Course Guide

PHIL10133: Logic, Computability and Incompleteness 2017/18

Course Organiser: Dr Paul Schweizer (paul@inf.ed.ac.uk)
Office Location: Dugald Stewart Building room 5.13
Office Hours: Friday 2-3pm and by Appointment

Course Secretary: Ann-Marie Cowe (annmarie.cowe@ed.ac.uk)

Contents
1. (Course) Aims and Objectives
2. Intended Learning Outcomes
3. Seminar Times and Locations
4. Seminar Content
5. PPLS Undergraduate Student Handbook
6. Readings
7. Assessment Information
8. Learn
9. Autonomous Learning Groups
10. Feedback
11. Useful Information
12. Common Marking Scheme

Department of Philosophy
School of Philosophy, Psychology and Language Sciences
University of Edinburgh
1. Course Aims and Objective

2. Intended Learning Outcomes

Upon successful completion of the course, students will be able to demonstrate:

i) Familiarity with the general philosophical/mathematical project of Hilbert's program and how this is impacted by the technical results explored in the course.

ii) Thorough understanding of some key limitative results in logic and computability, including the halting problem, the undecidability of first-order logic, and the incompleteness of first-order arithmetic.

iii) Ability to employ abstract, analytical and problem solving skills.

iv) Ability to formulate clear and precise pieces of mathematical reasoning.

Also, students will demonstrate the following transferable skills:

i) Evaluating abstract theoretical claims.

ii) Grasping and analysing complex metatheoretical concepts.

iii) Deploy rigorous formal methods.

3. Seminar Times and Locations

Thursdays 2.10pm – 4pm, Medical School, BLT (Basement Lecture Theatre) - Doorway 6.

4. Seminar Content (core readings)

Week 1: Cardinality, Enumerability, Diagonalization
Week 2: Turing Machines and Computability
Week 3: Recursive Functions
Week 4: First-Order Logic Revisited
Week 5: Uncomputability and Undecidability
Week 6: Completeness, Compactness and Löwenheim-Skolem
Week 7: Formal Arithmetic
Week 8: Diagonal Lemma, Gödel and Tarski Theorems
Week 9: Provability Predicates and Löb’s Theorem
Week 10: Computational Complexity
Week 11: TBA
5. PPLS Undergraduate Student Handbook
The PPLS Undergraduate Student Handbook has more information on Student Support and academic guidance; late coursework and plagiarism; illness and disability adjustments, and useful sources of advice.

The Handbook can be found here:

6. Readings
The weekly course readings are provided on the Learn website. Please refer to the Readings folder.

7. Assessment Information

Final two hour examination in the May diet (100%)

4th Year
Coursework dissertations are submitted on Thursday 23rd April 2015, by 4pm, please check with the departmental office (G.06) for further details. The title of your coursework dissertation must be approved in advance by submitting it to me in person or by email. After your title is approved you will complete a form confirming this title and submit it to the departmental office on Thursday 5th March 2015, by 4pm. Generally, any question listed for discussion in a seminar is a suitable short dissertation title.

Word Count Penalties
Essays must not exceed the word limit, which includes footnotes but excludes bibliography. The precise word count must be written on the coversheet. Overlong essays will be penalised according to the following rule: 5% will be deducted for every 100 words, or part thereof, over the word limit. So, 1-100 words over lose 5%; 101-200 words over lose 10%; 201-300 words over lose 15%; and so on.

Penalties for Late Submission of Essays
Unless an extension has been granted, essays must be submitted by the dates shown in the table of Submission Dates below. Essays submitted late without an extension may not be marked, but, if marked, will incur a penalty (in accordance with section 3.8 of the University Undergraduate Assessment Regulations at:
http://www.ed.ac.uk/schools-departments/academic-services/policies-regulations/regulations/assessment

For each working day that the work is late there will be a reduction of the mark by 5% of the maximum obtainable mark (e.g. a mark of 65% on the common marking scale would be reduced to 60% up to 24 hours later). This penalty applies for up to five working days, after which a mark of zero will be given.

Plagiarism
Essays will be checked for plagiarism using Turnitin.

The University treats plagiarism by honours students as a disciplinary offence, and anyone caught plagiarising will be referred to the College’s Academic Misconduct Officer. If you are unsure what constitutes plagiarism or need further guidance, you should consult the University’s guidelines:

http://www.ed.ac.uk/schools-departments/academic-services/students/undergraduate/discipline/plagiarism

Students can read more about plagiarism and proper referencing practices, and use Turnitin on a trial copy of their essays, in the Philosophy Tools course on LEARN.

Extensions
Students are expected to monitor their workload, be aware of all deadlines, and organise themselves accordingly.

Extension requests should be submitted before the submission deadline. They must be submitted to the Teaching Office for approval, and must include details of the assessment(s) affected and the length of extension requested, together with supporting evidence if required.

Other than in exceptional circumstances, extensions will only be granted in cases of illness or family emergency. If students are seeking extensions for more than one week, they must provide medical evidence and/or discuss the request with the Student Support Officer.

Extension requests due to time management, personal computing/printing problems or ignorance of deadline will not be accepted.

The Teaching Office will email the student to tell them whether the extension has been granted. The decision conveyed in this email is final; if students feel that they have been unfairly denied an extension they should make a case to the special circumstances committee for the removal of late submission penalties at the examination board.

Retrospective extensions will not be granted.
However, late submission penalties may be waived if a student requests an extension on the day of the deadline but cannot get medical evidence until some days later.

Students with Adjustment Schedules.
Extension requests from students with adjustment schedules that allow ‘short notice extensions’ will be treated sympathetically where possible. Students should however be prepared to give a reason for the extension request; simply citing an adjustment schedule is not an adequate reason. If students are seeking extensions for more than one week, they must provide medical evidence and/or discuss the request with the Student Support Officer.

Special Circumstances.
Students may apply for consideration of special circumstances if they feel that events out with their control have resulted in poor exam performance in comparison to their
previous coursework record or even missing an exam. These circumstances most commonly include illness or bereavement but can be submitted for a variety of issues. It is the student’s responsibility to complete a Special Circumstances form giving as much detail as possible and providing supporting evidence. All submissions must be accompanied by medical or other documentation.

Please note - Regulation 14 Assessment deadlines: Student responsibilities

It is a student’s responsibility to ascertain and meet his or her assessment deadlines, including examination times and locations.

8. Learn

This year the majority of courses will use electronic submissions for Honours coursework. For essay submission instructions please see the instructions on LEARN. Please note you should not include your name or matriculation number on coursework, only your exam number.

9. Autonomous Learning Groups

One of the best ways to learn, and get feedback, is from talking to each other. In order to facilitate this, each of your Honours courses now has dedicated Autonomous Learning Groups. In week 2, you will receive an email from our Student Support Officer (Sarah Nicol, sarah.nicol@ed.ac.uk) asking if you would like to be part of an Autonomous Learning Group (ALG) for each of your Honours courses. If you agree, Sarah will form the ALGs for you and email you with details of which group you are in, and the email addresses of the other members of the group.

It is up to you, the members of the ALG, to organize the meetings. You decide how often to meet and what to do in your ALG. ALGs are designed to help you learn and get to know your classmates; they are not a formal requirement of the course. It is important to note that assessment in your courses is non-competitive: you are not competing against your classmates, only against the general grade criteria. It is in your interests to help each other.

As a rough guide, we suggest your ALG meets every 2-3 weeks. You could use the meetings to:

- Read and discuss the papers together
- Discuss essay-writing and time-management techniques
- Constructively critique each other's draft essays or plans
- Read some of the further readings or related papers
- Work on presentations or discussion posts that the class may involve
- Share tips on career advice

Sarah will be able to help you with room booking (you can also do this yourself through MyEd). Please email the CO of the course if you feel that it would be useful for the group if she or he joined one of your sessions.
Please contact Sarah if you find it necessary during the semester to transfer into a different group.

ALGs are a new initiative by Philosophy and we appreciate your thoughts. If you feedback on how to make ALGs even better, please email Sarah Nicol (sarah.nicol@ed.ac.uk) or the Director of Undergraduate Teaching, Dr. Mark Sprevak (mark.sprevak@ed.ac.uk).

10. Feedback

You will get many feedback or feedforward opportunities in your courses. Feedback could be in the form of an essay, a draft write-up, self-generated or peer feedback, small group discussions or quizzes within lectures etc. Feedforward might include a discussion of how to write an essay, or prepare for an exam.

Feedback is essential to learning and it takes many forms. We strongly encourage you to use all forms of feedback, including:

- Asking and answering questions in lectures or classes
- Asking questions of your Course Organiser or lecturer in their office hours
- Discussing your work with lecturers and examiners on Philosophy's dedicated Feedback Days (Honours students)
- Actively participating in your tutorials (pre-Honours students)
- Actively participating in Autonomous Learning Groups (Honours students)
- Talking about your ideas outside class with fellow Philosophy students
- Taking your essay to PhilSoc essay surgeries
- Participating in PhilSoc discussion groups and study-skills events
- Participating in PhilSoc debates and talks: http://euphilsoc.weebly.com/
- Participating in the British Undergraduate Philosophy Society, including undergraduate conferences: http://www.bups.org

If you have any suggestions on how to improve feedback further, please contact either:

- Your Tutor (pre-Honours students)
- Your Course Organiser
- Your Personal Tutor
- Sarah Nicol, PPLS Student Support Officer (sarah.nicol@ed.ac.uk)
- Dr Mark Sprevak, Director of Undergraduate Teaching (mark.sprevak@ed.ac.uk)

11. Useful Information

WEEK 6 INNOVATIVE LEARNING WEEK (16-20 February 2015). Normal teaching slots will be suspended and in their place will be a range of other activities such as master classes, a research day, a science fair, and guest lectures. More information will follow nearer the time so please check the School website where details will be
Attendance by ALL students at University classes, seminars and tutorials etc
The University expects all students to attend all their University classes, lectures and tutorials etc, whether or not these are described as “compulsory” by the School. This includes participating fully in the requirements of all courses, including submitting assignments, contributing to tutorials and workshops or laboratories, attending meetings with Personal Tutors and sitting examinations.

Your attendance will be monitored by the School, so that staff can help you to manage your progress through the courses. We will do this so we can be quickly alerted to any additional pastoral or academic support needs any student might require, and so that the School can provide advice, guidance or support in a timely and useful manner.

12. Common Marking Scheme

http://www.ed.ac.uk/schools-departments/registry/exams/regulations/common-marking-scheme

<table>
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<th>Grade</th>
<th>Range</th>
<th>Description</th>
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</table>
| A1    | 90-100| Excellent  
Outstanding in every respect, the work is well beyond the level expected of a competent student at their level of study. |
| A2    | 80-89 | Excellent  
Outstanding in some respects, the work is often beyond what is expected of a competent student at their level of study. |
| A3    | 70-79 | Excellent  
Very good or excellent in most respects, the work is what might be expected of a very competent student. |
| B     | 60-69 | Very Good  
Good or very good in most respects, the work displays thorough mastery of the relevant learning outcomes. |
| C     | 50-59 | Good       
The work clearly meets requirements for demonstrating the relevant learning outcomes. |
| D     | 40-49 | Pass       
The work meets minimum requirements for demonstrating the relevant learning outcomes. |
| E     | 30-39 | Marginal fail  
The work fails to meet minimum requirements for demonstrating the relevant learning outcomes. |
Grade-related Marking Guidelines

Explaining the function of these guidelines:

(1) These are only guidelines; marking still requires discretion and judgment.

(2) The guidelines are “bottom up” — each band presupposes that the student has at least satisfied the criteria laid down under the lower bands. So to get a first, it is assumed that you at least satisfy all the criteria for a 2-1, etc.

(3) Each set of guidelines should be understood not as providing necessary and sufficient conditions for a mark in the band specified. Rather, the guidelines under each band provide a kind of “cluster” which defines a paradigm of a piece of work falling within the band in question. A piece of work might deviate from the paradigm in certain respects but still fall within the band. It might help to explain the idea of a paradigm being invoked here. By way of comparison, an ornamental chair (as one might find in a museum, and that is not fit for sitting on) is a less paradigmatic instance of a piece of furniture than an ordinary sofa, but plausibly an ornamental chair still counts as a piece of furniture all the same. This is because it satisfies enough of the criteria in the cluster of concepts associated with being a piece of furniture, though it satisfies fewer of those criteria than an ordinary sofa. Similarly, a piece of work might be a less than fully paradigmatic instance of a 2-1 but still count as a 2-1 all the same.

(4) Although they are written in a way that might naturally suggest a binary reading, the guidelines are generally scalar – satisfying each of them comes in degrees, and is not all or nothing. This is important, and relevant to the “paradigm” point above, in that doing better with respect to one criteria under a given band could offset doing slightly less well with regards to another. Also, precisely where within the band a piece of work is assessed will typically reflect how well the work does in terms of each of these criteria.

(5) The guidelines apply most clearly for essays. In the case of exam questions, part of the exercise will be for the student to work out the extent to which the question calls for something going beyond pure exegesis.

(6) For history of philosophy classes, where the instructor explicitly indicates this is the case, the contrast between exegesis and original argument may be less clear. In these cases, the original argumentation may be an original argument for an interpretation or reading of a text, for example. Individual instructors have

<table>
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<tr>
<th>Grade</th>
<th>Score Range</th>
<th>Description</th>
<th>Definition</th>
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<tbody>
<tr>
<td>F</td>
<td>20-29</td>
<td>Clear fail</td>
<td>The work is very weak or shows a decided lack of effort.</td>
</tr>
<tr>
<td>G</td>
<td>10-19</td>
<td>Bad fail</td>
<td>The work is extremely weak.</td>
</tr>
<tr>
<td>H</td>
<td>0-9</td>
<td>Bad fail</td>
<td>The work is of very little consequence, if any, to the area in question.</td>
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some discretion in explaining how the specific details of their course mean these guidelines should be interpreted. As mere guidelines, they provide only a sort of “default setting” rather than a one size fits all set of prescriptions, amenable to only one canonical interpretation.

**General Guidelines**

- **Clarity:**
  - Is the writing clear?
  - Is the grammar and spelling correct?
  - Is the language used appropriate?

- **Structure:**
  - Is a clear thesis or position stated?
  - Is an argument, or arguments, offered in support of the thesis?
  - Does each part of the essay/exam have a clearly indicated purpose?

- **Understanding:**
  - Is a sound understanding of relevant issues demonstrated?
  - Is the exposition of others’ views accurate?
  - Are technical terms adequately defined?

- **Originality:**
  - Is there evidence of independent thought?
  - Is there critical engagement with the material?

- **Argument:**
  - Is the argument convincing?
  - Are the inferences valid?
  - Are obvious objections anticipated?

**Grade Bands**

**Fail (less than 40)**

**Third Class (40–49):**

- Writing is generally unclear. Frequent spelling or grammar mistakes, incorrect language, and/or excessively convoluted sentence structure.
- Neglects clearly to state a thesis or position and/or fails to support this with arguments. Contains irrelevant material, or material whose relevance is not adequately explained.
- Demonstrates a barely adequate understanding of central issues. Contains several errors in exposition or in explanation of concepts.
- No evidence of independent thought or critical engagement. Merely rehashes arguments from readings or lectures.
- Where arguments are given, these are weak, depend on invalid inferences or implausible premises. Fails to anticipate obvious objections.

**Lower Second Class (50–59):**

- Writing is generally clear, but there are occasional spelling/grammar infelicities and/or poorly constructed sentences.
- A thesis/position is indicated but not clearly defined. Some arguments given, but
their structure often unclear.
- Demonstrates a basic grasp of key concepts, but occasional inaccuracies in exposition/explanation.
- Little evidence of independent thought. Some suggestion of original ideas, but these are under-developed and/or expressed unclearly.
- Arguments generally weak or unconvincing.

Upper Second Class (60–69):
- Writing is generally clear, marred only by the rare spelling/grammar infelicity or poorly constructed sentence.
- A thesis/position is indicated and clearly defined. Arguments are given with relatively clear structure. It is generally clear what is going on in each section, why one section follows on from the previous one, and how the essay as a whole hangs together.
- Demonstrates a solid understanding of the key concepts, and the exposition is generally accurate and thorough.
- Substantial evidence of original thought – either an original argument of some kind for a familiar position or an original argument for a novel position. In either case, the argument should be reasonably well developed.
- The author’s original arguments are interesting and promising, but fairly central or glaring problems with the argument are not discussed or addressed in any way, or are given only a highly cursory treatment.

Low First Class (70–79):
- Writing is very clear and engaging throughout. Where examples are used they are both relevant and memorable. The writing will also be concise.
- The essay’s structure is not only clear and well defined; it also provides a satisfying narrative arc.
- Demonstrates a deep understanding of the key concepts. Explains other philosopher’s ideas in the author’s own terms, clearly presenting those ideas in a way that indicates that the author has “made them his/her own.” Where technical terms are used they are always carefully defined.
- Highly original thought, with well developed arguments. The exegesis will generally be sufficiently concise as to allow the author to develop his or her own arguments in considerable detail.
- The author very carefully considers the most central and obvious problems with his/her original argument(s) and has interesting things to say about them.

Mid-First Class (80–89):
- Writing is crystal clear and highly engaging throughout. Memorable examples are used to underscore key points. The writing is concise without coming across as terse or stilted.
- The essay’s structure is clear and well defined, with a highly satisfying narrative arc.
- Demonstrates a deep understanding of key concepts. Not only explains the ideas of other philosophers in a way that shows he/she has “made them his/her own,”
but that actually casts new light on how we might charitably understand the ideas of those philosophers.

- Very original thought, above and beyond what we would normally expect from an undergraduate. These original ideas will be developed in great detail.
- The author very carefully considers the most central and obvious problems with his/her original argument(s) and has prima facie convincing rejoinders. Author may also consider more subtle objections to his/her argument(s)/view(s).

**High First Class (90–100):**

- Writing is extremely clear, concise, and engaging — of a publishable quality.
- The essay’s structure is extremely clear and well-defined, with a highly satisfying narrative arc.
- Demonstrates a deep understanding of key concepts. Not only explains the ideas of other philosophers in a way that shows he/she has “made them his/her own,” but that actually casts new light on how we might charitably understand the ideas of those philosophers.
- A highly original and well developed line of argument and/or novel view, such that the essay is publishable, at least in an undergraduate or postgraduate journal, perhaps bordering on being publishable in a mainstream professional journal.
- The author considers the most important objections to his/her arguments/views. The replies are generally convincing and subtle. If space allows, less obvious objections may also be discussed in interesting ways.