PHI 1060: Symbolic Logic Syllabus (tentative)

Instructor Details

Dr. Raja Rosenhagen (Professor Raja)

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WhatsApp (emergency):8222930532

Office Hours: WF 10 – 11 a.m.

Location: virtual (see Canvas)
(book slots via AMS)

Teaching Assistants

[redacted]

Office Hours: M 1 – 2 p.m.

Location: virtual (see link on Canvas)

[redacted]

Office Hours: W 11 a.m. – 12 p.m.

Location: virtual (see link on Canvas)

Course Details

Sessions: Tu/Th 10:10 – 11:50 a.m. (virtual links on **AMS**)

Discussion Sessions (mandatory): [redacted]: **M 11:50 a.m.–12:50 p.m.**; [redacted]: **F 4:30–5:30 p.m.**

I. Course Description

Critical thinking in any field requires the ability to assess arguments. In this course, you will work on sharpening your formal reasoning skills. To that end, we will study the nature of good and bad arguments by analyzing the properties of an artificial language known as *first-order logic*.

II. Learning Objectives

By the end of this course, you will

- be familiar with and fluent in the basic concepts of logic,
- be able to translate statements from ordinary language into well-formed sentences of first-order logic and interpret well-formed sentences of first-order logic in terms of ordinary language statements,
- be able to determine logical properties of arguments such as (various forms of) validity and soundness and thus be able to distinguish good from bad deductive arguments.

Relatedly, you will

- be able to construct formal proofs in propositional logic and predicate logic, involving
  - (multiply) quantified expressions,
  - identity,
  - function symbols, and both
  - definite and
  - indefinite descriptions.

Logic is a rigorous discipline. As we will see, the (artificial) language of first-order logic has one huge advantage over natural languages: it is precise and completely unambiguous. As we work on translating English sentences into the language of first-order logic, we will discover that ordinary language is much more ambiguous than we typically realize. Expressing one's thoughts and one's arguments in a precise and logically compelling way is a skill that, to be mastered, requires a lot of practice. But it is also a skill that, once acquired, boosts your analytical abilities and allows you to look at your own writing and that of others with an understanding improved by the discerning force of reason.

You can get a lot out of this course, but you must take it seriously. It's like dancing with the devil – you really need to watch your step! The first step is one that in my experience, at least 50% of all participants fail to take: **read the following pages thoroughly**. You must do this to be prepared for the first session. It really helps if you are.

III. Notes and Instructions Regarding the Material and the Online Platform

1. **FREE MATERIAL/LEARNING PLATFORM**:

- **No need to buy anything**. We will use an **e-learning platform**, a **software**, and **Zoom for the lecture meetings** (you can access these meetings via the links in your time table in your schedule):
- The e-learning platform we use is **Canvas**. You will receive an invitation to join the course soon. The important elements of the assessment are all listed on Canvas: the ***weekly quiz***, the ***homework***, ***discussion session attendance*** and participation, and the ***three online assessments***.
- The software is called **Logic 2010** (developed by David Kaplan at UCLA). It lets you do and submit (much of) your homework on your laptop. The user interface does not look too exciting (this is an understatement), but it gets the job done. **Installing it on your laptop/computer before the first class is mandatory.** How? See below. [**Note**: If you are on campus, the program is pre-installed on all the computers in the computer lab (Admin Block, #304) and can be accessed from there.]

2. **INSTALLING THE SOFTWARE**:

- You can find the program here: https://logiclx.humnet.ucla.edu/Logic/Download
- **Download and install** the program. Also make sure to carefully **read** the document that you find near the top of that page ("Installing, Starting, [etc…]"). You also find it in the **General** Module on Canvas. Some of this (the backup part) may not make sense to you yet. Regardless, just follow instructions.
- As you start the program, you will be asked to set the preferences. Pick **Ashoka** as the institution (from the top of the menu), the term is **Fall 2021**, the Course **Philosophy 1060 LS 1 2021F**. The instructor listed is Prof. Raja (that's me), Mr. Utkarsh Bansal and Ms. Tejaswini Vondivillu are listed as TAs.
- As you register, you will be asked to provide your unique student ID. **Use your 10-digit Ashoka ID#**.
- You will be asked to set a password. Please do and **note the password somewhere** where you would find it again even after a complete amnesia. **If you lose or forget it, I may not be able to help you recover your account.**

IV. Some General Learning Instructions

- Typically, there is a reading assigned for every class. For every reading, I provide ***read-outs/walk-throughs***, uploaded to Canvas. In them, I basically take you through the text by reading it and making comments along the way. This makes the course content **accessible** for more students. As past online teaching experience indicates, students get through the text more easily if there is someone they can read along with. Given the technical nature of the text, **reading along** will be most useful.
- This is a ***labor-intensive course*** and also probably the most thoroughly technical course you will encounter in your UG Philosophy trajectory. At various points throughout the semester, you may need to spend several hours a week on derivations, watching walk-throughs, thinking about conceptual issues, or doing the exercises that are part of the readings (highly recommended). **Schedule enough time for this course!** Look at the syllabus and get a sense of when assignments are due. Mark these days in your calendar and make sure you have enough time to prepare.
- Students almost never really believe this (and it regularly bites them back), but you must ***pay attention to the details and the concepts from the very beginning***. All the material that follows will depend on what we do in the beginning. So make sure you understand e.g. what validity and soundness are, what the connectives are, and what it means for connectives to be truth-functional (or not). Start a file that has all the definitions in it and learn them by heart. Seriously, do it.
- ***If*** you feel like ***you are losing touch with what is going on in class***, reach out to your TA / to me immediately. Once you lose touch, it very soon gets much harder to catch up. Be proactive and seek help. We are happy to provide, but you must reach out to us!
- In the ***weekly discussion board***, you are invited to engage in discussion. You can also raise questions yourself! In fact, if you have any, this is what you should do first! If that doesn't help you, take your question to your TA, the discussion session, or to office hour with either them or me.
- The ***homework exercises*** on Logic 2010 account for a significant part of the grade, so take them very seriously. That involves planning ahead, for these will take time to complete! ***You really cannot just start on the due day and hope to finish these exercises in time***. Get started on them soon, also to get a hang of the programme. Upload what you complete right away to make sure it will be counted.

- ***Sometimes***, as you think about the homework, ***you may feel as if you have a knot in your brain*** and just cannot go on. That creates massive stress if you **have** to continue because you are running out of time. The best way to avoid this situation, again, is to **start on your homework *early***. Seriously. Do it. Do some every day.
- Feel free to do ***additional exercises*** on Logic 2010. Whatever practice you get will be helpful! If you look at these exercises as puzzles, doing them can actually be fun!
- You may enjoy or hate ***derivations*** (people differ here), but one thing is certain: ***the only thing that makes you get better at derivations is doing them***. It is not enough to understand lecture content in an abstract way, you really need to ***do the exercises***.
- There is nothing wrong with ***creating study groups***. In fact, doing this may be very helpful! You can discuss the material with and thereby help and be helped by your learning pal(s). You must, however, do the homework assignments on your own. You can discuss them with others, but **it helps you zilch to just copy solutions from others**. For when the longer assessments come, you are on your own. And then you will wish you had actually done and understood these assignments by yourself. Doing Logic is like training a muscle. Without training, you can't do it, and nobody else can train it for you. Let me say this again, since every year, those who don't believe this fail the course. **YOU CANNOT PASS THIS COURSE BY COPYING HOMEWORK**.
- In this class, we work with a strict ***no late assignment policy***. Assignments and parts of assignments that you do **not submit on time** will get **no credit**.

V. Structure of Assessments

Your final grade in this course will be determined as follows (more on these below):

Homework Assignments		29%
Weekly Quizzes		25%
3 x Online Assessments (1.5 h each) spread out over the course	3x 12% =	36%
Discussion Session Participation		10%

		100%

Extra Credit Options:

- **There will be 2 make-up homework assignments to get points you missed before (1 for sentential Logic, 1 for predicate logic). And no, you cannot hoard points for future assignments.**
- **present a difficult solution to your peers** — 1 good solution video serves to bump up your worst past quiz score by 7%.
- **come to office hour (any) at least twice** — your final grade is fudged upwards by 3%
- **submit a sheet with definitions from a future reading beforehand** — 1 point per correct definition counts as a percentage point toward your next online assessment score (max: 7 pts/assessment)

Discussion Board Participation

Every week, the Canvas discussion board will be pre-populated with questions pertaining to the readings. This is not a mandatory part of the course, but one that helps you get clear on definitions and concepts. Use the DB to raise questions, help your peers, etc..

Homework Assignments

As you can see, homework assignments make for a large component of your grade. It is an excellent idea for you to form teams or study groups within your discussion session. You may, indeed should, discuss the readings and the exercises in them together. This is the non-graded part of your homework. For the graded part, you must do and submit your Logic 2010 assignments individually – the software lets you know whether or not you got this right. With enough time, you can get up to 100% every week. So again, plan ahead. There is a strict **no late submissions** policy. You can submit partial homework (but only complete derivations will be graded). **Work submitted after the deadline will not count**.

Weekly Quizzes

These quizzes will test your conceptual understanding of the material. You will do well on these if you are firm on your definitions and understand the concepts. These quizzes will be conducted on Canvas and be open during a fixed time slot at the end of every week (either Friday evening or Sunday, as per the class poll). There is a large question bank that the questions are pulled from randomly. Your three worst quizzes will be dropped.

Online Assessments

Instead of a large and high-percentage midterm and a large and high-percentage final exam, we will have three Online Assessments throughout the course that will account for 12% of your final grade each. The last assessment will be conducted during exam week, the other two as per the tentative schedule below.

Discussion Sessions

These are mandatory, you will be graded on participation. You have 2 excused absences, every further absence yields 0 (F) for that session, if you miss more than 5 total (including excused absences), you get an F for this component of your grade.

Make-up Homework Assignment

Twice in the semester, you will have the opportunity to do extra homework exercises (*see schedule below*). The points you score as you solve these extra exercises are used to supplement points that you missed on previous regular assignments (***Make-up Assignment 1*** fills up missing points from Assignments 0-4, ***Make-up Assignment 2*** fills up Assignments 5-10, there is no carry-over).

Present a Difficult solution to your peers

The TAs will conduct a poll after each homework assignment as to which you took to be the most difficult derivations. The top contenders will be listed and students can ask to make a video explaining how to solve them. (You can use FreeCam 8 or any other free screen-capturing software to do this… Upload the video to your Google Drive and share the link with your TA). If more people want to make a video than problems are available, the students who benefit most will get to avail of the extra credit opportunity. One video serves to bump up your worst previous quiz score by 7%. You cannot do more than one per week.

Come to some Office Hour at least twice

…and have your final grade fudged upward by 3%. The point of this is to give you an incentive to come to office hours. People rarely do although they would benefit from it and those who would <u>really</u> benefit almost never do. Also, it is always good to talk a bit about Logic *off the record*, as it were, and I'd also like to get to know you a bit – since I won't see you in person at least until the midterm break, perhaps longer. The TAs and I will keep track of who shows up when and we will then give you those percentages if you have earned them.

Submit a sheet with definitions from a future reading beforehand

If you want to do this, coordinate with your TA beforehand. In every reading, there are definitions of new concepts and techniques to be explained. You can gain a maximum of 7 points toward each assessment.

VI. Tentative Schedule (subject to modification)

UNIT I: PROPOSITIONAL LOGIC

WEEK 1: sentences, arguments and their respective properties & connectives

1	Tu	31/8	General Introduction – Why logic? Argument types; valid, invalid, sound and unsound arguments, true and false sentences; NOT, AND, OR; disambiguation through parentheses **Reading**: Logic Text, ***Introductory Chapter 0***
2	Th	2/9	IF-THEN; IFF; Formation Rules; Main Connective; Parsing; Symbolization; Ambiguity (and how to prevent it) **Reading**: Logic Text, ***Chapter 1*** (up to & including 1.3), Chapter 2 (up to & including 2.3)

WEEK 2: proofs, (sub)derivations, and derivation strategies (I)

3	Tu	7/9	first derivation rules (r, mp, mt, dn); proof components; proof strategies: direct derivation (dd), conditional derivation (cd) **Reading**: Logic Text, ***Chapter 1*** (up to & including 1.6)

Assignment 0 & Assignment 1 due <u>before</u> Thursday class!

4	Th	9/9	proof strategy: reductio/indirect derivation (id); subderivations **Reading**: Logic Text, Chapter 1 (up to & including 1.8)

WEEK 3: more strategies and derivation rules, theorems / first logical truths

5	Tu	14/9	mixed derivations, strategies, logical truths/theorems **Reading**: Rest of Logic Text, ***Chapter 1*** (remainder)

Assignment 2 due <u>before</u> Thursday class!

6	Th	16/9	further derivation rules (s, adj, add, mtp, bc, cb); further strategies; abbreviations **Reading**: Logic Text, ***Chapter 2*** (up to & including 2.6)

WEEK 4: theorems as rules, more rules and truth tables

7	Tu	21/9	Theorems as rules; derived rules (nc, cdj, sc, dm, nb) **Reading**: Logic Text, ***Chapter 2*** (up to & including 2.9)

Assignment 3 due <u>before</u> Thursday class!

8	Th	23/9	Truth Tables, Tautological Validities **Reading**: Logic Text, ***Chapter 2*** (remainder)

WEEK 5: Concepts, Truths, and first Online Assessment

9	Tu	28/9	Logical Concepts & General logical truths

Assignment 4 due <u>before</u> Thursday class!

10	Th	30/9	**Online Assessment 1**

UNIT II: (MONADIC) PREDICATE CALCULUS

WEEK 6: subsentential units, tautologies and beyond, variables, quantifiers and their scope

11	Tu	5/10	<u>Intro to the Predicate Calculus</u>: names and predicate letters; moving beyond tautological notions of truth, falsehood, validity, equivalence, consequence atomic formulas, molecular formulas, scope, free vs. bound variables, def. sentence **Reading**: Logic Text, ***Chapter 3*** (up to & including 3.3)
12	Th	7/10	Quantifiers (I); quantifier definitions, interpretation (intentional and extensional) of predicates and UD; elements of an interpretation, symbolizing sentences with quantified expressions (section 3) **Reading**: Logic Text, ***Chapter 3*** (up to & including 3.5E)

MIDTERM BREAK [9.10. – 17.10.]

[optional Make-Up Assignment 1 due <u>before class</u> on Tuesday 19/10]

WEEK 7: first derivations and invalidities involving quantifiers

13 Tu 19/10 Quantifiers (II) – first derivation rules: ui, eg, no capturing, rule ei
Readings: Logic Text, ***Chapter 3*** (up to & including 3.7)

14 Th 21/10 Quantifiers (III) – derived rules qn and av, invalidities
Readings: Logic Text, ***Chapter 3*** (up to & including 3.10)

Assignment 5 due <u>before class</u> next Tuesday (26/10)!

UNIT III: (POLYADIC) PREDICATE CALCULUS

WEEK 8: expansions and intro polyadic predicate logic

15 Tu 26/10 Quantifiers (IV) expansions, Polyadic Predicate Logic (I)
Readings: Logic Text, ***Chapter 3.11***, ***Chapter 4.1-3***

16 Th 28/10 Polyadic Predicate Logic (II): rule ie, biconditional derivations
Readings: Logic Text, ***Chapter 4*** (up to and including 4.5)

Assignment 6 due <u>before class</u> next Tuesday!

WEEK 9: reducing overlay, prenex form, and invalidities

17 Tu 2/11 Polyadic Predicate Logic (III): overlay, prenex form, theorems, invalidities
Readings: Logic Text, ***Chapter 4*** (up to & including 4.8)

[flipped classroom session: recorded lecture by Professors & exercises with TAs]

Th 4/11 **Happy Diwali!** [make-up class during reading week]

WEEK 10: review and Online assessment 2

18 Tu 9/11 review session: expansions, rule ie, & biconditional derivations, etc. [TA class]

Assignment 7 due <u>before class</u> on Thursday!

19 Th 11/11 **Online Assessment 2 (Predicate Calculus without Identity)**

UNIT IV: IDENTITY, OPERATION SYMBOLS, & DESCRIPTIONS

WEEK 11: identity rulez! …and operation symbols

20 Tu 16/11 Polyadic Predicate Logic (IV): inifinite universes, Identity (I)
Readings: Logic Text, ***Chapter 4.9&10***, ***Chapter 5*** (up to & including 5.2)

21 Th 18/11 Identity (II): rules sid, LL, sm; invalidities with identity, operation symbols
Readings: Logic Text, ***Chapter 5*** (up to & including 5.5)

Assignment 8 due <u>before class</u> next Tuesday!

WEEK 12: more on identity & complex terms, invalidities & infinite universes, and descriptions

22 Tu 23/11 Identity (III): derivations with complex terms, rule el, invalid arguments with operation symbols, counter-examples with infinite universes
Readings: Logic Text, ***Chapter 5*** (up to & including 5.8)

23 Th 25/11 Definite Descriptions (I): ι, symbolizing sentences, derivational rules for proper descriptions
Readings: Logic Text, ***Chapter 6*** (up to & including 6.3)

Assignment 9 due <u>before class</u> next Tuesday!

WEEK 13: wrapping up descriptions and looking beyond PHI 1060

24	Tu	30/11	Definite Descriptions (II): symbolization issues, derivational rules for improper descriptions, invalidities with definite descriptions, infinite universes **Readings**: Logic Text, ***Chapter 6*** (up to & including 6.7)
	Th	02/12	no class [Professor Raja attends a conference, make up during make-up week] No Friday OH with Professor **Assignment 10 due before the make-up Tuesday class!**

MAKE-UP WEEK (strictly fun and useful, no new readings) – class times TBA (because of a likely time zone difference)

25	Tu	07/12	Wrap-up 1: The Road Ahead – what else is there in the world of Logic? **NO Readings**
26	Th	09/12	Wrap-Up 2: Applying Logic in your Courses **NO Readings**
			[optional Make-Up Assignment 2 due <u>before</u> Online Assessment 3]
	Tu	14/12	optional review session
	Th	16/12	**Online Assessment 3**

VII. Additional Student Responsibilities

Behavior in the (virtual) Classroom

Treat the instructor, the Teaching Assistants, and your fellow classmates with respect. Be considerate when speaking or typing on the discussion board and make sure others get a chance to voice their views (or answer questions), too. While your participation is actively encouraged, remember that listening what others say and reading closely what others type is as much a form of participation as speaking. Do not confuse the volume of your participation with its value. You are welcome to vigorously disagree, but remember not to be disagreeable! If you are rude or disruptive, you will be asked to leave the classroom.

Electronic Etiquette

1. Your phone must be off or on silent mode, and out of sight.
2. **I would like to see you during our Zoom calls**. If you don't feel comfortable letting everyone take a peek at your home, use a Zoom background. But if possible, do let me see your faces.
3. Ever wondered how to email your professor? Nobody is born knowing how to do this, but luckily there's a useful guide: http://www.wikihow.com/Email-a-Professor

Academic Integrity

You are expected to uphold the highest standards of academic integrity. Your work must be your own. Submitting work which you have not composed yourself, or using another person's ideas without due credit, or failing to mark another person's words with appropriate quotation marks all constitute plagiarism. The instructor reserves the right to assess penalties for violations of academic integrity, which may include giving a failing grade for an assignment, for the entire course, or referral to a University disciplinary committee. I typically assign an F for the assignment in the first instance (unless it is severe), a failing grade for the course if there is a repeated offence. In any event, an Academic Integrity Violation form will be filled and submitted.

Timely work submission

All work must be submitted on time. **Work that is submitted past the deadline will not be assessed**. If you miss a Quiz, you will not be able to make up for it (apart from the make-up option provided).

Students with (Learning and other) Disabilities

Reasonable academic accommodation will be made for students with documented disabilities. **You must contact me or the TAs as early as possible if you need such accommodation.**

Athletes and Artists

Reasonable academic accommodation will be made for students who represent Ashoka as athletes or as artists. **Athletes** must provide their schedules as early as possible, as must artists, and in any case 2 weeks prior to the date they seek an excuse for.

Make-Up Policy

Make-Up Assessments beyond the ones listed above will only be granted in absolutely extraordinary circumstances and are fully at the discretion of the instructor. **Note**: **You cannot just not show up and then ask for a make-up assessment. This is emphatically so for Online Assessments –** since **creating** make-up Online Assessments is a huge amount of extra work for me, I will only consider doing this if you alert me that you are sick (and then provide good evidence for it) **before the assessment takes place**. Ex post accommodations will not be given under any circumstances.