College of San Mateo
Official Course Outline

1. **COURSE ID:** PHIL 200 **TITLE:** Introduction to Logic **C-ID:** PHIL 110
   Units: 3.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; 96.0-108.0 Homework hours; 144.0-162.0 Total Student Learning hours
   Method of Grading: Letter Grade Only
   Recommended Preparation:
   Eligibility for ENGL 100 or ENGL 105.

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
   CSM - GENERAL EDUCATION REQUIREMENTS: E2b. Communication and Analytical Thinking
   CSU GE:
   CSU GE Area A: ENGLISH LANGUAGE COMMUNICATION AND CRITICAL THINKING: A3 - Critical Thinking

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   This course introduces some principles of valid reasoning with emphasis on proof systems for propositional and predicate logic. Includes translation of English sentences into a symbolic language, patterns and techniques of deductive and inductive inference, and basic probability theory.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Demonstrate understanding of deductive reasoning and competence in some methods of formal logic.
   2. Use formal techniques to determine logical properties of individual statements and logical relationships that hold between pairs of statements such as contradiction, contingency, consistency, equivalence, etc.
   3. Represent the form of an argument by translating English statements into a formal language using truth-functional operators and (multiple) quantifiers.
   4. Construct proofs for valid arguments and theorems in truth-functional and predicate logic (or show that an argument is invalid) using appropriate techniques such as truth tables, truth trees, Venn diagrams, natural deduction, etc.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Demonstrate understanding of deductive reasoning and competence in some methods of formal logic.
   2. Use formal techniques to determine logical properties of individual statements and logical relationships that hold between pairs of statements such as contradiction, contingency, consistency, equivalence, etc.
   3. Represent the form of an argument by translating English statements into a formal language using truth-functional operators and (multiple) quantifiers.
   4. Construct proofs for valid arguments and theorems in truth-functional and predicate logic (or show that an argument is invalid) using appropriate techniques such as truth tables, truth trees, Venn diagrams, natural deduction, etc.

6. **COURSE CONTENT:**
   Lecture Content:

   1. Basic Concepts
      A. Sentences and Propositions
      B. Forms of Statements
      C. Forms of Arguments
      D. Deductive and Inductive Patterns of Reasoning
      E. Substitution Instances and Counterexamples
      F. Validity and Soundness
      G. Strength and Cogency
      H. Analyzing Arguments: Identifying Premises and Conclusion and Restating an Argument in Logical

Standard Form

2. Truth-Functions and Truth Tables
   A. Symbolizing Compound Statements and Arguments
   B. Truth Tables and Truth-functional Analysis
   C. Using Truth Tables to Evaluate Truth-functional Compounds and Arguments
   D. Using Tables to Determine Tautology, Contradiction, Contingency, and Logical Equivalence
3. Propositional Logic: Proofs in Natural Deduction
   A. Implicational and Equivalence Rules of Inference
   B. Conditional Proofs in Propositional Logic
   C. Reductio Ad Absurdum Proofs in Propositional Logic
   D. Proving Theorems of Propositional Logic
4. Predicate Logic: Proofs in Natural Deduction
   A. Predicate Terms, Variables, and Quantifiers
   B. Inference Rules of The Predicate Calculus
   C. Demonstrating Invalidity
   D. Conditional Proofs in Predicate Logic
   E. Reductio Ad Absurdum Proofs in Predicate Logic
   F. Quantifier Negation
   G. The Logic of Relations: Symbolization and Proofs
5. Probability
   A. Classical, Frequency, and Subjective Theories of Probability
   B. The Rules of The Probability Calculus
   C. Derivation and Application of Bayes' Theorem
6. Additional Topics May Include One or More of the Following
   A. The Method of Truth Trees
   B. Venn Diagrams
   C. The Logic of Identity and Definite Descriptions
   D. Modal Logic

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**

Typical methods of instruction may include:

A. Lecture
B. Discussion
C. Guest Speakers
D. Individualized Instruction
E. Observation and Demonstration

8. **REPRESENTATIVE ASSIGNMENTS**

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

Written exercises from the text and/or additional exercises or supplementary materials (1-3 pages) for every logical system.

Reading Assignments:

Reading assignment from the text that correspond to the chapter exercises for each logical system (1-2 chapters for each logical system or theory) approximately 20-40 pages for every 2-4 weeks.

Other Outside Assignments:

Homework Problems
Quizzes and Exams
Examples of typical problems:
Basic concepts. The student will be able to explain what an argument is, identify its premises and conclusion, re-state the argument in logical standard form, and say what makes an argument deductively valid or inductively strong.
Concepts and techniques in propositional logic: Student will be able to provide a truth table demonstration of the invalidity of the argument ¬[(J·K)→(M?N)]∴K·N
Concepts and techniques in predicate logic: Student will be able to provide a proof in natural deduction of the following valid arguments(x)[Bx→(Cx · Dx)], (?x)Bx ∴(?x)¬(¬Cx?¬Dx) ¬(?x)[Px · (?y)(Py · Lxy)] ∴(x)[Px→(y)(Py→¬Lxy)]
Student will be able to prove that the following is a theorem[(P→Q)·(R→¬Q)]→¬(P·R)
Applications of probability theory-the student will be able to solve a problem such as the following: "A

veterinarian has diagnosed a dog as having either leukemia or severe anemia, but not both. Given the symptoms, 90 percent of dogs have severe anemia and 10 percent of dogs have leukemia. So, the vet initially surmises that the dog has severe anemia. Later, however, the vet conducts a lab test on the dog that turns out positive. Seventy percent of cases of leukemia yield a positive result when this test is applied, and 20 percent of cases of anemia yield a positive result. What is the probability that the dog has leukemia given the results of the test?"
Students will be able to render the statement "Some but not all sick dogs have leukemia," in the symbolic notation of predicate logic.

9. **REPRESENTATIVE METHODS OF EVALUATION**
Representative methods of evaluation may include:
   A. Class Performance
   B. Class Work
   C. Group Projects
   D. Homework
   E. Projects
   F. Quizzes
   G. Typical methods of evaluation may include the following: From the results of class exercises and group work: instructor verification of the understanding of terms and concepts used, as well as correct application of the techniques of logic; student performance on textbook and lab exercises and problem sets; student participation in class provides evidence of understanding of concepts and application of techniques; quizzes and examinations provide evidence that students understand the concepts of logic and are able to correctly deploy the techniques of logic (for example, in demonstrating validity using a truth table, or deriving a theorem using the rules of inference).

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
   A. Patrick J. Hurley. *A Concise Introduction to Logic* , 12th ed. Cengage learning, 2015
   B. Kahane, Howard and Hausman, A. *Logic and Philosophy*, ed. 13th ed: Hackett, 2021
   C. Baronett, Stan. *Logic: An Emphasis on Formal Logic*, 5th ed ed. Oxford University Press, 2021

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Course Originator: Jeremy Ball