

Coding and Transformations

Code: CE00998-3

Level: 3

Module Leader: Dr P. A. Lewis

Module Team:

This module will be delivered by:

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Introduction

The transformation and storage of data often use coding techniques in order to adapt data to the properties, limitations and defects of transmission channels or storage technologies. The coding itself incorporates functional transformation operations designed primarily to reveal specific properties that will be exploited during coding. One application of these general principles is to compression systems, notably to compression with loss, used mostly for audio-visual data or for cases in which data loss is likely.

This module will introduce the student to the Mathematical concepts which underpin these applications.

Lectures/Tutorials

You will attend one large lecture (all groups together); one two hour lecture/tutorial/workshop (in groups of 20); and one Lab session (in groups of 40).

During the **first two weeks** of the semester all of the sessions (except the large lecture) will be held in Computer Labs. During these two weeks you will be introduced to the software package Maple. If you wish to have a copy of Maple on your laptop/computer then you can borrow a disk from E5, the Resources Centre.

The large lecture is scheduled at 9:00 on Monday and will take place in the Red Lecture Theatre (except for week 3 when it will be in the Green Lecture Theatre). These lectures will take place **every week** and it is during this slot that tests will take place. For the remaining sessions you will be split into smaller groups.

The times and locations for weeks 1 to 2 are as follows:

	Session 1			Session 2		
Group 1	Thursday	4:00-6:00	in KC018	Friday	12:00-1:00	in KC018
Group 2	Monday	4:00-6:00	in KC018	Friday	11:00-12:00	in KC018
Group 3	Tuesday	11:00-1:00	in KC018	Friday	12:00-1:00	in KC018
Group 4	Monday	4:00-6:00	in KC018	Friday	11:00-12:00	in KC018

The times and locations for weeks 3 to 11 are as follows:

	Session			Lecturer
Group 1	Thursday	4:00-6:00	in C346	Pat Lewis
	Friday	12:00-1:00	in KC018	Pat Lewis
Group 2	Monday	4:00-6:00	in C321	Brian Burrows
	Friday	11:00-12:00	in KC018	Martin Paisley
Group 3	Tuesday	11:00-1:00	in C324	Pat Lewis
	Friday	12:00-1:00	in KC018	Pat Lewis
Group 4	Monday	4:00-6:00	in C324	Martin Paisley
	Friday	11:00-12:00	in KC018	Martin Paisley

In Week 12 your only class will be the session where the final test takes place.

Prerequisites:

A knowledge of basic Mathematical techniques equivalent to CE60015-1 Mathematical Foundations for Engineers or similar.

Syllabus

- Introduction to Maple
- Fourier Series
- Fourier Transforms
- Coding

You will be provided with handouts for each topic. They will contain basic material with exercises. The examples that will be worked through during the lectures can be found in the handouts. It is important to keep up to date with the material and work through the exercises. Mathematics is not a spectator sport - you will only learn by trying the exercises and asking for help if you have difficulties.

Attendance

Students are expected to attend all scheduled classes, be they lectures, tutorials or laboratory sessions. Please note that under the regulations of the University you may be withdrawn from your module if you miss more than 4 consecutive sessions as detailed in Section 1.3 of the Undergraduate Modular Framework (http://www.staffs.ac.uk/images/ugrad_mod_fram_tcm68-12695.pdf). Staff will ensure that attendance is monitored in the module.

Textbooks

Modern Engineering Mathematics, G. James, Prentice Hall, 2008,
ISBN: 9780132391443

Advanced Modern Engineering Mathematics, G. James, Prentice Hall, 2004,
ISBN: 0130454257

Engineering Mathematics, K.A. Stroud & Dexter J. Booth, Palgrave, 2001,
ISBN: 0333919394

Mathematics in Communication Theory, R.H. Jones & N.C. Steele, Ellis Horwood, 1989, ISBN: 0745803040

Data & Computer Communications 6th Edition, William Stallings Prentice Hall, 2000, ISBN: 0130863882

Digital Image Processing, R.C. Gonzalez & R.E. Woods, Addison Wesley, 2002,
ISBN: 0130946508

Getting started with MAPLE, C. K. Cheung & G. E. Keough, Michael May Wiley, 2003, ISBN: 047147013-9

MAPLE by example, M. L. Abell & J. P. Braselton, Elsevier, 2005,
ISBN: 0120885263

These books are not essential for the course, but should be referred to for additional and broadening study.

Materials required

A scientific calculator is necessary for this module. You will also require access to Maple.

Assessment

Assessment is comprised of coursework and tests. There will be three tests, which have a total weighting of 50%. These tests will be on the topics of Fourier Series; Fourier Transforms and Coding. They will last for 40 minutes and take place in the large lecture session. You will be provided with a Formula Book.

The assignment will comprise three Maple worksheets on each of the same topics. The dates of assessments are

Topic	Test Date	Hand-in Date
Fourier Series	Monday 12th October, 9:00, RLT	Monday 19th October
Fourier Transforms	Monday 2nd November, 9:00, RLT	Monday 9th November
Coding	Monday 23rd November, 9:00, RLT	Thursday 26th November

If you miss a test/examination/assignment deadline for **any** reason please contact the module leader as soon as possible.

To pass the module you must obtain an overall mark of 40% or above. In addition you must also achieve a minimum mark of 30% for the combined class tests marks and a minimum of 30% for the combined assignment marks.

Plagiarism

The University takes plagiarism very seriously. Although we would not wish to discourage you from talking to other students about the MAPLE assignments, it is essential that the final submission is your own work. Contravention of this advice may lead to disciplinary action being taken. Any student may be required to undertake a viva (interview) to confirm their understanding of work submitted for assessment.

Provisional timetable

This schedule is provisional and is subject to change.

Weeks 1 and 2

	Lecture	Session 1	Session 2	Session 3
Week 1	Introduction to the module	Introduction to Maple	Introduction to Maple	Integration revision
Week 2	Integration by parts	Step Functions	Matrices	Programming in Maple

Weeks 3 to 12

Week 3	Fourier Series	Introduction
Week 4		Odd and Even Functions
Week 5		Exponential Form
Week 6		Class Test 1
	Fourier Transforms	Introduction
Week 7		Properties
Week 8		Transforms of Generalised Functions
Week 9		Class Test 2
	Coding Techniques	Discrete Fourier Transforms
Week 10		Fast Fourier Transforms
Week 11		Huffman Coding
Week 12		Class Test 3

Further Information

Further information about this module is available on Blackboard <http://blackboard.staffs.ac.uk>. You login to Blackboard using your university username and password. You can also access information from staff websites:

Prof. Burrows	http://www.fcet.staffs.ac.uk/blb1
Dr Lewis	http://www.fcet.staffs.ac.uk/pal2
Dr Paisley	http://www.fcet.staffs.ac.uk/mfp1