1. **Title of the module**

 EENG8760 (EL876) - Advanced Control Systems

1. **School or partner institution which will be responsible for management of the module**

Engineering and Digital Arts

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 7

1. **The number of credits and the ECTS value which the module represents**

15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Autumn

1. **Prerequisite and co-requisite modules**

None

1. **The programmes of study to which the module contributes**

MSc in Advanced Digital Systems Engineering (option)

MSc in Advanced Electronic Systems Engineering (option)

MSc in Engineering Finance

MSc in Biotechnology and Bioengineering

MEng in Electronic and Communication Engineering

1. **The intended subject specific learning outcomes.
On successfully completing the module students will be able to:**
* Have an understanding of the factors that limit the performance of feedback control systems.
* Be able to understand the implication of digital implementation of feedback control systems.
* Use classical feedback control methods for design and analysis.
* Apply appropriate system analysis tools to inform the control design process.
* Design and analyse feedback control systems using a range of techniques.
* Be able to design and analyse control systems using state-of-the-art software in the Matlab environment.
1. **The intended generic learning outcomes.
On successfully completing the module students will be able to:**

Demonstrate skills in generating, analysing, presenting and interpreting data, will learn to use ICT, and will develop core key skills, such as learning effectively, critical thinking and time management, contributing to the Transferable/Key Skills in the generic learning outcomes for the MSc and PGDip programmes.

* Students will show an ability to deal with complex issues systematically and creatively and make judgements in the absence of complete data, and show that they are capable of self-direction and problem solving.
* The ability to use and understand a range of modern CAD tools and general ICT.
* Demonstrate the ability to communicate complex ideas and concepts to specialist and non-specialist audiences.
* Show that they are capable of learning independently, use critical thinking and analysis and demonstrate autonomy in time and resource management.
1. **A synopsis of the curriculum**

This course is concerned with the design of practical feedback controllers. Feedback is used in a control system to change the dynamics of the plant or process, and to reduce the sensitivity of the system to uncertainty from external signals (for example, disturbances and noise) and model uncertainty. If the performance specifications are achieved in the presence of the expected uncertainties, then the control is said to be robust.

Control Fundamentals and Modelling:

Methods for modelling engineering processes, state space representation, controllability and observability. The feedback control paradigm.

Digital Feedback Control:

Implications of digital implementation of feedback control systems. Controller Emulation Methods. Direct digital design of feedback control systems. Case study examples.

Nonlinear Control Systems:

Characteristics of nonlinear system behaviour, Phase-plane methods, Variable-structure systems and sliding-mode control. Case study examples.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**
* Dorf, RC, Bishop, Robert H. (c2011) Modern Control Systems, Pearson, Boston, London
* Dorsey, J (2002) Continuous and Discrete Control Systems: Modelling, Identification, Design, and Implementation, McGraw-Hill, Boston, London
* Nise, NS. (c2011) Control Systems Engineering, J Wiley, Hoboken N.J
* Systems and Control, Stanislaw H. Zak, Oxford, 2003, ISBN-10: 0195150112
* Modern Control Systems, Richard C. Dorf and Robert H. Bishop, Prentice Hall, 2008, ISBN-10: 0132451921
* Sliding Mode Control: Theory and Application, Christopher Edwards and Sarah Spurgeon, Taylor and Francis, 1998, ISBN-10: 0748406018
1. **Learning and teaching methods**

Total contact hours: 38

Private study hours: 112

Total study hours: 150

1. **Assessment methods**
	1. Main assessment methods

Assignment (6%)

Workshop (8%)

Assignment (12%)

Assignment (6%)

Workshop (8%)

Examination (60%)

In order to obtain credit for this module on IET accredited programmes, the coursework mark and the exam mark must each be greater than or equal to 40% as well as achieving the pass mark for the module. This module will only be considered for compensation if the coursework mark and exam mark are each greater than 40%.

13.2 Reassessment methods

Like-for-like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | *8.1* | *8.2* | *8.3* | *8.4* | *8.5* | *8.6* | *9.1* | *9.2* | *9.3* | *9.4* |  |  |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Private Study** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  |  |
| *Lectures* | **X** | **X** | **X** | **X** |  |  | **X** |  | **X** | **X** |  |  |
| *Example Classes* | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  |  |
| *Laboratory* | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** | **X** | **X** |  |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |
| *Case Study* |  | **X** | **X** |  | **X** | **X** | **X** | **X** | **X** | **X** |  |  |
| *Examination* | **X** | **X** | **X** | **X** | **X** |  | **X** |  |  | **X** |  |  |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Practical work undertaken using internationally recognised system modelling tools such as MATLAB and Simulink to illustrate the design process for DSP systems.

**FACULTIES SUPPORT OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
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Revised FSO Jan 2018