School of Mathematics

Module MA1S11 — Mathematics for Scientists (first semester) 2011-12
(JF Mathematics as a whole subject within the Science Moderatorships. JF Human Genetics. JF Computational Chemistry. JF Medicinal Chemistry. JF Physics & Chemistry of Advanced Materials.)

Lecturer: Prof. Stefan Sint, Prof. Richard Timoney

Requirements/prerequisites: none.

Duration: Michaelmas term, 11 weeks

Number of lectures per week: This is the first semester module of a two semester seqeuence but can be taken on its own. It leads on to module MA1S12 in the second semester. (MA1S11 and MA1S12 each have 10 ECTS credits. There will be separate results for MA1S11 and MA1S12, weighted as 10 credits each, and compensation rules will apply according to the degree programme.) For the first semester, there will be 6 lectures and 2 tutorials.

Assessment: Assignments and tutorial work will count for 20% of the marks, There will be final examination in April counting for the remaining 80%.

ECTS credits: 10

End-of-year Examination: Three hour exam.

Description:

Calculus with applications for Scientists

The lecturer for this part will be Prof. Sint. The main textbook will be [Anton] and the syllabus will be approximately 7 Chapters of [Anton] (numbered differently depending on the version and edition)

Chapter headings are

- Before Calculus (9th ed) {was 'Functions' in the 8th edition};
- Limits and Continuity;
- The Derivative;
- The Derivative in Graphing and Applications;
- Integration;
- Exponential, Logarithmic and Inverse Trigonometric Functions;

Discrete Mathematics for Scientists

The lecturer for this part will be Prof. Timoney. See `http://www.maths.tcd.ie/~richardt/MA1S11` for additional information about this part.

The order of the topics listed is not necessarily chronological. Some of the topics listed below linear algebra will be interspersed with linear algebra.

- *Linear algebra* This reference for this part of the course will be [AntonRorres]. The syllabus will be approximately chapters 1, 3 and parts of 10 from [AntonRorres].
  - Vectors, geometric, norm, vector addition, dot product
  - Systems of linear equations and Gauss-Jordan elimination;
  - Matrices, inverses, diagonal, triangular, symmetric, trace;
  - selected application in different branches of science.
- Computer algebra.

  We will make use of the online resource `http://www.wolframalpha.com` for some assignments.

  It is a mixture of a mathematical search engine and a computer algebra system. It is less rigid in terms of requiring precisely formulated input than computer algebra systems (like **Mathematica** upon which it is based) but the downside is that it may not provide exactly the information you would want.

  Uses for calculus, graphing, matrix calculations. Exercises could include applications of ideas from calculus (graphing, Newton's method, numerical integration via trapezoidal rule and Simpsons rule).
- *Spreadsheets.* A brief overview of what spreadsheets do. Assignments based on Google docs.
- *Numbers.* Binary, octal and hexadecimal numbers and algorithms for converting between them.

Essential References

[**Anton**] Combined edition :
Calculus : late transcendentals : Howard Anton, Irl Bivens, Stephen Davis. Combined 9th ed; Publisher New York : Wiley, c2010). [Hamilton 515 P23*8;2]
or
Calculus : single variable / Howard A. Anton, Irl Bivens, Stephen Davis. 9th ed. 2009 [Hamilton 515 P2*8;4, S-LEN 515 P2*8]

[**AntonRorres**] Howard Anton & Chris Rorres, Elementary Linear Algebra with supplementary applications. International Student Version (10th edition). Publisher Wiley, c2011. [Hamilton 512.5 L32*9;-5, S-LEN 512.5 L32*9;6-15]

Recommended reference

[**Thomas**] Thomas' calculus. Author Weir, Maurice D. Edition 11th ed / based on the original work by George B. Thomas, Jr., as revised by Maurice D. Weir, Joel Hass, Frank R. Giordano Publisher Boston, Mass., London : Pearson/Addison Wesley, c2005. [Hamilton 515.1 K82*10;*]

September 26, 2011