DEPARTMENT OF AFRICAN AMERICAN STUDIES

AAS 245 Harlem Renaissance and Black Arts Movements
Professor: Chika O. Okeke-Agulu

Description: This course surveys important moments in 20th-Century African American art from the Harlem Renaissance in the 1920s to the 1960s Black Arts movement. Our close studies of the work of major artists will be accompanied by examination of influential theories and ideologies of blackness during two key moments of black racial consciousness in the United States. We shall cover canonical artists and writers such as Aaron Douglas, James van der Zee, William H. Johnson, Jacob Lawrence, Romare Bearden, Faith Ringgold, Betye Saar, W. E. B. Du Bois, Alain Locke, James Porter and Jeff Donaldson.

Schedule: 8:30 am - 9:50 am T Th

AAS 367 African American History Since Emancipation
Professor: Joshua B. Guild

Description: Offers an introduction to the major themes, critical questions, and pivotal moments in post emancipation African American history. Traces the social, political, cultural, intellectual, and legal contours of the black experience in the United States from Reconstruction to the rise of Jim Crow, through the World Wars, Depression, and the Great Migrations, to the long civil rights era and the contemporary period of racial politics. Using a wide variety of texts, images, and creative works, the course situates African American history within broader national and international contexts.

Schedule: 11:00 am - 11:50 am T Th

SCHOOL OF ARCHITECTURE

ARC 308 History of Architectural Theory
Professor: Lucia Allais

Description: This course offers a history of architectural theory, criticism, and historiography from the Renaissance to the present, emphasizing the texts, media and institutions that have supported architecture's claim to modernity since the late 17th Century. Architectural thought is examined in its social and cultural context as it relates both to the Western philosophical tradition and to design method and practice.

Schedule: 11:00 am - 11:50 am T Th

ART AND ARCHAEOLOGY

ART 100 An Introduction to the History of Art: Meanings in the Visual Arts
Professor: Carolina Mangone

Description: Introduction to the history of art and to the discipline of art history. Not a comprehensive survey but a sampling of arts -- painting, sculpture, architecture, photography and prints -- and artistic practices from diverse historical periods, regions, and cultures. The course balances consideration of historical developments with attention to individual works of art. Faculty members of the Department of Art and Archaeology lecture in their fields of expertise; all precepts are held in the Princeton University Art Museum to facilitate direct engagement with works of art.

Schedule: 10:00 am - 10:50 am M W

ART 212 Neoclassicism through Impressionism
Professor: Bridget A. Alsdorf

Description: This course provides an introduction to core anthropological modes of inquiry into being human across space and time. Engaging key concepts of culture as lenses on contemporary phenomena, we will explore universalism and variation across societies. How do communities express difference and identity, make meaning, transmit knowledge, circulate objects and power, live, love, wish and dream? Case-studies vary, from women's piety movements in Cairo to the role of mosquitoes, germs, and machines in making lives and worlds. We will also consider anthropology's colonial origins, examining intersections between knowledge and domination.

Schedule: 10:00 am - 10:50 am M W
Description: A broad study of European painting and sculpture from the French revolution to 1900 with special attention to art's relationship to social, economic, and cultural changes. Precepts in the Princeton University Art Museum. Lectures explore a range of themes including art and revolution, the rise of landscape painting, shifting conceptions of realism, the nude, and the birth of "modernism" and the avant-garde. Emphasis on major figures including David, Canova, Goya, Ingres, Turner, Courbet, Manet, Monet, Degas, Rodin, van Gogh and Cezanne.

Schedule: 10:00 am - 10:50 am T Th

ART 216 Aesthetics and Politics of Chinese Painting
Professor: Cheng-hua Wang

Description: In this thematic introduction to the role of painting in Chinese cultural history, we will attend to the critical questions discussed within the field of Chinese painting in particular and art history in general. These questions, revolving around the dynamic between aesthetics and politics, include the influence of class, gender, political changes, and social behavior on painting; the formation of painting canons and lineages; and how local and global elements interacted in early modern, modern and contemporary Chinese painting. Students will have the opportunity to study Chinese painting first hand.

Schedule: 3:30 pm - 4:20 pm T Th

ART 233 Renaissance Art and Architecture
Professor: Carolina Mangone, Carolyn Yerkes

Description: What was the Renaissance? This class explores the major artistic currents that swept northern and southern Europe from the fourteenth through the sixteenth centuries in an attempt to answer that question. In addition to considering key themes such as the revival of antiquity, imitation and license, religious devotion, artistic style, and the art market, we will survey significant works by artists and architects including Donatello, Raphael, Leonardo, Jan van Eyck, Durer, and Michelangelo. Precepts will focus on direct study of original objects, with visits to Princeton's collections of paintings, sculpture, prints, drawings, books and maps.

Schedule: 11:00 am - 11:50 am T Th

ART 296 The Foundations of Civilization: the Art and Archaeology of the Ancient Middle East
Professor: Deborah A. Vischak

Description: While most people are familiar with the modern Middle East, few understand the deep history of the region. This geographically diverse area rich with resources engendered civilization as we conceive it, being home to the earliest domesticated agriculture, oldest monumental art and architecture, first cities, first political and economic systems, and the first examples of writing in human history. In this course we will examine objects, architecture, and archaeological sites from across this region from roughly 8,000-400 BCE, considering the nature of civilization and the enduring influence of these earliest societies.

Schedule: 11:00 am - 11:50 am M W

ASTROPHYSICAL SCIENCES

AST 205 Planets in the Universe
Professor: Gaspar Bakos

Description: This is an introductory course in astronomy focusing on planets in our Solar System, and around other stars (exoplanets). First we review the formation, evolution and properties of the Solar system. Following an introduction to stars, we then discuss the exciting new field of exoplanets; discovery methods, earth-like planets, and extraterrestrial life. Core values of the course are quantitative analysis and hands-on experience, including telescopic observations.

Other information: Students will be involved in telescopic observations and astrophotography. Some of these will be during selected lectures (in the daytime, e.g. observing the Sun and Venus), and others will be in the evenings (e.g. Jupiter, Saturn, Uranus, Neptune).

Schedule: 1:30 pm - 2:50 pm T Th
AST 303 Modeling and Observing the Universe: Research Methods in Astrophysics
Professor: Jenny E. Greene, Matthew W. Kunz

Description: How do we observe and model the universe? We discuss the wide range of observational tools available to the modern astronomer: from space-based gamma ray telescopes, to globe-spanning radio interferometry, to optical telescopes and particle detectors. We review basic statistics and introduce students to techniques used in analysis and interpretation of modern data sets containing millions of galaxies, quasars and stars, as well as the numerical methods used by theoretical astrophysicists to model these data. The course is problem-set-based and aims to provide students with tools needed for independent research in astrophysics.

Schedule: 3:00 pm - 4:20 pm M W

CHEMICAL AND BIOLOGICAL ENGINEERING

CBE 260 Ethics and Technology: Engineering in the Real World
Professor: Jay B. Benziger

Description: This course examines engineering as a profession and the responsibilities of that profession to society. Professional responsibilities of engineers are compared to those of lawyers, doctors, scientists and business leaders. Ethical theories are introduced as frameworks to guide decisions of technology implementation. Simple quantitative decision making concepts, including risk-benefit analysis, are introduced as a method for engineers to make ethically optimal choices.

Other information: There will be movies relevant to technology development, e.g. "Who Killed the Electric Car", "The Day After Trinity", "China Syndrome". These will be available for viewing on Blackboard.

Schedule: 10:00 am - 10:50 am T Th

CIVIL AND ENVIRONMENTAL ENGINEERING

CEE 102A Engineering in the Modern World
Professor: Michael G. Littman

Description: Lectures and readings focus on bridges, railroads, power plants, steamboats, telegraph, highways, automobiles, aircraft, computers, and the microchip. Historical analysis provides a basis for studying societal impact by focusing on scientific, political, ethical, and aesthetic aspects in the evolution of engineering over the past two and a half centuries. The precepts and the papers will focus historically on engineering ideas including the social and political issues raised by these innovations and how they were shaped by society as well as how they helped shape culture.

Schedule: 11:00 am - 11:50 am M W

CEE 205 Mechanics of Solids
Professors: Sigrid M. Adriaenssens

Description: This course teaches fundamental principles of solid mechanics. Equilibrium equations, reactions, internal forces, stress, strain, Mohr's circle, and Hooke's law. Analysis of the stress and deformation in simple structural members for safe and stable engineering design. Axial force in bars, torsion in shafts, bending and shearing in beams, stability of elastic columns, strain transformation, stress transformation, combined loadings, design project.

Schedule: 11:00 am - 12:20 pm T Th

CEE 207 Introduction to Environmental Engineering
Professor: Ian C. Bourg

Description: The course introduces the basic chemical and physical processes of relevance in environmental engineering. Mass and energy balance and transport concepts are introduced and the chemical principles governing reaction kinetics and phase partitioning are presented. We then turn our focus to the applications in environmental engineering problems related to water and air pollution.

Schedule: 1:30 pm - 02:50 pm M W
CEE 305 Environmental Fluid Mechanics  
**Professor:** Elie R. Bou-Zeid

**Description:** The course starts by introducing the conservation principles and related concepts used to describe fluids and their behavior. Mass conservation is addressed first, with a focus on its application to pollutant transport problems in environmental media. Momentum conservation, including the effects of buoyancy and earth’s rotation, is then presented. Fundamentals of heat transfer are then combined with the first law of thermodynamics to understand the coupling between heat and momentum transport. We then proceed to apply these laws to study air and water flows in various environmental systems, with a focus on the atmospheric boundary layer.

**Schedule:** 1:30 pm - 2:50 pm T Th

CEE 471 Introduction to Water Pollution Technology  
**Professor:** Peter R. Jaffe

**Description:** An introduction to the science of water quality management and pollution control in natural systems; fundamentals of biological and chemical transformations in natural waters; identification of sources of pollution; water and wastewater treatment methods; fundamentals of water quality modeling.

**Schedule:** 8:30 am - 9:50 am T Th

CLASSICS

CLA 216 Archaic and Classical Greece  
**Professor:** Marc Domingo Gygax

**Description:** The social, political, and cultural history of ancient Greece from ca.750 B.C. through the time of the Peloponnesian War (404 B.C.). Special attention is paid to the emergence of the distinctively Greek form of political organization, the city state, and to democracy, imperialism, social practices, and cultural developments. Emphasis is placed on study of the ancient sources, methods of source analysis, and historical reasoning.

**Schedule:** 3:30 pm - 4:20 pm M W

COMPARATIVE LITERATURE

COM 205 The Classical Roots of Western Literature  
**Professor:** Leonard Barkan

**Description:** A reading of some of the greatest works of literature in the Western tradition from Homer to the late Middle Ages. The course is also designed as an introduction to Comparative Literature -- that is, a reading of literary works across the boundaries of time, geography, and language. All works taught in English.

**Schedule:** 12:30 pm - 01:20 pm M W

COM 218 Literature and Society  
**Professor:** Benjamin Conisbee Baer

**Description:** What kind of social institution is literature? Through close study of literary and theoretical texts, we examine ways literature is understood as reflecting, conditioning, representing, subverting, performing, or constructing the ethics and values of societies and cultures. We focus on the death penalty and representations of violence and coexistence. Does literature depict the experiences of real people? How (and why) do we “identify”? How do these ethical aspects of literature relate to moments of social crisis or the maintenance of social stability? To social and cultural differences? We address such questions in a global literary frame.

**Other information:**
We explore literary works as rehearsals of-and means of subjective or spiritual preparation for-ethical and political dilemmas and predicaments in society. Please be prepared to go out of your comfort zone in approaching writings that activate representations of racism, sexism, violence and oppression (as well, of course, as writings that imagine everydayness, love, and all sorts of other things!). Be prepared to read a range of classic texts afresh, and to tackle some literary theory.

**Schedule:** 11:00 am - 12:20 pm T Th
COM 219 A Cultural History of Nineteenth Century Europe through Wagner's Ring
Professor: Guangchen Chen

Description/Objectives: Wagner's 15-hour opera cycle Der Ring des Nibelungen is a unique masterpiece that transformed opera as a genre. With enormous emotional and intellectual power, it provides insight into key social and political issues that were particularly troubling in 19th-century Europe. It is also the magnum opus of a controversial composer whose overt anti-Semitism resonates well into the present. Through a close study of audio and video recordings, and with equal emphasis on musical and theatrical aspects, this course will offer a cross-disciplinary introduction to the Ring, unpacking the musical, cultural, political and economic history of the period.

Schedule: 1:30 pm - 2:50 pm M W

COMPUTER SCIENCE

COS 109 Computers in Our World
Professor: Brian W. Kernighan

Description: Computers are all around us. How does this affect the world we live in? This course is a broad introduction to computing technology for humanities and social sciences students. Topics will be drawn from current issues and events, and will include discussion of how computers work; what programming is and why it is hard; how the Internet and the Web work; security and privacy.

Schedule: 1:30 pm - 2:50 pm M W

COS 217 Introduction to Programming Systems
Professor: Andrew W. Appel

Description: Introduction to programming systems, including modular programming, advanced program design, programming style, test, debugging and performance tuning; machine languages and assembly language; and use of system call services.

Schedule: 10:00 am - 10:50 am T Th

COS 226 Algorithms and Data Structures
Professor: Kevin Wayne

Description: This course surveys the most important algorithms and data structures in use on computers today. Particular emphasis is given to algorithms for sorting, searching, graphs and strings. The course will concentrate on developing implementations, understanding their performance characteristics, and estimating their potential effectiveness in applications.

Schedule: 11:00 am - 12:20 pm T Th

COS 318 Operating Systems
Professor: Jaswinder P. Singh

Description: An introduction to operating systems. Emphasis is on the fundamentals of how to design and implement an operating system. Topics include operating system structure, processes, threads, synchronizations, concurrent programming, interprocess communications, virtual memory, I/O device management, and file systems.

Schedule: 11:00 am - 12:20 pm M W

COS 324 Introduction to Machine Learning
Professors: Ryan P. Adams, Yoram Singer

Description: Gives broad introduction to different learning paradigms and algorithms, providing a foundation for further study or independent work in artificial intelligence and data science. Supervised learning: regression, classification, multiclass categorization, deep learning, and ensemble methods. Unsupervised learning: linear factor analysis, PCA, clustering, probabilistic modeling. Reinforcement learning: sequential decision making, exploration/exploitation tradeoffs, optimal planning in a markov decision process.

Sample Reading List: See instructor for complete list.

Schedule: 11:00 am - 12:20 pm T Th

COS 326 Functional Programming
Professor: David P. Walker

Description: An introduction to the principles of typed functional programming. Programming recursive functions over structured data types and informal reasoning by induction about the correctness of those functions. Functional algorithms and data structures. Principles of
modular programming, type abstraction, representation invariants and representation independence. Parallel functional programming, algorithms and applications.

Schedule: 11:00 am - 12:20 pm M W

COS 333 Advanced Programming Techniques
Professor: Robert M. Dondero

Description: This is a course about the practice of programming. Programming is more than just writing code. Programmers must also assess tradeoffs, choose among design alternatives, debug and test, improve performance, and maintain software written by themselves & others. At the same time, they must be concerned with compatibility, robustness, and reliability, while meeting specifications. Students will have the opportunity to develop these skills by working on their own code and in group projects.

Schedule: 1:30 pm - 2:50 pm T Th

COS 340 Reasoning about Computation
Professors: Bernard Chazelle, Iasonas Petras

Description: An introduction to mathematical topics relevant to computer science. Combinatorics, probability and graph theory will be covered in the context of computer science applications. The course will present a computer science approach to thinking and modeling. Students will be introduced to fundamental concepts such as NP-completeness and cryptography that arise from the world view of efficient computation.

Schedule: 3:00 pm - 4:20 pm M W

COS 418 Distributed Systems
Professor: Wyatt A. Lloyd

Description: This course covers the design and implementation of distributed systems. Students will gain an understanding of the principles and techniques behind the design of modern, reliable, and high-performance distributed systems. Topics include server design, network programming, naming, concurrency and locking, consistency models and techniques, security, and fault tolerance. Modern techniques and systems employed at some of the largest Internet sites (e.g., Google, Facebook, Amazon) will also be covered. Through programming assignments, students will gain practical experience designing, implementing, and debugging real distributed systems.

Schedule: 10:00 am - 10:50 am M W

COS 429 Computer Vision
Professor: Olga Russakovsky

Description: This course is an introduction to the concepts of 2D and 3D computer vision. It surveys a wide range of topics from level-level vision to high-level recognition. We will discuss concepts such as filtering and edge detection; cameras and shape reconstruction; segmentation and clustering; optical flow and tracking; object recognition; motion recognition; statistical modeling of visual data, etc. Throughout the course, there will also be examination of aspects of human vision and perception that guide and inspire computer vision techniques.

Schedule: 3:00 pm - 4:20 pm T Th

COS 432 Information Security
Professor: Arvind Narayanan

Description/Objectives: How to secure computing systems, communications, and users. Basic cryptography; private and authenticated communication; software security; malware; operating system protection; network security; web security; physical security; cryptocurrencies and blockchains; privacy and anonymity; usable security; economics of security; ethics of security; legal and policy issues.

Schedule: 11:00 am - 12:20 pm T Th

COS 436 Human-Computer Interface Technology
Professor: Marshini Chetty

Description: Creating technologies that fit into people's everyday lives involves more than having technically sophisticated algorithms, systems, and infrastructure. It involves understanding how people think and behave and using this information to design user-facing interfaces that enhance and augment human capabilities. You will be introduced to the field of human-computer interaction and the tools, techniques, and principles that guide research on people. Design and implement user-facing
systems that bring joy rather than frustrate the user and put these skills into practice in a semester long group project involving the creation of an interactive system.

Schedule: 1:30 pm - 2:50 pm M W

COS 487 Theory of Computation
Professor: Zeev Dvir

Description: Introduction to computability and complexity theory. Topics will include models of computation such as automata, and Turing machines; decidability and decidability; computational complexity; P, NP, and NP completeness; others.

Schedule: 1:30 pm - 2:50 pm T Th

EAST ASIAN STUDIES

EAS 231 Chinese Martial Arts Classics: Fiction, Film, Fact
Professor: Pieter C. Keulemans

Description: This course provides an overview of Chinese martial arts fiction and film from earliest times to the present day. The focus will be on the close-reading of literary, art-historical, and cinematic texts, but will also include discussion of the significance of these works against their broader historical and social background. Topics to be discussed: the literary/cinematic pleasure of watching violence, the relationship between violence and the law, gender ambiguity and the woman warrior, the imperial and (trans)national order of martial arts cinema, and the moral and physical economy of vengeance.

Schedule: 10:00 am - 10:50 am T Th

EAS 280 Nomadic Empires: From the Scythian Confederation to the Mongol Conquest
Professor: Xin Wen

Description: In telling histories of East Asia, South Asia, the Middle East, and Europe, various groups of nomadic people often loomed large in the background and served as the foil to the travail of their sedentary neighbors. In this course we put the nomadic peoples of Inner Asia front and center, and ask how the nomadic way of life and mode of state building served as agents of change in pre-modern Eurasia.

Schedule: 11:00 am - 12:20 pm T

ECONOMICS

ECO 100 Introduction to Microeconomics
Professor: Harvey S. Rosen

Description: Economics is the study of the allocation of scarce resources. The subject of this course is microeconomics, which examines the decision making of individuals and firms with regard to consumption, production, and allocation of good and services in a market system. We examine the benchmark "perfectly competitive" market setting as well as market settings that are not perfectly competitive. We discuss the appropriate role of government in addressing these "market failures"

Schedule: 2:30 pm - 3:20 pm T Th

ECO 101 Introduction to Macroeconomics
Professor: Elizabeth C. Bogan

Description/Objectives: The theory of the determination of the level of national income and economic activity, including an examination of the financial system. Emphasis on economic growth and such economic problems as inflation, unemployment and recession, and on appropriate policy responses. Some attention is also paid to international issues.

Schedule: 11:00 am - 11:50 am T Th

ECO 312 Econometrics: A Mathematical Approach
Professor: Mikkel Plagborg-Moller

Description: This course is an introduction to econometrics. Econometrics is a sub-discipline of statistics that provides methods for inferring economic structure from data. This course has two goals. The first goal is to give you means to evaluate an econometric analysis critically and logically. Second, you should be able to analyze a data set methodically and comprehensively using the tools of econometrics.

Schedule: 1:30 pm - 2:50 pm M W
ECO 317 The Economics of Uncertainty
Professor: Leeat Yariv


Other information: Note, the text is an unpublished manuscript.

Schedule: 11:00 am - 12:20 pm T Th

ECO 324 Law and Economics
Professor: Thomas C. Leonard

Description: An introduction to the economics of law. Application of price theory and welfare analysis to problems and actual cases in the common law - property, contracts, torts - and to criminal and constitutional law. Topics include the Coase Theorem, intellectual property, inalienable goods, product liability, crime and punishment, and social choice theory.

Schedule: 11:00 am - 12:20 pm T Th

ECO 331 Economics of the Labor Market
Professor: Orley C. Ashenfelter

Description: To provide a general overview of labor markets. Covering labor force participation, the allocation of time to market work, migration, labor demand, investment in human capital (education, on-the-job training, man-power training), discrimination, unions and unemployment. The course will also examine the impact of government programs (such as unemployment insurance, minimum wages, or a negative income tax) on the labor market.

Schedule: 11:00 am - 12:20 pm M W

ECO 332 Economics of Health and Health Care
Professor: Kelly Noonan

Description: Health economics is a growing field of applied microeconomics and is an important aspect of public policy. This course explores the health care sector and health policy issues from an economic perspective. Microeconomics tools will be used to analyze the functioning of different pieces of the health care system. Topics will range from fundamental subjects, such as the demand for health, to more recent developments, such as mental health, child health and risky health behaviors. This course teaches an economic approach to studying the various polices that affect health and health behaviors.

Schedule: 3:00 pm - 4:20 pm M W

ECO 353 International Monetary Economics
Professor: Iqbal Zaidi

Description: This course studies topics in open-economy macroeconomics and international finance. Topics include Exchange Rates, Current Account Imbalances, Inflation, Sovereign Debt, and Open Economy Macroeconomics. The course will include economic theory as well as several applications.

Schedule: 11:00 am - 12:20 pm M W

ECO 372 Economics of Europe
Professor: Silvia Weyerbrock

Description: Europe is at a crossroads. Political and economic integration in the European Union (EU) exceeds levels reached in the rest of the world. Economic integration not only affects trade but also migration, agriculture, competition, regions, energy, and money. Most euro area economies have been struggling with interlocking crises involving debt, banking and growth. The EU is facing a migration crisis. The UK voted for Brexit, and other countries may follow. This course studies economic integration and the ongoing crises. It uses economic analysis to study policy issues.

Schedule: 8:30 am - 9:50 am T Th

ECO 418 Strategy and Information
Professor: Faruk R. Gul

Description: Explores basic themes in modern game theory and information economics. Non-cooperative solution concepts for games will be developed and applied in a variety of contexts
including auctions, bargaining, repeated games
dynamic interaction in oligopolistic industries,
and reputation formation.

**Schedule:** 11:00 am - 12:20 pm M W

**ECOLOGY AND EVOLUTIONARY BIOLOGY**

**EEB 211 Life on Earth: Chaos and Clockwork of Biological Design**
**Professor:** Joshua Akey, Andrew P. Dobson, Katherine M. Sullivan

**Description:** An examination of how life evolved and how organisms function. Design--’intelligent’ and otherwise--will provide a unifying theme. Why do some microbes produce slime and others do not? Why are males brightly colored in some species, but in others females are the showy sex? Why do humans have knees that fail whereas horses and zebras do not? These and other ‘why is it so’ questions related to the origin and history of life, genetic code, biochemistry, physiology, morphology and body plans, sex and reproduction, cooperation, and ecosystems will be explored.

**Schedule:** 11:00 am - 12:20 pm M W

**EEB 309 Evolutionary Biology**
**Professor:** Bridgett M. vonHoldt

**Description:** All life on Earth has, and continues to, evolve. This course will explore evolution within two frameworks: conservation genetics and species interactions. In the first half of the course, we will explore fundamental processes that work together to shape biodiversity and viability, both at the organismal and molecular levels. We then will examine how species interactions can be the driver of change, from sexual selection to predation and pathogens. Overall, this course will provide you with the basic tools to understand how evolution continues to shape contemporary ecological and the phenotypic traits we observe on our planet.

**Schedule:** 8:30 am - 9:50 am T Th

**EEB 327 Immune Systems: From Molecules to Populations**
**Professor:** Andrea L. Graham

**Description:** How do immune systems work, and why do they work as they do? Why is there so much immunological polymorphism in animal populations? To address these questions, students will examine immunology across multiple biological scales. At the molecular and cellular scales, students will learn mechanisms by which animals recognize and kill parasites. At the population scale, students will investigate causes of the tremendous immunological heterogeneity exhibited by animals. Both the clinical relevance and the evolutionary basis of polymorphisms will be emphasized.

**Schedule:** 8:30 am - 9:50 am T Th

**ENGINEERING**

**EGR 395 Venture Capital and Finance of Innovation**
**Professor:** Shahram Hejazi

**Description:** Venture capital is a driving force behind innovation and entrepreneurship, although the unique working details of venture capital firms and their processes are well-kept secrets. Early stage investors not only fund startups but also enable innovation through mentorship and partnership with the entrepreneurs. Understanding how these investors think and operate is critical to students who are interested in entrepreneurship, as well as to those who would like to pursue venture capital.

**Other:** Auditors interested in this class should send an email to pucap@princeton.edu. Please
include a 150 word paragraph stating background experience and the reason for taking this class. Registration will be per instructor approval. RSVP by 8/25/18.

Schedule: 1:30 pm - 4:20 pm F

EGR 488 Designing Ventures To Change the World
Professor: John D. Danner

Description: This course looks at global challenges reflected in the UN's Sustainable Development Goals (SDGs), e.g., widespread poverty, disease, gender inequality, poor water, inadequate housing and illiteracy, through the lens of entrepreneurial ventures, exploring whether and how entrepreneurs can meaningfully address those issues in ways that complement governmental and charitable initiatives. First, we will consider the SDGs themselves, second, we will focus on one issue in particular: coffee business.

Other: Auditors interested in this class should send an email to pucap@princeton.edu. Please include a 150 word paragraph stating background experience and the reason for taking this class. Registration will be per instructor approval. RSVP by 8/25/18.

Schedule: 12:30 pm - 01:20 pm M

EGR 497 Entrepreneurial Leadership
Professor: Derek B. Lidow

Description: The mission of the class is to enable students to successfully create and lead enterprises by teaching the basic skills required to be a successful entrepreneurial leader. This class compliments EGR 491 "High Tech Entrepreneurship" which focuses on 'giving birth to a company', by focusing instead on enterprise 'early child rearing'. The basic skills taught fall into three major categories: how to create and manage powerful relationships, how to know and manage yourself, in addition to understanding how organizations work as they evolve from the idea stage to become value producing, self-sustaining enterprises.

Other information: Goal is to provide an experiential learning opportunity showing how professionals, really build companies.

Schedule: 11:00 am - 12:20 pm T Th

ELECTRICAL ENGINEERING

ELE 341 Solid-State Devices
Professor: Barry P. Rand

Description: The physics and technology of solid state devices. Review of electronic structure of semiconductors, energy bands and doping, followed by discussion of carrier transport by drift and diffusion and recombination/generation. Detailed analysis of p-n junctions, bipolar transistors and field effect transistors. Survey of a wide range of devices, including photodetectors, solar cells, light-emitting diodes and semiconductor lasers, highlighting contemporary concepts such as thin film electronics and 2D semiconductors.

Schedule: 3:00 pm - 4:20 pm T Th

ELE 458 Photonic and Light Wave Communications
Professor: Paul Prucnal

Description: This course provides a working knowledge of the components comprising fiber-optic networks, which form the backbone of today's communication networks, including the global internet, 4G wireless, home access and data center networks. The operation of lasers, fiber optics and optical routers will be discussed, as will current applications such as fiber to the home, the broadband wireless-optical interface, all-optical switching, signal processing and computing, and security in fibers. The course will also provide lab demonstrations and visits to the Lightwave Communications Research Lab.

Schedule: 1:30 am - 2:50 pm M W

ELE 462 Design of Very Large-Scale Integrated (VLSI) Systems
Professor: Naveen Verma

Description: Analysis and design of digital integrated circuits using deep sub-micron CMOS technologies as well as emerging and post-CMOS technologies (Si finFETs, III-V, carbon). Emphasis on design, including synthesis, simulation, layout and post-layout verification. Analysis of energy, power,
performance, area of logic-gates, interconnect and signaling structures.

Schedule: 11:00 am - 12:20 pm T Th

ENERGY STUDIES

ENE 267 Materials for Energy Technologies and Efficiency
Professor: Claire E. White

Description: An introductory course focusing on new and existing materials that are mitigating worldwide anthropogenic CO2 emissions and associated greenhouse gases. Emphasis will be placed on how materials science is used in energy technologies and energy efficiency; including solar power, cements and natural materials, sustainable buildings, batteries, water filtration, and wind and ocean energy. Topics include: nanomaterials; composites; energy conversion processes; cost implications; lifecycle analysis; material degradation.

Schedule: 10:00 am - 10:50 am T Th

ENE 318 Fundamentals of Biofuels
Professor: Jose L. Avalos

Description: What are biofuels, and why are we making them? What are 1st, 2nd, and 3rd generation biofuels? What is the controversy surrounding the food versus fuel debate? Will thermocatalysis or genetic engineering improve biofuel production? Can we make biofuels directly from light or electricity? These are some of the questions we will answer through engaging discussions, primary literature readings, and hands-on experience in making biofuels. In precept we will make bioethanol from corn (beer) or molasses (wine), biodiesel from cooking oil, and oil from algae. Grades are based on participation, an oral presentation, and three short lab reports.

Schedule: 11:00 am - 12:20 pm M W

ENGLISH

ENG 207 Reading Literature: Drama
Professor: Michael W. Cadden

Description: This course is designed to teach students how to read plays as literature written for performance. Key assumptions are that every act of reading is an act of interpretation, that a good reader of dramatic literature engages in an activity nearly identical to that of a good director or actor or designer, and that a reader might learn from theater practitioners how to make critical choices based on close reading and a knowledge of theatre history.

Schedule: 12:30 pm - 1:20 pm M W

ENG 309 Graphic Novels and Comics
Professor: Alfred Bendixen

Description: An exploration of comics and the graphic novel with particular attention to the ways specific works combine visual imagery and language to enlarge the possibilities of narrative form. Through our analysis of highly acclaimed graphic memoirs as well as popular comics, we will develop strategies for interpreting and evaluating the cultural significance and aesthetic quality of narratives based on sequential art from multiple traditions.

Schedule: 10:00 am - 10:50 am M W

ENG 320 Shakespeare I
Professor: Leonard Barkan

Description: The first half of Shakespeare's career, with a focus on the great comedies and histories of the 1590's, culminating in a study of Hamlet.

Schedule: 10:00 am - 10:50 am M W

ENG 345 19th-Century Fiction
Professor: Jeff Nuno

Description: This course will acquaint students with the distinctive features of the nineteenth century novel, from Austen to Hardy. Lectures will seek to illuminate relations between social and aesthetic dimensions of the texts we read. We will consider how these fictional imaginings of things like love, sex, money, class, and race help shape the ways we live now.

Schedule: 2:30 pm - 3:20 pm M W

ENG 368 American Literature: 1930-Present
Professor: Lee C. Mitchell

Description: A study of eleven modern American writers over eighty years that
emphasizes the transition from modernism to postmodernism to retro-realism.

**Schedule:** 10:00 am - 10:50 am T Th

**ENG 390 The Bible as Literature**  
**Professor:** Donald Vance Smith

**Description:** This course will study what it means to read the Bible in a literary way: what literary devices does it contain, and how has it influenced the way we read literature today? What new patterns and meanings emerge? This course will examine the structures and modes of the Biblical books; the formation of the canon and the history of the apocryphal or deuterocanonical books; questions of authorship; its literary genres; histories of exegesis, interpretation, and commentary; the redaction, division, and ordering of biblical texts; the cultural, political, and intellectual worlds within which these texts were written.

**Other information:** Even if you do not know Hebrew or Greek (and you do not need to), you will learn how to study Biblical texts in the original languages.

**Schedule:** 1:30 pm - 2:20 pm M W

**PROGRAM IN CONTEMPORARY EUROPEAN POLITICS**

**EPS 300 European Politics and Society in the 20th Century**  
**Professor:** Ezra N. Suleiman

**Description:** The course aims to cover the critical developments of twentieth-century and twenty-first century Europe and the consolidation of democracy in European countries. It will deal with the legacy of the two world wars, Nazism, Stalinism, the Cold War, the legacy of colonialism and decolonization, the collapse of Communism and the re-unification of Europe, the birth and development of the European Community, the development of the welfare state, the problems confronting the European Union (immigration, enlargement, political institutions, military role, and the single currency), and the varieties of democratic institutions in Europe.

**Schedule:** 11:00 am - 12:20 pm T Th

**GEO 102A Climate: Past, Present, and Future**  
**Professor:** Daniel M. Sigman

**Description:** Which human activities are changing our climate, and does climate change constitute a significant problem? We will investigate these questions through an introduction to climate processes and an exploration of climate from the distant past to today. We will also consider the implications of climate change for the global environment and humans. Intended to be accessible to students not concentrating in science or engineering.

**Schedule:** 11:00 am - 12:20 pm T Th

**GEO 203 Fundamentals of Solid Earth Science**  
**Professor:** Jessica C. Irving

**Description:** A quantitative introduction to Solid Earth system science, focusing on the underlying physical and chemical processes and their geological and geophysical expression. Through the course we investigate the Earth starting from its basic constituents and continue through its accretion, differentiation and evolution and discuss how these processes create and sustain habitable conditions on Earth's surface. Topics include nucleosynthesis, planetary thermodynamics, plate tectonics, seismology, geomagnetism, petrology, sedimentology and the global carbon cycle. Two field trips included.

**Schedule:** 3:00 pm - 4:20 pm T Th

**GEO 255A Life in the Universe**  
**Professors:** Christopher F. Chyba, Michael H. Hecht, Tullis C. Onstott, Edwin L. Turner

**Description:** This course introduces students to a new field, Astrobiology, where scientists trained in biology, chemistry, astronomy and geology combine their skills to discover life's origins and to seek extraterrestrial life. Topics include: the origin of life on Earth; the prospects of life on Mars, Europa, Enceladus and extrasolar planets. Students will also compete in class to select landing sites and payloads for the next robotic missions to Mars and Europa.
Schedule: 1:30 pm - 2:50 pm M W

GEO 361 Earth's Atmosphere
Professor: Stephan A. Fueglistaler

Description: This course discusses the processes that control Earth's climate - and as such the habitability of Earth - with a focus on the atmosphere and the global hydrological cycle. The course balances overview lectures (also covering topics that have high media coverage like the 'Ozone hole' and 'Global warming', and the impact of volcanoes on climate) with selected in-depth analyses. The lectures are complemented with homework based on real data, demonstrating basic data analysis techniques employed in climate sciences.

Other information: The main goal of the course is to demonstrate how interplay between measurements and a hierarchy of models (that starts with the highly idealized and gradually becomes more elaborate) can lead to an understanding of very complex phenomena such as weather and climate.

Schedule: 11:00 am - 12:20 pm T Th

GEO 378 Mineralogy
Professor: Thomas S. Duffy

Description: Minerals are the fundamental building blocks of the Earth. Their physical, chemical, and structural properties determine the nature of the Earth and they are the primary recorders of the past history of the Earth and other planets. This course will provide a survey of the properties of the major rock-forming minerals. Topics include crystallography, crystal chemistry, mineral thermodynamics and mineral occurrence. Emphasis will be on the role of minerals in understanding geological processes. Laboratories will focus on hand specimen identification and modern analytical techniques.

Schedule: 1:30 pm - 2:50 pm T Th

GEO 425 Introduction to Ocean Physics for Climate
Professor: Gabriel A. Vecchi

Description: The study of the oceans as a major influence on the atmosphere and the world environment. The contrasts between the properties of the upper and deep oceans; the effects of stratification; the effect of rotation; the wind-driven gyres; the thermohaline circulation.

Schedule: 10:00 am - 10:50 am M W F

HISTORY

HIS 201 A History of the World
Professor: Jeremy I. Adelman

Description: An introduction to the history of the modern world, this course traces the global processes that connected regions with each other from the time of Genghis Khan to the present. The major themes of the course include the environmental impact of human development, the role of wars and empires in shaping world power, and the transformations of global trade, finance, and migration.

Other information: Students will be required to view two lectures online per week. There will also be one live town hall forum per week with Prof. Adelman.

Schedule: 11:00 am - 11:50 am W

HIS 211 Europe from Antiquity to 1700
Professor: Anthony T. Grafton

Description: This course traces an epic story: How Greeks and Romans, Jews and Christians, nobles and merchants, princesses and servants, serfs and slaves built what is now called Western Civilization.

Schedule: 11:00 am - 11:50 am M W

HIS 316 South African History, 1497 to the Present
Professor: Emmanuel H. Kreike

Description: South Africa's past and present were and are closely intertwined with those of its neighbors, including Angola, Zimbabwe, and Mozambique. South Africa's industrial expansion, for example, relied on thousands of migrant laborers from its neighbors. The course will highlight a variety of themes, including the rise and fall of African empires (Great Zimbabwe and the Zulu kingdom), the effects of European colonization, and the repression caused by the Apartheid system. The course will also focus on the dramatic political changes that
occurred in the 1990s, including the end of the wars in the region and the rise of democracy.

**Schedule:** 11:00 am - 12:20 pm T Th

**HIS 325 China, 1850 to the Present**  
**Professor:** Janet Y. Chen

**Description:** This course is an introduction to the history of modern China, from imperial dynasty to Republic, from the Red Guards to red capitalists. Through primary sources in translation, we will explore political and social revolutions, transformations in intellectual life and culture, as well as competing explanations for events such as the rise of the Communist Party and the Cultural Revolution. Major themes include: the impact of imperialism and war, tensions between governance and dissent, the emergence of nationalism, and the significance of China's history for its present and future.

**Schedule:** 10:00 am - 10:50 am M W

**HIS 343 The Civilization of the Early Middle Ages**  
**Professor:** Helmut Reimitz

**Description:** The course studies the formation of Europe in the first millennium, from the Roman empire to the year 1000 CE. It was in this period that we observe the emergence of a Western Latin culture whose distinctive features came to characterize Europe and Western civilization for many centuries to come, even until now. In pursuing the question why and how the early medieval present became so different from the Roman past we will explore the formation of some of the foundational features of the Latin West-such as the emergence of a plurality of ethnically defined nations, a Western legal pluralism, or the formation of a distinct Western Christianity.

**Schedule:** 2:30 pm - 3:20 pm M W

**HIS 345 The Crusades**  
**Professor:** Teresa Shawcross

**Description:** The Crusades were a central phenomenon of the Middle Ages. This course examines the origins and development of the Crusades and the Crusader States in the Islamic East. It explores dramatic events, such as the great Siege of Jerusalem, and introduces vivid personalities, including Richard the Lionheart and Saladin. We will consider aspects of institutional, economic, social and cultural history and compare medieval Christian (Western and Byzantine), Muslim and Jewish perceptions of the crusading movement. Finally, we will critically examine the resonance the movement continues to have in current political and ideological debates.

**Schedule:** 1:30 pm - 2:20 pm T Th

**HIS 376 The American Civil War and Reconstruction**  
**Professor:** Matthew J. Karp

**Description:** Why did the flourishing United States, by some measures the richest and most democratic nation of its era, fight the bloodiest civil war in the 19th century Western world? How did that war escalate into a revolutionary political struggle that transformed the nation--and then, almost as rapidly, give way to a reactionary backlash? This course will explore the causes, course, and consequences of the U.S. Civil War and Reconstruction, keeping in mind the ways that America's greatest conflict also represented a major event in the history of the global 19th century, and a landmark moment in the making of the modern world.

**Schedule:** 1:30 pm - 2:20 pm T Th

**HIS 383 The United States, 1920-1974**  
**Professor:** Kevin M. Kruse

**Description:** The history of modern America, with particular focus on domestic political and social changes. Topics include the Roaring 20s; the Great Depression and the New Deal; the homefront of World War II and the Cold War; the civil rights movement and the Great Society; the Vietnam War; the sexual revolution; the Silent Majority, the Nixon administration, and Watergate.

**Schedule:** 10:00 am - 10:50 am M W

**HIS 388 Unrest and Renewal in Urban America**  
**Professor:** Alison E. Isenberg

**Description:** This course surveys the history of cities in the United States from colonial settlement to the present. Over centuries, cities
have symbolized democratic ideals of immigrant "melting pots" and cutting-edge innovation, as well as urban crises of disorder, decline, crime, and poverty. Urban life has concentrated extremes like rich and poor; racial and ethnic divides; philanthropy and greed; skyscrapers and parks; violence and hope; center and suburb. The course examines how cities in U.S. history have brokered revolution, transformation and renewal, focusing on class, race, gender, immigration, capitalism, and the built environment.

**HIS 391 History of Contemporary Science**
**Professor:** Michael D. Gordin

**Description:** More science has been done since 1970 than in the history of the world before that date--- combined. This course traces a series of developments in contemporary science across a broad array of disciplines, with the goal of illuminating the historical processes that have brought them about and providing students with a set of tools to understand the particular position of the sciences in today's world. Topics covered include AIDS, nuclear power, string theory, evolutionary psychology, brain drain, and genomics.

**Schedule:** 11:00am - 11:50am T Th

**PROGRAM IN HUMANISTIC STUDIES**

**HUM 233 East Asian Humanities I: The Classical Foundations**
**Professor:** Anna M. Shields

**Description:** An introduction to the literature, art, religion and philosophy of China, Japan and Korea from antiquity to ca. 1400. Readings focus on primary texts in translation and are complemented by museum visits and supplementary materials on the course website. The course aims to allow students to explore the unique aspects of East Asian civilizations and the connections between them through an interactive web-based platform, in which assignments are integrated with the texts and media on the website. No prior knowledge of working with digital media is required.

**Schedule:** 1:30 pm - 2:20 pm T Th

**HUM 290 Jesus and Buddha**
**Professor:** Jonathan C. Gold, Elaine H. Pagels

**Description:** This course introduces the study of religion by juxtaposing the narratives, teachings, careers and legacies of the founders of Christianity and Buddhism. While respecting each tradition's unique and distinctive texts, rituals, philosophies, and histories, the course invites us to deepen our understanding of each tradition by looking through the lens of the other. Course readings will include accounts of the lives of Jesus and Buddha, what each taught about how to live and create society, and how each understood the meaning of life and death, suffering and salvation.

**Schedule:** 11:00 am - 11:50 am M W

**PROGRAM IN LINGUISTICS**

**LIN 201 Introduction to Language and Linguistics**
**Professor:** Florian Lionnet

**Description:** An introduction to the scientific analysis of the structure and uses of language. Core areas covered include phonetics and phonology, morphology, the lexicon, syntax, semantics and pragmatics, with data from a wide range of languages. Additional topics include language acquisition, language and the brain, and language change.

**Schedule:** 10:00 am - 10:50 am M W

**LIN 260 Languages of Africa**
**Professor:** Florian Lionnet

**Description:** About 2000 of the world's 6000 to 7000 languages are spoken in Africa. The diversity that characterizes these languages is exceptional, but very little is known to non-specialists. In this course, we will learn about the languages of Africa: the diversity of their linguistic structures (including famous features that are found nowhere else, e.g. click consonants), their history and the history of their speakers (from ca 10,000 BP to the (post) colonial period), and their cultural contexts, among other topics. This course has no prerequisites, and is open to anyone with an interest in African languages or the African continent.

**Schedule:** 3:00 pm - 4:20 pm M W
LIN 235 Mythbusting Language  
**Professor:** Byron T. Ahn  
**Description:** As educated users of language, many of us have strong feelings about it, such as how we should use it (“That isn’t what ‘literally’ means!”) and why. Which of these feelings are valid and which are closer to folklore? In this class, we investigate many preconceptions about language, objectively explore their validity as myth or fact, and make conclusions about how human languages can(not) be described. Topics may include whether: women talk more than men, children learn languages better than adults, legalese is more precise, dolphins use language, all languages/dialects are equally sophisticated, and bilingualism makes you smarter.  
**Schedule:** 1:30pm - 2:50pm M W

MECHANICAL AND AEROSPACE ENGINEERING

MAE 223 Modern Solid Mechanics  
**Professor:** Andrej Kosmrlj  
**Description:** Fundamental principles of solid mechanics: equilibrium equations, reactions, internal forces, stress, strain, Hooke’s law, torsion, beam bending and deflection, and analysis of stress and deformation in simple structures. Integrates aspects of solid mechanics that have applications to mechanical and aerospace structures (engines and wings), as well as to microelectronic and biomedical devices (thin films and artificial hearts). Topics include stress concentration, fracture, plasticity, and thermal expansion. The course synthesizes descriptive observations, mathematical theories, and engineering consequences.  
**Schedule:** 11:00 am - 12:20 pm T Th

MAE 324 Structure and Properties of Materials  
**Professor:** Craig B. Arnold  
**Description:** Relates to the structures, properties, processing and performance of different materials including metals, alloys, polymers, composites, and ceramics. This course also discusses how to select materials for engineering applications. This course satisfies the MAE departmental requirement in materials as well as the MSE certificate core requirement.  
**Schedule:** 1:30 pm - 2:50 pm M W

MAE 331 Aircraft Flight Dynamics  
**Professor:** Robert F. Stengel  
**Description:** Introduction to the performance, stability, and control of aircraft. Fundamentals of configuration aerodynamics. Methods for analyzing the dynamics of physical systems. Characterization of modes of motion and desirable flying qualities. Case studies in aircraft stability and control.  
**Schedule:** 3:00 pm - 4:20 pm T Th

MAE 335 Fluid Dynamics  
**Professor:** Daniel M. Nosenchuck  
**Description:** The course is focused on compressible and incompressible inviscid fluid flow. Compressible subsonic and supersonic flows are studied in the first half of the course. The remaining portion of the semester addresses low-speed, incompressible fluid flows and aerodynamics of two and three-dimensional wings and bodies. Concepts of thrust, lift and drag are introduced and applied.  
**Schedule:** 08:30 am - 09:50 am T Th

MATHEMATICS

MAT 321 Numerical Methods  
**Professor:** Nicholas Boumal  
**Description:** Introduction to numerical methods with emphasis on algorithms, applications and numerical analysis. Topics covered include solution of nonlinear equations; numerical differentiation, integration, and interpolation; direct and iterative methods for solving linear systems; computation of eigenvectors and eigenvalues; and approximation theory. Lectures include mathematical proofs where they provide insight and are supplemented with numerical demos using MATLAB.  
**Schedule:** 1:30 pm - 2:50 pm M W

MAT 335 Analysis II: Complex Analysis  
**Professor:** Assaf Naor  
**Description:** Study of functions of a complex
variable, with emphasis on interrelations with other parts of mathematics. Cauchy's theorems, singularities, contour integration, power series, infinite products. The gamma and zeta functions and the prime number theorem. Elliptic functions, theta functions, Jacobi's triple product and combinatorics. This course is the second semester of a four-semester sequence, but may be taken independently of the other semesters.

**Schedule:** 1:30 pm - 2:50 pm T TH

**MAT 340 Applied Algebra**  
**Professor:** Mark W. McConnell

**Description:** An applied algebra course that integrates the basics of theory and modern applications for students in MAT, APC, PHY, CBE, COS, ELE. This course is intended for students who have taken a semester of linear algebra and who have an interest in a course that treats the structures, properties and application of groups, rings, and fields. Applications and algorithmic aspects of algebra will be emphasized throughout.

**Schedule:** 3:00 pm - 4:20 pm T Th

**MAT 477 Advanced Graph Theory**  
**Professor:** Maria Chudnovsky

**Description:** Advanced course in Graph Theory. Further study of graph coloring, graph minors, perfect graphs, graph matching theory. Topics covered include: stable matching theorem, list coloring, chi-boundedness, excluded minors and average degree, Hadwiger's conjecture, the weak perfect graph theorem, operations on perfect graphs, and other topics as time permits.

**Schedule:** 11:00 am - 12:20 pm T Th

**PROGRAM IN MEDIEVAL STUDIES**

**MED 227 The World of the Middle Ages**  
**Professor:** Sara S. Poor

**Description:** An introduction to medieval culture in Western Europe from the end of the classical world to ca. 1400. The course focuses on themes such as the medieval concepts of self, humanity, and God; nation-building, conquest and crusade; relations among Christians, Jews, and Moslems; literacy, heresy, and the rise of vernacular literature; gender, chivalry, and the medieval court. Material approached through various cultural forms and media; several lectures by invited guest lecturers. Seminar discussion format with some lecturing.

**Schedule:** 11:00 am - 12:20 pm T Th

**MOLECULAR BIOLOGY**

**MOL 214 Introduction to Cellular and Molecular Biology**  
**Professors:** Clifford P. Brangwynne, Daniel A. Noterman, Heather A. Thieringer

**Description:** Important concepts and elements of molecular biology, biochemistry, genetics, and cell biology are examined in an experimental context. This course fulfills the requirement for students majoring in the biological sciences and satisfies the biology requirement for entrance into medical school.

**Schedule:** 11:00 am - 12:20 pm M W

**MOL 345 Biochemistry**  
**Professors:** Frederick M. Hughson

**Description:** Fundamental concepts of biomolecular structure and function will be discussed, with an emphasis on principles of thermodynamics, binding and catalysis. A major portion of the course will focus on metabolism and its logic and regulation.

**Schedule:** 10:00 am - 10:50 am M W F

**MOL 459 Viruses: Strategy and Tactics**  
**Professor:** Lynn W. Enquist

**Description:** Viruses are unique parasites of living cells and may be the most abundant, highest evolved life forms on the planet. The general strategies encoded by all known viral genomes are discussed using selected viruses as examples. The first half of the course covers the molecular biology (the tactics) inherent in these strategies. The second half introduces the biology of engagement of viruses with host defenses, what happens when viral infection leads to disease, vaccines and antiviral drugs, and the evolution of infectious agents and emergence of new viruses.

**Schedule:** 11:00 am - 11:50 am M W F
**MUSIC**

**MUS 205 Species Counterpoint**  
**Professor:** Steven Mackey  
**Description:** To lay the foundations for a thorough understanding of the principles of linear structure and voice-leading through the study of species counterpoint. Twice weekly exercises will lead to a complete 4-5 voice Mass Movement as a final project.  
**Schedule:** 12:30 pm - 1:20 pm M W

**MUS 238 Music of the Romantic Era**  
**Professor:** Simon A. Morrison  
**Description:** A survey of major composers, styles, genres, and aesthetic, technical, and philosophical issues related to the development of art music through the 19th century.  
**Schedule:** 11:00 am - 11:50 am M W

**NEAR EASTERN STUDIES**

**NES 201 Introduction to the Middle East**  
**Professor:** Michael A. Cook  
**Description:** A sweep through Middle Eastern history, globally contextualized. Weeks 1-6 treat the rise of Islam, the Caliphate, the Ottoman Empire, 19th-century reforms, European imperialism, and incipient globalization in the region. Weeks 7-12 focus on state-society relations & political ideologies, and foreign actors in the 20th/21st centuries. You will come away with a basic grasp of the region's past and present and its mix of idiosyncrasies and global links.  
**Other information:** There will be background reading, but the main focus will be on close study of short primary-source texts; these are to be read the way historians read them.  
**Schedule:** 11:00 am - 11:50 am T Th

**NES 269 The Politics of Modern Islam**  
**Professor:** Bernard A. Haykel  
**Description:** This course examines the political dimensions of Islam. This will involve a study of the nature of Islamic political theory, the relationship between the religious and political establishments, the characteristics of an Islamic state, the radicalization of Sunni and Shi'i thought, and the compatibility of Islam and the nation-state, democracy, and constitutionalism, among other topics. Students will be introduced to the complex and polemical phenomenon of political Islam. The examples will be drawn mainly, though not exclusively, from cases and writings from the Middle East.  
**Schedule:** 11:00 am - 11:50 am M W

**NEUROSCIENCE**

**NEU 200 Functional Neuroanatomy**  
**Professor:** Michael S. Graziano  
**Description:** A crucial part of neuroscience is understanding how function has its foundation in anatomy. This course traces neuroanatomical pathways through the central nervous system. It emphasizes the primate brain, especially the human brain. The course covers how nuclei, ganglia, and layered structures such as cortex are arranged physically in the brain, the fiber pathways by which they connect to each other, and how this connectivity relates to their function. The material will encompass systems within the brain stem, sensory systems, motor systems, higher cognitive systems, and the interconnectivity and interaction of these systems.  
**Schedule:** 11:00 am - 12:20 pm M W

**NEU 201 Fundamentals of Neuroscience**  
**Professor:** Ilana B. Witten  
**Description:** An intensive introduction to fundamental topics in neuroscience, including neuronal excitability, synaptic physiology, neural networks, and circuits that mediate perception, action, emotion, and memory. We will examine neuroscience at scales ranging from single neurons, to the activity of small sets of neurons, to the organization of brain and behavior. The course will address broad questions including: How does information enter the brain? What neural pathways transmit these signals? How is information processed and used to construct an internal model of reality? How does the brain choose and execute the correct behavioral response?  
**Schedule:** 1:30 pm - 2:50 pm T Th
OPERATIONS RESEARCH AND FINANCIAL ENGINEERING

ORF 363 Computing and Optimization for the Physical and Social Sciences
Professor: Amir Ali Ahmadi

Description: An introduction to several fundamental and practically-relevant areas of modern optimization and numerical computing. Topics include computational linear algebra, first and second order descent methods, convex sets and functions, basics of linear and semidefinite programming, optimization for statistical regression and classification, and techniques for dealing with uncertainty and intractability in optimization problems. Extensive hands-on experience with high-level optimization software. Applications drawn from operations research, statistics and machine learning, economics, control theory, and engineering.

Other information: Students will use the MATLAB-based optimization software CVX/YALMIP, which is free to download

Schedule: 1:30 pm - 2:50 pm T Th

ORF 411 Sequential Decision Analytics and Modeling
Professor: Warren B. Powell

Description: Students will develop mathematical modeling skills in the context of sequential decisions under uncertainty. Students will learn the five elements of a sequential decision problem: state variables, identifying and modeling decisions, uncertainty quantification, creating transition functions, and designing objective junctions. They will learn how to design policies, and the principles of policy search and evaluation in both offline and online settings. All concepts will be taught through a series of carefully chosen problems designed to bring out specific modeling features.

Other information: Students will benefit if they have taken courses such as ORF 311, ORF 360, ORF 407 or ORF 418.

Schedule: 11:00 am - 12:20 pm T Th

ORF 435 Financial Risk Management
Professor: John M. Mulvey

Description: This course covers the basic concepts of modeling, measuring and managing financial risks. Topics include portfolio optimization in the mean-variance and expected utility sense, interest rate risk, credit risk, risk measures, systemic risk. Algorithms from machine learning are introduced and linked to the stochastic planning models.

Schedule: 1:30 pm - 2:50 pm T Th

PHILOSOPHY

PHI 200 Philosophy and the Modern Mind
Professor: Daniel Garber

Description: In this course, we will survey some of the key issues that emerged in Philosophy during the sixteenth through the eighteenth centuries, using classical texts from the period. Issues to be discussed may include authority, both political and intellectual, personhood and the individual, religion and science, free will, experience and reason, materialism and the mind, and the limits of human knowledge. Figures discussed may include Montaigne, Descartes, Hobbes, Galileo, Spinoza, Locke, and Hume.

Schedule: 2:30 pm - 3:20 pm M W

PHI 202 Introduction to Moral Philosophy
Professor: Sarah E. McGrath

Description: This course will be an examination of some central topics in moral philosophy. We will consider questions such as: Is abortion morally permissible? Is there a moral difference between killing someone and letting someone die? How is it permissible to treat animals? We will also consider more general moral questions, such as what makes an action right or wrong & to what extent is this a matter of the action's consequences? When is an agent morally responsible for her actions? Is there a single true morality, or is moral truth relative to cultures or individuals?

Schedule: 11:00 am - 11:50 am T Th

PHI 306 Nietzsche
Professor: Alexander Nehamas

Description: An examination of Nietzsche's central views, including the role of tragedy, the
place of science, the eternal recurrence, the will to power, and the primacy of the individual. We will also examine Nietzsche's ambiguous attitude toward philosophy and his influence on literature and criticism.

**Schedule:** 1:30 pm - 2:20 pm M W

**PHI 318 Metaphysics  
Professor:** Boris C. Kment

**Description:** A survey of central issue in metaphysics, such as: What is time? Is it true that the past is fixed and immutable while the future is a branching tree of alternative possibilities? Or could we in principle change the past? What makes a certain object at one time identical with a certain object at a later time? Are human beings truly free, or are their actions determined by factors beyond their control? Or both?

**Schedule:** 12:30 pm - 01:20 pm T Th

**PHI 338 Philosophical Analysis from 1900 to 1950  
Professor:** Thomas P. Kelly

**Description:** A study of philosophical analysis in the first half of the 20th century. Topics include the early analytic paradigms of Moore and Russell, the logical atomism of middle Russell and early Wittgenstein, the rise and fall of logical positivism, the post-positivist perspective of Quine. The course will trace changes in the nature of analysis as a philosophical method, and chart the development of major metaphysical, epistemological, and ethical views.

**Schedule:** 11:00 am - 11:50 am M W

**PHYSICS**

**PHY 101 Introductory Physics I  
Professor:** Katerina Visnjic

**Description:** The course is concerned with an introduction to the fundamental laws underlying physics and having general application to other areas of science. The treatment is complete and detailed; however, less mathematical preparation is assumed than for PHY 103-104. Mechanics and thermodynamics are treated quantitatively with a special emphasis on problem solving. In the spring semester PHY 102 covers electricity and magnetism, optics and relativity using the topics treated in PHY 101.

**Schedule:** 12:30 pm - 01:20 pm Th

**PHY 305 Introduction to the Quantum Theory  
Professor:** David A. Huse

**Description:** This course is a continuation of PHY 208. We will continue to develop the formalism of quantum mechanics and to explore its basis. We will apply our methods to phenomena from atomic, high energy, and condensed matter physics.

**Schedule:** 11:00 am - 12:20 pm T Th

**POLITICS**

**POL 220 American Politics  
Professor:** Paul Frymer, Sarah L. Staszak

**Description:** An introduction to the institutions and political processes of American government and democracy. Topics will include the Constitution and American political tradition, federalism, political institutions, elections and representation, interest groups and social movements, civil rights and liberties, and the politics of public policy.

**Schedule:** 10:00 am - 10:50 am T Th

**POL 230 Introduction to Comparative Politics  
Professor:** Alisha C. Holland

**Description:** Why are some countries rich and others poor? Why do some countries have revolutions, while others never do? This course explores such questions about the domestic politics of other countries, or comparative politics, focusing on five major themes: 1) economic development 2) democratization 3) revolution 4) ethnic conflict and 5) income redistribution. Readings on Africa, Asia, Europe, the Middle East, and Latin America are used to provide an introduction to politics in different regions of the world and to show how cross-national comparisons provide insight into contemporary political outcomes.

**Schedule:** 10:00 am - 10:50 am M W
POL 240 International Relations  
Professor: Andrew Moravcsik

Description: This course is an introduction to the causes and nature of international conflict and cooperation. We critically examine various theories of international politics by drawing on examples drawn from international security, economic and legal affairs across different historical eras from 10,000 BC to the present. Topics include the causes of war, the pursuit of economic prosperity, the sources of international order and its breakdown, and the rise of challenges to national sovereignty, and such contemporary issues as international environmental politics, human rights promotion, global terrorism, and the future of US foreign policy.

Schedule: 11:00 am - 11:50 am M W

POL 303 Modern Political Theory  
Professor: Gregory A. Conti

Description: A survey of the foundational texts of modern political theory. Emphasis is placed on close reading and the reconstruction and analysis of theoretical arguments.

Schedule: 1:30 pm - 2:20 pm T Th

POL 313 Global Justice  
Professor: Charles R. Beitz

Description: What, if any, norms of justice apply to the institutions and practice of world politics? Topics may include "political realism" and skepticism about global morality; just wars and justice in warfare; ethics of humanitarian intervention; the nature and basis of human rights; world poverty and global distributive justice; climate change; democracy and accountability in global institutions. Readings chosen from recent works in political philosophy.

Schedule: 11:00 am - 11:50 am T Th

POL 315 Constitutional Interpretation  
Professor: Robert P. George

Description: A study of the structure of the American constitutional system and of the meaning of key constitutional provisions. Students will critically evaluate competing theories of, and approaches to, constitutional interpretation.

Schedule: 11:00 am - 12:20 pm T

POL 320 Judicial Politics  
Professor: John Kastellec

Description: This course provides an introduction to the political science of law and courts. Topics typically include: bargaining and decision making on the U.S. Supreme Court; political struggles over doctrine within the judicial hierarchy; the politics of Supreme Court nominations; juries as political institutions; court packing, jurisdiction stripping and judicial intimidation.

Schedule: 2:30 pm - 3:20 pm M W

POL 327 Mass Media, Social Media, and American Politics  
Professor: Andrew Guess

Description: This course considers the role of both mass media and social media in American politics and the influence of the media on Americans' political attitudes, beliefs, and behaviors. We will examine the nature of news and news-making organizations, the role of the news media in electoral campaigns, how the media shape the behavior of politicians once in office, political advertising, and the ability of social media to facilitate collective action.

Schedule: 3:30 pm - 4:20 pm M W

POL 341 Experimental Methods in Politics  
Professor: Ali A. Valenzuela

Description: The use of experiments to study and influence politics is widespread and growing, partly because they can identify cause and effect not possible with surveys or other data. No longer confined to the lab, political scientists and campaign operatives use new technology to conduct experiments on thousands of voters in real elections. Massive political experiments have been conducted on Facebook, by mail and telephone, but is it ethical to influence politics in pursuit of new knowledge? What have experiments taught us about voting, race, and representation in America? This class
will cover these and other aspects of using experiments in politics.

**Schedule:** 2:30 pm - 3:20 pm T Th

**POL 362 Chinese Politics**
**Professor:** Rory Truex

**Description:** This course provides an overview of China's political system. We will begin with a brief historical overview of China's political development from 1949 to the present. The remainder of the course will examine the key challenges facing the current generation of CCP leadership, focusing on prospects for democratization and political reform. Among other topics, we will examine: factionalism and political purges; corruption; avenues for political participation; village elections; public opinion; protest movements and dissidents; co-optation of the business class; and media and internet control.

**Schedule:** 3:30 pm - 4:20 pm T Th

**POL 366 Politics in Africa**
**Professor:** Jennifer A. Widner

**Description:** This course introduces the study of African politics. The lectures and readings briefly review the social and historical context of contemporary political life. They then profile the changes of the early post-Independence period, the authoritarian turn of the 1970s and 80s, the second liberation of the 1990s, and problems of war, state-building, and development. Although the lectures trace a narrative, each also introduces a major analytical debate and an important policy problem. Broadly comparative with some special attention to selected countries.

**Schedule:** 10:00 am - 10:50 am T Th

**PSYCHOLOGY**

**PSY 255 Cognitive Psychology**
**Professor:** Jordan A. Taylor

**Description:** The course will survey discoveries and progress made over the past 50 years of research, from classic experimental findings and fundamental theoretical principles to the cutting edge of research that lies increasingly at the interface of psychology with neuroscience (neural mechanisms underlying cognitive processes), computer science (artificial intelligence and machine learning), and mathematics (formal models of complex processes). Topics will include perception, attention, memory, decision making, reasoning, problem solving, language, and cognitive control.

**Schedule:** 3:30 pm - 4:20 pm M W

**PSY 316 The Cognitive Neuroscience of Selective Attention**
**Professor:** Timothy J. Buschman

**Description:** Attention is our ability to select information relevant to behavior; focusing our limited cognitive/neural resources on those stimuli and thoughts that are critical to our current task. This course will review the neuroscience of selective attention, from the theoretical foundations provided by cognitive psychology to the neural underpinnings identified by systems neuroscience. The course will present a 'hands on' science experience, combining experimental demonstrations and discussions of current research topics to learn the design and analyses of contemporary experiments in the attention field.

**Schedule:** 11:00 am - 12:20 pm T Th

**RELIGION**

**REL 225 The Buddhist World of Thought and Practice**
**Professor:** Jacqueline I. Stone
**Description:** This course surveys the development of Buddhism from its beginnings in India through some of its later forms in East Asia, Tibet, and the West. Attention will be given to continuity and diversity within Buddhism, its modes of self-definition as a religious tradition, the interplay of its practical and trans-worldly concerns, and its transformations in specific historical and cultural settings.

**Schedule:** 1:30 pm - 2:20 pm M W

**REL 244 Judaism, Christianity, and Islam: Their Emergence in Antiquity**  
**Professor:** Moulie Vidas

**Description:** The period studied in this course saw wide-ranging transformations that inform religion and culture to this day, such as the emergence of the traditions now called Judaism, Christianity and Islam, a spread in allegiance to a single God, and a decline in public animal sacrifice. The course will introduce students to a critical examination of these changes. We will learn to identify patterns across different traditions, uncover the ways these traditions shaped one another, trace the development of beliefs from their earliest forms, and analyze the social and political context of these changes.

**Schedule:** 10:00 am - 10:50 am T Th

**REL 261 Christian Ethics and Modern Society**  
**Professor:** Eric S. Gregory

**Description:** An introduction to ethical controversies in public life in light of modern disputes over the interpretation of Christian thought and practice. Is Christianity fundamentally at odds with the ethos of liberal democracy oriented toward rights, equality, and freedom? What do Christian beliefs and moral concepts imply about issues related to feminism, racism, and pluralism? What is the relationship between religious convictions, morality, and law? Special emphasis on selected political and economic problems, sexuality and marriage, bioethics, capital punishment, the environment, war, immigration, and the role of religion in American culture.

**Schedule:** 11:00 am - 11:50 am T Th

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**SLAVIC LANGUAGES AND LITERATURES**

**SLA 219 Pushkin, Gogol, Dostoevsky: Introduction to the Great Russian Novel**  
**Professor:** Olga P. Hasty

**Description:** A study in English of masterpieces of Russian literature from the first half of the nineteenth century. The focus of the course is on works by authors who figure prominently in the development of a uniquely Russian literary tradition and inspire writers, composers, and filmmakers the world over. No previous knowledge of Russian language, history, or culture is expected.

**Schedule:** 1:30 pm - 2:20 pm T Th

**STATISTICS & MACHINE LEARNING**

**SML 201 Introduction to Data Science**  
**Professor:** Daisy Yan Huang

**Description:** Introduction to Data Science provides a practical introduction to the burgeoning field of data science. The course introduces students to the essential tools for conducting data-driven research, including the fundamentals of programming techniques and essentials of statistics. Students learn to work with real-world datasets from various domains, such as writing computer code to manipulate, explore, and analyze data; using basic data analysis techniques from statistics and machine learning; drawing conclusions using sound statistical reasoning; and producing scientific reports. No prior knowledge in programming or statistics is required.

**Schedule:** 11:00 am - 12:20 pm T Th

**SOCIOMETRY**

**SOC 101 Introduction to Sociology**  
**Professor:** Timothy J. Nelson

**Description:** This course will introduces students to the discipline of sociology (the systematic study of human groups, institutions and societies). Students will learn the major theoretical approaches within the field as well as the diverse research methods used in
sociological investigations. These tools will be applied to a wide variety of special topics studied by sociologists, including family, work, education, religion and social movements, as well as dynamics of class, gender, race and ethnic inequalities within and across countries.

**SOC 227 Race and Ethnicity**  
**Professor:** Patricia Fernandez-Kelly

**Description:** Our goal in this course is (a) to understand various definitions of race and ethnicity from a theoretical perspective and in a plurality of contexts and (b) to account for the rise of ethnicity and race as political and cultural forces in the age of globalization. Why are ethnic and racial delimitations expanding in areas of the world where such distinctions were formerly muted? Is race and racial discrimination all the same regardless of geographical region? What are the main theories and methodologies now available for the study of race and ethnicity from a comparative point of view? These are among the questions our course aims to answer.

**Schedule:** 10:00 am - 10:50 am T Th

**SOC 250 The Western Way of War**  
**Professor:** Miguel A. Centeno

**Description:** A historical and analytical overview of war focusing on the origins and consequences of organized violence, the experience of battle, the creation and behavior of warriors, and the future of such conflicts.

**Schedule:** 11:00 am - 11:50 am M W

**WOODROW WILSON SCHOOL**

**WWS 302 International Development**  
**Professor:** Alicia Adsera

**Description:** This course will focus on less developed countries and will consider topics such as economic growth and personal well-being; economic inequality and poverty; intra-household resource allocation and gender inequality; fertility and population change, credit markets and microfinance; health and education provision, labor markets and trade policy. The course will tackle these issues both theoretically and empirically. The class will use basic economic concepts: ECO 100 and ECO 101.

**Schedule:** 10:00 am - 10:50 am M W

**WWS 307 Public Economics**  
**Professor:** Elizabeth Bogen

**Description:** The role of government in promoting efficiency and equity in the U.S. economy. Conditions when markets fail to be efficient. Problems with government allocation of resources. Economic analysis and public policies regarding health care, education, poverty, the environment, financial regulations and other important issues.

**Schedule:** 3:30 pm - 4:20 pm T Th

**WWS 345 Prejudice: Its Causes, Consequences, and Cures**  
**Professor:** Stacey A. Sinclair

**Description:** Prejudice is one of the most contentious topics in modern American society. There is debate regarding its causes, pervasiveness, and impact. This goal of this course is to familiarize students with the psychological research relevant to these questions, particularly its cognitive aspects. We will review theoretical perspectives on prejudice to develop an understanding of its cognitive, affective, and motivational underpinnings. We will also discuss how these psychological biases relate to evaluations of, and behavior toward, members of targeted groups. Finally, research-based strategies for reducing prejudice will be discussed.

**Schedule:** 11:00 am - 11:50 am M W