

Welcome to SMSTC!

Tom Leinster
SMSTC Director

Maxwell Institute for Mathematical Sciences
University of Edinburgh

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 community 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) until 31 Dec, David from 1 Jan

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
- Diffusion processes
- Homogenisation I: multiscale modelling and analysis of physical and biological processes

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):

- Central simple algebras and Galois cohomology
- Probabilistic representation for linear and nonlinear PDEs
- Variational methods for PDEs
- Spectral theory and differential operators (to be confirmed)

Themes

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 convenience, we organize the core modules into four themes:

Analysis

Applications of
Mathematics

Probability and
Statistics

Structure and
Symmetry

Themes

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Analysis

Theme Head: Heiko Gimperlein (Heriot-Watt)



Core modules:

- Dynamical systems and conservation laws (Semester 1)
- Measure and integration (Sem 1)
- Elliptic and parabolic PDEs (Sem 2)
- Functional analysis (Sem 2)

Themes

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Applications of Mathematics

Theme Head: Mark Chaplain (St Andrews)



Core modules:

- Asymptotic and analytical methods (Semester 1)
- Continuum mechanics (Sem 1)
- Numerical methods (Sem 2)
- Mathematical biology and physiology (Sem 2)

Themes

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- your department agrees.

But for convenience, we organize the core modules into four themes:

Probability and Statistics

Theme Head: Fraser Daly (Heriot-Watt)



Core modules:

- Foundations of probability (Semester 1)
- Regression and simulation methods (Sem 1)
- Stochastic processes (Sem 2)
- Modern regression and Bayesian methods (Sem 2)

Themes

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Structure and Symmetry

Theme Head: Vanya Cheltsov (Edinburgh)



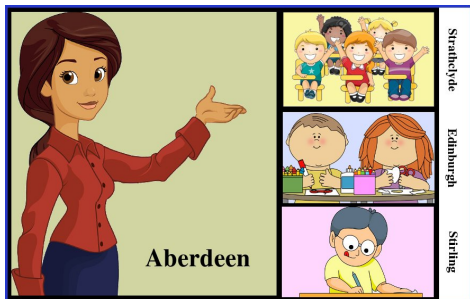
Core modules:

- Groups, rings and modules (Semester 1)
- Algebraic topology (Sem 1)
- Algebras and representation theory (Sem 2)
- Manifolds (Sem 2)

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 $|A| = \lim_{n \rightarrow \infty} |B_n|$.

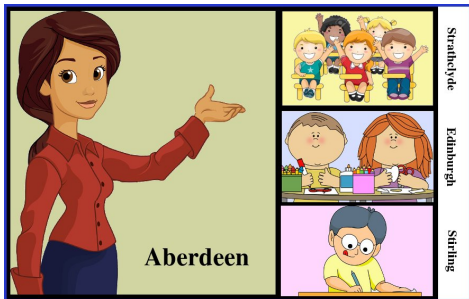
The definition can also be expressed directly, without using finite approximations.

Screen 2

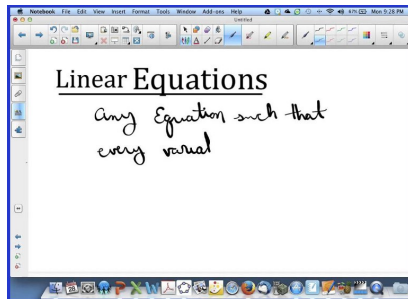
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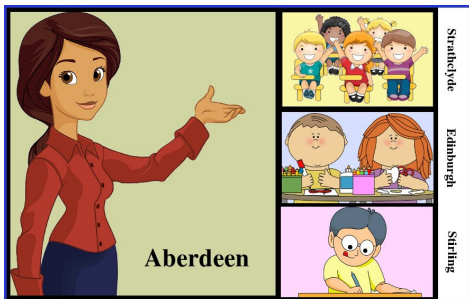


Screen 2

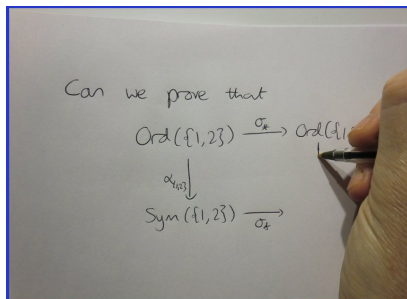
How do lectures work?

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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) 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 force you to do anything.

Your department might, your supervisor might, your funder might. . .
. . . but we merely provide 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 to your department!*

Who can I ask stuff?

Local tutors: e.g. specific mathematical points

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

Theme Head: e.g. feedback on course provision

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

Johanna McBryde (SMSTC administrator): purely administrative questions

David Pritchard (student liaison officer; director from 1 Jan 2019): 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 theme head.
- 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 theme, 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 a former SMSTC student, with question and answer sessions
- ~~Some fun~~ Networking and team-building: curling and dinner.