

# Welcome to SMSTC!

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# What is SMSTC?

**SMSTC** is the Scottish Mathematical Sciences Training Centre.

We provide graduate mathematics courses to all of Scotland.

## Where is SMSTC?

SMSTC is everywhere (in Scotland) and nowhere (no physical centre).

There are eight member departments...



... basically everywhere in Scotland you can get a maths PhD.

## Why do we exist?

Compared to other developed nations, UK higher education in mathematics has traditionally been. . .

- **short**: typically 3 years undergrad + 1 year masters + 3 years PhD, which is shorter than most of the rest of Europe
- **narrow**: e.g. in the USA, you'd probably spend your first year or two of graduate school taking courses.

The 2004 International Review of UK mathematics concluded that British PhD graduates were often strong in their narrow field, but lacked breadth.

As a result:

- The standard PhD programme was **lengthened** to 3.5 years. . .
- . . . with the first 0.5 years to be spent on **broadening** training.

This training is provided by six 'taught course centres' across the UK.

SMSTC is Scotland's taught course centre.

# Who are we?

We are you!

SMSTC is a cooperative project, not an external body. It consists of:

**Students:** mostly 1st year maths PhD, but also higher years, other subjects, other universities, postdocs, staff, . . .

**Lecturers:** 40–50 per year, drawn from all eight universities

**Administrator:** Johanna McBryde

**Deputy Director and Student Liaison Officer:** David Pritchard (Strathclyde)

**Director:** Tom Leinster (Edinburgh)

**Student representative** at each university—**volunteers needed!**

**Technical staff** at all universities

**Website developer**

**Postgraduate directors of studies** at all universities

**Tutors** at all universities

**External advisers** from outside Scotland

**Student representative** on the SMSTC committee—**volunteer needed!**

.....

# What courses do we offer?

We run **core modules** and **supplementary modules**.

## Core modules:

- run every year
- are aimed at first-year PhD students
- consist of two-hour lectures once a week for ten weeks
- have graded assignments.

## Supplementary modules:

- appear and disappear from year to year: an ever-changing selection
- are *often* more advanced and taken by higher-year PhD students
- are however long the lecturer feels like
- usually don't have graded assignments.

If you want a supplementary module to count towards your department's training requirements, talk to your supervisor or postgraduate coordinator.

## First semester modules

All this information is on the SMSTC website, under the [Timetable](#) tab.

### Core modules:

- Algebraic topology
- Asymptotic and analytical methods
- Continuum mechanics
- Dynamical systems and conservation laws
- Foundations of probability
- Groups, rings and modules
- Measure and integration
- Regression and simulation methods

### Supplementary modules (this year's selection):

- Advanced PDE 1
- Analysis and numerics of stochastic PDEs
- Stochastic integration
- The mod 2 Steenrod algebra in theory and in practice

## Second semester modules

All this information is on the SMSTC website, under the [Timetable](#) tab.

### Core modules:

- Algebras and representation theory
- Elliptic and parabolic PDEs
- Functional analysis
- Manifolds
- Mathematical biology and physiology
- Modern regression and Bayesian methods
- Numerical methods
- Stochastic processes

### Supplementary modules (this year's selection):

- Advanced PDE 2 (to be confirmed)
- Analysis of diffusion processes (to be confirmed)
- Homogenisation I: multiscale modelling and analysis of physical and biological processes
- Homogenisation II: stochastic problems
- What is numerical analysis?



# Streams

You can take any combination of modules you want, as long as:

- you have the prerequisites: see the Prospectus (under the Timetable tab)
- your department agrees.

But for administrative convenience, we organize the core modules into eight pairs, called **streams**:

- Algebra
- Applied analysis and PDEs
- Applied mathematics methods
- Geometry and topology
- Mathematical models
- Probability
- Pure analysis
- Statistics

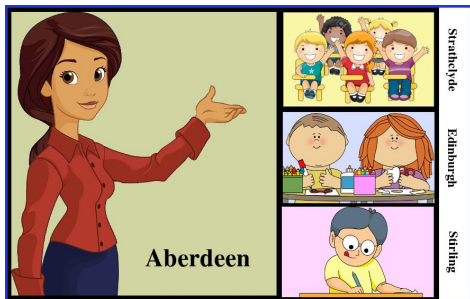
**Example:** The Algebra stream consists of two modules:

- \* *Groups, rings and modules* (first semester)
- \* *Algebras and representation theory* (second semester).

# How do lectures work?

Lectures are delivered by videoconference.

**Example:** If you're in Dundee and the lecturer is in Aberdeen, you see this:



Screen 1

### The definition

A metric space  $X$  is **positive definite** if for every finite  $A \subseteq X$ , the matrix  $Z_A$  is positive definite.

E.g.:  $\mathbb{R}^n$  with the Euclidean or taxicab metric, hyperbolic space, any ultrametric space.

**Theorem (Meckes)**

*All sensible ways of extending the definition of magnitude from finite metric spaces to compact positive definite spaces are equivalent.*

E.g.: For a compact positive definite space  $A$ , we can define

$$|A| = \sup\{|B| : \text{finite } B \subseteq A\}.$$

Or equivalently, we can choose a sequence  $(B_n)$  of finite subsets with  $B_n \rightarrow A$  in the Hausdorff metric, then define  $|A| = \lim_{n \rightarrow \infty} |B_n|$ .

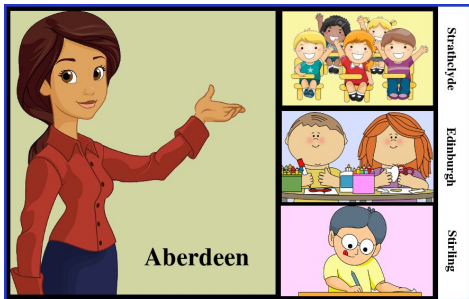
The definition can also be expressed directly, without using finite approximations.

Screen 2

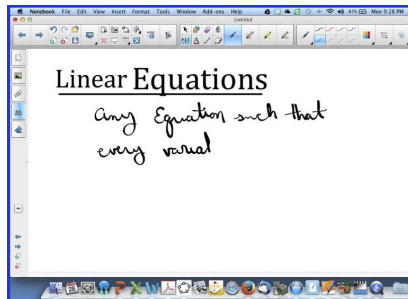
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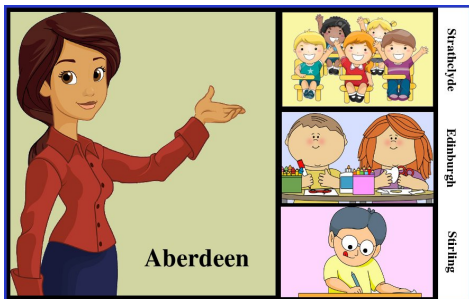


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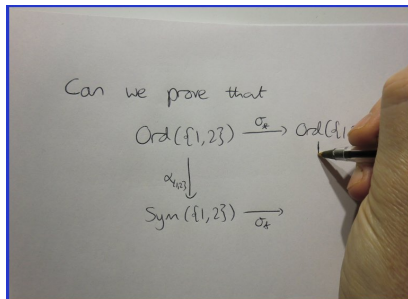
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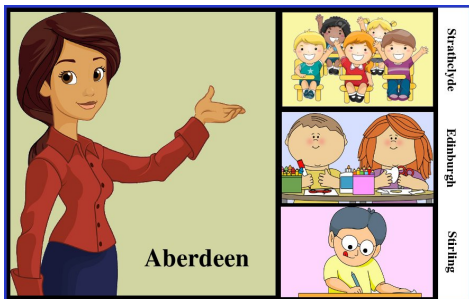


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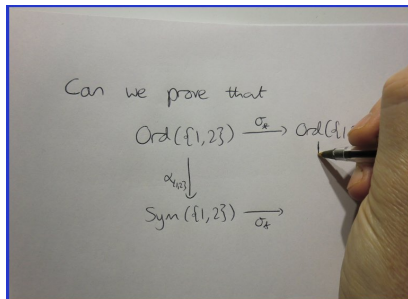
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Screen 1



Screen 2

It's interactive: you can ask questions etc. But usually keep microphone off.

## What happens outside lectures?

**Material on the website:** The website ([www.smstc.ac.uk](http://www.smstc.ac.uk)) is crucial!

Study the notes, do the exercises, follow up on suggested texts, etc. Some modules are 'flipped': you're expected to read in advance.

**Local tutorial support:** Each department provides support for its own students.

It could be a scheduled class, or office hours, or a 'drop in any time' arrangement.

Your postgraduate director of studies (PG tutor, PG coordinator, head of graduate school) will tell you what the arrangements are in your department.

**Assessment:** Each core module is assessed in either one or two assignments.

You get written feedback, a grade for each assignment, and an overall grade for the module. All this is visible to your supervisor.

As ever: if you don't do the exercises and assignments, you probably won't get much out of the course.

## How many modules should I do?

If you're EPSRC-funded, the amount of training that EPSRC demands is equivalent to five or six modules.

If you're not EPSRC-funded, your department will probably require a similar amount anyway.

Your postgraduate director of studies decides what's required (not us).

### Example scenarios:

- Student A takes six core modules.
- Student B has already done a lot of high-level courses in her Master's degree, so only takes three modules: two core, one supplementary.
- Student C takes four core modules, but wants to learn some other subjects that SMSTC doesn't offer, so also takes an undergraduate course and a reading course.

## How much time does all this take?

Typically, about **75% of your time for the first six months of your PhD** is intended to be spent on training.

**Make sure your supervisor doesn't overload you with other work.**

**Warning:** You are likely to have clusters of assignment deadlines around the middle and end of semesters.

**Plan ahead for this!**



## What doesn't SMSTC do?

SMSTC doesn't make you do anything.

Your department might, your supervisor might, your funder might. . .  
. . . but we are merely a provider of courses.

SMSTC doesn't provide tutorials.

These are the responsibility of your department.

Lectures are done centrally by videoconference—organized by SMSTC.

Tutorials are done locally in person—organized by your department.

If you're not being offered tutorial support, complain!

# Who can I ask stuff?

**Local tutors:** e.g. specific mathematical points

**Lecturer:** e.g. points that your tutor can't answer

**Stream leader:** e.g. questions about the module as a whole

**Postgraduate director of studies and supervisor:** e.g. questions about your training

**Johanna McBryde (SMSTC administrator):** purely administrative questions

**David Pritchard (student liaison officer):** academic questions about SMSTC as a whole

**Me, now:** ...?

## Why oh why?

We have a **feedback exercise** every spring to get detailed feedback from you on every module.

**This is extremely useful** for future years of students.

But you don't have to wait for spring!

Feedback is welcome at all moments. Options:

- Speak directly to the lecturer or stream leader.
- Talk to your student representative, who will pass it on to us.
- Talk to the student liaison officer, David Pritchard.
- Contact me.

# What now?

Here's what happens over the next couple of days:

- An overview of each stream, including content, prerequisites and assessment, and giving you...
- ... help to make up (or change) your mind on which modules to take
- ... an opportunity to broaden your knowledge, even if you've already made your choices
- Presentations on essential skills for PhD students
- Meeting students and staff from universities across Scotland
- Meeting former SMSTC students, with question and answer sessions
- ~~Some fun~~ Networking and team-building: curling and dinner.