MSM203a Polynomials and Rings

Dr. Richard Kaye

Autumn term, 2013

Lectures Tuesdays 3:00-3:50 in Watson LRA and Fridays 14:00-14:50 in Arts LR6.

Examples classes These are currently officially scheduled for Tuesdays 17:00-17:50 in Physics West Lecture Theatre (117) on EVEN weeks of term, starting in the second week of term. (I shall count the weeks 1,2,3,...,11. So classes are weeks 2,4,6,8,10. If you prefer to start counting at 6 then classes are in weeks 7,9,11,13,15.) Note: I am aware that a substantial number of students now have a clash with MSM201 at this time. We are investigating what if anything we can do about this and will make an announcement in due course.

Assessment deadlines All students will have fortnightly work to hand in by 14:00 on Fridays of weeks 2,4,6,8,10 in the white box or directly to me at the very beginning of the 2pm lecture. Third year students will have a single additional piece to hand in, in the last week of term.

Office hours Tuesdays 10:00 to 10:50, Thursdays 13:00-13:30, in room 308. I will be available at these times to help individual queries, etc.

Email R.W.Kaye@bham.ac.uk

Web http://web.mat.bham.ac.uk/R.W.Kaye/teaching/modules/msm203a/

Canvas I do not plan to use this much at all. I find that making material available online can encourage some students to skip lectures. *Do not skip lectures—these will be your main source of information for the course and are essential.*

Total workload There are 27 hours of lectures and classes. This half of the module is expected to contain about 100 hours work. That means you are also expected to find your own time to study your notes during term time as well as the revision at Easter. This includes reading through exercise notes and attempting exercises, but doing just this will not be enough. At a *minimum* there will be one hour extra for each lecture and each exercise class. Most students should do more than the minimum.

Assessment for second year students The (full) module MSM203 is assessed both continuously and by a final examination covering work from both terms. In the Autumn term there will be 5 examples classes each with its own exercise sheet. They will all be marked. Of these, the marks from the best 4 of the 5 exercises contribute as continuous assessment. However, the main reason for the exercise classes is not to give you marks but to

allow you to test your knowledge and understanding as we go along. Note that all exercise classes are 'open book' and so I cannot ask 'bookwork questions' such as 'give the definition of an X'. Such bookwork questions will be a major part of the exam and you must prepare for them.

Assessment for third year students These lectures and course materials are available to third year students under the code MSM3P04. (For simplicity I will continue to use "MSM203".) Assessment arrangements for third years are slightly different.

Third year students will be expected to attend the same exercise classes and attempt the same exercises as second year students. This will provide the formative assessment and feedback for the course. This is a requirement: if you do not do the exercises you fail. (Good reasons such as illness etc. will be accepted.) However, the continuous assessment is based on a single work-sheet containing a mixture of exercises and opportunities for a small amount of open-ended research. When this is marked your performance in exercise classes will be reviewed and may also taken into consideration. The mark scheme and manner in which your work will be marked will be made clear. You also have an exam, which will be similar to but possibly not quite the same as the exam the second years sit.

Topics to be covered this term

1. **Introduction:** properties of $\mathbb{Z}$, $\mathbb{Q}$, $\mathbb{R}$, $\mathbb{C}$, etc. The axiomatic method. Axioms for ring and fields. Consequences. Examples. The ring of polynomials $R[X]$.
2. **Quotients, ideals and homomorphisms:** Recap on equivalence relations. Homomorphisms of Rings. Ideals. Quotient rings. Isomorphism theorems. Examples.
3. **Integral domains and fields:** Zero divisors. Integral domains. Characteristic. Examples. Units and fields. Maximal and prime ideals. The field of fractions over an integral domain.
4. **Polynomials:** Degree. Division algorithm and remainder theorem. Roots. Irreducibility. Examples. Finite fields.

Textbook I will not insist you buy a textbook, and expect you will be able to get very good notes by attending lectures. Two or three books are available in bookhops with titles such as 'Integers, Polynomials, and Rings: A Course in Algebra' by Ronald S. Irving. I have not read these and cannot make a definite recommendation, but this one looks reasonable from the contents and blurb and, like all books, if you buy it and read it carefully I am sure you will learn a lot from it. (But if you buy it and never look at it it is a waste of money!) Internet articles may help too, though not everything one he internet is correct, and much of it may not be at the right level for you.

Printed notes Some printed handouts will be provided summarising the module. The printed handouts are not a complete write-up of everything you need for the module, nor are they a substitute for lectures, but the should be a very good guide for revision.