

Engineering Tripos Part IB, 2P6: Communications, 2018-19

Leader

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Lecturer

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Timing and Structure

7 lectures: 1 in week 5, 2 per week in weeks 6-8

Aims

The aims of the course are to:

- Introduce the basic elements of typical communication systems.
- Provide an understanding of bandwidth, as it applies to signals and transmission channels.
- Discuss digitisation of signals and how it affects their properties.
- Understand the basic elements of analogue and digital modulation schemes.

Objectives

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

- Describe the key elements of a communication system.
- Understand analogue modulation, and discuss the merits of amplitude and frequency modulation, and their power and bandwidth requirements.
- Understand how digitisation affects the characteristics of a signal; in particular, the separate effects of sampling (in time) and quantisation (in amplitude).
- Analyse the trade-off between quantisation rate and the quality of digital representation.
- Understand the basic principles of digital modulation, be familiar with the design choices involved, and analyse the performance of modulation schemes in terms of error probability and data rates.
- Understand the need for coding, and encode and decode bits using simple error-correcting codes such as repetition and Hamming codes

Content

Signals and Channels

- Key signal properties (Energy, Power, Bandwidth)
- Communication channels and some simple channel models

Analogue Modulation

- Amplitude Modulation

- Frequency Modulation

Digitisation of Analogue Signals

- Digitisation of signals (sampling, quantisation)

Digital Communication

- Basics of Baseband modulation, Passband modulation
- Data rate, probability of detection error
- Introduction to coding: Repetition codes and Hamming codes

Multiple Access

- Frequency-division, Time-division, and Code-division multiple access

Booklists

Please see the [Booklist for Part IB Courses](#) [3] for references for this module.

Examination Guidelines

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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Links

[1] <mailto:jl221@cam.ac.uk>

[2] <mailto:rv285@cam.ac.uk>

[3] <https://www.vle.cam.ac.uk/mod/book/view.php?id=364081&chapterid=43781>

[4] <http://teaching.eng.cam.ac.uk/content/form-conduct-examinations>

[5] <http://www.engc.org.uk/ukspec.aspx>

[6] <http://www.engc.org.uk/standards-guidance/standards/accreditation-of-higher-education-programmes-ahep/>

[7] <http://teaching.eng.cam.ac.uk/content/output-standards-matrices>

