1. **Title of the module**

EENG8710 (EL871) - Digital Signal Processing (DSP)

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/PDip in Advanced Communications Engineering (Wireless Systems and Networks (Option)

MSc/PDip in Advanced Digital Systems Engineering

MSc/PDip in Advanced Electronic Systems Engineering (Option)

MEng in Computer Systems Engineering (Option)

MEng in Computer Systems Engineering with a Year in Industry (Option)

MSc/PDip in Engineering with Finance

MSc/PDip in Advanced Digital Systems Engineering (Communications)

MSc/PDip in Advanced Digital Systems Engineering (Integrated Circuit Design) (Option)

1. **The intended subject specific learning outcomes.  
   On successfully completing the module students will be able to:**

8.1 Understand the principles of Digital Signals in both the time and frequency domains and use the Fourier Transform, the Fast Fourier Transform and the Z-Transform to analyse such signals.

8.2 Understand and critically appraise the effects of noise on digital systems.

8.3 Employ standard methods to design filters for use in processing digital signals.

8.4 Comprehensively understand how DSP techniques can be used in Instrumentation and Measurement, image processing (and image compression) and modern communication systems.

1. **The intended generic learning outcomes.  
   On successfully completing the module students will be able to:**

9.1 Show ability to deal with complex issues systematically and creatively and make judgements in the absence of complete data, and show self-direction in tackling and solving problems.

9.2 Use ICT.

9.3 Demonstrate effective communication to specialist (and non-specialist) audiences.

9.4 Show that they can learn independently for CPD, will use critical thinking, reasoning and reflection and demonstrate autonomy in time and resource management.

1. **A synopsis of the curriculum**

Signals:

Introduction to signals and signal analysis. Frequency and time domain representations of signals. A review of the Fourier Series, Fourier Transform and Laplace Transforms. Noise: definitions and sources of noise in signal analysis.

Digital Signal Processing:

The sampling theorem, Aliasing, Anti-Aliasing and Anti-Imaging Filters, ADCs and DACs. The Fourier Transform (FT). The Discrete Fourier Transform (DFT) and The Fast Fourier Transform (FFT).The Z-transform. Pole-Zero placement methods for signal analysis. Transfer functions in S and Z domains. Theory, design and performance of Finite Impulse-Response (FIR) and Infinite-Impulse-Response (IIR) Filters. Multirate DSP. Architectures and devices for digital signal processing. Effects of Finite Precision.

Applications of DSP:

Processing and filtering of signals for Instrumentation and measurement, Processing and filtering of images: DSP in modern communication systems.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

* Benoit, Hervé, 2002. Digital television: MPEG-1, MPEG-2, and principles of the DVB system. Oxford: Focal Press. ISBN 0240516958
* Crochiere, R E., 1983. Multirate digital signal processing. S.l.: Prentice-Hall. ISBN 0136051626
* Dudgeon, D E., 1984. Multidimensional digital signal processing. S.l.: Prentice-Hall. ISBN 0136049591
* Ifeachor, Emmanuel C. and Jervis, Barrie W., 2002. Digital signal processing: a practical approach. Harlow: Prentice Hall. ISBN 0201596199
* Jackson, Leland B., 1996. Digital filters and signal processing: with MATLAB exercises. Boston: Kluwer Academic Publishers. ISBN 079239559X
* Lathi, B. P. and Ding, Zhi, 2010. Modern digital and analog communication systems. New York: Oxford University Press. ISBN 0195331451
* Lynn, Paul A. and Fuerst, Wolfgang, 1998. Introductory digital signal processing with computer applications. Chichester: John Wiley. ISBN 0471976318
* Oppenheim, A V., 1978. Applications of digital signal processing. S.l.: Prentice-Hall. ISBN 0130391158
* Oppenheim, Alan V. and Schafer, Ronald W., 1975. Digital signal processing. Englewood Cliffs, N.J.: Prentice-Hall. ISBN 0132146355
* Proakis, John G. and Manolakis, Dimitris G., 2007. Digital signal processing. Upper Saddle River, N.J.: Pearson Prentice Hall. ISBN 0131873741
* Stremler, Ferrel G., 1990. Introduction to communication systems. Wokingham: Addison-Wesley. ISBN 0201184982
* Stroud, K. A., 1996. Further engineering mathematics: programmes and problems. Basingstoke: Macmillan. ISBN 0333657411
* Stroud, K. A. and Booth, Dexter J., 2001. Engineering mathematics. Basingstoke: Palgrave. ISBN 0333919394
* Stroud, K. A. and Booth, Dexter J., 2007. Engineering mathematics. Basingstoke: Palgrave Macmillan. ISBN 1403942463
* Williams, Charles Sterling, 1986. Designing digital filters. Englewood Cliffs: Prentice-Hall. ISBN 013201856x

1. **Learning and teaching methods**

Total contact hours: 62

Private study hours: 88

Total study hours: 150

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

Workshop (10%)

Workshop (10%)

Workshop (10%)

Workshop (10%)

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* |  |  | *9.1* | *9.2* | *9.3* | *9.4* |  |  |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Private Study** | **X** | **X** | **X** | **X** |  |  | **X** | **X** | **X** | **X** |  |  |
| *Lectures* | **X** | **X** | **X** | **X** |  |  | **X** |  |  | **X** |  |  |
| *Workshops* | **X** | **X** | **X** | **X** |  |  | **X** | **X** | **X** | **X** |  |  |
| *Laboratories* | **X** | **X** | **X** | **X** |  |  | **X** | **X** | **X** | **X** |  |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |
| *Examination* | **X** | **X** | **X** | **X** |  |  | **X** |  |  | **X** |  |  |
| *Workshops* | **X** | **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