Course information
Course outlines, handouts and tutorials will be available on the course page on www.moodle.rhul.ac.uk.
In addition to Moodle, to help with student learning, the department has purchased online learning materials offered by the publishers of the main textbooks (one for mathematical economics and one for statistics). The materials include electronic textbooks, electronic learning exercises with feedback and online tests. It is expected that students spend a few hours each week on these platforms to gain a stronger understanding of the course contents. Details on how to access these materials will be provided at the beginning of term.

Aims
EC1102 is a mandatory course in quantitative methods for economics. It covers basic mathematical, quantitative, computing and statistical tools for the study of economics. The emphasis is on economic applications.

Learning Outcomes
Specific learning outcomes and prescribed reading are provided for each week of the course. Upon completion of the year-long course students should:

- Have a full grasp of mathematical/statistical topics and techniques such as algebraic manipulation, functions, simultaneous equations, optimization, descriptive statistics, probability theory, regressions.
- Be able to apply mathematical and statistical techniques to economic problems.

Course calendar:
- Mathematical economics (Autumn Weeks 2-12)
- Statistics (Spring – Weeks 2-11)

Course Delivery
The course will be delivered through
- three one-hour lectures each week
- a one-hour seminar each week.
- In the spring term, there is an additional hour of computer classes during which students will learn to use the quantitative elements of EXCEL and the statistical package STATA which will be used throughout the degree.
Feedback to students

Students can test their knowledge in several ways throughout the course:

- **Worksheets** which will be handed out for each topic. The worksheets, though not compulsory, form the basis for the seminars. Worksheets will be collected in and a serious attempt at the week's work will be noted. They will, however, not be graded.

- The seminars are conducted in smaller groups than the lectures to enable students to interact more actively and test their knowledge through **course participation**.

- Additional feedback will be given in the form of **formative assessments**. Details will be given in the first lecture of each term.

- Students will be asked to take part in a weekly **Online Assessment** in both terms. Details about the quiz will be given in the first lecture. These quizzes will be part of the (marked) course assessment.

- **Tutorials** – The Department operates a Tutorial program to support your learning in this course, extra classes (led by Postgraduate students) will take place where students can ask questions relating to the previous week's seminars and related lecture material. It is available on a sign-up basis. Participation is not obligatory, but it is expected that students struggling with the course will attend. See the relevant notice board in the Horton Building for details and a sign-up sheet, or ask in Department Office.

- Further feedback will be given in the form of **marked assessments**. Please find details below.

- Lecturers and seminar leaders are available for consultation (either by you individually, or in small groups) during advertised **office hours** or by appointment.

Assessment

**Summative**

*Autumn term (Maths, KR)*

- **4 Online Assessments** that count 5% each to the final course grade. They will take place at these points in time:
  - End of 3rd week
  - End of 5th week
  - End of 8th week
  - End of 10th week
  
  Quiz runs for 2 days from Friday morning (00:00) to Saturday night (24:00).

- **A mid-term exam** that counts for 10% and takes place TBA

*Spring term (Stats, AC)*

- **4 Online Assessments** that count 5% each to the final course grade. They will take place at these points in time:
  - End of 3rd week
  - End of 5th week
  - End of 8th week
  - End of 10th week
  
  Quiz runs for 2 days from Friday morning (00:00) to Saturday night (24:00).

- **A mid-term exam** that counts for 10% and takes place TBA

All of these assessments take place during the course and will cover all course contents that have been covered up to the point of the piece of assessment.
- **2-hour unseen examination** (40% of final mark) is taken during the Exam term (April-May). The exam will test your knowledge and understanding of the material covered in the entire course, your ability to apply the techniques you have learned and your ability to apply the methods to situations commonly encountered in economics.

**Formative**

- Students are also very strongly encouraged to make use of the weekly worksheets and the exercises at the end of each section of the book. Students are responsible for solving worksheets in preparation of weekly seminars.
- Assessed and non-assessed Online Assessments will be organized regularly to assess your understanding of the current material. **Students are expected to solve all assessments.** Students failing the assessments will be advised to attend additional tutorials.

**A Note on Calculators**

For parts of the course you may wish to use a calculator. This **must be** the Casio fx-83GT PLUS model specified by the department and this is also **the only permitted for use in Economics exams**, where the use of a calculator is permitted.

**A Note on Stata**

Stata IC is available in all the PC labs on campus. Students can purchase their own copy of Stata, at a reduced price under the GradPlan scheme, directly from Timberlake. Email info@timberlake.co.uk for information on how to order. See option 3 on this page for current pricing: [http://www.timberlake.co.uk/Stata/?id=372](http://www.timberlake.co.uk/Stata/?id=372)

**Readings**

An **electronic version of a bespoke textbook covering both the mathematics and statistics part and the online learning materials produced by the publishers will be provided free of charge to every student on the course.** Details of how to access this will be provided at the beginning of the course.

Students may obtain their own personal copy of the source texts (the bespoke combined textbook is only available in E-book format).

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<td>Recommended further reading</td>
<td>On occasion students may wish to consult other books. The library has a wide variety of appropriate texts. Single</td>
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and multiple copies of these can be found under the 330.0151 class-mark upstairs in the Bedford Library.

Syllabus

I. Mathematical Economics (autumn, week 2-12)

Tentative lecture plan (SHS: Sydsaeter, Hammond and Strom, 2012):

Week 2: Introductory topics (SHS, ch. 1-3)
1. Basic algebra
2. Manipulating and solving equations
3. Basic mathematical notation and logic

Week 3: Functions of one variable (SHS, ch. 4-5)
1. Linear and quadratic functions
2. Polynomials
3. Exponential and logarithmic functions
4. Manipulating functions
5. Inverse functions
6. Distance in the plane

Week 4: Differentiation (SHS ch. 6)
1. Tangents and derivatives
2. Decreasing and increasing functions
3. Rules of differentiation
4. Chain rule
5. Higher order derivatives

Week 5: Differentiation (SHS, ch. 7)
1. Implicit differentiation
2. Taylor's Formula
3. Intermediate Value Theorem
4. L'Hopital's rule

Week 6: Single-variable optimization (SHS, ch. 8)
1. Extreme points
2. The Extreme Value Theorem
3. Local extreme points

Week 7: Reading week (revise SHS, ch. 1-8)

Week 8: Integration (SHS, ch. 9-10)
1. Indefinite integrals
2. Area and definite integrals
3. Integration by parts
4. Integration by substitution

Week 9: Integration (SHS, ch. 9-10)
1. Continuous compounding
2. Present value
3. Geometric series  
4. Total present value  
5. Internal rate of return

Week 10: Functions of many variables (SHS, ch. 11-12)  
1. Geometric representation  
2. Partial derivatives  
3. Partial elasticities  
4. Rules of differentiation  
5. Elasticity of substitution  
6. Homogenous and homothetic functions

Week 11: Multivariable optimization (SHS, ch. 13)  
1. Two variables: Necessary and sufficient conditions  
2. Local extreme points  
3. The Extreme Value Theorem  
4. Comparative Statics and the Envelope Theorem

Week 12: Constrained optimization (SHS, ch. 14)  
1. The Lagrange Multiplier Method  
2. Interpreting the Lagrange Multiplier  
3. Multiple inequality constraints  
4. Nonnegativity constraints

II. Statistics (Spring week 2-11)

Descriptive statistics (B, ch.1)  
1. Variables, Data sources  
2. Histograms  
3. Distribution moments: mode, median and mean  
4. Symmetrical and skewed distributions  
5. Measures of spread: range, interquartile range, variance, standard deviation  
6. Indices

Probability (B, ch.2)  
1. Definition of probability  
2. Simple events, Compound events and related formulae  
3. Conditional probability and Bayes Theorem  
4. Independence

Random variables (B, ch. 3)  
1. Discrete random variables: probability distributions, mean and variance, expectation  
2. Binomial distribution  
3. Continuous random variables: probability density function, standard normal distribution, general normal distribution  
4. Expectation of functions.

Interval & point estimation (B, ch.4)
1. Estimation, sampling distribution
2. Confidence intervals
3. Small samples: t-distribution

Hypothesis testing (B, ch. 5-6)
1. Using confidence intervals: null hypothesis
2. One-sided tests: alternative hypothesis, p-value
3. Type I and type II errors
4. Two-sided tests

Correlation and Simple regression (B, ch. 7)
1. Ordinary least squares
2. Experimental design
3. Regression: assumptions and consequences, confidence intervals,
4. Prediction: confidence intervals and extrapolation, Regression to the mean
5. Identification
6. Causality in Statistics