Research and Epistemology B—Numeracy and Quantitative Reasoning

Overview: Courses in this category include the majority of general education math courses through Calculus II as well as two logic courses and a computer programming course. They focus on understanding and analyzing numerical data, problem solving, and critical thinking. Many majors include one or more of these courses as lower-division requirements, so by completing the lower-division requirements this general education category is met. On the other hand, some BA degrees require no specific course in this area. Those students will need to select any course from this category, with CSCI 2611, MATH 1115 or PHIL 2090 being the most common choices.

Approved Courses:

CSCI 2611 A Gentle Introduction to Computer Programming
A gentle introduction to computer programming using a fun, popular, and powerful programming language such as Ruby or Python. Designed to teach computer programming to non-programmers, this course is also valuable to programmers. Students learn fundamental and universal programming concepts, as well as problem-solving and critical-thinking skills valuable for other courses and in life. Extensive programming assignments. Topics include: variables and assignment, basic data types, strings, arrays, conditional and iterative control structures, control flow, modularization, objects, methods, parameters, testing, and debugging. Mastery of Ruby or Python also provides a foundation for learning Web programming frameworks Rails or Django.

MATH 1110 Introduction to Mathematical Logic
An introduction to mathematical logic covering Sentential and First Order Logic including the methodology of writing mathematical proofs; the course will look at logic from both the syntactic and semantic perspective. Topics include deductive calculus, valid forms, the Soundness Theorem, and some programming in a functional language such as Scheme.

MATH 1115 Survey of Mathematics
Survey of Mathematics is a general course that emphasizes both quantitative and non-quantitative reasoning skills and applications of Mathematics. Topics may include inductive and deductive reasoning, sequences, drawing and interpreting graphs of polynomial, logarithmic and trigonometric functions, scientific notation, symmetry and solids, curves, permutations and combinations, and an introduction to probability and statistics and topology, plus individual topics to prepare students for subsequence courses in their major and/or pursue student interests. It is designed to serve students who do not need a preparation for Calculus and who could benefit from a more general and conceptual course in mathematics. The course is designed to support the student who finds typical math classes very challenging yet have talents in their major. MATH 1115 gives students the opportunity to see mathematics used in interesting and creative ways and in important real-life applications.

MATH 1130 Pre-Calculus I
This course is the first in the Pre-Calculus series. It presents the mathematical concepts that will prepare students for higher-level mathematics courses. Core topics include: functions; linear and quadratic functions and their graphs; polynomial and rational functions and their graphs; exponential and logarithmic functions; trigonometric functions of real numbers and angles; and systems of equations and inequalities. Optional topics may include: complex numbers; matrices; linear programming; and an introduction to probability.

MATH 1140 Pre-Calculus II
This course is the second in the Pre-Calculus series for students who have successfully completed MATH 1130 at HPU. Topics include: a brief review of functions; an in-depth development of the trigonometric and transcendental functions and their applications; topics from analytical geometry including conic sections, translation and rotation of axes; vectors, polar coordinates; parametric equations; trigonometric form of complex numbers; sequences and series; mathematical induction; limits; and an introduction to the calculus.

**MATH 1150 Pre-Calculus I and II Accelerated**
This course is designed for well-qualified students who are prepared to complete the Pre-Calculus sequence in one term. The course includes all the topics covered in Pre-Calculus I, Math 1130, and Pre-Calculus II, Math 1140. Topics will include: polynomial and rational functions, including complex numbers; exponential and logarithmic functions; trigonometric functions and their graphs; systems of equations and inequalities; transcendental functions; conic sections; polar coordinates; parametric equations; sequences and series; and an introduction to calculus. Heavy emphasis will be placed on problem-solving skills and the application of procedures to real-world data.

**MATH 2214 Calculus I**
Calculus I primarily emphasizes the fundamental concept of the differentiation with applications, and an introduction to integration with applications. The course covers topics in five chapters in the text, namely chapters 2, 3, 4, 5, and 6. These topics include: limit, continuity, derivative, arithmetic differentiation rules, chain rule, implicit differentiation, related rates, curve sketching, optimization, definite integral, indefinite integral, substitution in definite and indefinite integrals, area between curves, and volumes of revolution.

**MATH 2215 Calculus II**
This course is a continuation of Math 2214 Calculus I that completes the development of the integral. Integration topics include: trigonometric integrals, trigonometric substitution, integration by parts, and partial fractions; with application to area between curves, length of curves, and volumes and surfaces of revolution. Other topics include: infinite series; tests of convergence; power series; radius of convergence; and Taylor’s formula.

**PHIL 2090  Principles of Logic**
The course includes analysis of argument structure; argument diagrams; informal fallacies; logic of categories and quantified statements; propositional logic; translation; truth functions; method of formal proof; truth table method; method of Venn diagrams; elementary quantification theory. Knowledge derived from the study of quantified reasoning and Venn diagrams can be used in the process of forming conclusions or inferences from propositions expressing quantitative information. The course aims to make students more aware of their own reasoning patterns, and to provide them with principles which they can use to distinguish good from bad patterns of reasoning.
Student Learning Outcomes—Courses in Research and Epistemology B must address both of the outcomes below from Research and Epistemology

- Students will seek and achieve understanding of numerical data. [R&E 5]
- Students will recognize the multiple interpretations numerical data permit and ways that they can be manipulated. [R&E 6]

Plus at least one of the following:

- Students will identify a research question or problem, gather and organize relevant information, apply problem solving strategies, and communicate the results to others [R&E2]
- Students will utilize methods and technologies appropriate to the discipline to investigate research questions, generate predictions, test hypotheses and/or solve problems. [R&E 7]

If the course does not address all four of the above outcomes, the fourth outcome can be drawn from any theme.

In addition students in these courses meet the following special requirements that apply just to this category:

1. Students will apply effective critical thinking and quantitative reasoning skills to the solution of mathematical problems.

2. Students will use the following approaches of presenting data and solving mathematical problems: verbal (written and oral), numerical (lists and tables), symbolic (equations and formulas), graphical (graphs), and diagrammatic (diagrams). Cover at least two of the kinds of approaches listed.

3. Students will use calculators and/or computer software as a tool to model and solve mathematical problems.

4. Students will submit evidence of their quantitative reasoning on course assignments, such as midterm and final exams, quizzes, projects, research papers, and homework. These assignments will represent at least 70% of the final course grade.

Additional Research and Epistemology Outcomes addressed by courses in this category

- Students will understand the concept of epistemology, i.e., that there are various systems of gathering/organizing/analyzing/evaluating in the process of constructing knowledge as well as multiple ways to solve a given problem. [R&E 1]
- Students will use reasoning skills, such as identifying assumptions, considering multiple perspectives and positions including one's own, making inferences, and drawing conclusions, to advance an argument supported by reasons and evidence. [R&E 4]
Research and Epistemology outcomes addressed by each approved course:

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<th>Research and Epistemology Outcomes</th>
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