Engineering Tripos Part IIA, 3F1: Signals & Systems, 2014-15

Module Leader
Dr J Sayir [1]

Lecturers
Prof J Maciejowski, Prof B Byrne and Dr Sayir

Lab Leader
Prof M Smith [2]

Timing and Structure
Michaelmas term. 16 lectures.

Aims
The aims of the course are to:

- Cover three basic topics in signals and systems which provide the basis for further topics in signal processing, communications, control and related subjects.
- Introduce the z-transform, which is the generalisation of the Laplace transform to discrete time systems.
- Introduce stochastic processes.
- Introduce to the theory of information in the context of transmission along a channel.

Objectives
As specific objectives, by the end of the course students should be able to:

- Be familiar with the theory and application of the z-transform.
- Analyse the stability of discrete-time systems.
- Understand the use of correlation and spectral density functions.
- Analyse the behaviour of linear systems with random inputs.
- Be familiar with the key concepts of information Theory, such as how much information is conveyed by a given message, and be able to calculate the entropy of source data with known statistics.

Syllabus
Discrete Time Systems (6L) Prof J Maciejowski

- Definition and properties of z-transforms.
- Convolution sum.
- Solution of difference equations.
- Stability.
- Impulse and frequency responses.
- Analysis of systems with discrete/continuous interfaces.
- Nyquist Stability Criterion
Random Processes (5L) Prof W J Byrne

- Probability and Random variables.
- Random vectors.
- Ensembles and stochastic inputs.
- Stationary and ergodic processes.
- Correlation functions.
- Spectral density.
- Response of linear systems to stochastic inputs.

Information Theory (5L) Dr J Sayir

- Information and Entropy.
- Channel capacity.
- Coding.

Coursework

Flight control experiment. Laboratory report and/or full technical report.

Booklists

Please see the Booklist for Part IIA Courses [3] for references for this module.

Assessment

Please refer to Form & conduct of the examinations [4].

UK-SPEC

The UK Standard for Professional Engineering Competence (UK-SPEC) [5] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the 'Accreditation of Higher Education Programmes' (AHEP) document [6] which sets out the standard for degree accreditation.

The Output Standards Matrices [7] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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