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## **MATH32031**

Coding Theory

<b>Unit code:</b>	MATH32031
<b>Credit Rating:</b>	10
<b>Unit level:</b>	Level 3
<b>Teaching period(s):</b>	Semester 1
<b>Offered by</b>	School of Mathematics
<b>Available as a free choice unit?:</b>	N

### **Requisites**

#### **Prerequisite**

- [MATH20201 - Algebraic Structures 1](#) (Compulsory)

### **Additional Requirements**

MATH32031 pre-requisites

### **Aims**

To introduce students to a subject of convincing practical relevance that relies heavily on results and techniques from Pure Mathematics.

### **Overview**

Coding theory plays a crucial role in the transmission of information. Due to the effect of noise and interference, the received message may differ somewhat from the original message which is transmitted. The main goal of Coding Theory is the study of techniques which permit the detection

of errors and which, if necessary, provide methods to reconstruct the original message. The subject involves some elegant algebra and has become an important tool in banking and commerce.

### **Assessment methods**

- Other - 20%
- Written exam - 80%

### **Assessment Further Information**

- Coursework: weighting 20%
- End of semester examination: two hours weighting 80%

### **Learning outcomes**

On successful completion of this course unit students will

- have a theoretical understanding of how methods of linear and polynomial algebra are applied in design of error correcting codes,
- and be able to analyse and compare error detecting/correcting facilities of simple linear and cyclic codes for the symmetric binary channel;
- be able to design simple cyclic codes with given properties.

### **Syllabus**

- Introduction to the Main Problem of Coding Theory. [1 lecture]
- Hamming Distance. Code detection. Code correction. ISBN code. [2]
- Length and weight of a code. Perfect codes. [3]
- Linear codes. Generator matrices and standard forms. Encoding. Nearest neighbour decoding. [4]
- Dual code. Parity check matrix. Syndrome decoding. Incomplete decoding. [4]
- Hamming Codes and Decoding. [4]
- Finite fields. Cyclic codes. [4]
- Reed-Muller codes.

### **Recommended reading**

Recommended text:

R Hill, A First Course in Coding Theory, 1986, OUP.

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

### **Study hours**

- Lectures - 22 hours
- Tutorials - 11 hours
- Independent study hours - 67 hours

### **Teaching staff**

Yuri Bazlov - Unit coordinator