**General Education Course Inclusion Proposal**

**Quantitative Reasoning and Analysis**

*This proposal form is intended for departments proposing a course for inclusion in the Northern Michigan University General Education Program. Courses in a component satisfy both the Critical Thinking and the component learning outcomes. Departments should complete this form and submit it electronically through the General Education SHARE site.*

**Course Name and Number:** PL 160 Introduction to Logic

**Home Department:** Philosophy

**Department Coordinator Name and Contact Information** (phone, email): Antony Aumann (x1682/aaumann@nmu.edu)

**Expected frequency of Offering of the course**: Every semester

**Official Course Status**: Has this course been approved by CUP and Senate? YES

*Courses that have not yet been approved by CUP must be submitted to CUP prior to review by GEC. Note that GEC is able to review courses that are in the process of approval; however, inclusion in the General Education Program is dependent upon Senate and Academic Affairs approval of the course into the overall curriculum.*

**Overview of course** (please attach a current syllabus as well): *Please limit the overview to two pages (not including the syllabus)*



1. **Overview of the course content**

The primary goal of PL 160 is to help students become more skilled at evaluating arguments. To this end, the class acquaints students with the methods and principles that guide the assessment of arguments. In addition, it gives students practice applying these methods and principles to concrete cases.

By the end of the course, students are expected to be able to do the following: (1) understand basic concepts such as truth, validity, soundness, and cogency; (2) detect formal and informal fallacies; (3) assess the validity of arguments using Venn diagrams; (4) translate arguments into a formal symbolic language in order to assess their validity using truth tables; and (5) construct and evaluate logical proofs in a formal symbolic language.

1. **Explain why this course satisfies the Component specified and significantly addresses both learning outcomes.**

**Critical Thinking Component:** To satisfy the *Evidence* dimension, PL 160 requires students to determine whether the premises of an argument are relevant to its conclusion. In addition, it requires students to identify whether a fallacy has been committed because of reliance on irrelevant or otherwise problematic premises. PL 160 evaluates this dimension through homework assignments and tests in which students must determine what (if any) fallacy is committed in sample arguments.

To satisfy the *Integrate* dimension, PL 160 requires students to apply basic logical concepts such as truth, validity, soundness, and cogency to everyday arguments. PL 160 evaluates this dimension through homework assignments and tests in which students must determine whether sample arguments are inductively strong or weak, cogent or uncogent, valid or invalid, and sound or unsound.

To satisfy the *Evaluate* dimension, PL 160 requires students to determine whether arguments are valid or invalid using a variety of methods including Venn diagrams, truth tables, and/or the natural deduction system. (Not all versions of the class will cover Venn diagrams.) PL 160 assesses this dimension through homework assignments and tests in which students must identify whether sample arguments are valid or invalid using the foregoing methods.

**Quantitative Reasoning and Analysis Component:** To satisfy the *Calculation* dimension, PL 160 requires students to translate arguments into a formal symbolic language and then to determine whether the conclusion of the argument follows necessarily from the premises using both truth tables and the natural deduction system. PL 160 assesses this dimension through homework assignments and tests in which students must perform the operations just described. (Note: Although the operations here are not strictly mathematical or numerical, they do utilize a formal symbolic language. Moreover, on some views, these logical operations provide the foundation for mathematical operations.)

To satisfy the *Analysis/Application* dimension, PL 160 requires students to apply the basic logical rules of the natural deduction system to sample sets of statements in order to establish what conclusion(s) follow from them. PL 160 assesses this dimension through homework assignments and tests in which students must construct logical proofs in a formal symbolic language using the rules of the natural deduction system.

To satisfy the *Interpretation* dimension, PL 160 requires students to construct and then interpret Venn Diagrams and/or logical proofs using the natural deduction system in order to assess the validity of arguments. (Not all versions of the class will cover Venn Diagrams.) PL 160 assesses this dimension through homework assignments and tests in which students must perform the task just described.

**How Logic is Quantitative:** The operations involved in logical proofs and logical derivations require the application of formal rules to statements that symbolically represent reality. The result of the application of these formal rules is a new set of statements that can in turn be subjected to the same formal rules in order to generate a further set of statements. In this respect, logical derivations directly resemble the calculations that occur in mathematics and all quantitative disciplines. Perhaps the closest cousins would be the geometric proofs we all performed in high school and the proofs of theorems in algebra, calculus, etc. that occur at higher academic levels.

It is important not to restrict being quantitative to being numerical. There are many things that are obviously quantitative, such as algebra and calculus, but that need not traffic in numbers. A discipline is quantitative just in case its results are subject to iterative rule-based calculations, i.e. if the application of a set of formal rules to a piece of information produces new useful information that can in turn be subject to the same set of formal rules to generate still further useful information. We are used to doing these kind of iterative operations with numbers and things we can measure in terms of numbers: distance, time, money, etc. What happens in logic is that we extend the idea to all domains of life. We perform iterative operations on everything from distance, time, and money to love, politics, and religion.

There is also a more fundamental sense in which logic has to do with quantitative analysis. At some point, we would like to know why we should trust quantitative analysis. What makes it true, for instance, that 1+1=2 and 2x2=4. One of the projects of logic has been to prove that such basic mathematical operations—indeed all mathematical and quantitative operations—derive from fundamental logical operations. In other words, all quantitative analysis whatsoever is ultimately a form of logic. See, most notably, Gottlob Frege, 1980 [1884], *The Foundations of Arithmetic: A Logico-mathematical Enquiry into the Concept of Number*, J.L. Austin (trans.), Evanston: Northwestern University Press; Alfred North Whitehead and Bertrand Russell, 1910, 1912, 1913, Principia Mathematica, 3 vols, Cambridge: Cambridge University Press; Crispin Wright, 1983, *Frege's Conception of Numbers as Objects* (Scots Philosophical Monographs, Volume 2), Aberdeen: Aberdeen University Press.

1. **Describe the target audience (level, student groups, etc.)**

PL 160 has a dual target audience. In part, it is intended to provide the general undergraduate population with rigorous training in critical thinking and logical analysis. In addition, it is intended to provide students interested in philosophy with an introduction to the tools and principles often used in more advanced classes in the discipline.

1. **Give information on other roles this course may serve (e.g. University Requirement, required for a major(s), etc.)**

PL 160 serves as an elective for the philosophy major and minor.

1. **Provide any other information that may be relevant to the review of the course by GEC.**

N/A.

**PLAN FOR LEARNING OUTCOMES  
CRITICAL THINKING**

*Attainment of the CRITICAL THINKING Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Critical Thinking Rubric for more information on student performance/proficiency in this area. Note that courses are expected to meaningfully address all dimensions of the learning outcome.*

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| **DIMENSION** | **WHAT IS BEING ASSESSED** | **PLAN FOR ASSESSMENT** |
| **Evidence** | Assesses quality of information that may be integrated into an argument | **Task Type**: Homework assignments (problem sets) and tests that involve identifying what logical fallacy (if any) is committed when relying on a given piece of evidence to support a given conclusion.  **Frequency:** approx. 5 homework assignments and 1 test.  **Overall Grading Weight**: The relevant homework assignments are worth approx. 5% of total grade. The relevant test is worth approx. 15% of total grade. Note: Not all versions of the class grade the homework assignments.  **Expected Proficiency Rate**: 70%  **Rationale**: Logic requires students to reflect in an unusually sustained and careful fashion about complex issues. Almost all students find it incredibly difficult. Experience suggests 30% fail to achieve “proficient” status. |
| **Integrate** | Integrates insight and or reasoning with existing understanding to reach informed conclusions and/or understanding | **Task Type**: Homework assignments (problem sets) and tests that involve determining whether sample arguments have the following logical properties: inductively strong/weak, cogent/uncogent, valid/invalid, and sound/unsound.  **Frequency:** approx. 5 homework assignments and 1 test.  **Overall Grading Weight**: The relevant homework assignments are worth approx. 5% of total grade. The relevant test is worth approx. 15% of total grade. Note: Not all versions of the class grade the homework assignments.  **Expected Proficiency Rate**: 70%  **Rationale**: Logic requires students to reflect in an unusually sustained and careful fashion about complex issues. Almost all students find it incredibly difficult. Experience suggests 30% fail to achieve “proficient” status. |
| **Evaluate** | Evaluates information, ideas, and activities according to established principles and guidelines | **Task Type**: Homework assignments (problem sets) and tests that involve determining whether sample arguments are valid or invalid using Venn Diagrams, truth tables, and/or the natural deduction system. Note: Not all versions of the class cover Venn Diagrams.  **Frequency:** approx. 15 homework assignments and 3 tests.  **Overall Grading Weight**: The relevant homework assignments are worth approx. 15% of total grade. The relevant tests are worth approx. 45% of total grade. Note: Not all versions of the class grade the homework assignments.  **Expected Proficiency Rate**: 70%  **Rationale**: Logic requires students to reflect in an unusually sustained and careful fashion about complex issues. Almost all students find it incredibly difficult. Experience suggests 30% fail to achieve “proficient” status. |
|  |  | **Overall Note**: The tests and homework assignments referred to in the different dimensions above **do not** overlap. The result is that **100%** of the total course grade is dedicated to one dimension or another of this outcome. |

**PLAN FOR LEARNING OUTCOMES  
QUANTITATIVE REASONING AND ANALYSIS**

*Attainment of the QUANTITATIVE REASONING AND ANALYSIS Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Rubric for more information on student performance/proficiency in this learning outcome. Note that courses are expected to meaningfully address all dimensions of the learning outcome.*

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| **DIMENSION** | **WHAT IS BEING ASSESSED** | **PLAN FOR ASSESSMENT** |
| **Calculation** | Ability to perform mathematical/numerical operations. | **Task Type**: Homework assignments (problem sets) and tests that involve translating arguments into a formal symbolic language and determining whether the conclusion follows necessarily from the premises using truth tables or the natural deduction system.  **Frequency:** approx. 10 homework assignments and 2 tests.  **Overall Grading Weight**: The relevant homework assignments are worth approx. 10% of total grade. The relevant tests are worth approx. 30% of total grade. Note: Not all versions of the class grade the homework assignments.  **Expected Proficiency Rate**: 70%  **Rationale**: Logic requires students to reflect in an unusually sustained and careful fashion about complex issues. Almost all students find it incredibly difficult. Experience suggests 30% fail to achieve “proficient” status. |
| **Analysis/Application** | Ability to manipulate quantitative data to produce new data.  Ability to use data to make judgments and draw conclusions. | **Task Type**: Homework assignments (problem sets) and tests that involve applying the basic rules of the natural deduction system to sample statements to establish what conclusion(s) follows from them.  **Frequency:** approx. 5 homework assignments and 1 test.  **Overall Grading Weight**: The relevant homework assignments are worth approx. 5% of total grade. The relevant test is worth approx. 15% of total grade. Note: Not all versions of the class grade the homework assignments.  **Expected Proficiency Rate**: 70%  **Rationale**: Logic requires students to reflect in an unusually sustained and careful fashion about complex issues. Almost all students find it incredibly difficult. Experience suggests 30% fail to achieve “proficient” status. |
| **Interpretation** | Ability to explain information presented in mathematical forms (e.g. equations, graphs, diagrams, tables, and words) | **Task Type**: Homework assignments (problem sets) and tests that involve constructing and then interpreting Venn Diagrams and/or logical proofs in order to assess the validity of arguments. Note: Not all versions of the class use Venn Diagrams.  **Frequency:** approx. 10 homework assignments and 2 tests.  **Overall Grading Weight**: The relevant homework assignments are worth approx. 10% of total grade. The relevant tests are worth approx. 30% of total grade. Note: Not all versions of the class grade the homework assignments.  **Expected Proficiency Rate**: 70%  **Rationale**: Logic requires students to reflect in an unusually sustained and careful fashion about complex issues. Almost all students find it incredibly difficult. Experience suggests 30% fail to achieve “proficient” status. |
|  |  | **Overall Note**: The tests and homework assignments referred to in the different dimensions above **do not** overlap. The result is that **100%** of the total course grade is dedicated to one dimension or another of this outcome. |