

ECON0114 Syllabus 2020/2021

The schedule below is the recommended weekly schedule.

Required Software

You are required to install Mathematica on your laptop / desktop or use UCL cluster-room computers where Mathematica is pre-installed. You will be able to download a copy of Mathematica from the ISD Software Database under the UCL campus license for free. The module will be taught using Mathematica, but students are welcome to submit their solutions to assignments and exams using Python, R or MatLab. Teaching will however only use Mathematica.

You are required to install the MS Teams app on your laptop / device.

Teaching & Timetabling

ECON0114 in pre-covid time had two 2-hour, large-group classes that were a mix of lecture and practical and there were no tutorials. In 2020/2021 this will change.

First of all you will be taught in small-scale study-groups of up to 15 students. Each week you will have

- 2 classes of 30 minutes with your study-group
- 2 Moodle lessons to work through on your own or in your group
- A problem set to engage in learning-by-doing.

Study-groups

Classes will happen in small-group Study Groups of a maximum of 15 students. At least 4 of those study-groups (A through D) will be time-tabled during the 2 x 2-hours that are on the timetable. Groups E & F will be reserved for students in time-zones that are more than 4 hours away from the UK time-zone. These two groups will get a time-slot for the 2 classes adjusted to their location.

Shorter Classes

Instead of a 2-hour class you will have

- roughly 90 minutes (workload) of non-live activities that include watching short videos, reading, and doing questions & quizzes connecting the videos, etc;
- roughly 30 minutes (attendance duration) of a class in your Study Group of maximally 15 students;

Hence, teaching will take place twice a week in groups of 15 students these hours will be online unless they can be offered face-to-face on campus. I hope after taking this module you will agree that taking 30-minute classes you prepared for in a small-group is more efficient than taking 2-hour classes where you mainly just listen.

The Study Groups with their associated times will be available for you to select yourself into on Moodle at the start of term. They will take place during the following slots (which you will see on your timetable):

- Tuesdays 30 minutes between 2h-4h pm (UK time)
- Fridays 30 minutes between 2h-4h pm (UK time)

If there are more than 60 students on the module, then for students in time-zones quite different from the UK time-zone there will also be Study Group classes on offer during early morning hours UK time.

Textbook & Lecture notes

The main part of this module (weeks 4 through 10) uses the following textbook:

Estrada, E. & Knight P.A, *A first course in Network theory*, Oxford University Press (2015)
You are strongly advised to get your own copy, which is available on Amazon for £27.

Weeks 3 through 5 are based entirely on Lecture notes that will be available prior to the start of the module. There will also be lecture notes available covering the material of weeks 6 through 10.

The topics and weeks

The topics of the course as they were taught in the previous 2 years will all return, however their order has been adapted to the new format for 20/21. The schedule will now be

Linear algebra of Networks

- **Week 1:** *Linear Algebra concepts & Intro to Mathematica* (Chapter 5 + Tensor product)
- **Week 2:** *Spectra of Matrices* (Chapter 6 + 7 + Eigenvalue problem for nonsymmetric matrices)

Functional Optimization

- **Week 3:** *Cycles and spectral analysis*
- **Week 4:** *Functional optimization & maximum Entropy distributions*
- **Week 5:** *Dynamic optimization*

Network Theory

- **Week 6:** Nodes, links degree, paths and loops
- **Week 7:** Degree Centrality, Eigenvector centrality and fragment-based measures of centrality
- **Week 8:** Clustering & Correlations on networks
- **Week 9:** Time-dependent networks
- **Week 10:** Spectral classifications of networks

General structure of the Course material

Every week there will be *one online class on Tuesday and one online class on Friday* during the times scheduled in the UCL timetable.

Week Schedule

The schedule of a typical week would look as follows:

- Monday: Do Moodle lesson 1 and have a look at this week's problem set;
- Tuesday: Attempt the practical 1 notebook and attend class I;
- Wednesday: Finish up practical 1 notebook and do Moodle lesson 2;
- Thursday: Attempt the practical 2 notebook;
- Friday: Round off most work for problem set and attend class II;
- Weekend: Wrap up practical notebook 2 prepare the problem set of the week for submission on Monday;

The week's problem set can be submitted on the Monday morning of the subsequent week before 13h UK time. In some weeks this will be a Moodle assignment submission link for the pdf-file of your summative problem set. In other weeks it will be a quiz about your formative problem set that assumes you have completed the problem set.

Summative & Formative Assessment

The problem sets of the bold weeks count towards your final mark, the others are formative quizzes:

- Week 1: (submitted in week 2 & feedback in week 3!)
- Week 2: You can submit a quiz based on problem set 2 for feedback.
- Week 3: (submitted in week 4 & feedback in week 5!)
- Week 4: You can submit a quiz based on problem set 4 for feedback.
- Week 5: (submitted in Reading week & feedback in week 6!)
- Week 6: (submitted in week 7 & feedback in week 8!)
- Week 7: You can submit a quiz based on problem set 7 for feedback.
- Week 8: (submitted in week 9 & feedback in week 10!)
- Week 9: You can submit a quiz based on problem set 9 for feedback.

The weighted geometric mean of the best 4 summative assignments will count 40% towards your final mark. The final piece of summative assessment is the 60% Take Home Exam.

- Take-Home Exam: Issued in week 10, to be submitted in the first week of the next term.

The Take-Home Exam has the same format as the summative assignments, except that it will also involve reading an academic paper.

Workload

Standard UCL 15-credit modules should require about 150 hours of quality-time work.

- The ECON0114 Take-Home exam has a workload of approximately 8 hours;

The remaining hours workload of the module is distributed as follows:

- 10h preparation for the Take-Home Exam (December-January outside of term)
- 11 weeks (including reading week) of 12h per week of assignments, readings, problem sets, video-lectures, contact hours, etc.

Be aware that the workload of a term 1 module that finishes before term 2 starts will have a higher workload in term 1 than term 1 modules with a large final exam in term 3!