JOHN ABBOTT COLLEGE
LIBERAL ARTS PROGRAM
PRINCIPLES OF MATHEMATICS AND LOGIC

COURSE NO.: 360-124-AB PONDERATION: 3-2-3 ($2\frac{2}{3}$ credits)
INSTRUCTOR: Robert Seely OFFICE: Herzberg Maths Dept, H226, 457-6610 Ext. 5865
SEMESTER: Fall 2019 Office Hours and Course Schedule: (on webpage)
Web page: `http://www.math.mcgill.ca/rags/jac.html`
Email: `robert.seely@mcgill.ca`

INTRODUCTION

The purpose of this course in the Liberal Arts program is to demonstrate the nature of formal reasoning in general and mathematical reasoning in particular. The course aims to demonstrate the elegance, beauty, and power of logic and mathematics. With respect to the objectives of the Liberal Arts program, this course aims to develop "Critical Thought and Reflection," with its two specific objectives: "Recognition of how knowledge is organized, how it is divided into disciplines in the fields of social science, science, logic, mathematics, arts, and letters; and its limits" and "Recognition, assessment, criticism, and formulation of valid arguments in these disciplines".

OBJECTIVES Students should be able to:

- Understand and use the vocabulary of formal reasoning and mathematics, and be able to distinguish: rationality *vs.* logic; inductive *vs.* deductive arguments; logical argument *vs.* metaphor *vs.* description *vs.* example.
- Understand the strategies and frameworks of formal argument.
- Construct and evaluate formal deductive arguments, both verbal and symbolic / mathematical.
- Recognize the forms of argument and kinds of evidence appropriate in mathematical and logical reasoning.
- Understand the relationship between pure logical / mathematical reasoning and its application in other fields of knowledge.
- Understand the limits of deductive reasoning in mathematics and in non-mathematical domains.
- Respond aesthetically to elegant proofs.
- Understand certain "non-classical" logics and their philosophical significance.
- Apply the techniques of a formal logic to a suitable non-logical context.

REQUIRED TEXT

- The principle course text is R.A.G. Seely, *Principles of Mathematics and Logic*.
- You will also be asked to read Harry Frankfurt, *On Bullshit*.

COURSE COSTS: About $25 for the text.

COURSE CONTENT

- The vocabulary of formal reasoning, mathematics, and metamathematics: (*e.g.*, reasoning and rational, logic and logical, valid, sound, infer and inference, imply and implication, axiom, postulate, assumption, premise, proof, tautology and contradiction, conclusion, formal system, completeness, consistency, derivation, paradox, *etc.*).
- Postulational formal systems. Interpretation of a formal system. Pure *vs.* applied mathematics. Mathematics as language ("the language of science").
- Numeracy. The nature of number.
- Time permitting, Gödel's Incompleteness Theorems; application of the proof theory of formal systems to linguistics, and possibly to other domains.

METHODS At least two (usually three) lectures each week will be devoted to articulating and discussing the concepts and demonstrating the methods of logic and mathematics. Some two-hour "labs" will be spent constructing arguments and proofs, and solving problems.

ATTENDANCE Attendance at all classes is mandatory. Students who miss more than 10 hours of classes (*i.e.* roughly two weeks of the semester) for any reason should not expect to pass the course. Doctors' notes or other evidence of serious reasons for absence are not a substitute for attendance.

EVALUATION Grades will be based on:

- Five class tests (given roughly every third Friday). The test getting the lowest mark will count toward 10% of the final grade, and the others will each count toward 20% of the final grade.
- Informed participation in class discussion (10%). Participation will be judged on the amount of involvement in class discussion, demonstrated familiarity with assigned readings and lecture material, and on the soundness and originality of the ideas expressed.

AVAILABILITY To get help, students may call me at 457-6610 (Ext. 5865) (my office, where you can leave a "voice-mail" message) or email me at `robert.seely@mcgill.ca`. My office is in Herzberg (in the main Maths Dept Area).

Cheating and Plagiarism are serious infractions against academic integrity, which is highly valued at the college; they are unacceptable at John Abbott College. Students are expected to conduct themselves accordingly and must be responsible for all of their actions.

Grade review: It is the responsibility of students to keep all assessed material for at least one month past the grade review deadline in the event that they would want to request a grade review. Students can learn more about their rights and responsibilities by reading the IPESA.

Assessment: Changes to the evaluation plan during the semester require unanimous consent of students. Students will receive a Mid-Semester Assessment in accordance with College procedures.

Religious Holidays: Students who wish to observe religious holidays must inform me of their intent, in writing, within the first two weeks of the semester.

For more information on Student Academic Rights and Responsibilities consult the IPESA on the JAC website.

Maths & Logic Test Dates

There will be five tests in class, on the following dates:

1. 13 September 2019
2. 4 October 2019
3. 25 October 2019
4. 15 November 2019
5. 6 December 2019

The test getting the lowest mark will count toward 10% of the final grade, and the others will each count toward 20% of the final grade. The remaining 10% is for class participation.

Absence and other policies

If there is a class cancellation on the day of a test, you ought to expect that it will be held on the next possible day, unless I have announced otherwise.

I strongly recommend that you attend all classes, and if you expect to miss a class, please tell me ahead of time if possible, so I can let you know what material you will have to make up on your own.

You are responsible for covering missed classes, and for doing missed assignments, yourself, regardless of the reasons for missing the classes.

Students who wish to observe religious holidays must inform me of their intent, in writing, within the first two weeks of the semester. As with other absences, you are responsible for making up the missed material yourself.

If you have to miss a test, let me know *as soon as possible* (leave me a message by phone, send me an email, or otherwise inform me of the circumstances at the earliest possible moment). If you know ahead of time, we may be able to arrange an alternate schedule; if that is impossible, let me know when you will be back at college (for the same reason). Do **not** just show up to class after the test without having been in touch, expecting me to arrange things for you at that time!

The use of *cell phones* in class is strictly forbidden—be sure to put your phone away, especially during tests (where the use of a cell phone could be interpreted as cheating). If you wish to use a laptop or other electronic device in class, clear it with me beforehand. Such use will not be allowed during tests, of course.

Availability

My office is located in Herzberg, H226 in the Maths Dept Area. My office hours are posted on my door: I am available 11:30 to 13:00 and 14:30 to 16:00 Monday and Wednesday, and 12:00 to 12:30 Thursday; I am also available at other times (when mutually convenient) by appointment (see the schedule posted on my door, and on the course webpage).

My office phone is 514-457-6610 (ext 5865); my email is `robert.seely@mcgill.ca`; use that email address or MIO. My webpage is `www.math.mcgill.ca/rags/jac.html`. Bookmark this page—I will use it throughout the semester as a way of communicating with the whole class, and it will have useful stuff (such as extra notes, assignments, test solutions, *etc.*).

OBJECTIVE	STANDARD
Statement of the competency	**Achievement context**
To demonstrate the importance of the principles, ideas and methods of logic and mathematics as disciplines.	Using appropriate laboratory exercises. Using appropriate texts.
Elements	**Performance criteria**
1. To recognize the nature of logical reasoning and of mathematical reasoning.	1.1 Accurate definition of concepts such as proof, axiom or postulate, consistency, validity and soundness of arguments, and so on. 1.2 Appropriate illustration of the nature of proof by the use of these concepts.
2. To formulate arguments in accordance with the central concepts of mathematics and logic.	2.1 Accurate identification of the component parts of arguments. 2.2 Appropriate use of various forms of valid argument. 2.3 Explication of the use of valid argument in mathematics.
3. To explain relationships between mathematics, logic and other disciplines.	3.1 Clear statement of concepts common to philosophy, sciences and mathematics. 3.2 Appropriate illustration of the uses or importance of mathematics in arts and in sciences. 3.3 Adequate description of accomplishments in mathematics that are important in the history of other fields.
4. To apply deductive systems and inductive systems in various instances.	4.1 Correct distinction between the respective natures of deductive and inductive systems. 4.2 Appropriate illustration of deductive and inductive systems. 4.3 Demonstration of proof in such systems.
5. To do an assignment in an area of mathematics and logic.	5.1 Correct use of appropriate terms in an area of mathematics and logic. 5.2 Correct solution of problems in an area of mathematics and logic.