80-100 Introduction to Philosophy

All Semesters: 9 units

In this introductory course we will explore three major areas of Philosophy: Ethics, Metaphysics, and Epistemology. Accordingly the course is divided into three sections. In each section we will read primary sources and discuss some of the main philosophic problems associated with that area. These will include: moral problems (Ethics), problems arising from the debates about free will, personal identity or intelligence (Metaphysics), and inquiries about the scope and limits of human knowledge (Epistemology). We will then introduce some theories designed to solve such problems, and try to understand the strengths and weaknesses of these theories. We will apply different techniques to theories about issues that we might encounter in the real world. We will use class discussions, homeworks and papers to learn skills for evaluating arguments. These skills include: how to present a philosophic argument, what are the assumptions that justify it, what are its weaknesses and its strengths, whether such weaknesses can be resolved and, if they cannot be resolved, why.

80-110 Nature of Mathematical Reasoning

Intermittent: 9 units

This course focuses on understanding the principles and problems at the root of mathematical reasoning, if it is any course on any specific mathematical theory, like linear algebra or topology. We will explore the foundations of mathematics, both in terms of their historical origin and their modern purpose as a base for the study of mathematics. Then we will see how problems which seem to have no intuitive solution look simple after being put in the right mathematical form, but also consider the limitations this type of approach. We will treat such issues as they arise both in applied fields (policy decision-making, physics, computer science) and as more recreational, speculative and abstract (Conway’s game of life, the works of Escher, music). The course is aimed for students at the freshman and sophomore level who do not necessarily intend to pursue a mathematically intense major.

80-130 Introduction to Ethics

Intermittent: 9 units

Philosophical ethics, or moral philosophy, covers a lot of ground. It asks and tries to answer questions like: What’s good in life? What matters? What should I (and others) do? How should I (and others) act? What kinds of things out there must be treated ethically? Do we have moral duties to (at least some) non-human animals? Is morality subjective? Are there actually any objective moral truths? Morally speaking, what (if anything) is the difference between killing someone, and simply letting them die? In trying to answer these questions (and others), we’ll engage in some wonderfully weird thought experiments, class discussions, smaller group discussions, debates, etc. We’ll study and critique several moral theories which try to explain and help guide our moral judgments, and we’ll try to apply these theories to real-life moral controversies. Past classes covered topics including drug prohibition, abortion, euthanasia, and physician-assisted suicide. This is an introductory philosophy class, so you’ll be learning how to read, critique, do, and write philosophy generally, not just ethics. Considerable time and effort, both in lectures and in recitations, will be spent helping you learn to recognize and evaluate philosophical arguments, as well as empowering you to create, improve, and defend your own arguments in class assignments.

80-135 Introduction to Political Philosophy

Intermittent: 9 units

As an introductory course, we will seek to trace out the historical and philosophical dimensions of the polis from its origins in Ancient Greece to its current manifestation in present-day society. Special emphasis will be placed on the concept and practice of “democracy.” We’ll begin with the history of political philosophy from Plato and Aristotle (two of the early critics of democracy) to the modern period and the arguments in support of “republicanism” as found in the Federalist Papers (Madison, Jay, Hamilton). These historical moments cast light on the philosophy behind the development of the US constitution. Following Ketcham, we’ll discuss the debate between the “ancients and moderns,” enlightenment ideas regarding liberty and equality as well as the distinction between private rights and public goods. After presenting some fundamental justifications for democracy and our current models of democratic governance, we’ll study the basic political frameworks of our day through a thorough-going analytic analysis of the writings and arguments of recent and contemporary political philosophers such as John Rawls, Ronald Dworkin, Robert Nozick, Charles Talyor, Michael Sandel, and Annette Baier. The course will end with a discussion of the theory and practice of deliberative democracy and a chance for students to engage in this model of democracy through the activities of an ersatz “deliberative poll.”

80-136 Social Structure, Public Policy & Ethics

Intermittent: 9 units

This course will consider ethical questions surrounding social structure and public policy. It will analyze the role of political institutions and individual citizens in dealing with some of the greatest challenges facing our world: Global health crises, the spread of (and threats to) democracy worldwide, and world poverty. Some of the questions we will consider include: Are developed countries obligated to ameliorate poverty by providing foreign aid? What is democratic governance, and what do democratic representatives owe to their constituents? Should wealthy nations and corporations assist in the fight against life-threatening diseases worldwide? The course uses ethical and political theory, case studies, and empirical evidence to consider these questions.

80-150 Nature of Reason

Intermittent: 9 units

This course offers an intellectual history of philosophical views regarding the nature of human reasoning in mathematics and the sciences, from ancient to modern times. The first part of the course traces the search for deductive methods for obtaining certain knowledge, starting with Aristotle and Euclid, and continuing through the Middle Ages and late Renaissance thought, to the work of Boole and Frege in the nineteenth century. The second part of the course considers the history of skepticism about empirical knowledge, covering Plato, Sextus Empiricus, Descartes, Pascal, and Hume, along with replies to skepticism in the works of Bayes and Kant. The third part of the course discusses theories of the nature of mind, culminating in the computational conception of mind that underlies contemporary cognitive science.

80-180 Nature of Language

Fall and Spring: 9 units

Language is used to talk about the world or to describe it, but how do we go about describing language itself? Linguistics is the name given to the science of language, whose task it is to give such a description. The discipline of linguistics has developed novel tools for describing and analyzing language over the last two hundred years and in this course we learn what these tools are and practice applying them. Sub-areas of linguistics which we study include phonetics (the study of speech sounds), phonology (the study of sound systems), morphology (the study of parts of words), and syntax (the study of combinations of words). Beyond this, we look at changes in language over time, and we consider the puzzle of linguistic meaning. The methods of linguistics are useful in the study of particular languages and in the study of language generally, so this course is useful for students of foreign languages as well as those interested in going on to study language acquisition, psycholinguistics, sociolinguistics, philosophy of language, and computer modeling of language.
80-201 Knowledge and Justified Belief
Intermittent: 9 units
What does it mean to have knowledge? How do we know things, and what can be known? These are some of the central questions in the discipline of epistemology ("the theory of knowledge"). The answers to these questions are not as obvious as some casual thought may suggest. If you think the senses provide us with knowledge, how will you know when your senses deceive you? If you think knowledge is gained through reasoning, where will you start reasoning? This course investigates these questions, focusing on both classic questions and treatments and more recent work in the field of social epistemology. There are no prerequisites, but students may find previous experience with philosophical reasoning to be helpful. Students both with and without such experience are encouraged to take the class.

80-208 Critical Thinking
Intermittent: 9 units
This course is an introduction to practical reasoning. The course will contain an elementary introduction to concepts important for reasoning and decision making, such as validity, probability, and utilities. Students will extensively practice critically analyzing and evaluating a wide variety of arguments found in newspapers, magazines, and elementary accounts of scientific reasoning. In order to help students develop the skills to analyze and evaluate arguments, the course will introduce several software packages recently developed at CMU that help students diagram arguments and causal reasoning; these packages have been shown to improve students critical reasoning skills. In addition, students will learn about a wide variety of statistical, logical, psychological, and causal fallacies that are used to mislead people.

80-210 Logic and Proofs
All Semesters: 9 units
This web-based course introduces students to central issues in logic and develops their ability for constructing and refuting arguments. It addresses the question: How can one analyze the structure of rational discourse or, more specifically, the logical structure of argumentation? An answer to this question requires: (i) uncovering the logical form of statements; (ii) defining the correctness of logical steps; (iii) formulating inference rules for the logical forms; (iv) designing strategies for argumentation with the inference rules. The course takes these steps for both sentential and quantification logic. Presentation: The material is presented on-line, though some exercises must be done with pen and paper. Additional reading of historical and philosophical character complements the systematic on-line presentation. Weekly small discussion meetings with collaborative reviews, substantive discussions and critical reflections supplement the on-line material.

80-211 Logic and Mathematical Inquiry
Intermittent: 9 units
Since ancient times, mathematical arguments have served as a paradigm for rational inquiry. This course studies the structure of such arguments and their applications. We will study foundational mathematical concepts and informal proofs, as they appear in everyday mathematics. At the same time, in parallel, we will study mathematical logic, which provides formal symbolic languages for mathematics. The course will make use of a computational "proof assistant" to develop fully rigorous, machine-checked proofs. This course prepares students to take the 310-311 series on the fundamental (in)completeness and (un)decidability theorems of modern logic.

80-214 Computing, AI, and Philosophy
Intermittent: 9 units
The aim of the course is to give an interdisciplinary introduction to computation, artificial intelligence, and philosophical questions regarding them. It will also include historical and sociological issues concerning these topics as well as their representation in the arts. The course does not require a background in mathematics, computer science or philosophy.

80-220 Philosophy of Science
Intermittent: 9 units
In this course, we will examine some historical case studies (e.g., the Copernican revolution in astronomy) against which we will assess views pertaining to the significance, justification, and production of scientific knowledge. For example, should scientific theories be understood literally or as computational devices for deriving new predictions? How can universal conclusions ever be justified by a finite data set? Does explanation contribute to a theory's confirmation by the evidence? Does science aim to find the truth? Is probability in the world or only in our minds? Is explanation a matter of finding causes or are causes whatever it is that explains? Is scientific rationality objective or culture-relative?

80-221 Philosophy of Social Science
Spring: 9 units
This course will explore various philosophical issues germane to social science. The central question of the course asks whether we can use traditional scientific tools to understand social phenomena, e.g. wars and religions, in the same way that we use them to understand natural phenomena, e.g. gases, lasers and planetary orbits. Some of the more specific questions we address: Because humans possess free will and act with intentions while light rays and planets in motion do not, are we forced to use logically different species of explanations in the two cases? How can we explain social institutions that depend upon cooperation? Whereas natural scientists actively conduct experiments, social scientists can often only collect statistical data. Does this difference prevent social scientists from inferring causal relations? Is our understanding of social phenomena always value laden?

80-222 Measurement and Methodology
Spring: 9 units
This is intended as an introduction to the theory of measurement. How are units chosen? Under what conditions do qualitative relationships determine quantitative ones? We shall investigate theories of extensive measurement, with and without error. Applications will be taken from the natural and social sciences. Prerequisites: None specifically; however, students should have background in elementary logic and be comfortable with taking mathematical approaches to conceptual problems.

80-223 Causality and Probability
Intermittent: 9 units
Does smoking cause cancer? What causes global warming? Would World War II happen if World War I had never happened? In our daily life and science, people often attempt to answer such causal questions, and probability theory, as a mathematical model of uncertainty, serves as a fundamental tool. This course explores the history of causality and probability and the basic methodologies for causal inference and statistical analysis. In particular, we will study what causality is, how it is related to and different from correlation, the relationship between causality and regression, the benefit of using causal knowledge, the classical ways to find causal relations, when it is possible to achieve so from purely observational data, and machine learning methods for discovering causal structure.

80-224 Race, Gender and Science
Intermittent: 9 units
In this course, we will focus on the interplay between science, technology, & medicine, on the one hand, and race & gender on the other. Taking up a series of controversial issues and cases from the past and the present, we will consider the implications of developments in the life sciences for politics, social identity, and cultural belonging. In our readings and discussions, we will consider the role of science, technology, and medicine in defining and redefining race and gender; the ways in which cultural beliefs about race and gender have influenced scientific research and the development of knowledge; and the efforts by individuals and social movements to challenge scientific institutions and assert new claims about identity, difference, and inequality.

80-226 Revolutions in Science
Intermittent: 9 units
Science is an ever-changing enterprise. Most scientific advances, though significant, occur within a stable framework of accepted theories and data. A few episodes of change in the history of science involve discarding and replacing fundamental theories of the world. These are often accompanied by significant changes in the vocabulary in which those theories are expressed, the tools used by scientists, the phenomena on which scientists focus, and the kinds of explanations they consider acceptable. A very small number of these episodes change the way humanity views its ability to know the natural world and its place in universe. The latter two kinds of change in science have often been called "scientific revolutions." We will focus on three such radical transformations: The "Copernican Revolution" (or "the Scientific Revolution") of the 16th and 17th centuries, the Darwinian revolution of the 19th century, and the quantum revolution of the late 19th and 20th centuries. This course has two intertwined components: history of science and philosophy of science. In the historical component, we will examine in some detail the three major scientific revolutions. The philosophical components will help us understanding the reasoning involved in scientific theory change. This course does not require detailed knowledge of any of the sciences used in examples of revolutionary change.

80-228 Philosophy of Science
Intermittent: 9 units
This course will examine various historical case studies (e.g., the Copernican revolution in astronomy) against which we will assess views pertaining to the significance, justification, and production of scientific knowledge. For example, should scientific theories be understood literally or as computational devices for deriving new predictions? How can universal conclusions ever be justified by a finite data set? Does explanation contribute to a theory's confirmation by the evidence? Does science aim to find the truth? Is probability in the world or only in our minds? Is explanation a matter of finding causes or are causes whatever it is that explains? Is scientific rationality objective or culture-relative?
80-241 Ethical Judgments in Professional Life
Intermittent: 9 units
This is a multimedia, hybrid course that examines the numerous ethical issues, problems and dilemmas that confront professionals in such areas as medicine, law, engineering, the media, government and the natural and social sciences. As a hybrid course, it includes educational materials in video streaming format, an audio CD, an electronic discussion board and web-based "guided inquiries" that students navigate and complete. Topics discussed include: Responsibility in the professions, obligations to clients, conflicts of interest, Whistleblowing, codes of ethics and ethics in engineering, medicine, law, media, computer science and business among others. This course meets one day a week and employs a case study discussion format during class.

80-242 Conflict and Dispute Resolution
Intermittent: 9 units
Conflict is an intractable feature of human life, whether occurring between family members, friends, coworkers, political organizations, nations, and even within oneself. You must then be prepared to negotiate with others to get your job done, to advance your career, and even to maintain meaningful personal relationships with your family and friends. The purpose of this course is to help prepare you for these negotiations. In particular, in this course, you will reflect on your current approaches to conflict, study the nature of conflict and why it tends to escalate, and develop your own skills for principled negotiation. Throughout the course you will also participate in negotiation simulations exercising your powers of communication and persuasion while practicing conflict resolution tactics. My goal is that you finish this course a more reflective and effective negotiator, better prepared to handle the conflicts you will inevitably face.

80-243 Ethics of Leadership
Intermittent: 9 units
From business operations to international affairs, leadership concerns the use of power or influence to coordinate a group towards common purpose. However, leadership also requires the acceptance of responsibilities not shared with the other group's members. Given their distinctive role and responsibilities, leaders must be prepared to face a unique host of moral problems and dilemmas. In this course, we will pursue the question of what makes a morally good leader, as opposed to a merely effective one. To that end, we will critically examine various competing theories of leadership while considering the moral challenges that arise when power, self-interest, justice, and the collective good collide.

80-244 Environmental Ethics
Intermittent: 9 units
In this class, we will try to figure out what obligations we might have to the natural environment and the non-human living beings within it, as well as to justice requires of us in our use of natural resources given the needs of other human beings. Among other things, we'll spend considerable time on animal ethics: What moral obligations do we have to non-human animals? Is it morally OK to eat them? Does a dog count (morally speaking) as much as a human? Does a factory-farm chicken count as much as a wild endangered tiger? Then, given that many of the most pressing environmental problems like climate change are collective action problems, we'll consider why these problems are so sticky, what obligations we have as individuals in dealing with these problems, and what a just collective solution might look like. To that end, we'll examine the processes fueling climate change, we'll look at who is responsible for these processes, and we'll try to determine whether any current proposal to deal with climate change is an effective, just response to the problem.

80-245 Medical Ethics
Fall: 9 units
This course provides an introduction to core ethical issues in health care, medical research, and public policy. Topics include: the moral responsibilities of health care providers to patients and various third parties such as the government or insurance companies, the status of health as a social good, and questions of individual liberty and social responsibility at the ends of life including issues such as abortion, physician assisted suicide, and the definition of death. We will also examine specific ethical issues in the conduct of medical research and look at the impact of technological innovation on our notions of health, disease, life, death, and the family. If time permits, we may also discuss issues related to genetics and cloning. While the course engages such substantive ethical issues it also attempts to sharpen students' skills in practical reasoning through argument analysis, analytical reasoning, and the application of theory and principles to particular cases.

80-246 Moral Psychology
Intermittent: 9 units
Moral psychology is the study of how we think about morality, make moral judgments, and behave in moral situations. This has important implications for how we should think about morality, make moral judgments, and behave in moral situations. In this course we will examine empirical research on moral thinking and behavior by psychologists, neuroscientists, economists, and philosophers and discuss the implications this research has for issues in ethics. We will address questions such as: What motivates our moral behavior? Do we ever act altruistically or do we only do the right thing because it's somehow in our own interest? Is it even possible to tell what people's real motivations are? How do we make moral judgments and decisions? What roles do reason, intuition, and emotion play in our moral judgments? What role should they play? What role should a person's beliefs, desires, and intentions play in our judgments of how blameworthy the person is or of how much punishment he or she deserves? What role should the outcomes of the person's actions play in our judgments of him or her? Should we hold people responsible for things that are not entirely under their control?

80-248 Engineering Ethics
Fall: 9 units
This course provides an introduction to core ethical issues in engineering research and practice. Topics include: the moral responsibilities of engineers to clients and various third parties such as the government or insurance companies, conflicts of interest, whistleblowing, codes of ethics, and the status of engineering projects as social goods. While the course engages such substantive ethical issues it also attempts to sharpen students' skills in practical reasoning through argument analysis, analogical reasoning, and the application of theory and principles to particular cases. This course meets two days a week and employs a case study discussion format during class.

80-249 AI, Society, and Humanity
Intermittent: 9 units
AI and robotic technologies are rapidly developing and spreading, with corresponding social and human impacts & opportunities. Understanding these potential risks and benefits requires a multidisciplinary approach, drawing from ethics, philosophy, psychology, sociology, economics, and more. These diverse perspectives can help us to ensure that new technologies support and advance human and social values & interests. In this course, we will study relevant disciplinary methods & frameworks through a series of case studies of current or near-future AI and robotic technologies. We will learn to apply those techniques to analyze and understand the challenges & opportunities presented by novel technology.

80-250 Ancient Philosophy
Intermittent: 9 units
This course will cover Ancient Greek philosophy from the pre-Socratics to the later Hellenistic writers. We will prepare the background for Socrates and Plato by tracing the various historical and intellectual movements that led up to and through the flourishing and downfall of Periclean Athens. A study of Socrates (as presented in Aristophanes' comedy and Plato's early dialogues) will lead to an in-depth reading of Plato's Gorgias, Symposium and sections of the Republic. We will approach Aristotle through his 'practical philosophy' as presented in the Nicomachean Ethics. The final sections will discuss the Epicurean, Skeptic, and Stoic movements as well as the work of Cicero. Excerpts from other works of Plato and Aristotle as well as Martha Nussbaum's recent work on Aristotle and Hellenistic philosophy will accompany selected parts of the course.

80-251 Modern Philosophy
Intermittent: 9 units
Descartes' project to doubt all received knowledge and begin from scratch marked the beginning of an intellectual upheaval, helping to launch what is now called the Modern period of philosophical thought; the Western world is today the heir of modernism. Locke, Leibniz, Hume, and Kant are several of the most important figures of this period. We will examine works of these thinkers, exploring both the new sorts of questions that these philosophers raised and their new methods of doing philosophy, which together mark a fundamental break with the traditions that preceded them. We will devote special attention to the new theories about perception and representation and to their work in ethics and political philosophy. The philosophical revolution of the 17th and 18th centuries occurred during a time of great scientific progress and political upheaval in Europe; as part of our course we will consider the relation of these developments to the new questions and methods of the modern philosophers and to their works in ethics and political philosophy.
80-252 Kant
Intermittent: 9 units
Immanuel Kant’s ‘Critical philosophy’ may be seen as the result of his attempts to determine the sources of human knowledge, and to find metaphysical foundations for Newton’s mechanics. This course will involve readings in Kant’s ‘Critique of Pure Reason’ and other texts. Emphasis will be placed on understanding Kant’s thought in the context of contemporary intellectual developments and on his theory of human cognition.

80-253 Continental Philosophy
Intermittent: 9 units
This course provides students with an overview of key movements in European Philosophy. The historical background covers Descartes, Kant, Kierkegaard, and Nietzsche. The central tenets of phenomenology and existentialism (e.g., intentionality, Being-in-the-World, Bad Faith) will be discussed in the context of selected works from Husserl, Heidegger, Sartre and Merleau-Ponty. The course will conclude with the background for and current work of Habermas.

80-254 Analytic Philosophy
Intermittent: 9 units
This course examines the revolutionary impact of philosophy at the turn of the 20th century on contemporary thought and progress. By the 1920s some scientists and philosophers became aware that the end of the long tradition of philosophical deadlock was finally within reach. Buoyed in particular by Einstein’s theory of relativity and the invention of modern logic, they created a new kind of philosophy with the goal of applying logical and empirical methods to philosophical problems. This new approach led to new puzzles and paradoxes, along with a focus on the old age question of what can be known and what is meaningful. The modern fields of linguistics, cognitive science, and information and computer sciences all owe a debt to these sources, as does course contemporary philosophy. Our quest will be to understand both what authors like Frege, Russell, and the Vienna Circle were up to in the first place, and how their work contributed to the world we live in today.

80-255 Pragmatism
Intermittent: 9 units
American Pragmatism represents an energetic attempt to bridge the divergent cultures of science and the humanities. The movement’s founder, C.S. Peirce, was trained in chemistry and worked as a physicist, but he was also deeply concerned with the contemporary philosophical portrayal of science, which distinguished sharply between theoretical knowledge and practice. Peirce responded by constructing a comprehensive philosophy emphasizing the scientific importance of community, fallibility, and action. Pragmatism was also developed and vigorously popularized by William James, who aspired to be a painter and ended up as an acknowledged founder of modern empirical psychology. James extended Peirce’s position by defining the role of values in even the purest of empirical sciences. John Dewey, who is also well-known for his role in education, interpreted science as an evolving social system and developed a theory of aesthetics based on what we now call the psychology of problem solving. The pragmatists made and continue to make lasting contributions to modern statistics, logic, and social science and their emphasis on community, fallibility, action, and value in science are still of primary importance in philosophy and in the ongoing dialogue between the scientific and humanistic cultures.

80-256 Modern Moral Philosophy
Intermittent: 9 units
This course will follow moral theory through the modern era (roughly 1600-1900), with special emphasis on the works of Hobbes, Hume, and Kant, as well as the development of utilitarianism. Since moral theorizing was only one part of these thinkers? larger systems of philosophy, it cannot be fully separated from questions of metaphysics and epistemology (e.g. free will, determinism, materialism, etc.), and we’ll spend some time situating their ethical thought within their larger projects. In doing so, we’ll also examine these theories within the context of the rapidly changing social, political, and scientific landscape of the modern period.

80-257 Nietzsche
Intermittent: 9 units
During his life in the late 19th-century, Friedrich Nietzsche was a relatively obscure German philosopher. Since his death, however, he has become deeply influential and well-known, and was a source of inspiration for many important 20th-century thinkers. Despite this popularity, Nietzsche’s philosophy remains relatively mysterious, and often misunderstood. Much of his writing consisted of aphorisms, rather than more traditional prose and arguments, and many of his positions seem to contradict one another. This course will cover a broad range of Nietzsche’s writings, focusing on such central concepts as the will to power, eternal recurrence, and the oft-misunderstood Ubermensch (“overman”). Throughout, we will focus on developing a consistent interpretation of an enigmatic philosopher whose views have been mischaracterized and misappropriated throughout the past century.

80-261 Experience, Reason, and Truth
Intermittent: 9 units
A central issue in Western philosophy has been whether reason or experience (or some of both?) provides the foundations for human knowledge. This course explores that question by looking at various “empiricist” vs. “rationalist” debates from the 17th century to the present day. We will focus on the problems encountered in trying to give an adequate account of the our knowledge of the external world, the structure of our minds, and the nature and limitations of human knowledge. The scope of our investigation will extend to the nature of mathematical knowledge, to “thought experiments” in both science and philosophy, and to “naturalism” vs. “empiricism” issues in contemporary cognitive science and moral theory. The course has two main goals: (1) to study key metaphysical and epistemological issues surrounding the nature of human knowledge and (2) to help improve our analytical and critical skills by extracting and evaluating various relevant philosophical arguments.

80-263 Approaching Chinese Philosophy: Basic Texts and Implications
Intermittent: 9 units
This course focuses on ancient texts of Chinese philosophy, which have had a foundational role in Chinese society and culture. We will look at original texts from the Chinese classics, including the I Ching (Book of Changes) and the Tao Te Ching (basic treatise on Taoism). We will consider the role and place of science and explanation in Chinese society. We will also discuss the difficulty of translation from one language to another or from the writings of one era into another. The course will seek to connect the ancient literature and practice with modern perspectives on science, metaphysics, mind/body dualism, and causation. We will take the ancient texts in their original form as points of departure for our exploration. No prior knowledge of the Chinese language is assumed. The course is relevant for cultural and language studies, as well as studies in history and philosophy of science.

80-270 Philosophy of Mind
Intermittent: 9 units
The mind poses one of the greatest challenges to understanding how the world works. What is a mind? What is consciousness? What is sensing? What is agency? How are these facets of subjectivity related to the objective, physical world? In this course, we tackle these challenging questions with a philosophical approach that highlights analysis and argument, though we will also bring in relevant empirical understanding of the mind and brain to enrich our discussion (a complementary course, Philosophy and Psychology, is taught in alternate years where the empirical issues are the focus with enrichment from philosophy). A central practical aim of this course is to promote development of analytical skills through practice engaging with arguments.

80-271 Philosophy and Psychology
Intermittent: 9 units
This course has two parts. First, we will look at basic concepts used in psychology (and cognitive science broadly) through the lens of philosophy including: representation, computation, information, explanation, modularity, attention, automaticity and control. Having some concrete proposals about these ideas will allow us to formulate psychological claims more concretely. Second, we will reverse course and look at traditional philosophical problems through the lens of psychology focusing on three topics: consciousness, agency, and perception. Specifically: what is consciousness, what is it to be an agent, what is it to perceive?
80-275 Metaphysics
Intermittent: 9 units
The topical agenda of this course will vary. Typical topics include the problem of personal identity, the nature of human freedom, the nature of the self, the nature of reality and being, the nature of causality, and the question of whether solutions to such problems can be given. Classical as well as contemporary philosophic texts will be studied. For Spring 2011: Issues we will consider, in no particular order, include: Do properties exist? Why should you think there is an external world? What is a number? Why should you think other people have mental states? What are natural kinds? What constitutes the identity of things through time? What constitutes the identity of persons through time? What does determinism mean? Is there freedom of the will? What is possibility? What is necessity? Are there other possible worlds? When does one event cause another, and what does that mean? What could a deity be, and should you think there is one?

80-276 Philosophy of Religion
Intermittent: 9 units
While many interesting questions about religion are belief-specific, we will begin in this course to keep a global perspective. We will begin by considering a concept at the center of Western religion — God — as it presents itself in various traditions. We will then move to consider major Eastern religions, with a focus on their influence on philosophical thought. In both of these studies, we will emphasize the relationship between language and religion. We will conclude the course by considering commonalities between Eastern and Western religious thought. The student should leave the course with 1) the tools to consider religious text and rhetoric philosophically, and 2) a sharpened idea of what 'religion' is (though this might differ from my own).

80-280 Linguistic Analysis
Intermittent: 9 units
At one level, language is constituted by nothing but sounds, or marks on paper. How can such physical objects be used to create or transmit meaning? The answer assumed in this course is that objects with specific physical features are assigned symbolic or linguistic values on the basis of those features. By the juxtaposition of such objects (phonemes or graphemes), larger symbolic objects are created (morphemes). Morphemes have the special property that they can be associated in a consistent way with meanings. In a progressive fashion, words are built from morphemes: phrases from words, and sentences from phrases. Sentences have different moods, and these moods correspond to their function with respect to the encoding and transmission of information. Indicative sentences carry information, interrogative sentences request information, imperative sentences demand action, conditional and modal sentences present alternative possibilities, and so on. The goal of this course is to investigate the structure of the linguistic entities by which these communicative functions are realized. Building on material found in Nature of Language, we look in detail at the morphology and syntax of human languages, paying special attention to cross-linguistic variety.
Prerequisite: 80-180

80-281 Language and Thought
Intermittent: 9 units
The goal of this course is to provide students with the opportunity to comparatively explore some difficult questions about the relationship between language and thought, questions such as: How does the human capacity to use language relate to the human capacity to think? Does the language that a person speaks affect the way she thinks? If meaning is in the head, how can we succeed in communicating with each other? How is our ability to reason related to our ability to successfully communicate? None of these questions have definite answers; throughout the course, we will draw on work in philosophy, psychology and linguistics to try to understand some of the possible answers that might be entertained. Students in the course should be prepared for extensive reading, writing and peer discussion assignments.

80-282 Phonetics and Phonology I
Fall: 9 units
This course aims to provide students with practical tools for the study of speech sounds. The acoustic properties of sounds are examined using spectrograms and other devices, with emphasis on consonants. Following this, basic phonological notions are covered, tracing their development in the twentieth century up through optimality theory. In optimality theory, contrast and allophonic variation are explained in terms of an input output device which selects the most harmonic candidate still faithful to phonemes in the input. The course should be relevant not only to linguistics students, but to students of language generally, with applications to sociolinguistics, child language development, speech recognition technology, and the study of foreign languages.
Prerequisite: 80-180

80-283 It Matters How You Say It
Intermittent: 9 units
Why do languages give us multiple ways to say the same thing? Given that in English we can say “My dog ate my homework,” why do we sometimes prefer “My homework got eaten by my dog”? Why do we sometimes choose to refer to someone with just a pronoun (“he”), and sometimes choose their full name (“Charles Dickens”)? What’s the difference between telling someone: “This expensive coffee is tasteless,” or telling them: “This tasteless coffee was expensive”? This course is about the choices that languages give us for conveying a particular message, and the communicative effects of those choices. We will see that it is both the words you use and the way you put them together that determines the total communicative effect of your utterance. While the course will focus on English, students will have an opportunity to work on another language of interest in their final project.

80-284 Invented Languages
Intermittent: 9 units
Language is normally something that develops and changes organically within human communities, without much in the way of organized design or invention. Over the centuries, however, many have succumbed to what J. R. R. Tolkien called the “secret vice” of language creation. The purposes of these invented languages have been diverse. Some, like Tolkien’s Elvish languages, Oikrand’s Klingon, and Peterson’s Dothaki and Trigedasiang have been designed for artistic or entertainment purposes: they have set out to be “natural” languages within fictional worlds. Others, like Zamenhof’s Esperanto, Brown’s Loglan, and Elgin’s Laadan have tried to address perceived inadequacies of the natural languages of their creators or saw the world around them. The study of language invention is thus both the study of a distinctive art form, and an exploration of the history of how people have thought about language in different ages and societies. In this course, we will explore the linguistic considerations involved in language invention, and the linguistic lessons of the history of invented languages, with a particular emphasis on applying these insights to our own language invention projects. Over the course of the semester, students will be expected to develop their own languages, and to complete various shorter assignments to supplement relevant ideas and skills. This course does not assume any background in linguistics, and is intended to accommodate both newcomers and advanced students.

80-285 Natural Language Syntax
Fall: 9 units
This course is intended to provide an introduction to the methods of syntactic analysis, and to some major themes of contemporary syntactic theory, following up on syntactic concepts introduced in 80180, Nature of Language. A primary theme of the course is the structural constituency of a sentence, and the course will address some of the following questions. What are syntactic constituents? Do all aspects of syntax manipulate the same kinds of structural units, or do different grammatical processes rest on incompatible notions of constituency? How do other syntactic relations connect with constituent structure? To the extent that there is mismatch between different notions of syntactic structure, how can it be reconciled within a theory of grammar? These questions are engaged in through the diagnostics and techniques of modern syntactic analysis and argumentation. Those tools will allow us to explore the striking ways in which syntactic theory unifies diverse grammatical phenomena in terms of a common notion of phrase structure. The course complements 80280, Linguistic Analysis, building on but not presupposing syntactic analyses developed in that class.

80-286 Words and Word Formation: Introduction to Morphology
Intermittent: 9 units
How many words do you know? Is ‘gonna’ one word or two? How many meanings does ‘unlockable’ have? If someone can be ‘inept’, why can’t they be ‘ept’? In this course we study the linguistics of words and word formation, known as morphology. We begin by asking what a word is, about the internal structure of words, and how new words are formed. Throughout, we will consider these questions from a cross-linguistic perspective, looking at morphological data from a wide range of languages. We will also consider how morphology interacts with other subfields of linguistics, including phonology, syntax and semantics. Finally, we will survey morphological questions from the perspectives of language acquisition, psychology, and cognitive science.
Prerequisite: 80-180
80-287 Language Variation and Change
Intermittent: 9 units
This course explores language variation across space and time. Our experience of language is full of direct and indirect evidence of language change and variation, and of the ways that these interact and intersect with other historical and social phenomena. How do languages change over time, and what kinds of factors influence this change? How do we determine whether, say, Farsi and Nepali (or Farsi and English) were at some point in the past the same language, before different changes took them in different directions? If they are, how do we investigate what that past language might have sounded like? What are the sources of variation within and between languages, and how can we investigate the nature of this variation? How can an understanding of language change help us to make sense of language variation, and how can an understanding of language variation help us to make sense of language change? How do issues of social status and political power affect language variation and change? What happens when languages come into contact? How can linguistic theory inform the study of variation and change, and what insights can the study of these phenomena contribute to linguistic theory? This course is intended to provide students with the tools to begin to explore and address these kinds of questions.
Prerequisite: 80-180

80-288 Intonation: Transcription and Analysis
Intermittent: 9 units
intonation is the melody of speech: how a speaker's pitch changes over the course of an utterance, along with the placement of emphasis, or sentence-level stress. Intonation and stress contribute to the interpretation of utterances in multiple ways. For example, the questions "Did Bob go to the store?" and "Did Bob go to the STORE?" contain the same words, but request different information. Similarly, whether the sentence "Bob went to the store" is interpreted as a statement or as a question, and whether as expressing certainty or uncertainty on the part of the speaker, depends on its intonation. Features of intonation can also convey information about the speaker's attitudes and affect: sarcasm and irony, for example, may be signaled by intonation. The goal of this course is two-fold. First, students will learn about the phonetic correlates of intonation and stress, and learn how to analyze intonation as a system of high and low tones, using the intonation transcription system ToBI. This will enable students to accurately describe the intonation pattern of an utterance. Second, students will learn how intonation is used to convey semantic and pragmatic information. The course will focus primarily on English, but other languages will be explored to serve as a basis of comparison. There is no prerequisite, and no familiarity with either phonetics or semantics is assumed. The course will be of interest to students interested in learning some of the intricacies of face-to-face communicative interaction. Students in the departments of English, Modern Languages, Language Technology, Human-Computer Interaction, and Psychology will find the material relevant to their prior topics. The course serves as an elective for the Linguistics Major, and is a natural companion to other courses on the expression of linguistic meaning: Meaning in Language, Language in Use, and Syntax and Discourse.

80-292 Learning Science Principles
Spring: 12 units
The ability to learn - that is, to change and adapt to one's environment - is one of the hallmarks of intelligence, whether in humans, animals, or machines. In this course, we will examine the nature, components, and significance of learning in many different manifestations, with a particular focus on the fundamental concepts that underlie the ways in which we understand the concept of learning in different disciplines. This course will thus focus more on concepts and foundations, rather than technical aspects of learning, whether mathematical, experimental, or computational. This course will be almost entirely project-based: you will work in groups (with students from different backgrounds) to identify opportunities for learning media, and then develop designs that appropriately address those opportunities. In the course of developing these media designs, you will learn, and come to understand, concepts and principles of learning from different disciplines. The emphasis throughout will be on careful conceptualization, description, and design of the learning through and about media. This course will work in tandem with 05-292 Learning Media Methods. To waive an IDEaTE portal course requirement, students should have prior project-based coursework in design, social science research methods, or interactive prototyping experience.

80-294 Ethics Internship / Practicum
Intermittent: 9 units
Internship
80-324 Philosophy of Economics
Intermittent: 9 units
The science of economics has come to occupy a central position in contemporary society. Because of this central position in political decision making, economics is intertwined with a number of other philosophical issues surrounding justice, rights, and fairness. The central theme of this course will be on the arguments in favor and against markets as effective solutions to political problems. This issue will allow us to analyze a wide number of foundational issues in economics including the testability of economic claims, the use of “rationality” postulates, the foundation of the right to property, and measuring the success or failure of an economy.

80-327 Philosophy of Neuroscience
Intermittent: 9 units
400 years ago Rene Descartes claimed that the body is a machine manipulated via the pineal gland by a thinking soul with free will. At about the same time, Thomas Hobbes claimed the mind is the product of the brain, and the brain is a calculating device. Most of Descartes view endures to this day in popular belief, but something more like Hobbes opinion has come to dominate science. This historical part of the course will contrast Descartes The Passions of the Soul, with the contemporary scientific view of mind and brain in Patricia Churchlands Touching a Nerve. The course will describe the vision of a materialist, deterministic physiology of mind developed by Helmholtz, Freud and others in the 19th century, and opposition by the most influential psychologist of the time, William James. The main focus of the course will turn on how that scientific perspective has developed in classical and contemporary neuropsychology; on how new kinds of measurement of brain activities do or do not provide understanding of the mechanisms of thought and emotion; on how theories of mental functioning are argued for (or against); and on ethical issues posed by the advance of neuroscience. No philosophical background will be assumed of students. A previous course in neuroscience would be helpful, but is not required.

80-330 Ethical Theory
Spring: 9 units
Every day, even in very subtle ways, we make judgments of value that shape our lives and our conduct. This course will examine four influential attempts at providing a systematic account of the source and nature of moral value, its relationship to other kinds of value, and the practical implications of different answers to these questions. This focus on the fundamental structure of moral value will frequently engage topics such as the nature of the good, subjectivist and objectivist accounts of value, forms of moral naturalism verses attempts at moral constructivism, and will draw on historical as well as more contemporary sources. Particular attention will be paid to articulating the specific sources of disagreement that distinguish competing moral theories in order to facilitate our ability to adjudicate between them on a reasoned basis.

80-335 Social and Political Philosophy
Intermittent: 9 units
Broadly speaking, political philosophers are interested in whether, and to what extent, government use of coercion can be justified, and how social and political institutions should be structured in order to be legitimate. This is an advanced course in social and political philosophy, aimed at providing students with a more in-depth familiarity with classic and contemporary questions both theoretical and applied. The course is topical, and course topics will vary from year to year. Typically 4-5 topics are covered in a term. Previous years’ topics have included the nature and value of freedom, social contract theory, racial and epistemic injustice and the nature of white ignorance, the intersecting concepts of justice and equality, structural injustice, responsibility for injustice, and immigration. Students are expected to come away from the course with a strong understanding of some of the major debates in social and political theory as well as the tools to analyze ongoing debates within contemporary US and global politics regarding the appropriate way to organize our social and political reality. This course is primarily conducted as a seminar and is discussion- rather than lecture-based.

80-336 Philosophy of Law
Intermittent: 9 units
In recent years, the U.S. legal system has been beset by claims of overcriminalization, racially discriminatory enforcement, and inadequate or unequal protection of individual civil rights. What should we make of these claims, and what, if anything, would be implied by their truth? In seeking to answer these questions, this course will examine the nature of the law and its enforcement. We will begin by discussing the issue of criminalization and whether the expansion of the criminal law is or is not problematic. From there, we will turn to the more foundational questions of what, precisely, the law is, and what its connection to morality is or should be. Are we obligated to obey the law, and if so, why? Finally, we will ask whether it is possible for the law to remain neutral with regards to morality and politics, and whether the supposed “neutrality” of the law may itself be an instrument of oppression. If the legal system lacks the kind of neutrality that many legal theorists claim for it, what (if anything) does that license us (as citizens) to do?

80-341 Computers, Society and Ethics
Intermittent: 9 units
This course explores many of the social and ethical issues that have emerged in the wake of the significant advances that we have witnessed in computer science and information technology (IT). Computers and communications technologies have had an increasing impact on the whole of society and have raised new and difficult ethical questions. In turn, these ethical issues have spurred the need for a consideration of new policies and regulations. In this new world of IT, some are concerned about the protection of their privacy while others find problems of ownership and, more generally, restrictions on information access to be their main focus as a problematic social issue. This course will address these and other issues such as: questions of free speech, surveillance in the workplace, intellectual property and copyright, information acquisition and ethics and the Internet.

80-344 Management, Environment, and Ethics
Intermittent: 9 units
This course addresses the complex issues at the intersection of management and ethical decision making. The course will examine the role of organizations in shaping ethical behavior, with a particular focus on the ethical responsibilities of managers in both public and private sectors. Through case studies and discussions, students will explore the ethical challenges facing managers in making decisions that impact the environment, society, and stakeholders. The course will cover topics such as corporate social responsibility, environmental ethics, and the role of leadership in fostering a culture of ethics.

80-348 Health, Human Rights, and International Development
Fall: 9 units
Approximately 767 million people, or more than 10% of the world’s population, live in a condition the World Bank refers to as “extreme poverty”. Those who live in extreme poverty frequently lack effective access to proper nutrition, adequate shelter, safe drinking water, and sanitation. As a result, they also bear the greatest burdens of famine and epidemic disease and frequently face social and political conditions of unrest and systematic oppression. This course aims to introduce students to the problem of global public health and its intersection with claims of human rights. We will focus on theoretical accounts of human rights and questions arising from them: What constitutes a human right, and on what basis or bases might the existence of human rights be defended? If human rights exist, whose responsibility is it to see that they are defended/provided/not violated, and why? What is the relationship between health deficits and human rights deficits, and what would a “human right to health” look like? Are global institutions such as the protection of strong intellectual property rights consistent with respect for a human right to health?
80-358 Hume
Interrment: 9 units
This course will investigate the philosophy of David Hume. We will focus on his philosophical thought expressed in the book A Treatise of Human Nature. Hume was an influential philosopher who wrote on many issues ranging from skepticism, to ethics, to the philosophy of science, and his views continue to be influential today. In this course we will attempt to understand Hume’s philosophy on all of these subjects both to better understand his contribution to the philosophy of his day, but also to see what his arguments can contribute to contemporary thought.

80-362 Russell
Interrment: 9 units
Near the start of the 20th Century, Bertrand Russell helped to create what today we call “Analytic Philosophy.” We will study Russell’s contributions to this important approach to Philosophy by using his 1912 book, The Problems of Philosophy as a springboard to other readings, many of which are found in his collection, The Basic Writings of Bertrand Russell. The issues we’ll cover include several specific challenges in the Theory of Knowledge and Perception, and some of his contributions to Logic and Mathematics. For example, What is the difference between appearance and reality, and can we tell? Also, we’ll consider issues that stem from reflecting on our thinking. For example, What constitutes a philosophical question? And we’ll review Russell’s paradox about the set of all sets, his attempts at a resolution, and how those affect contemporary set theory.

80-363 19th Century Foundations of Science
Prerequisite: 80-180
Invented Languages, and other relevant courses.

80-381 Meaning in Language
Interrment: 9 units
Human language involves an association between arbitrary signs and meaning. The study of meaning in language, semantics, is a recently developed subfield of linguistics, since it presupposes advances in phonology, morphology, and syntactic structure. In addition, semantics faces the conceptual challenge of saying what meaning is. This course will reflect the history of semantics within linguistic theory and examine solutions to the problem of the definition of meaning. The course begins with the meanings of words and examines how these meanings combine to give the meanings of sentences, based on the notion of truth conditions for indicative sentences. That notion of meaning is then extended to sentences in other contexts, and to sentences that do not literally describe how the world is, including sentences which are modal, conditional, or simply fictional. Semantics is a subject that can be developed in a highly formal way, but here it will be presented to make it accessible to students with varied backgrounds and interests. The components of the resulting theory will apply to any human language, and be an important component in the toolkit of any student of language.
Prerequisite: 80-180

80-382 Phonetics and Phonology II
Interrment: 9 units
This course is a continuation of Phonetics and Phonology I (80-282), and is designed to expand upon the phonetic and phonological skills and knowledge developed in that course. Students will carry out an acoustic study designed by the instructor; the particular topic varies from semester to semester. As co-researchers, students will be involved in all aspects of data collection and analysis. Lessons in phonetics will be designed to train students in the necessary skills and concepts required, including understanding the articulatory and acoustic bases of the phenomenon under investigation, recording techniques, how to take appropriate acoustic measurements, and interpretation of the results. A presentation session will be organized for the end of the semester. In tandem with the acoustic study, a related phonological phenomenon will be investigated throughout the semester. This phenomenon will be explored by using a set of case studies that can be investigated through various phonological and psycholinguistic perspectives. We will cover major developments in phonological theory, including SPE-style features, feature geometry/autosegmental phonology, and Optimality Theory. We will also consider these phenomena in light of more recent approaches to phonological representation, including Exemplar Theory and Articulatory Phonology. Assessment of phonetics will primarily come from the research project and in-class lab work, but will be supplemented with quizzes and a test to ensure that core concepts are acquired. Assessment of phonology will primarily come from problem sets. Students will finish this course with a solid understanding of how to do phonetic research, and an appreciation of how various theoretical frameworks have attempted to account for phonological phenomena.
Prerequisites: 80-282 and 80-180

80-383 Language in Use
Interrment: 9 units
The meaning of a sentence depends only on the meanings of the words it contains, and how they are put together in a syntactic structure. But the meaning of an utterance “a linguistic expression produced by a speaker in a particular context” depends on both sentence meaning and on features of the context of and of the discourse itself. This course focuses on the analysis and description of utterance meaning. We will develop a treatment of context as a linguistically relevant notion and explore how linguistic analysis can be expanded from the domain of the sentence to the domain of connected discourse. In addition, the course will be concerned with the treatment of linguistic items (words and constructions) whose meaning can only properly be characterized in terms that make essential reference to context, to ongoing discourse, or to the speaker.
Prerequisites: 80-100 or 80-180

80-384 Linguistics of Turkic Languages
Interrment: 9 units
In this course we look at languages from within a single language group, Turkic. Turkic languages are spoken across continental Asia and include such languages as Turkish, Tatar, Kazakh, Uighur, and Uzbek. In this course we concentrate especially on Yakut (Sakha) and Azerbaijanian, Modern Turkish will provide a reference language. We look at various linguistic systems within each language (phonology, morphology, syntax, and writing systems) both to understand each particular language and to see how the languages are related. We consider the role of sound in the synchronic study of language. This course can be seen as an extended case-study for applying concepts and analytical strategies from basic linguistics, as taught in Nature of Language, Phonetics and Phonology, Invented Languages, and other relevant courses.
Prerequisite: 80-180
80-385 Linguistics of Germanic Languages
Intermittent: 9 units
The Germanic languages include English, Dutch, Frisian, German, Pennsylvania, Afrikaans, Yiddish, Icelandic and the Scandinavian languages, excluding Finnish. The course will serve as an extended case-study for the application of concepts and analytical strategies taught in basic linguistics courses to some of these languages. Specifically, we take a bottom-up approach to Dutch, Frisian, Icelandic, and Danish, starting with raw language material whenever possible, which we progressively analyze in terms of phonetics and phonology, morphology, and syntax. These case studies lead to comparisons between the languages and insight into their development and divergence over time. We follow this hands-on approach with historical and grammatical overviews, touching on some of the outstanding issues in Germanic linguistics. The approach should also help bring out the relevance of diachronic factors in the synchronic study of language, with historical forms of English being open to investigation, as these often reflect patterns found in contemporary Germanic languages. Prerequisite: 80-180

80-388 Linguistic Typology: Diversity and Universals
Intermittent: 9 units
What is the most common word order? What is the rarest consonant? What kinds of case marking are attested in the world’s languages? Which linguistic structures tend to co-occur? What can we learn by looking at the rarity of linguistic structures? These are the kinds of questions central to linguistic typology, the study and classification of languages based on their structural properties. In this course we will look at the variety of linguistic structures attested in several linguistic subfields, including phonology, morphology, syntax, and semantics. Understanding linguistic diversity is closely tied with the search for linguistic universals, since there appear to be some ways in which linguistic structures seem to be limited. But what are the nature of those limits (if they truly exist), and what do they tell us? We will also look at methodological issues that arise in comparing languages and forming meaningful generalizations. Prerequisites: 80-180, and one of 80-280, 80-282, 80-285 or permission of the instructor. Prerequisites: 80-180 and (80-282 or 80-285 or 80-280)

80-405 Game Theory
Intermittent: 9 units
Game theory is the study of interactive decision-making: making choices in the context of other agents who are also making choices. Famous examples include the “Prisoner’s Dilemma” (pitting rational self-interest against the benefits of cooperation), and the “Cournot duopoly” (a basic model of market competition and supply-and-demand). Game theory has been applied to situations as diverse as traffic flow, auctions, the search and competition for scarce resources, and bargaining. This course will develop conceptual and technical facility with the mathematical tools used to model and analyze such situations. We will cover games in strategic and extensive form and games of perfect and imperfect information; we’ll also study solution concepts such as Nash equilibrium and rationalizability. Finally, throughout the course we will take the opportunity to actually play several of the games we study to help build intuitions and foster insights into the formal mathematical models we develop.

80-411 Proof Theory
Intermittent: 9 units
An introduction to the general study of deductive systems and their properties. Topics include the natural deduction and sequent calculus; cut-elimination and normalization theorems; metamathematical properties of first-order logic and theories of arithmetic; and conservation theorems. Prerequisites: 21-300 or 80-310 or 80-311

80-413 Category Theory
Intermittent: 9 units
Category theory is a formal framework devoted to studying the structural relationships between mathematical objects. Developed in the mid-20th century to attack geometrical problems, subsequent progress has revealed deep connections to algebra and logic, as well as to mathematical physics and computer science. The course emphasizes two perspectives. On one hand, we develop the basic theory of categories, regarded as mathematical structures in their own right. At the same time, we will consider the application of these results to the concrete examples from logic and algebra. Some familiarity with abstract algebra or logic required.

Course Website: http://www.andrew.cmu.edu/user/avigad/itp/

80-419 Interactive Theorem Proving
Intermittent: 9 units
Interactive theorem proving involves using computational proof assistants to verify that mathematical proofs are correct, or to verify that hardware and software designs meet their formal specifications. This course uses a new interactive theorem prover, Lean, to explore this new technology and its logical foundations. We will study dependent type theory, a powerful and expressive language for representing mathematical objects, algorithms, and proofs. We will also consider automated methods that can be used in support of formal verification, including propositional, equational, first-order, and higher-order methods, as well as decision procedures for real and integer arithmetic. Prerequisites: 80-211 or 21-300 or 15-317 or 80-310

Course Website: http://www.andrew.cmu.edu/user/avigad/itp/

80-430 Ethics and Medical Research
Intermittent: 9 units
Ethics & Medical Research: This course covers foundational issues in the ethical evaluation and regulation of research involving human subjects. It begins with a historical overview of the origins of research ethics after World War II as a response to high profile cases of abuse or scandal. This unit covers “classic cases” including the Tuskegee syphilis study, the Willowbrook hepatitis study, the Jewish Chronic Disease Hospital Case, and others. It also covers seminal documents such as the Nuremberg Code, the Belmont Report, and the current federal regulations known as the Common Rule. Against this historical backdrop, the course then examines foundational philosophical issues in human-subjects research including ethical issues in clinical trial design, the concept of equipoise and the use of placebo controls, the requirements of justice in the research context, and the values of privacy and informed consent. Prerequisite: 80-310

80-431 Meta-ethics
Fall: 9 units
First we will survey of proposals for necessary and sufficient conditions for “x is a morally permissible act.” Then we will consider T.S. Scanlon’s claim that metaethics is immune from criticism from other subjects. We will then consider moral voting rules—varieties of consequentialism and Scanlon’s ‘inequality aversion’. Against this historical backdrop, the course then examines foundational philosophical issues in human-subjects research including ethical issues in clinical trial design, the concept of equipoise and the use of placebo controls, the requirements of justice in the research context, and the values of privacy and informed consent.

80-447 Global Justice
Intermittent: 9 units
Until recently, the dominant view of international relations has been that the governments and citizens of one country have no moral obligations to those beyond their borders. With the rapid growth in globalization has come a drastic shift in attitudes about our obligations to those with whom we share global institutions of trade but neither legal systems nor national identities. This course aims to introduce students to the problem of global distributive justice in the context of a globalized world, with emphases on both theoretical accounts of justice and the practical implications of these accounts for important current issues. Theoretical topics will include the nature of justice, the sources and limits of our moral obligations, and how and whether those notions of justice extend to global society; while applied topics will include our obligations with regard to the environment, human rights deficits, the status of women, and global economic policy.

80-449 EHPP Project Course
Fall: 12 units
The Ethics, History and Public Policy Project Course is required for the Ethics, History and Public Policy Project major and is taken in the fall semester of the senior year. In this capstone course, Ethics, History and Public Policy majors carry out a collaborative research project that examines a compelling current policy issue that can be illuminated with historical research and philosophical and policy analysis for a chosen client. The students develop an original research report based on both archival and contemporary policy analysis and they present their results to their client and a review panel.
80-485 Language and Thought  
Intermittent: 9 units  
The goal of this course is to provide students with the opportunity to creatively explore some difficult questions about the relationship between language and thought, questions such as: How does the human capacity to use language relate to the human capacity to think? Does the language that a person speaks affect the way she thinks? If meaning is in the head, how can we succeed in communicating with each other? How is our ability to reason related to our ability to successfully communicate? None of these questions have definite answers; throughout the course, we will draw on work in philosophy, psychology and linguistics to try to understand some of the possible answers that might be entertained. Students in the course should be prepared for extensive reading, writing and peer discussion assignments.

80-495 Independent Study  
Fall and Spring  
Independent Study

80-501 Philosophy Senior Honors Thesis I  
Fall: 9 units  
Philosophy Department majors with outstanding academic records and intellectual promise will be given the opportunity to earn Dietrich College Honors by engaging in original research under the direction of an individual faculty member. Research topics are selected by student. Students must submit a proposal to the Dean's Office for permission.

80-502 Philosophy Senior Honors Thesis II  
Spring: 9 units  
Philosophy Department majors with outstanding academic records and intellectual promise will be given the opportunity to earn Dietrich College Honors by engaging in original research under the direction of an individual faculty member. Research topics are selected by student. Students must submit a proposal to the Dean's Office for permission.

80-511 Thesis Seminar  
Spring: 6 units  
This course provides a forum for the presentation and detailed discussion of research done by students, be they undergraduates working on their Senior Thesis or graduate students engaged with their M.S. thesis.

80-513 Seminar on Philosophy of Mathematics  
Intermittent: 9 units  
The "linguistic turn" in twentieth century philosophy lets us think about mathematics as a collection of linguistic rules and norms that helps us reason effectively and make sense of our experiences. The advent of computational proof assistants, which use stylized languages to convey mathematical content, provides new perspectives on these rules and norms. This seminar will explore ways these formal models of mathematical language and inference can be brought to bear on traditional questions in the philosophy of mathematics.

80-514 Categorical Logic  
Intermittent: 9 units  
This course focuses on applications of category theory in logic and computer science. A leading idea is functorial semantics, according to which a model of a logical theory is a set-valued functor on a category determined by the theory. This gives rise to a syntax-invariant notion of a theory and introduces many algebraic methods into logic, leading naturally to the universal and other general models that distinguish functorial from classical semantics. Such categorical models occur, for example, in denotational semantics. e.g. treating the lambda-calculus via the theory of cartesian closed categories. Higher-order logic is treated categorically by the theory of topos. We will also consider the categorical semantics of type theory via locally cartesian closed categories. A prerequisite for this course if familiarity with basic category theory (as treated in the course 80-413/713), but depending on demand the course can start with a quick refresher of the central concepts.

80-515 Seminar on the Foundations of Statistics  
Intermittent: 9 units  
This decision-theoretic seminar is organized in three parts. 1. In the first we examine Savage's theory of subjective expected utility, primarily chapters 2-5 of his classic book, The Foundations of Statistics. 2. In the second part of the course, we focus on the following issues: 2.1. A comparison of Savage's theory and deFinetti's criteria of coherence. 2.2. Personal vs. group decisions. Topics to include: Arrow's impossibility theorem, consensus, and Savage's position in §7.2 & §13.5 of his book. 2.3. Contemporary theories that highlight violations of the sure-thing principle — violations of Savage's postulate P2. 3. For the third part, we discuss issues related to Indeterministic and/or Imprecise Probability (IP) theory. The seminar explores some of the ongoing research programs falling under IP, mostly as reflected in the Society for Imprecise Probability: Theories and Applications (www.sipta.org).

80-516 Causality and Learning  
Fall  
Causal connections are usually more informative and helpful than associational information, especially in understanding, control, decision-making, and prediction in changing environments. In the past decades, interesting advances were made in machine learning and statistics for tackling long-standing causality problems, such as how to discover causal knowledge from purely observational data and how to infer the effect of interventions using such data. Furthermore, recently it has been shown that causal information can facilitate understanding and solving various machine learning problems. This course explores how causality is different from and related to association, recent machine learning methods for causal discovery, and why and how the causal perspective helps in machine learning.

80-518 Seminar on Topics in Logic  
Intermittent: 9 units  
Topic: Introduction to Homotopy Type Theory Homotopy Type Theory (HoTT) is a new field of mathematics that extends Martin-Löf's dependent type theory by the addition of the univalence axiom and higher inductive types. In HoTT we think of types as spaces, dependent types as fibrations, and of the identity types as path spaces. We will see that many spaces that are familiar to topologists can be represented as higher inductive types, and we will develop the basic theorems and constructions in HoTT to reason about them.

80-519 Seminar on Computability: History and Analysis  
Spring: 9 units  
The history of computability is presented in the context of pertinent developments in mathematics and the sciences, in particular, in astronomy. The analysis of the notion takes seriously normative philosophical considerations, starting with Leibniz and Descartes. Complementary developments in mathematics and logic during the second half of the 19th century led to fundamental issues in logic during the first half of the 20th century. A certain "resolution" of those issues was achieved in the work of Post and, in particular, Turing. The seminar will end with a brief discussion of the abstract notion of "computable dynamical system" and its use in the discussion surrounding the "Church-Turing Thesis".

80-520 Seminar on Philosophy Science  
Intermittent: 9 units  
In the past 25 years there has been a great deal of research in Machine Learning, Statistics, and Philosophy on inferring graphical causal models from both experimental and non-experimental data, under a variety of different background assumptions. The goals of this course are (i) to give students enough background to be able to read, understand, and contribute to the current literature on topics in the representation, use of, and inferences about causal graphs of various kinds; (ii) to relate the current computer science/statistics literature on causation to the philosophical literature on related topics. The broad topics of the course will be: 1. How to use various kinds of graphs for representation of probabilities, causal models, actual causation, and counterfactuals 2. How to use graphs to answer questions about conditional probabilities, the effects of manipulations, and counterfactuals. 3. Assumptions relating probabilities to causation.
80-521 Seminar on Formal Epistemology
Spring: 9 units
This seminar will focus on dynamic and epistemic logics, with special emphasis on the use of topological tools in such settings. No background in topology is necessary, though some familiarity with modal logic will be very helpful. We will begin with a review of foundational and introductory works and then progress to contemporary research articles. Core topics include public announcement logic, action logic, propositional dynamic logic (for nondeterministic program executions), dynamic topological logic, and evidence models. Additional topics will be chosen based on the interests and suggestions of those in the seminar. The format will be presentation-style: each student will be expected to prepare (in consultation with the professor) and present approximately two papers over the course of the semester.

80-524 Topics in Formal Epistemology: The Topology of Learning
Intermittent: 9 units
When faced with a question concerning learning or scientific method, one habitually reaches for logic and probability theory. But sometimes habits should be questioned. There is increasing awareness, scattered across philosophy, informatics, mathematical statistics, that the the relevant issues are more fundamentally topological. That might sound shocking: what could rubber geometry have to do with learning or inductive inference? The answer is that the set of empirically verifiable propositions over a set of possibilities automatically satisfies the axioms of a topological space over possible worlds. Once that is recognized, there is a systematic translation between topology and familiar concepts and issues in learning, statistics and the philosophy of science. This seminar will introduce to the student then topological concepts and will explore the methodological correspondences in detail. Topics covered include Hume's problem of induction, the problem of non-refutable theories and paradigm choice, convergence to the truth, simplicity and Ockham's razor, statistical model selection, causal discovery, and computability. The class will place students at the cutting edge of research in this fresh and exciting new area, and will provide them with a high-level, explanatory perspective that unifies much of the detail encountered in standard statistics and machine learning curricula.

80-529 Incommensurability: Ethics and Philosophy of Science
Intermittent: 9 units
Claims that certain things are incommensurable are common in several areas of philosophical discourse. In the philosophy of science, for example, it has been claimed that different scientific theories, or particular claims or terms within these theories, are incommensurable. In ethics, some have argued that different types of values (rights, utility, personal commitments, individual identities) are incommensurable. In many cases, incommensurability is treated as a problem that needs to be surmounted in order for agents to make rational decisions to compare alternative theories or to evaluate acts or policies that implicate different kinds of value. The first part of this course examines what incommensurability is supposed to be, how it supposedly arises in various fields, and what kind of challenge it poses for theories of rationality and rational choice. In the second part of the course we examine theories in which incommensurability is not a problem to be overcome, but a kind of moral requirement in itself. For instance, the injunction at the heart of Kantian ethics not to treat agents (with dignity) like things (with a price) requires that these entities not be brought into certain kinds of comparative relationship. Similar claims seem to be at work in certain liberal political theories (Walzer and Rawls), in views that seek to limit the scope of goods that can be distributed in markets, and in views of science that treat conceptual diversity as an source of important possibilities automatically satisfies the axioms of a topological space over possible worlds. In the concluding section of the seminar, we will focus on particular linguistic/cognitive phenomena and try to modify the various models to (hopefully) find characterizations and explanations of the diverse phenomena.

80-530 Seminar on Ethical Theory
Intermittent
This seminar will focus on classic and contemporary accounts of moral and political autonomy and their application to current topics in ethics, political philosophy, and global justice. We will pay special attention to the neorepublican notion of freedom as non-domination, how and to what extent this concept interacts with conceptions of autonomy, and what can be gained or lost by applying the neorepublican framework to various debates.

80-536 Ethics & Policy of AI
Intermittent: 9 units
AI, robots, and other autonomous technologies are having deep and wide impacts on individuals, communities, and societies. In this seminar, we will examine the ethical & policy dimensions of these novel (autonomous) technologies. We will emphasize analyses of current and near-future systems, grounded in the actual technological details. Students will be expected to have either prior ethics or prior policy familiarity/experience.