
Written Report	Students are required to complete an assignment on controller design	2	10	Week 10
Practical/Skills Evaluation	Present a poster summarising project	4,5	20	Week 12
Other	Compile and present portfolio of evidence of achievement of LO's	1,2,3,4,5	50	Week 12

The institute reserves the right to alter the nature and timings of assessment



Module Workload & Resources

Workload		Full-time mode			
Type	Description	Hours	Frequency	Average Weekly Learner Workload	
Lecture	Tradition Lecture	2	Every Week	2.00	
Lab	Lab time is dedicated to completing the co-operative project	2	Every Week	2.00	
Independent & Directed Learning (Non-contact)	Apply theory/develop skills/prepare portfolio	3	Every Week	3.00	
Total Weekly Learner Workload				7.00	
Total Weekly Contact Hours				4.00	

Workload		Part-time mode			
Type	Description	Hours	Frequency	Average Weekly Learner Workload	
Lecture	Traditional Lecture	1	Every Week	1.00	
Lab	Co-operative project based learning	2	Every Week	2.00	
Independent & Directed Learning (Non-contact)	No Description	4	Every Week	4.00	
Total Weekly Learner Workload				7.00	

Resources	
Recommended Book Resources	
• Astrom and Murray 2007, <i>Feedback Systems: An introduction for scientists and engineers</i> , 1 Ed., Princeton University Press http://www.cds.caltech.edu/~murray/amwiki (last assessed 13/02/08)	
Supplementary Book Resources	
• Bobal, Bohrs, Fessl & Machacek 2005, <i>Digital Self-tuning Controllers - Algorithms, Implementation and Applications</i> , 1 Ed., Springer [ISBN: 1-85233-980-2] • Smith & Corripio 2005, <i>Principles and Practices of Automatic Process Control</i> , 3 Ed., Wiley [ISBN: 0-471-43190-7] • Jacques 2000, <i>Learning in Groups: A handbook for improving group work</i> , 3 Ed., Kogan Page [ISBN: 0-7494-3091-5] • Mantel, Meredith, Shafer & Sutton 2004, <i>Core Concepts: Project Management in Practice</i> , 2 Ed., John Wiley & Sons [ISBN: 0471229652]	
Other Resources	
• Website: Wilson, Dept. of Electrical and Computing Engineering, University of Waterloo <i>Lecture Notes: Control Systems</i> , last accessed 11/07/07 http://www.ece.uwaterloo.ca/~ece380/ • Website: Tham, University of Newcastle Upon Tyne <i>SWOT Course Notes and Resources</i> , last accessed 11/07/07 http://lorien.ncl.ac.uk/ning/dept/Swot/connotes.htm • Website: Johnston, MIT OpenCourseWare <i>Lecture Notes: Process Dynamics Operations and Control</i> , last accessed 11/07/07 http://ocw.mit.edu/OcwWeb/Chemical-Engineering/10-450Spring-2006/CourseHome/index.htm • Website: Carnegie Mellon <i>Control Tutorials for MATLAB</i> , last accessed 11/07/07 http://www.engin.umich.edu/group/ctm/ • Website: Gockenbach <i>A practical introduction to MATLAB</i> , last accessed 11/07/07 http://www.math.mtu.edu/~msgocken/intro/intro.html	