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MA30044/MA40044/MA50181: Mathematical Methods I
Information Sheet

The course will be taught by **Dr. Philippe Trinh**.

Schedule of Classes

There will be three classes per week.

Lecture:	Tuesday	16:15h	in 3E 2.1
Lecture:	Thursday	11:15h	in CB 2.6
Problems class:	Friday	9:15h	in CB 2.6

The problems class will be replaced by a lecture in week 1. For MA50181 students there will be an additional lecture on *Asymptotic Methods*, which **starts in week 2** and will **not take place in week 5**:

Lecture (**MA50181 only**): Thursday (weeks 2-4 and 6-11) 11:15h in 3W 3.7

Some or all lectures might be recorded, please get in touch if you have any issues with this.

Content of lectures

This course will introduce you to a number of useful advanced mathematical methods that can be applied to the solution of linear systems and partial differential equations. Although we will prove key theorems, the focus will be on introducing you to a number of practical techniques and their applications, rather than mathematical rigour. Topics covered are:

Sturm Liouville Theory Definition of and reduction to Sturm-Liouville systems, Self-adjoint operators, eigenfunction, othogonality and orthonormal expansions, approximation of functions, Legendre polynomials, inhomogeneous equations and the Fredholm alternative, solution of PDEs, applications in electrostatics

The Fourier Transform Definition of the Fourier transform, elementary properties (shift theorems, derivative theorems, distributions and the Dirac δ-function, the convolution theorem, solution of second order equations, Plancherel's theorem, solving PDEs

Quasilinear first order PDEs Classification of PDEs, data curves and contour lines, the method of characteristics, envelopes and domains of influence, Burgers' equation

Second order hyperbolic PDEs Classification of second order PDEs (elliptic, parabolic, hyperbolic), characteristics and changes of variables, d'Alemberts' solution of the wave equation

Assessment scheme

The course will be assessed by an exam at the end of the semester. The format of the exam will be the same as in the last years; you can find past exams on the library webpage. **All material covered in the lectures and applied on the problem sheets is examinable, unless explicitly marked otherwise.**

MA30044 students: The exams counts as 100% of the final mark.

MA40044 students: There will be an **additional** piece of **coursework**, set by physics[1], in week 8 and due in the revision week. The final mark consists of the exam (80%) and the coursework (20%).

MA50181 students: There will be an **additional** 40-minute written **class test** on asymptotic methods in the revision week. The final mark consists of the exam (75%) and the class test (25%). The exact date, time and location for this test is:

Class test (**MA50181 only**): Thursday 13th Jan 2022 (to be confirmed) TBD in TBD

Problem sheets

IMPORTANT. Each week some **problem sheets** will be set. Their solutions will be made available and discussed in the weekly problems class (which starts in week 2 and is replaced by a lecture in week 1). Doing the exercises is an **essential** part of the course. More important than finding the correct solution is that you have a go at the problems yourself. Even though they are not part of the assessed coursework, doing the problem sheets is an efficient way of preparing for the formal assessment at the end of the course.

Problem sheets can be submitted via scans on the Moodle course page for feedback. In order to obtain feedback, your problem set should be accompanied by a cover page.

Schedule for problem sheets ($n = 1, 2, \ldots, 10$):

Tue week n:	problem sheet (PS) n is handed out and available on moodle
Tue week $n+1$ at 12:00h:	PS n due (pigeon hole, 4West level 1)
Fri week $n+1$ at 9:15h:	PS n discussed in problem class
Fri week $n+1$:	marked PS n returned to pigeon holes

Resources

The `Moodle` page for the course is

`https://moodle.bath.ac.uk/course/view.php?id=29834`

referred to throughout the course as the `homepage`. It will contain lecture notes, problem sheets and solutions. You should automatically be enrolled. If not, please contact me.

References

The lecture notes aim to be self-contained and should provide you with all material for the course. There is a plethora of books on topic in engineering mathematics and mathematical methods for physicists available in the library.

I sincerely hope you will enjoy the course. If you have any problems please do not hesitate to see me at the end of a lecture or email me.

[1] The coursework for MA40044 students will be set and overseen by Dr. Simon Crampin (`s.crampin@bath.ac.uk`), please direct any queries regarding the coursework directly to him.