

Below is a list of all new or changed courses:

[ANTH 005](#), [092](#), [110](#), [112](#), [114](#), [116](#), [121](#), [124](#), [126](#), [144](#), [146](#), [148](#),
[150](#), [160](#), [162](#), [169](#), [170](#), [174](#), [176](#), [190](#), [192](#),
[ARTS 002B](#), [009](#), [015](#), [020](#), [021](#), [023](#), [026A](#), [027B](#), [032](#), [036](#), [042A](#),
[092](#), [121A](#), [129](#), [141](#), [150](#), [159](#), [180](#), [181](#), [183](#), [190](#), [192](#),
[BEST 226](#), [294](#),
[BIO 001](#), [001L](#), [002](#), [002L](#), [104](#), [107](#), [125](#), [141](#), [148](#), [151L](#), [161](#), [180](#),
[182](#),
[BIOE 103](#), [126](#), [150](#),
[CHEM 095](#), [122](#), [194](#), [195](#),
[CHN 092](#), [192](#),
[COGS 005](#), [092](#), [121](#), [141](#), [159](#), [173](#), [192](#), [250](#), [269](#),
[CSE 020](#), [021](#), [030](#), [031](#), [100](#), [170](#), [171](#), [180](#),
[ECON 010](#), [092](#), [120](#), [160](#), [192](#),
[EECS 205](#), [250](#), [252](#), [260](#), [262](#), [270](#), [273](#), [274](#), [275](#), [287](#),
[ENGR 057](#), [065](#), [097](#), [120](#), [165](#), [166](#), [191](#), [197](#),
[ENVE 010](#), [160](#), [164](#),
[ES 210](#), [248](#), [252](#), [260](#), [264](#),
[ESS 002](#), [010](#), [120](#), [148](#), [170](#), [170L](#),
[FRE 092](#), [192](#),
[GASP 015](#), [026](#), [032](#), [092](#), [101](#), [121](#), [131](#), [132](#), [141](#), [151](#),
[175](#), [192](#),
[HIST 025](#), [030A](#), [030B](#), [080](#), [081](#), [092](#), [101](#), [103](#), [104](#), [113](#), [114](#), [121](#),
[123](#), [126](#), [138](#), [158](#), [165A](#), [165B](#), [165C](#), [165D](#), [170](#), [191](#), [192](#), [193](#),
[194](#),
[JPN 092](#), [192](#),
[LIT 032](#), [060](#), [092](#), [120](#), [137](#), [181](#), [192](#),
[MATH 011](#), [012](#), [018](#), [021](#), [022](#), [122](#), [125](#), [126](#), [141](#), [292](#),
[ME 107](#), [136](#), [137](#), [140](#), [170](#), [188](#),
[MEAM 237](#), [250](#), [280](#),
[MGMT 092](#), [121](#), [130](#), [160](#), [192](#),
[MSE 126](#),
[NSED 100](#),
[PHIL 001](#), [005](#), [092](#), [104](#), [105](#), [134](#), [170](#), [192](#),
[PHYS 010](#), [104](#), [105](#), [122](#), [124](#), [141](#), [160](#), [204](#), [241](#), [249](#),
[POLI 010](#), [092](#), [100](#), [106](#), [140](#), [142](#), [165](#), [171](#), [192](#),
[PSY 092](#), [105](#), [124](#), [131](#), [157](#), [158](#), [160](#), [162](#), [181](#), [192](#), [290](#),
[PUBP 092](#), [192](#),
[QSB 207](#), [248](#), [253](#), [282](#), [294](#), [297](#), [297L](#), [299](#),
[SOC 010](#), [015](#), [020](#), [030](#), [035](#), [036](#), [055](#), [092](#), [100](#), [118](#), [120](#), [130](#),
[132](#), [140](#), [150](#), [160](#), [161](#), [170](#), [192](#),
[SPAN 001](#), [002](#), [003](#), [004](#), [092](#), [105](#), [106](#), [192](#),
[USTU 010](#), [092](#), [110](#), [192](#),
[WCH 211](#), [229](#),
[WH 002](#), [003](#), [092](#), [120](#), [192](#),
[WRI 011](#), [092](#), [120](#), [150](#), [155](#), [160](#), [192](#)

ANTHROPOLOGY

ANTH 001: Introduction to Sociocultural Anthropology [4]

Introduction to human culture and cultural diversity, including the methods by which anthropology--via the study of social institutions, shared practices, and collective meanings--seeks to understand how people adapt to, make sense of, and transform their worlds. *Discussion included.*

ANTH 003: Introduction to Anthropological Archaeology [4]

Survey of theory, field and analysis methods, and objectives of anthropological archaeology. Examines how intellectual perspectives guide the ways in which archaeologists undertake their work and the types of materials they collect and analyze to study issues such as technology, exchange, subsistence, settlement, social organization, and ideology. *Discussion included.*

ANTH 005: Introduction to Biological Anthropology [4]

Introduction to evolution and how natural selection has shaped modern human variation. Examination of non-human primate behavior and how analogous it might be to that of early humans. Discussion of culture, the fossil evidence, genetics, and inheritance. *Laboratory included.*

ANTH 090X: Freshman Seminar [1]

Examination of a topic in anthropology. *May be repeated for credit.*

ANTH 092: Internship in Anthropology [1-4]

Provides oversight and structure for a student's internship in a field related to anthropology in community organizations, professional research projects, etc. connected to the study of anthropology. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of anthropology. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

ANTH 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ANTH 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ANTH 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ANTH 100: History of Anthropological Thought and Practice [4]

Historical overview of key individuals and central ideas influencing the practice of anthropology and the production of anthropological knowledge. Topics may include the disciplining of anthropology into related subfields; social evolutionism, historical particularism, British structural-functionalism; French structuralism; cultural ecology; sociobiology; symbolic and interpretive anthropology; feminist and other critiques of anthropology. *Prerequisite: ANTH 001 and (ANTH 003 or ANTH 005) or consent of instructor. Discussion included.*

ANTH 110: Migration, Diaspora and Transnational Belonging [4]

Exploration of modern, global movements of people with a focus on the conditions, processes, and practices of contemporary national and transnational belonging. Topics include globalization, migration, immigration, Diaspora, the nation-state, national identities and cultural citizenship. *Prerequisite: ANTH 001 or junior standing.*

ANTH 112: Political Anthropology [4]

Political anthropology involves the study of formal political institutions as well as the manifestations of power in everyday life. Topics may include anthropological perspectives on: the state and other forms of political authority; social inequality; conflict; indigenous responses to colonialism and the nation-state; social movements; citizenship; governmentality; and globalization. *Prerequisite: ANTH 001 or junior standing or consent of instructor.*

ANTH 114: Social Memory [4]

Introduction to the practices, spaces, artifacts and media through which social memory is formed, maintained and reproduced. Topics may include: how societies remember; how the past and its representation is bound up with national and other collective identities; commemoration; heritage; and the link between history, memory, and social justice. *Prerequisite: ANTH 001 and junior standing.*

ANTH 116: Indigenous Activism in the Americas [4]

Focusing on the contemporary struggles of Indigenous peoples for rights; self-determination; social, political, and environmental justice and/or increased nation-state participation. Examines how the mobilization of indigenous peoples is strengthened through regional, hemispheric and global solidarities; and how international law, media, and technology support indigenous actions for change. *Prerequisite: ANTH 001 and junior standing.*

ANTH 120: Introduction to Medical Anthropology [4]

This course provides knowledge about medical anthropology, how different cultures understand human physiology and health, definitions of sickness, types of medical systems and practitioners, how cultural practices affect health, issues in gender environmental health, and how medical anthropology influences health policy. *Prerequisite: ANTH 001 or ANTH 005. Letter grade only.*

ANTH 121: Ethnomedicine [4]

This course provides knowledge of medical systems cross culturally including the three ancient literary systems (Chinese, Ayurvedic, Greco-Arabic), shamanism, folk medicine, and biomedicine. Readings focus on the beliefs and organization of each system, types of practitioners, types of sicknesses treated, and how anthropologists research and understand these phenomena. *Prerequisite: ANTH 001 or ANTH 120.*

ANTH 124: Ethnopsychology [4]

This course covers anthropological perspectives on mental states, experience of emotions, and concepts of mental normality in a variety of cultural settings. Lectures and readings will focus especially on the relationship between individual and society, the role of emotions, and the definition of psychological phenomena cross culturally. *Prerequisite: ANTH 001 or ANTH 120.*

ANTH 126: Anthropological Approaches to Gender [4]

This course will examine gender and sexuality cross-culturally: cultural aspects of gender, sexuality, reproduction, and gender identity. Readings will explore definitions of male and female roles, sexual mores, issues in human reproduction, variations in definitions of sexual identity, and cultural, economic and religious aspects of gender, marriage, and family. *Prerequisite: ANTH 001 or ANTH 120.*

ANTH 130: Material Culture [4]

Examines the role that material objects play in human social relations, identity, and economy, including archaeological application of such knowledge to past societies. We explore the range of production and use of material objects, including theories of material culture, technology, style, meaning, memory, and agency. *Prerequisite: ANTH 003 or junior standing or consent of instructor.*

ANTH 134: Dynamics of Small-scale Societies [4]

Examines ethnographic and archaeological literature on small-scale hunter-gatherer-fisher and horticultural societies, and explores how these data contribute to study of subsistence and settlement strategies, technology, exchange, demography, and social relations in the past and present. *Prerequisite: ANTH 003 or junior standing or consent of instructor.*

ANTH 140: Cultural Heritage Policy and Practice [4]

Critical examination of the legal, practical, and ethical aspects of cultural heritage management in the United States and abroad. Topics include cultural resource management in public and private contexts, participation of stakeholders, the application of anthropological knowledge, and public outreach. *Prerequisite: ANTH 003 or WH 001 or junior standing or consent of instructor.*

ANTH 142: Archaeology of Colonialism [4]

Examines theoretical perspectives, issues, and interpretations in archaeological study of the interaction between indigenous peoples, European colonists, and enslaved Africans. Topics include disease, power, resistance, colonial institutions, multi-ethnic communities, and gender relations in diverse native engagements with colonists and others from a variety of homelands. *Prerequisite: ANTH 003 or junior standing or consent of instructor.*

ANTH 144: Archaeology of Religion [4]

Course examines ritual, religion, and cosmology in the archaeological record and explores theories that inform research and contribute to archaeological inferences. Takes a broad comparative approach and holistic perspective for the investigation of their historical, environmental, and social contexts. *Prerequisite: ANTH 003 or junior/senior standing or consent of instructor.*

ANTH 146: Topics in Small-scale Societies [4]

In-depth exploration of archaeological thought or data on one or more anthropological topics relevant to small-scale societies of North America, South America, Europe, Africa, and/or Asia. Topics vary and course may be repeated for credit if topics differ. *Prerequisite: ANTH 003 or junior standing or consent of instructor.*

ANTH 148: Topics in Complex Societies [4]

Exploration of a special topic or problem in the archaeology of complex societies. Topics vary and course may be repeated for credit if topics differ. *Prerequisite: ANTH 003 or junior/senior standing or consent of instructor. May be repeated for credit three times.*

ANTH 150: Race and Human Variation [4]

Investigation of how human biological variation is studied and how the definition of such variation differs between the scientific community and the public. Topics include historical perspectives on race and eugenics, how scientific racism has shaped national policy, and how genetic diversity and the Human Genome Project have informed such issues. *Prerequisite: ANTH 005 or junior standing.*

ANTH 151: Human Adaptability [4]

Examination of how humans live in marginal environments, such as extremely hot, extremely cold, or high altitude areas. Evolutionary, genetic ecological, demographic, and cultural explanations for human biological adaptability are explored. Students consider case studies from the high Andes, Siberia, equatorial South America, and the International Space Station. *Prerequisite: ANTH 005 or junior standing or consent of instructor.*

ANTH 152: Dying, Death, and Dead Persons [4]

Examination of the multiple cultural meanings of death and the dead person, including hospice, reactions to death, memorial gestures, rights to and constructions of the dead body in the U.S. legal system, cadavers in education and research, dead persons in mass disasters and human rights cases, archaeological examples, and repatriation issues. *Prerequisite: ANTH 005 or junior standing or consent of instructor.*

ANTH 155: Paleodemography [4]

Exploration of human population growth and decline, fertility and mortality, and population age and sex structure in the past without benefit of written records. Topics include the interplay of demography and hominid evolution, migration, environmental stress, the transition to agriculture, and the rise and fall of complex societies. *Prerequisite: ANTH 003 and ANTH 005 and junior standing or consent of instructor.*

ANTH 160: Human Origins [4]

This course explores the biological heritage of humans by providing students with a rigorous grounding in modern evolutionary theory and undertaking detailed Study of the phylogeny, morphology, and paleoecology of the Hominini. In addition, this course uses the fossil record to reveal the truly unique features of Homo sapiens. *Prerequisite: ANTH 005. Discussion included.*

ANTH 162: Growth, Development, and Human Evolution [4]

This course applies modern life history theory to understand how evolution of growth patterns contributed to divergence in adult morphology among human ancestors, as revealed by the fossil record of hominin species. We also examine the uniquely human phenomenon of childhood, and the geographic diversity observed among modern human beings. *Prerequisite: ANTH 005.*

ANTH 169: Trends in Biological Anthropology [4]

Explores current trends in biological anthropology. Course material will vary. Possible topics may include: isotopic analysis of human nutrition; genetic studies of human variation and adaptability; life history and population studies of health and disease; studies of the interaction of the environment, human behavior, and human biology; and ethics. *Prerequisite: ANTH 005. May be repeated for credit once.*

ANTH 170: Ethnographic Methods [4]

Training in how to conduct field based qualitative research including learning about ethics, training in human subjects protection, skills of participant-observation, interviewing, taking field notes, and the analysis and presentation of research results. *Prerequisite: ANTH 001 or junior standing.*

ANTH 172: Ethnohistory [4]

This course examines the critical use of historical documents, journals, and visual images; archives; and oral history to understanding past cultures and culture change. Analysis of case studies and original archival research demonstrate how these sources complement data collected through ethnographic, archaeological, or biological methods. *Prerequisite: ANTH 001 or ANTH 003 or junior standing or consent of instructor.*

ANTH 174: Lithic Artifact Analysis [4]

Systematic consideration and practical application of analytical laboratory and data recording techniques used to study stone tools and manufacturing debris. Topics include procurement; production and reuse; style and function; the organization of technology with respect to settlement and gender; and craft specialization. *Prerequisite: ANTH 003 or consent of instructor. ANTH majors/minors given priority. Laboratory included.*

ANTH 176: Archaeological Field Methods [4]

Introduction to the goals and methods of archaeological surface survey, excavation, and various forms of field documentation. The integration of research issues and methods is addressed through both classroom and field activities. *Prerequisite: ANTH 003 or junior standing in the major. Fieldwork included.*

ANTH 178: Human Osteology [4]

Students develop a basic familiarity with human skeletal remains, including the identification of the bones of the skull, dentition, and axial and appendicular skeletons. Identification of side (i.e., left, right) and element of both intact and fragmentary remains are considered. *Prerequisite: ANTH 005 or consent of instructor. ANTH majors/minors given priority. Laboratory included.*

ANTH 179: Bioarchaeology [4]

In-depth consideration of methods used to identify sex, age at death, stature, and ancestry from human skeletal remains. Anthropometrics, disease, trauma, and basic demographic techniques are also considered, preparing students for anthropological study of both individual remains and skeletal populations. *Prerequisite: ANTH 005 and ANTH 178 or consent of instructor. Laboratory included.*

ANTH 190: Topics in Anthropology [4]

Exploration of a special topic or problem within or between fields in anthropology. Topics vary and course may be repeated for credit if topics differ. *Prerequisite: ANTH 001 or ANTH 003 or ANTH 005 or junior standing or consent of instructor. May be repeated for credit three times.*

ANTH 192: Internship in Anthropology [1-4]

Provides oversight and structure for a student's internship in a field related to anthropology in community organizations, professional research projects, etc. connected to the study of anthropology. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of anthropology. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

ANTH 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ANTH 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ANTH 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ARTS**ARTS 001A: Learning to See: Beginner Drawing [4]**

Develops cognitive skill of drawing by teaching the ability to see accurately. Material covered is not limited to skills required for becoming an artist. Anyone interested in sharpening one's perceptions and creative abilities finds this course useful.

ARTS 002A: Learning to Vocalize: Beginning Vocal Instruction [4]

Vocal instruction for students with a beginning level of music proficiency.

ARTS 002B: Introduction to Choral Music [4]

Introduction to choral group singing focusing on the study and performance of choral literature chosen from all major eras and genres. Emphasis on part-singing, ensemble blend, diction, and vocal development. The course work includes written assignments, research, and analysis of the music, composers, and music fundamentals.

ARTS 002C: Introduction to Vocal Jazz Repertoire [4]

The study and performance of Jazz vocal repertoire with continued instruction in correct singing techniques, posture and breathing, diction, and anatomy of the singing instrument. In addition to vocal instruction, includes written assignments requiring research and analysis of the music, composers, style, and music fundamentals. *Prerequisite: ARTS 002A or ARTS 002 or consent of instructor.*

ARTS 002D: Introduction to Musical Theater Vocal [4]

The study and performance of Musical Theater/Broadway repertoire. Instruction in correct singing techniques, posture and breathing, diction, correct use of the chest and "theater" voice. Special attention to character development and stage movement. Includes written assignments requiring research and analysis of music, composers, style, and music fundamentals. *Prerequisite: ARTS 002A or ARTS 002 or consent of instructor.*

ARTS 003: Learning to See: Painting [4]

Development of the skill of painting in watercolor to develop the complex process of color vision to enhance one's perceptive powers. The use of this skill is not limited to those planning to be artists. This is a studio class that will include drawing and painting from nature.

ARTS 003B: Learning to See: Intermediate Painting [4]

Course teaches intermediate level techniques in acrylic, watercolor or oil painting, concentrating on enhancing the technique necessary to develop mastery of individual expression. *Prerequisite: ARTS 003.*

ARTS 004A: Learning to See in Three Dimensions [4]

Development of cognitive skill of seeing in three dimensions. Material covered is not limited to skills required for becoming an artist. Anyone interested in sharpening his or her perceptions and creative capabilities finds this course useful.

ARTS 004B: Introduction to Sculpture [4]

Introduces students to the traditional additive and subtractive sculptural methods along with contemporary sculptural processes. Students are taught to explore conventional media, such as clay, soft stone, wood, wax, plaster and paper pulp as well as unconventional materials. Emphasis is placed on successful union of technique and personal expression.

ARTS 005A: Learning to Listen: Beginner Music [4]

Cognitive skill of listening to music to enhance perceptive powers. The use of this skill is not limited to those planning to be artists.

ARTS 007: ArtScore: Introduction to Global Arts Studies Program [4]

Survey of arts around the globe, with an integrated and comparative approach to studying the history and ideas of arts from antiquity to the twentieth century. This is the foundation course for all students pursuing an arts major. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only. Discussion included.*

ARTS 008A: Learning to Perform: Beginner Acting [4]

Develops cognitive skill of physical and vocal performance by teaching the ability to act on stage. Material covered is not limited to skills required for becoming an artist. Anyone interested in sharpening one's abilities to perform finds this course useful.

ARTS 009: Learning to See: Beginning Photography [4]

Beginning level course stressing technical and critical photographic skills. The class aims to develop the student's capacity to produce well-wrought, effectively structured photographs utilizing in camera exposure, depth-of-field, and composition with either a digital or film camera.

ARTS 010: Substances of Arts [4]

Introduces students to substantive characteristics of the arts, with emphasis on cultural and social significance. Each student learns to develop his/her own understanding of what is art, what makes individual works of art significant and how art enriches human existence. Course work includes research, writing and art event attendance. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent.*

ARTS 011: Substances of Music [4]

Introduces students to substantive characteristics of the art of music, with emphasis on cultural and social significance. Each student learns to develop his/her own understanding of what the art of music entails, what makes individual works of music art significant and how music enriches human experience. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent.*

ARTS 012: Substances of Architecture [4]

Introduces students to substantive characteristics of architecture, with emphasis on cultural and social significance. Each student learns to develop his/her own understanding of what is architecture and why individual works of architecture become significant. Emphasizes the interrelatedness of architecture and socio-economic history.

ARTS 013: Substances of Visual Arts [4]

Introduces students to substantive characteristics of visual arts, with an emphasis on developing students' own critical skills in studying our contemporary and historical visual culture. Topics include artworks from the Renaissance to Neoclassicism to Pop, as well as issues in television, video, fashion, magazine, pop culture, computer art. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent.*

ARTS 015: History of Western Art Music [4]

Introduction to the art music of western culture, including music from Medieval, Renaissance, Baroque, Classical, Romantic, and 20th Century eras, featuring study of selected masterworks in relation to the periods which they represent. Emphasis is placed upon developing awareness of musical style and structure through lectures and directed listening.

ARTS 020: Fundamentals of Two Dimensional Design [4]

Course introduces students to two-dimensional design fundamentals as they apply to all aspects of the visual arts with emphasis on application in drawing, painting, film, digital art, and photography. Design is essential to all visual arts; it is where the thought process begins. Assignments include hands-on projects, research and writing.

ARTS 021: Fundamentals of Three Dimensional Design [4]

Course introduces concepts and methods designers use to order form in space in visually exciting way. Students acquire understanding of fundamental design theory, building processes and the ability to communicate through the use of design elements that can be utilized in diverse fields. Assignments include hands-on projects, reading, and writing.

ARTS 023: Multimedia Studio [4]

Course introduces students to conventional and unconventional techniques in two dimensional and three dimensional arts. Variety of techniques are covered such as screen printing, block printing, acrylic transfer, encaustic, casting, jewelry design, carving and construction, mixed media photography, illustration, and fiber art. Course work includes hands-on projects, research and writing.

ARTS 026A: Fundamentals of Music [3]

Course for beginners and those who learned to sing and/or play instrument without training in music fundamentals, including principals and procedures of rhythm and pitch, notation, scales (major, minor), key signatures, intervals, chord structures, and symbols as well as some harmonic analysis of chords and simple part writing is included.

ARTS 027B: Introduction to Music Technology [3]

Course introduces music technology through standard computer-based project workstation, audio interface, MIDI keyboard and computer software. Instruction includes recording and processing of digital audio, MIDI technology to encode and sequence computer-generated musical content, computer-assisted music notation programs, software-based editing, mixing, mastering techniques in producing notation, recordings of student's original music.

ARTS 032: Introduction to Jazz Studies: History of Jazz [4]

This course will introduce and students to the history of jazz, including its key developments, innovators and styles. *Prerequisite: Letter grade only. Discussion included.*

ARTS 036: Introduction to Art Song [4]

Course in the study and performance of vocal repertoire known as "art song" for students with some prior singing experience. Students will select repertoire appropriate to their own vocal ability and continue development in character study, stage movement and performance delivery to be put in practice in performance. *Prerequisite: ARTS 002A or audition or consent of instructor.*

ARTS 042A: Introduction to Photographic Techniques and Practices [4]

Course strengthens understanding of photographic techniques and principles by providing in depth study of technical aspects such as proper exposure of film or digital photos, effective usage of shutter speeds and apertures, concept and application of depth of field, creating perception of motion, camera perspective, composition and analysis of imagery. *Prerequisite: ARTS 009 or portfolio or consent of instructor.*

ARTS 070: Techniques of Contemporary Artists [4]

Students have opportunity to study with a contemporary artist. Open to any student interested in learning how acquisition of technique supports creative processes. Emphasis is put on process instead of result. Techniques taught vary depending on the instructor artist's medium of expression. *Permission of instructor required. May be repeated for credit four times*

ARTS 071: Techniques of Interdisciplinary Research in Arts [4]

Explores differences between research conducted by artists and by academics, and examines how artists process information, as well as how various forms of artistic expression influence content and meaning. The role of cliché and stereotypical representation in the creation of works of art is also explored. *May be repeated for credit three times.*

ARTS 090X: Freshman Seminar [1]

Examination of a topic in the arts.

ARTS 092: Internship in the Arts [1-4]

Provides oversight and structure for a student's internship in a field related to arts in community organizations, professional research projects, etc. connected to the study of art. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of art. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

ARTS 095: Lower Division Undergraduate Research [1-6]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ARTS 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ARTS 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ARTS 100: History of World Art [4]

Introduces students to significant examples of world art through analysis of selected works from a number of different geographical regions of the world. Emphasis is placed upon the influence of religious, economic, political and aesthetic factors. Course work includes research and writing. *Prerequisite: ARTS 010 or consent of instructor.*

ARTS 101: History of Clothing, Costume and Fashion: Euro-centric Pre-History to 1800 [4]

Survey of history of Euro-centric clothing, costumes and fashion from pre-history to 1800. Emphasizes the intrinsic connection between clothing and all aspects of human existence from politics, economics, sociology, cultural history, to climate, psychology and art. Each student is encouraged to pick research topics connected to his or her major.

ARTS 102: History of Clothing, Costume and Fashion: Euro-centric 1800 to 1980 [4]

Survey of history of Euro-centric clothing, costumes and fashion from 1800 to 1980. Emphasizes the intrinsic connection between clothing and all aspects of human existence from politics, economics, sociology, cultural history, to climate, psychology and art. Each student is encouraged to pick research topics connected to his or her major.

ARTS 103: History of Ethnic Costume [4]

Survey of ethnic costume across the globe. Covers indigenous clothing, emphasizing the intrinsic connection between clothing and cultural history. Each student is encouraged to pick research topics connected to his or her major. *Prerequisite: Junior standing or consent of instructor.*

ARTS 104: History of Costume Design [4]

Survey of history of costume design with emphasis on costumes for the stage. Examines the practice of costume design across world cultures as well as the relationship between costumes and prevailing cultural values. Course work concentrates on research but may include a creative component. *Prerequisite: Junior standing or consent of instructor.*

ARTS 115: Twentieth Century Drama: Theatre and Social Responsibility [4]

Examination of ways in which the works of selected 20th century playwrights contribute to awareness of social responsibility. Explores correlation between dramaturgy and political activism. Includes staged readings of plays, research and writing.

ARTS 120: Critical Popular Music Studies [4]

Investigate popular music and the various meanings it has held for musicians, critics and audiences. What, exactly, is popular music? This course will explore this and related questions in order to complicate our notions of what constitutes popular music. *Prerequisite: ARTS 011 and junior standing or consent of instructor.*

ARTS 121: Music of the Twentieth Century [3]

A critical investigation of various music trends in the 20th century with an emphasis on the musicians who have bridged or blurred the distinctions between art music and popular music. *Prerequisite: ARTS 007.*

ARTS 121A: Music Ensemble [3]

Course for students who are proficient in playing and have access to an instrument of their choice. Course gives students opportunity to play in ensembles with professional coaching, instruction, and supervision. Content is dedicated to explore numerous genres from the baroque, classical, romantic, and contemporary repertoire. *Prerequisite: Audition during semester prior to enrollment or consent of instructor.*

ARTS 125: African American Music of the 20th Century [4]

Focuses on a central question: how do we locate African American music, i.e., how can we define African American music? In attempting to answer this question, we think through concepts such as authenticity, representation, recognition, cultural ownership, appropriation, origin(s). *Prerequisite: Junior standing or consent of instructor.*

ARTS 129: Advanced Musicianship [4]

Course intended for students with foundational knowledge of music, and some proficiency in singing or playing an instrument who wish to further their musical understanding. Among other content, course seeks to enhance students' understanding of musical symbols, their physical execution, and the ability to translate them into practice. *Prerequisite: Audition or consent of instructor.*

ARTS 130: History of World Architecture [4]

Introduces students to significant examples of world architecture, concentrating on characteristics of structure, materials, and use. Course work includes research and writing. *Prerequisite: ARTS 012 or consent of instructor.*

ARTS 141: History and Practice of Photography [4]

In this course students examine critical texts on the history and theory of photography, study the work of photographers from diverse backgrounds, and investigate cultural and socio-political issues in photographic practice and production. Students will also learn some basic techniques of taking photographs through various in-class exercises and assignments. *Prerequisite: Any lower division ARTS or GASP course and sophomore standing. Letter grade only.*

ARTS 150: Assemblage Sculpture [4]

Course in assemblage sculpture, a unique three dimensional art form that consists of creating works of art that are assembled rather than modeled, carved or cast. The elements are pre-formed, natural or manufactured materials or objects. Course work includes research into the history and uses of assemblage, and writing. *Prerequisite: ARTS 004A and ARTS 004B or portfolio or consent of instructor.*

ARTS 159: Advanced Projects in Acrylic Painting [4]

Course in application of acrylic medium techniques for the purpose of creating original works. Course advances each student's understanding and application of color, composition, proportion, and principles of artistic creativity. *Prerequisite: ARTS 001 or (ARTS 003A and ARTS 003B) or portfolio or consent of instructor. May be repeated for credit twice.*

ARTS 170: Techniques of Contemporary Artists [4]

Students have opportunity to study with a contemporary artist. Open to any student interested in learning how acquisition of technique supports creative processes. Emphasis is put on process instead of result. Technique taught varies depending on instructor artist's medium of expression. *May be repeated for credit four times*

ARTS 171: Techniques of Interdisciplinary Research in Arts [4]

Explores differences between research conducted by artists and by academics. Examines how artists process information, as well as how various forms of artistic expression influence content and meaning. The role of cliché and stereotypical representation in the creation of works of art is also explored. *May be repeated for credit three times.*

ARTS 180: Architecture Design Studio: Modern Houses [4]

Course introduces students to issues of complex form making in architecture through the study of important works of Modern domestic architecture. Tools of exploration will include research and writing, drawing, three dimensional model-making and computer modeling. *Prerequisite: ARTS 001 or (ARTS 004A and ARTS 004B) or portfolio or consent of instructor.*

ARTS 181: Architecture Design Studio: Urban Architecture and Sustainability [4]

Course introduces students to issues of sustainability in urban architecture. Tools include analyzing and diagramming modern and pre-modern urban form, in-depth study of specific regional and urban issues around the city of Merced, and design projects created to address these subjects. Course work includes research, writing, drawing, and model-making. *Prerequisite: ARTS 001 or (ARTS 004A and ARTS 004B) or portfolio or consent of instructor.*

ARTS 183: 3-Dimensional Computer Modeling for Architecture [4]

Course introduces students to 3-Dimensional computer modeling in architecture. The software platform used is free version of Google Sketchup, a powerful and intuitive 3-Dimensional modeling program widely used by architects. Digital media represent substantive shift in representational possibilities when compared with traditional methods. Assignments include hands-on projects, research and writing. *Letter grade only.*

ARTS 190: UC Merced Chorus [2]

Selected mix of 50 to 80 voices performing choral music appropriate for a choral ensemble designed to provide singers and audiences with stimulating musical experience. Chorus will perform concert(s). Previous singing experience and sight reading skills are required. Acceptance into chorus is by audition only. *Prerequisite: Audition and proof of previous singing experience and sight reading skills. May be repeated for credit six times.*

ARTS 192: Internship in the Arts [1-4]

Provides oversight and structure for a student's internship in a field related to the arts in community organizations, professional research projects, etc. connected to the study of art. Students required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of art. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

ARTS 195: Upper Division Undergraduate Research [1-6]

Group or individual research projects. *Permission of instructor required. May be repeated for credit.*

ARTS 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ARTS 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

BIOLOGICAL ENGINEERING AND SMALL-SCALE TECHNOLOGIES**BEST 200: Special Topics in Bioengineering [3]**

Special Topics in Bioengineering cover background principles of cutting-edge research directions in the field of Biological Engineering. Includes 3 hours of lecture and discussion per week and significant out-of-class reading and study. The course format also emphasizes student-led presentation, analysis and discussion of reading assignments from the current and recent scientific literature. *Prerequisite: (ICP 001A or MATH 021) and BIO 100. Letter grade only.*

BEST 201: Special Topics in Materials [3]

Special Topics in Materials covers background principles of cutting-edge research directions in the field of material science. Includes 3 hours of lecture and discussion per week and significant out-of-class reading and study. The course format also emphasizes student-led presentation, analysis and discussion of reading assignments from the current and recent scientific literature. *Prerequisite: ICP 001A, ICP 001B and BIO 100 or equivalent. Letter grade only.*

BEST 210: Structure and Properties of Materials [4]

Structure and bonding of materials and their relationship to the mechanical, thermal, electrical, optical, and magnetic properties of materials within the context of structure-properties-processing performance relationships. Non- and quasi-crystalline materials and the role of defects. Processing and device applications. *Letter grade only. Laboratory and discussion included.*

BEST 214: Tissue Engineering Design [3]

Fundamental topics include: issues related to the cell source (including stem cells, plasticity, transdifferentiation, therapeutic cloning vs. reproductive cloning, bone marrow transplants, and cell differentiation and purification), cell culture and tissue organization, gene therapy delivery methods, cell adhesion and migration, issues in construct design, tissue preservation, and immunoisolation and/or modulation. We also cover current case studies and issues for FDA approval of tissue engineered products. *Letter grade only.*

BEST 217: Lab on a Chip: Developing 3rd World Diagnostics for Global Health [3]

This is the first-ever four campus course between UC San Francisco, UC Berkeley, UC Santa Cruz, and UC Merced which aims to 1) raise awareness and knowledge about global health issues 2) teach students critical engineering skills such as nano/micro-fabrication 3) enable students to design, build, and test their own diagnostics and 4) develop entrepreneurial skills. Students learn about tuberculosis from leading experts at UCSF and then address the dearth of sensitive diagnostics by designing and testing their own nano/micro-systems. Taught at UC Merced with tele-conferencing to the other campuses and two field trips. *Letter grade only. Laboratory included.*

BEST 226: Nanodevice Fabrication [3]

This course will teach basic properties of nanomaterials and their applications (the lecture part). A nanoscale transducer will be chosen as a sensing element and sensors will be fabricated and tested (the lab part). The interactive and experiential education will be blended into theoretical concept teaching. *Letter grade only. Laboratory included.*

BEST 291: Research Seminar [1]

Seminar series covering various topics in quantitative and systems biology, bioengineering, biomaterials and nanotechnology hosted by combined BEST and QSB Graduate Group. *May be repeated for credit.*

BEST 292: Group Meeting [1]

Meetings to describe current research progress and future research plans lead by BEST faculty. *May be repeated for credit.*

BEST 293: Journal Club [1]

Student-led presentation, analysis and discussion of reading assignments from the scientific literature. *May be repeated for credit.*

BEST 294: Responsible Conduct in Research [1]

Seminar covering responsibilities and expectations for researchers as well as advice for success in graduate school and science careers, required for NIH-funded graduate students. *Satisfactory/Unsatisfactory grading only.*

BEST 295: Graduate Research [1-12]

Supervised research with BEST faculty. *Permission of instructor required. May be repeated for credit.*

BEST 298: Directed Group Study [1-6]

Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.

BEST 299: Directed Independent Study [1-6]

Supervised course study with BEST faculty. *Permission of instructor required. Letter grade only. May be repeated for credit three times. Laboratory included.*

BIOLOGICAL SCIENCES**BIO 001: Contemporary Biology [4]**

Introduction to the major concepts in biology including origin of life, evolution, DNA, genes and genomes, principles and patterns of inheritance, genotype to phenotype, gene, environment and disease relationships, biotechnology, ecosystem structure and function, nutrient cycles and pollution, biodiversity, earth systems. *Letter grade only. Laboratory and discussion included.*

BIO 001L: Contemporary Biology Lab [1]

BIO 1L is the laboratory component of BIO 1 Contemporary Biology. BIO 001 must be taken concurrently. *Letter grade only.*

BIO 002: Introduction to Molecular Biology [4]

Introduction to the molecules and molecular processes underlying life. Overview of structures and chemical properties of biological macromolecules. *Prerequisite: BIO 001. Letter grade only. Discussion included.*

BIO 002L: Introduction to Molecular Biology Lab [1]

Laboratory exercises demonstrating and reinforcing topics covered in BIO 2. BIO 002 must be taken concurrently. *Letter grade only.*

BIO 003: To Know Ourselves: Molecular Basis of Health and Disease [4]

Introduction to the molecular basis of a number of human diseases and molecular-based therapies for disease treatment. *Laboratory and discussion included.*

BIO 005: Concepts and Issues in Biology Today [4]

Fundamental biological concepts in the areas of genetics, evolution and ecology are explored in the context of current issues enabling students to understand the relevance of biology to their lives both as individuals and as voting citizens. *Course cannot be taken after obtaining credit for BIO 001. Not recommended for BIO majors. Laboratory and discussion included.*

BIO 010: Genetics, Stem Cells and Development [4]

Issues associated with genes, stem cells and embryonic development increasingly impact our lives. Integrates an overview of biologic topics such as genetic testing, stem cells and the use of animal models with their bioethical considerations. It places science in the context of personal decisions and ethics. *Discussion included.*

BIO 034: Introduction to Marine Science [4]

An introduction to biological, chemical, and physical oceanography, marine geomorphology, and their synthesis in the study of marine life; also including relationships with atmospheric, freshwater, and terrestrial systems. Areas of emphasis include ecosystems (from the deep sea to saltwater ponds), the integrated coastal zone, resource management, and global change. *Letter grade only. Laboratory and discussion included.*

BIO 043: Biodiversity and Conservation [4]

Introduction to the study of biodiversity and conservation. Patterns, origin, and importance of biodiversity are discussed. An introduction to the major biological groups and the conservation efforts used to preserve contemporary biodiversity. *Laboratory included.*

BIO 046: Paleobiology: Age of Dinosaurs [4]

Dinosaurs are used to explore the development of science and fundamental concepts of geology, evolution, and biodiversity. Students are also introduced to basic anatomy and the underlying unity of animal form. Current controversies such as mass extinctions are explored, and students weigh evidence in coming to their own interpretations. *Laboratory and discussion included.*

BIO 050: Human Development [4]

Male and female reproductive systems, hormonal control of egg-sperm interactions, fertilization, venereal disease, embryonic development, fetal physiology. *Laboratory and discussion included.*

BIO 051: Cancer and Aging [4]

Introduction to the biology of cancer and aging, including discussions of the biological and molecular basis of aging and cancer, novel and conventional cancer treatments, cancer prevention, and prospects for new approaches to increase longevity and health. *Laboratory and discussion included.*

BIO 060: Nutrition [4]

Introduction to nutrition science that integrates basic concepts of nutrients, human physiology, microbiology, biochemistry, and the psychology of wellness. *Laboratory and discussion included.*

BIO 090X: Freshman Seminar [1]

Examination of a topic in the biological sciences. *May be repeated for credit three times.*

BIO 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

BIO 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

BIO 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

BIO 101: Biochemistry I [4]

Advanced study of proteins, enzymes, enzyme kinetics, and carbohydrates metabolism in living organisms. *Prerequisite: CHEM 100. Letter grade only. Discussion included.*

BIO 102: Advanced Biochemistry and Molecular Biology [4]

Mechanisms of amino acid, nucleic acid, and lipid metabolism plus advanced mechanisms of gene expression, signal transduction, and regulation of gene expression. *Prerequisite: BIO 101. Letter grade only. Laboratory and discussion included.*

BIO 104: Biophysics [4]

This course aims to give students an understanding of relevant physical principles for biological systems, introduce them to experimental and theoretical techniques of biophysics and to communicate the excitement of cutting-edge biophysics research. Topics include diffusion, fluids, entropic forces, motor proteins, enzymes, nerve impulses, networks and evolution. *Prerequisite: (PHYS 018 or PHYS 008) and (PHYS 019 or PHYS 009). Letter grade only. Discussion included.*

BIO 104L: Biophysics Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 104. BIO 104 must be taken concurrently. *Prerequisite: (BIO 100 or BIO 101 or BIO 002) and (ENGR 130 or CHEM 010) or consent of instructor. Letter grade only.*

BIO 105: Enzymology [4]

Advanced study of enzyme mechanisms and regulation. *Prerequisite: (BIO 100 or BIO 002) and CHEM 010. Discussion included.*

BIO 105L: Enzymology Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 105. BIO 105 must be taken concurrently. *Prerequisite: (BIO or BIO 002) and CHEM 010.*

BIO 106: Introduction to Molecular and Cell Biology [4]

Advanced study of the mechanisms of nucleic acid replication, transcription and translation as well as gene regulation and expression. *Prerequisite: BIO 001. Letter grade only. Laboratory and discussion included.*

BIO 107: Physical Biochemistry [4]

Physical Biochemistry is the study of Biochemistry via properties that can be quantitatively assessed to provide specific molecular information. Such properties include macromolecular folding, multimerization, structure, and ligand binding. This course will instruct students on these properties of macromolecules and on the experimental techniques that can quantitatively probe these properties. *Prerequisite: BIO 101 and (MATH 021 or MATH 011). Letter grade only. Discussion included.*

BIO 110: The Cell [4]

Introduction to the structure and function of bacterial, plant and animal cells, with an emphasis on universal cellular systems, including regulation of subcellular organization, control of cellular processes by internal and external signaling, energy capture, storage and usage, and cell cycle. *Prerequisite: BIO 101, which may be taken concurrently, or BIO 100 or BIO 002. Laboratory and discussion included.*

BIO 111: Cells, Tissues, and Organs [4]

Introduction to principles of cell structure and the organization of cells into tissues, organs, and organ systems. Both the cellular and extracellular components of the primary tissues and their compilation into the major organic systems are covered. Emphasis on understanding the link between cellular architectures and organ function. *Prerequisite: BIO 110. Discussion included.*

BIO 120: General Microbiology [4]

Molecular basis for diversity in bacteria and archaea. Students explore the significance of molecular diversity in microbial biology and gain an understanding of the genetic, physiologic, and structure-function relationships that underlie the remarkable ability of these organisms to adapt to the environment. *Prerequisite: BIO 110. Discussion included.*

BIO 120L: General Microbiology Laboratory [2]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 120. BIO 120 must be taken concurrently. *Prerequisite: BIO 110. Laboratory included.*

BIO 122: Microbial Pathogenesis [4]

Genetic and biochemical features of infectious agents including identification and characterization of pathogens and the epidemiology of infectious diseases. *Prerequisite: BIO 120. Discussion included.*

BIO 123: Human Parasitology [4]

Introduction to protozoan, worm, and insect parasitism in animals and humans and resultant diseases. Emphasis on epidemiology, diagnosis, and immunology of parasitic infections. *Prerequisite: BIO 120. Discussion included.*

BIO 124: Microbial Evolution [4]

Evolution of microbes. Concepts covered include horizontal exchange, genome evolution, dispersal of microbes, population size, cryptic genes, mutagenesis and mutagenic pathways, phylogenetics, experimental evolution, metabolic evolution and antimicrobial resistance evolution. *Prerequisite: BIO 141, which may be taken concurrently, and BIO 120. Letter grade only. Discussion included.*

BIO 125: Emerging Public Health Threats [4]

Multidisciplinary study of the historical, sociological, medical, and biological issues underlying new public health threats and the scientific and policy-based approaches to responding to these new threats. *Prerequisite: BIO 001 and BIO 002 and WRI 010. Discussion included.*

BIO 127: General Virology [4]

Introduction to biology of bacterial and animal viruses, focusing on structure, infective cycle, interactions with host, transmission and methods of detection and control. Discusses scientific literature and current topics in virology. *Prerequisite: BIO 110, which may be taken concurrently, BIO 140 strongly recommended. Letter grade only. Discussion included.*

BIO 130: Plant Biology [4]

An introduction to the biology of plant life, including plant cell physiology, plant growth and development, and plant evolution and adaptation. *Prerequisite: BIO 110. Discussion included.*

BIO 134: Marine Sciences Theory and Practice [4]

Integrative studies of ocean and coastal ecosystems, including current issues. Also referencing relationships with atmospheric, freshwater, and terrestrial systems. Areas of emphasis include practical field study in the coastal zone in any area of marine science. *Prerequisite: BIO 034 and (BIO 141 or BIO 148) and junior standing. Letter grade only. Fieldwork and discussion included.*

BIO 140: Genetics [4]

Includes concepts of inheritance, structure and function of genes and genomes, recombination, genetic mapping, gene regulation, mutations, and recombinant DNA technology including labs and discussions. *Prerequisite: BIO 001. Letter grade only. Laboratory and discussion included.*

BIO 141: Evolution [4]

Natural Selection and Darwinian evolution, includes concepts of population and quantitative genetics, speciation, neutral theory and molecular evolution, phylogenetics, comparative genomics, and macroevolution including labs and discussion. *Prerequisite: BIO 100 or BIO 101 or BIO 002. Letter grade only. Laboratory included.*

BIO 142: Genome Biology [5]

Introduction to the concepts behind genome biology and a detailed overview of the many tools used in comparative genomics. Specific topics include genome assembly, gene modeling and comparative genomics, transcriptomics, and proteomics of prokaryotic and eukaryotic organisms. Students carry out real scientific projects in collaboration with course faculty and produce new genomic data of publishable quality. Includes mandatory weekly three hour lab. *Prerequisite: BIO 110. Letter grade only. Laboratory and discussion included.*

BIO 143: Biodiversity and the Tree of Life [4]

Introduction to the biological diversity in the three domains of the Tree of Life (Archaeobacteria, Eubacteria, and Eukaryotes): overview of species diversity as well as diversity in the deep characteristics (e.g., reproduction, metabolism, structure) of plants, animals, fungi, and microbes. Illustrated by complementary field trips and labs (part of BIO 143F). *Prerequisite: BIO 001. Letter grade only. Discussion included.*

BIO 143F: Biodiversity and the Tree of Life [1]

Field trips and labs reinforcing topics covered in BIO 143. Five field trips illustrate the biodiversity of different regions of California (seashore, Central Valley, foothills, and Sierra Nevada). Wet labs serve to examine the organisms collected during field trips, and participate in a long-term DNA Barcoding project of the field sites visited. BIO 143 must be taken concurrently. *Prerequisite: BIO 001. Letter grade only. Fieldwork and laboratory included*

BIO 144: Phylogenetics [4]

Theory behind phylogenetic reconstruction and an introduction to the diverse methods for phylogenetic inference. How to deal with morphological and molecular characters is discussed as well as the comparative method. *Prerequisite: BIO 140 and (MATH 032 or MATH 018). Discussion included.*

BIO 144L: Phylogenetics Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 144. BIO 144 must be taken concurrently. *Letter grade only.*

BIO 145: Introduction to Population and Community Ecology [4]

Comprehensive introduction to the ecology of populations, communities and ecosystems. Examines the dynamics of single-species populations, and then moves to species interactions including competition, predation, parasitism, and mutualism. Structure and dynamics of entire communities and food webs also are examined. Discusses conservation biology applications throughout. *Prerequisite: BIO 001 and (MATH 021 or ICP 001A). Discussion included.*

BIO 146: Paleobiology [4]

An introduction to the major geological factors that have affected the evolution and the diversity of organisms. We also present how the fossil record can help us understand evolution of Life through time, with an emphasis on macro-evolutionary events (e.g., mass extinctions, transitions between habitats, radiations). *Prerequisite: BIO 140. Discussion included.*

BIO 147: Astrobiology [4]

Astrobiology refers to the study of the origin and evolution of life in the cosmos. It is an integrative, multidisciplinary field that includes areas of biology, astronomy, geology, chemistry and physics. Students in the class face some of the most fundamental topics addressed by science today such as who we are, where we came from, and where we might go. We cover three main themes: How did life begin and evolve? Does life exist elsewhere in the universe? What is life's future on Earth and beyond? *Prerequisite: CORE 001 and (BIO 001 or BIO 005 or PHYS 006 or PHYS 008 or CHEM 002 or ESS 001) or consent of instructor. Letter grade only. Discussion included.*

BIO 148: Fundamentals of Ecology [4]

Introduction to the principles of ecology at population, community, ecosystem, landscape, and global scales. *Prerequisite: BIO 001 or BIO 005 or ESS 001 or ESS 005 or consent of instructor. Letter grade only. Fieldwork and discussion included.*

BIO 149: Conservation Biology [4]

Detailed examination of the evolutionary, ecological, management, and policy issues related to the conservation of ecosystems, species, and genetic diversity. Theory and practical aspects of biological conservation are also presented, with special reference to case studies from California. *Prerequisite: BIO 001 and (MATH 018 or MATH 032) BIO 148 recommended. Letter grade only. Discussion included.*

BIO 149F: Conservation Biology Laboratory [1]

Field and laboratory exercises reinforcing material presented in BIO 149/ESS 149. *Prerequisite: BIO 149, which may be taken concurrently. Letter grade only. Fieldwork and laboratory included*

BIO 150: Embryos, Genes, and Development [4]

Principles of developmental biology as revealed through analysis of invertebrate and vertebrate systems. Animal models are used to examine the molecular and cellular mechanisms that influence cell fate. Cell signaling is studied in the context of embryonic pattern formation and the development of body plans and organ systems. *Prerequisite: BIO 110. Discussion included.*

BIO 151: Molecular Immunology [4]

Emphasis on development and function of hematopoietic and immune systems and their roles in responding to environmental change, maintenance of health, and disease pathogenesis. *Prerequisite: BIO 110. Discussion included.*

BIO 151L: Molecular Immunology Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 151. BIO 151 must be taken concurrently. *Prerequisite: BIO 110. Letter grade only.*

BIO 152: Cancer Genetics and Tumor Biology [4]

Topics include viral and hormonal carcinogenesis, molecular aberrations in cancer, tumor development, epigenetics and cancer, tumor immunology, oncogenes. *Prerequisite: BIO 101 or BIO 110. Discussion included.*

BIO 153: Evolution and Development [4]

Comparison and contrast of the development and developmental cues of a variety of animals and emphasizes how conserved developmental pathways have been manipulated through evolutionary processes to produce different physical features. The effects of regulatory region mutations, gene duplication, and genetic co-opting are investigated. *Prerequisite: BIO 110. Letter grade only. Discussion included.*

BIO 154: Developmental Immunology [4]

An in-depth exploration of the development of the immune system. Topics include the biology of primary lymphoid organs (particularly the thymus and bone marrow) and early development of lymphoid and myeloid cells. Emphasis is on the temporal, microenvironmental, genetic and molecular control of immune cell development. *Prerequisite: BIO 151 and junior standing. Letter grade only. Discussion included.*

BIO 160: Comparative Physiology [4]

Covers the function of the major organ systems by studying species-specific adaptations across the vertebrate subphylum, emphasizing physiological adaptations to environmental challenges. Locomotion, reproduction, cardiovascular, renal, and pulmonary function serve as the models for assessing the cellular basis for physiologic adaptation across the spectrum of vertebrates. *Prerequisite: BIO 100 or BIO 101 or BIO 002. Discussion included.*

BIO 160L: Comparative Physiology Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 160. BIO 160 must be taken concurrently. *Prerequisite: BIO 110. Pass/No Pass grading only.*

BIO 161: Human Physiology [5]

Understanding the mechanisms underlying function of major human organs. Emphasis includes neural transmission and action potential, cardiovascular, renal and gastrointestinal physiology, metabolism, and endocrinology. Laboratory experiments demonstrating and reinforcing topics covered in lecture with an emphasis on scientific method. *Prerequisite: BIO 101 and (PHYS 009 or PHYS 019) and senior standing. Letter grade only. Laboratory included.*

BIO 162: Evolutionary Constraints of Physiology [4]

An introduction to the materials upon which evolution acts. We study the structure of animals, the materials from which living organisms are made and the limitations that those materials impose upon evolution. *Prerequisite: BIO 160. Discussion included.*

BIO 163: Endocrinology [4]

Basic principles of endocrinology; structure and functions of endocrine glands primarily in mammals with reference to other vertebrates for comparison; hormonal control of kidney function, metabolism, neural transmission, and reproduction; mechanisms of hormone actions. *Prerequisite: BIO 110 and BIO 160 and CHEM 008 or consent of instructor. Letter grade only. May be repeated for credit once. Discussion included.*

BIO 163L: Endocrinology Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 163 with an emphasis on analytical techniques in endocrinology. BIO 163 must be taken concurrently. *Letter grade only. May be repeated for credit once.*

BIO 164: Human Anatomy [5]

Introduction to the basic concepts of human anatomy at the cell, tissue, and organ levels, through a system-based approach (e.g., skeletal, muscular, nervous, cardiovascular, respiratory, digestive, urinary, reproductive). Laboratories include dissection of mammal organs (cat, sheep, cow), observation of human models and histological slides of human tissues, and interactive computer based exercises. *Prerequisite: BIO 110 and junior standing. Letter grade only. Laboratory and discussion included.*

BIO 170: Neurobiology [4]

Examination of the general operations of the central and peripheral nervous system. Covers cellular neuroscience, including the molecular basis of excitability, synaptic transmission, and neuronal signal transduction, as well as the organization and operations of the major neural systems associated with sensation, locomotion, and higher brain function. *Prerequisite: BIO 110. Discussion included.*

BIO 170L: Neurobiology Laboratory [1]

Laboratory experiments demonstrating and reinforcing topics covered in BIO 170. BIO 170 must be taken concurrently. *Prerequisite: BIO 110. Letter grade only.*

BIO 175: Biostatistics [4]

Advances in statistical techniques to investigate experimental data generated in molecular, cellular, and evolutionary biology, and health sciences research. *Prerequisite: (MATH 018 or MATH 032) and (ICP 001B or MATH 012 or MATH 022 or MATH 030). Discussion included.*

BIO 180: Mathematical Modeling for Biology [4]

Statistical analysis and mathematical modeling skills for life scientists. The first half of this course is about building statistical models of complex data sets and the second half is about using population models to describe demographic change, ecosystems and epidemics. Extensive computer laboratories using the "R" statistical language. *Prerequisite: (MATH 018 or MATH 032) and (BIO 100 or BIO 101 or BIO 002) and (MATH 012 or MATH 022 or MATH 030). Letter grade only. Discussion included.*

BIO 181: Introduction to Biomolecular Simulation [4]

Lectures and laboratory exercises teach the principles and practice of molecular modeling with a focus on simulations of biological macromolecules. Topics covered include classical molecular dynamics, molecular mechanics, docking, and visualization. The computational laboratories involve simulations of systems including water, micelles, DNA, and proteins. *Prerequisite: (ICP 001A or MATH 021 or MATH 011) and (BIO 100 or BIO 002) and CHEM 008 and (PHYS 008 or PHYS 018 or ICP 001B) or consent of instructor. Laboratory and discussion included.*

BIO 182: Bioinformatics [5]

Detailed introduction to the tools, algorithms, statistics and databases used in bioinformatics, emphasizing an open-source, command-line toolbox approach. Topics may include: alignments, search, gene/motif classification, phylogenetics, genomics, gene expression, ontologies, structure and networks. Course includes a mandatory computer laboratory. Prior programming experience recommended, but not assumed. *Prerequisite: (BIO 100 or BIO 101) and (BIO 140, which may be taken concurrently) and (MATH 018 or MATH 032). Letter grade only. Laboratory and discussion included.*

BIO 183: Population Genetics [4]

A study of the various factors that affect gene flow and frequency within a population. Theories of selection, neutrality, drift, hitchhiking, recombination, mutation, isolation, in-breeding, and selfish genetic elements are taught along with statistical tests and experimental methods for detecting these forces. *Prerequisite: BIO 140 and (MATH 021 or ICP 001A or MATH 011). Discussion included.*

BIO 185: Biomedical Ethics [3]

Ethical issues associated with contemporary biology and the complex relationships among medicine, science, and society. Topics include genetic engineering, cloning, and stem cell research. *Prerequisite: BIO 001 or BIO 003.*

BIO 190: Research Seminar [1]

Student-led presentations of current topics in biological sciences, including independent research presentations. *Prerequisite: Junior standing. Permission of instructor required.*

BIO 192: Communicating Science [1-2]

Development of skills to effectively communicate scientific topics to broad audiences. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit four times*

BIO 195: Upper Division Undergraduate Research [1-5]

Group or individual research projects in the biological sciences under the direction of a BIO faculty member. *Permission of instructor required. May be repeated for credit.*

BIO 198: Upper Division Directed Group Study [1-5]

Group directed study in the biological sciences under the guidance of a BIO faculty member. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.*

BIO 199: Upper Division Individual Study [1-6]

Independent study in the biological sciences under the direction of a BIO faculty member. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.*

BIOENGINEERING

BIOE 030: Introduction to Bioengineering [4]

Presents students with an overview of the creative synergies between engineering and life sciences that define the scope of Bioengineering. Examples of successful Bioengineering endeavors (devices, materials, processes, models) are provided. Discussion of current frontiers and future direction of Bioengineering, with an emphasis on information technology and nanotechnology. *Prerequisite: CHEM 002, which may be taken concurrently, and BIO 001 and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008). Letter grade only. Laboratory included.*

BIOE 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit. Laboratory included.*

BIOE 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

BIOE 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

BIOE 100: Physiology for Engineers [4]

Using the conceptual, analytical, modeling and design tools of engineering to achieve quantitative insights into physiological systems. Transport mechanisms, energy transduction, feedback and feed forward control, optimization, and materials selection principles in the context of cells, tissues, and organs. How muscles, nerves and biological fluids interact to allow you to read this course description. *Prerequisite: (BIO 100 or BIO 002) and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and CHEM 008. Letter grade only. Laboratory included.*

BIOE 101: Modeling of Nanoscale Process in Biology [3]

Advanced mathematical modeling, simulation and data analysis applied to biological problems at the molecular level; probabilistic models. Scope and limitations of these techniques. Molecular conformations and folding, protein structure, molecular interactions, binding sites, formation of aggregates and complexes, phase changes, membrane transport, physiological control systems in cells. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and MATH 023 and BIO 001 MATH 024 recommended. Letter grade only. Laboratory included.*

BIOE 102: Biosensors [4]

Design of natural and artificial devices for characterizing the physical and chemical environment inside and outside living cells. Detection of metabolites, toxins, pathogens and cancers. Molecular and nanoparticle probes. Immunosensors. Nucleic acid sensors and DNA chips. Enzyme-based biosensors. Organism and whole cell-based biosensors. Natural and synthetic receptors for biosensors. Remote diagnosis. *Prerequisite: BIO 001 and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008). Course cannot be taken after obtaining credit for BIOE 103. Letter grade only. Laboratory included.*

BIOE 103: Biosensors and Bioinstrumentation [4]

Intended for the last-year engineering student to facilitate the student's development into bioengineering investigation. Designed to introduce fundamental principles of circuit theory, analog and digital electronics and biological instrumentation techniques commonly used in biomedical research. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008 or PHYS 018) and BIO 001 and ENGR 166. Letter grade only.*

BIOE 104: Biotransport [3]

Biological Transport Phenomena is the quantitative description of momentum transport (viscous flow) and mass transport (convection and diffusion) in living systems. We explore the similarities between the fundamental principles of momentum, heat, and mass transfer, develop analogies between the fundamentals that apply at microscopic and macroscopic scales, and use the fundamentals in conjunction with conservation laws to develop mathematical descriptions of physiological and engineering systems. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 018) and (BIO 100 or BIO 002) and CHEM 002 and ENGR 120 and junior standing. Letter grade only.*

BIOE 110: Self-Assembling Molecular Systems [3]

Preparation, characterization, and applications of supramolecular structures. Factors that promote controlled molecular assembly at interfaces and in 3-D. Hydrophobic bonding and the role of water. Liquid crystalline phases. In vivo and in vitro examples of self-assembly. Biomimetic materials: the quest for adaptive responses to changes in environment, and self-healing. "Green" processing routes via biotechnology. Limitations of biomimetic materials. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and (BIO 100 or BIO 002). Letter grade only.*

BIOE 111: Biomembranes [3]

The molecular and physical chemistry of membranes formed from natural and synthetic amphiphiles. Relationships between surfactant molecular structures, chemical and physical environment, and membrane assembly. Solubility of proteins in biomembranes. Pore formation and structure. Transport through biomembranes. Biomembranes as catalysts and reaction vessels. Characterization of membrane structure and properties. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and BIO 100. Letter grade only.*

BIOE 112: Biomolecule-Substrate Interactions [3]

Cell receptor biology in the context of cell interactions with materials. Biomolecule adsorption to solid materials. Relevance to catalysis, adhesion, and responses to implanted biomaterials. Interactions between nanoparticles and biological tissue. Coagulation and thrombosis, infection, acute inflammation, chronic inflammation and the foreign body response, immune and tumorigenic mechanisms. Surface and interface characterization methods. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and (BIO 100 or BIO 002) and ENGR 045. Letter grade only.*

BIOE 113: Bioinstrumentation [4]

Signals and interactions that are useful in characterizing biomolecules and small-scale biological structures. Principles of 2-D and 3-D image formation. Resolution limits of imaging and non-imaging characterization techniques. Integration of mechanical, sensor and control technologies into devices that can perform diagnoses and repairs at cellular and subcellular length scales. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and BIO 001. Course cannot be taken after obtaining credit for BIOE 103. Letter grade only. Laboratory included.*

BIOE 114: Tissue Engineering Design [3]

Fundamental topics include: issues related to the cell source (including stem cells, plasticity, transdifferentiation, therapeutic cloning vs. reproductive cloning, bone marrow transplants, and cell differentiation and purification), cell culture and tissue organization, gene therapy delivery methods, cell adhesion and migration, issues in construct design, tissue preservation, and immunoisolation and/or modulation. We also cover current case studies and issues for FDA approval of tissue engineered products. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and (BIO 100 or BIO 002). Letter grade only.*

CHEMISTRY

BIOE 117: Lab on a Chip: Developing 3rd World

Diagnostics for Global Health [3]

Innovative campus course between UC San Francisco, UC Berkeley, UC Santa Cruz, and UC Merced which aims to 1) raise awareness and knowledge about global health issues 2) teach students critical engineering skills such as nano/micro-fabrication 3) enable students to design, build, and test their own diagnostics and 4) develop entrepreneurial skills. Students learn about tuberculosis from leading experts at UCSF and then address the death of sensitive diagnostics by designing and testing their own nano/micro-systems. Taught at UC Merced with tele-conferencing to the other campuses. Two field trips also are required. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and BIO 001 and CHEM 002 and junior standing. Letter grade only. Laboratory included.*

BIOE 120: Physiology for Engineers: Lab Only [1]

Human physiological functions in organ systems. Labs emphasize functional aspects of organs systems through experimentation. This lab should help you gain practical lab skills, scientific reasoning, understanding of physiology subject matter, and teamwork skills. Physiology laboratory is intended for transfer students that have completed the lecture portion of Physiology at another institution. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and (BIO 100 or BIO 002). Letter grade only.*

BIOE 126: Nanodevice Fabrication: Bridging Research and Education [3]

This course will teach basic properties of nanomaterials and their applications (the lecture part). A nanoscale transducer will be chosen as a sensing element and sensors will be fabricated and tested (the lab part). The interactive and experiential education will be blended into theoretical concept teaching. *Prerequisite: CHEM 002 and (PHYS 009 or PHYS 019) and (ENGR 065 or BIOE 102 or BIOE 103) and junior standing. Letter grade only. Laboratory included.*

BIOE 150: Bioengineering Design [3]

Students work in teams on bioengineering problems requiring design solutions. Students define the problem, propose a viable solution, acquire approval for the design, and build and test the designed device. *Prerequisite: CHEM 008 and ENGR 045 and ENGR 120 and ENGR 130 and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008 or PHYS 018) and (BIO 002 or BIO 100) and ENGR 065 and ENGR 166 and BIOE 103 and BIO 161. Letter grade only. Laboratory and discussion included.*

BIOE 195: Upper Division Undergraduate Research [1-5]

Research credit is designed to give credit to students that elect to conduct research in a laboratory on campus. Credits are proportional to the hours spent in the laboratory (1-5 credits). *Permission of instructor required. Letter grade only. May be repeated for credit.*

BIOE 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

BIOE 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CHEM 001: Preparatory Chemistry [3]

Preparation for general chemistry. Units of measurement, dimensional analysis, significant figures; elementary concepts of volume, mass, force, pressure, energy, density, temperature, heat, work; fundamentals of atomic and molecular structure; the mole concept; acids and bases; stoichiometry; properties of the states of matter; gas laws; solutions, concentrations. NOTE: Chemistry 1 satisfies no requirements other than contribution to the 120 units required for graduation. Designed for students who need additional help prior to enrollment in General Chemistry. *Course cannot be taken after obtaining credit for CHEM 002. Discussion included.*

CHEM 002: General Chemistry I [4]

First semester of a two-semester general chemistry sequence. Stoichiometric calculations, types of chemical reactions, properties of gases, thermochemistry, introduction to chemical equilibrium, basic atomic structure and atomic orbital theory, periodic properties, and chemical bonding. The concepts and quantitative skills introduced in lecture are reinforced by a laboratory section. *Prerequisite: CHEM 001 or passing score on the Chemistry Placement Exam or score of 3 or better on AP Chemistry Exam. Laboratory included.*

CHEM 008: Principles of Organic Chemistry [4]

Molecular shapes and charge distributions; resonance; electron delocalization; organic structures, nomenclature and isomerism, stereochemistry; optical activity; organic reactions; IR spectroscopy; intermolecular forces. Rational approaches to organic mechanism are emphasized. *Prerequisite: CHEM 002 or CHEM 010. Laboratory included.*

CHEM 010: General Chemistry II [4]

Second semester of a two-semester general chemistry sequence. Chemical kinetics, acid-base, ionic, and gaseous equilibria, chemical thermodynamics, electrochemistry, main-group and transition-metal chemistry, nuclear chemistry. The concepts and quantitative skills introduced in lecture are reinforced by a laboratory section. *Prerequisite: CHEM 002. Laboratory included.*

CHEM 090X: Freshman Seminar in Chemistry [1]

Examination of a topic in chemistry. *Pass/No Pass grading only.*

CHEM 095: Lower Division Undergraduate Research [1-5]

Laboratory, field, theoretical, and/or computational research under the supervision of a faculty member on a topic of mutual interest. A written report is required. *Permission of instructor required. Grading option is instructor preference. May be repeated for credit six times.*

CHEM 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CHEM 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CHEM 100: Organic Synthesis and Mechanism [3]

Reactions, syntheses, purification and characterization of all of the major classes of organic compounds. Includes standard organic reaction mechanisms and bioorganic mechanism. A retrosynthetic approach to synthetic design is emphasized. *Prerequisite: CHEM 008 and CHEM 010.*

CHEM 100L: Organic Chemistry Laboratory [1]

Laboratory experiments in synthetic methods and chemical and spectroscopic characterization of organic compounds. Emphasis is on microscale techniques. *Prerequisite: CHEM 100, which may be taken concurrently.*

CHEM 101L: Advanced Synthetic Laboratory [2]

Laboratory experiments in synthetic methods and chemical and spectroscopic characterization of organic and inorganic compounds. Emphasis is on microscale techniques. *Prerequisite: CHEM 100, which may be taken concurrently.*

CHEM 111: Biochemistry I [4]

Advanced study of proteins, enzymes, enzyme kinetics, and carbohydrates metabolism in living organisms. *Prerequisite: CHEM 100. Letter grade only. Discussion included.*

CHEM 112: Quantum Chemistry and Spectroscopy [3]

Theory and practical application of molecular quantum mechanics. Schrodinger equation and matrix representations of quantum mechanics; simple exactly solvable model problems; calculation of observable properties; vibrational and electronic wave functions; approximation methods; quantum mechanics of spectroscopy. *Prerequisite: CHEM 010 and MATH 024 and PHYS 009. Letter grade only.*

CHEM 113: Chemical Thermodynamics and Kinetics [3]

Statistical mechanics, thermodynamics, and chemical kinetics, taught from a perspective that develops the behavior of bulk matter from molecular properties. *Prerequisite: CHEM 112. Letter grade only.*

CHEM 114L: Physical Chemistry and Instrumental Analysis Laboratory [2]

Laboratory experiments in spectroscopy, electrochemistry, separations, and kinetics, including biochemical and biophysical applications. *Prerequisite: CHEM 112, which may be taken concurrently.*

CHEM 115: Instrumental Analysis and Bioanalytical Chemistry [3]

Spectroscopic, electrochemical, and separation methods of chemical analysis including bioanalytical techniques. *Prerequisite: CHEM 112, which may be taken concurrently.*

CHEM 120: Inorganic Chemistry [3]

Descriptive inorganic chemistry, reactivity, inorganic spectroscopy, group theory, and crystallography. *Prerequisite: CHEM 008 and CHEM 010. Letter grade only.*

CHEM 122: Advanced Biochemistry and Molecular Biology [4]

Mechanisms of amino acid, nucleic acid, and lipid metabolism plus advanced mechanisms of gene expression, signal transduction, and regulation of gene expression. *Prerequisite: BIO 101 or CHEM 111. Letter grade only. Laboratory and discussion included.*

CHEM 130: Organic Spectroscopy and Computation [3]

Modern methods and tools employed for the determination of organic molecular structure including NMR [1D and 2D FT], IR, and UV spectroscopy. Applications of quantum mechanical concepts and methods to understand and predict organic structures and reactivities. Computational modeling methods, including force field and quantum mechanical computer calculations. *Prerequisite: CHEM 100 and CHEM 112. Laboratory included.*

CHEM 131: Molecular Spectroscopy [3]

Time-dependent quantum mechanics; interaction of radiation with matter; electronic spectra of atoms and molecules; vibrational, rotational, and Raman spectra; magnetic resonance spectroscopy; X-ray, neutron, and electron diffraction. *Prerequisite: CHEM 112. Letter grade only.*

CHEM 133: Biophysical Chemistry [3]

Biochemical kinetics, solution thermodynamics of biochemical systems, multiple equilibria, hydrodynamics, energy levels, spectroscopy, and bonding. Three-dimensional structure of proteins, forces that stabilize protein structures, protein folding, prediction of protein structure from sequence. Three-dimensional structure of DNA and RNA, sequence-specific recognition of DNA and RNA, RNA-catalyzed processes. *Prerequisite: (CHEM 111 or BIO 101) and CHEM 113. Letter grade only.*

CHEM 140: Nanoscale Materials Chemistry [3]

An introduction to the properties of matter on size scales intermediate between atoms or molecules and bulk matter, with emphasis on metallic and semiconductor nanoparticles. Synthesis, characterization, physical and chemical properties, and applications of these materials. *Prerequisite: CHEM 100 and CHEM 113 and CHEM 120, all of which may be taken concurrently. Letter grade only.*

CHEM 147: Materials Chemistry Laboratory [3]

Laboratory examination of materials synthesis and physical properties of complex materials. Combines synthetic skills with fundamental physical understanding and characterization in approximately equal proportions to relate materials synthesis to materials function. *Prerequisite: CHEM 113, which may be taken concurrently, and CHEM 113. Laboratory included.*

CHEM 190: Advanced Topics in Chemistry [3]

In-depth treatment of a timely advanced topic in chemistry as selected by the faculty. More than one section covering different topics may be offered. *Permission of instructor required. Letter grade only. May be repeated for credit ten times.*

CHEM 194: Ethics and Communication in Chemistry [1]

This course addresses two key competencies that all professional chemists need: scientific ethics and oral communication skills. Scientific and professional ethics are taught through lectures, readings, and discussion of case studies. Oral communication skills are addressed through lectures and by having each student present a scientific seminar. *Prerequisite: Chemical Sciences (major or minor). Senior standing. Pass/No Pass grading only. Discussion and seminar included.*

CHEM 195: Upper Division Undergraduate Research [1-5]

Laboratory, field, theoretical, and/or computational research under the supervision of a faculty member on a topic of mutual interest. A written report is required. *Permission of instructor required. Grading option is instructor preference. May be repeated for credit six times.*

CHEM 198: Upper Division Directed Group Study [1-5]

Prerequisite: Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CHEM 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CHEM 200: Advanced Organic Synthesis [3]

Logical approaches to designing syntheses of target organic compounds. Introduction to retrosynthetic analyses and background on the reactions needed to achieve common syntheses; protecting groups and stereoselective methodologies. Classic syntheses are discussed in the context of modern methods. Introduction to literature search tools, a practical estimate of the reliability of published protocols, and references on chemical purification. *Prerequisite: One year of organic chemistry. Letter grade only.*

CHEM 201: Organic and Organometallic Reaction Mechanisms [3]

Thermodynamics, statistical mechanics, and molecular orbital theory are used to explain reactivity, product distributions, the stability of intermediates, and transition state structure. Elements of computational chemistry, kinetic methods of interrogation, linear free energy relationships, kinetic isotope effects, and other methods for empirically constructing plausible reaction mechanisms.

Prerequisite: One year of organic chemistry and one year of physical chemistry. Letter grade only.

CHEM 202: Bioorganic Chemistry [3]

The molecular basis of biological processes. Methods by which enzymes catalyze organic reactions; experimental methods by which the mechanisms of enzyme-catalyzed reactions are elucidated; chemistry of disease states and drug action. *Prerequisite: One year of organic chemistry and one semester of biochemistry. Letter grade only.*

CHEM 212: Molecular and Solid State Quantum Chemistry [3]

Theory and practical application of molecular quantum mechanics. Schrodinger equation and matrix representations of quantum mechanics; simple exactly solvable model problems; calculation of observable properties; vibrational and electronic wave functions; approximation methods; quantum mechanics of spectroscopy. Graduate requirements include computer laboratory and a computational project. *Letter grade only.*

CHEM 213: Chemical Thermodynamics and Kinetics [4]

Statistical mechanics, thermodynamics, and chemical kinetics, taught from a perspective that develops the behavior of bulk matter from molecular properties; modern experimental and theoretical methods in kinetics. *Prerequisite: CHEM 212. Letter grade only.*

CHEM 231: Molecular Spectroscopy [3]

Time-dependent quantum mechanics; interaction of radiation with matter; electronic spectra of atoms and molecules; vibrational, rotational, and Raman spectra; magnetic resonance spectroscopy; X-ray, neutron, and electron diffraction. Modern experimental and theoretical methods in spectroscopy. Graduate requirements include a term paper critically evaluating a recent technique in spectroscopy. *Prerequisite: CHEM 212.*

CHEM 251: Microstructures Processing and Properties of Materials [3]

Relationships between material properties and their molecular and higher-level organization; control of these properties by the environment to which the material is subjected during processing.

CHEM 290: Current Topics in Physics and Chemistry [3]

Exploration of current research directions, problems, and techniques in molecular and materials chemistry, physics, and engineering. Course format emphasizes student-led presentation, analysis, and discussion of reading assignments from the current and recent scientific literature. Topics are determined by the instructor and change each semester. *May be repeated for credit. Seminar included.*

CHEM 291: Physics and Chemistry Seminar [1]

Graduate seminar in physics and chemistry.

Satisfactory/Unsatisfactory grading only. May be repeated for credit.

CHEM 295: Graduate Research [1-15]

Supervised research. *Permission of instructor required.*

Satisfactory/Unsatisfactory grading only. May be repeated for credit.

CHEM 298: Directed Group Study [1-6]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

CHEM 299: Directed Independent Study [1-6]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

CHINESE

No credit is allowed for completing a less advanced course after successful completion (C- or better) of a more advanced course in the foreign languages. This applies only to lower division foreign language courses, not upper division courses.

CHN 001: Elementary Chinese I [4]

An introduction to modern standard Chinese (Mandarin) pronunciation and grammar as well as pinyin and simplified characters. Emphasis is on the basic language skills: speaking, listening, reading and writing.

CHN 002: Elementary Chinese II [4]

An introduction to modern standard Chinese (Mandarin) pronunciation and grammar as well as pinyin and simplified characters. Emphasis is on the basic language skills: speaking, listening, reading and writing. *Prerequisite: CHN 001 or equivalent score on the Chinese Placement Exam.*

CHN 003: Intermediate Chinese I [4]

Review of modern standard Chinese (Mandarin) pronunciation and grammar as well as pinyin and simplified characters. Emphasizes speaking and writing skills. Readings are utilized to build cultural understanding. *Prerequisite: CHN 002 or equivalent score on the Chinese Placement Exam.*

CHN 004: Intermediate Chinese II [4]

Review of modern standard Chinese (Mandarin) pronunciation and grammar as well as pinyin and simplified characters. Emphasizes speaking and writing skills. Readings are utilized to build cultural understanding. *Prerequisite: CHN 003 or equivalent score on the Chinese Placement Exam.*

CHN 092: Internship in Chinese [1-4]

Provides oversight and structure for a student's internship in a field related to Chinese in community organizations, professional research projects, etc. connected to the study of Chinese. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Chinese. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

CHN 192: Internship in Chinese [1-4]

Provides oversight and structure for a student's internship in a field related to Chinese in community organizations, professional research projects, etc. connected to the study of Chinese. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Chinese. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

COGNITIVE SCIENCES**COGS 001: Introduction to Cognitive Science [4]**

An introduction to the interdisciplinary field of cognitive science. Basic issues related to cognition, including perception, memory, language, learning, problem solving, spatial cognition, attention, mental imagery, consciousness, brain damage, development, and artificial intelligence, are considered from the perspectives of psychology, philosophy, computer science, and neuroscience. *Discussion included.*

COGS 005: Introduction to Language and Linguistics [4]

An introduction to the scientific study of language. Topics include phonology, phonetics, syntax, semantics, pragmatics, sociolinguistics, psycholinguistics, historical linguistics, language acquisition, and natural discourse. *Discussion included.*

COGS 090X: Freshman Seminar [1]

Examination of a topic in the cognitive sciences. *May be repeated for credit.*

COGS 092: Internship in Cognitive Science [1-4]

Provides oversight and structure for a student's internship in a field related to cognitive science connected to the study of cognitive science. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of cognitive science. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

COGS 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

COGS 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

COGS 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

COGS 101: Mind, Brain and Behavior [4]

Further explores the issues covered in COGS 1, but with greater emphasis on computation, brain structure, neurological deficits, and the connection between mind and brain. *Prerequisite: COGS 001 or PSY 001.*

COGS 102: Introduction to Cognitive Modeling [4]

An introduction to the use of computer programs in modeling and cognitive phenomena. Some proficiency in a high level programming language [C, Java, Lisp, etc.] is assumed. Topics include symbolic artificial intelligence, neural networks, genetic algorithms, and computer graphics. *Prerequisite: (COGS 001 or PSY 001) and (CSE 001 or CSE 002 or CSE 020) or consent of instructor.*

COGS 103: Introduction to Neural Networks in Cognitive Science [4]

Introduction to the use of neural networks in the study of cognitive phenomena. Topics include perception, attention, language, memory, and biologically realistic model neurons. *Prerequisite: COGS 001 or PSY 001 or consent of instructor.*

COGS 105: Research Methods for Cognitive Scientists [4]

Methods used for conducting interdisciplinary research in cognitive science. Topics range from identifying interesting problems, applying methods and theory to everyday cognitive tasks, designing projects, collecting data, analyzing and interpreting data, modeling data, and writing up results. Lab work and group projects are included. *Prerequisite: (COGS 001 or PSY 001) and PSY 010. Laboratory included.*

COGS 110: Philosophy of Cognitive Science [4]

Consideration of philosophical and foundational issues in cognitive science, including the Turing Test, the Chinese Room argument, the nature of cognitive architecture, animal cognition, connectionism vs. symbolic artificial intelligence, and the possibility of thinking machines. *Prerequisite: PHIL 001 and (COGS 001 or PSY 001).*

COGS 121: Cognitive Psychology [4]

Introduction to human information processing, mental representation and transformation, imagery, attention, memory, language processing, concept formation, problem solving and computer simulation. *Prerequisite: COGS 001 or PSY 001. Laboratory included.*

COGS 123: Computational Cognitive Neuroscience [4]

Design and analysis of computational simulations of human behavior and brain function. Techniques for modeling active membranes, individual neurons, the dynamics produced by recurrent excitation and lateral inhibition, synaptic plasticity, and the computational role of neurotransmitters. Formal models of perception, attention, learning, memory, language, categorization, and cognitive control. *Prerequisite: (COGS 001 or PSY 001) and one additional upper division COGS course or consent of instructor. Offered alternate years, spring only. Laboratory included.*

COGS 125: Introduction to Artificial Intelligence [4]

Provides an overview of the main concepts and algorithms underlying the understanding and construction of intelligent systems: agents, problem solving, search, representation, reasoning, planning, communication, perception, robotics, neural networks. Includes practical experimentation of algorithms in computer labs. *Prerequisite: (CSE 020 and CSE 021) or (CSE 001 and CSE 002) or (CSE 020 and CSE 021) or (CSE 030 and CSE 031) or consent of instructor. COGS 001 recommended. Laboratory included.*

COGS 128: Cognitive Engineering [4]

This survey provides an introduction to cognitive engineering, with an emphasis on cognitive science. Topics include human computer interaction, human robot interaction, speech recognition systems, animated characters, virtual reality systems, ubiquitous computing, computer supported cooperative work, and the implications of cognitive science research on the design and use of electronic devices and user interfaces in the 21st Century. *Prerequisite: COGS 001 or PSY 001 or consent of instructor. Laboratory included.*

COGS 130: Cognitive Neuroscience [4]

Brain systems involved in mental processes including perception, attention, language, reasoning, spatial cognition, memory, and decision-making. Neurobiological evidence for functional subsystems within these processes and the evolution of specialized systems are considered through examining findings from animal studies, human behavior and development research, and brain imaging studies. *Prerequisite: COGS 001 or BIO 001 or PSY 001.*

COGS 140: Perception [4]

An introduction to key theoretical constructs and experimental procedures in visual and auditory perception. Topics include psychophysics; perception of color, space, shape and motion; pattern recognition; perceptual attention; and brain areas engaged in perception. *Prerequisite: COGS 001 or PSY 001.*

COGS 141: Visual Perception [4]

A survey of central topics in the psychological study of vision: neurophysiological structure and function of the visual system; psychophysical methods for studying visual perception; color, motion, and form perception; three dimensional space perception; visual attention and oculomotor behavior; evolutionary advantages of vision; psychological and philosophical theories of visual consciousness. *Prerequisite: PSY 001 or COGS 001.*

COGS 144: Animal Cognition [4]

Focuses on how different species of animal animals process, organize, and retain information. Topics such as learning and memory, sensation and perception, navigation and migration, and communication, are discussed from ethological, experimental, behavioral, and neuroscientific perspectives. Contemporary issues in the comparative study of the evolution of human cognition are also addressed. *Prerequisite: PSY 001 or COGS 001 and junior standing or consent of instructor.*

COGS 150: Language, Cognition, and Interaction [4]

Examines the interactive nature of language. Discussion focuses on the extent to which perception, memory, and other non-linguistic processes interact with language and the way people use language to interact in everyday situations. Topics include conversational language, gesture, speech disfluencies, figurative language, spatial language, child-parent interaction, speech recognition, and human-computer processing. Integrates research from psychology, linguistics, sociolinguistics, and human-computer interaction. Research project required. *Prerequisite: (COGS 001 or PSY 001) and COGS 005 or consent of instructor.*

COGS 152: Services Science and Management [4]

Services, e.g., restaurants, hotels, lawyers, information technology operations, business consulting -- account for more than 70% of the US economy. Through case studies of businesses and scientific studies of people in real service settings, we focus on how to align people and technology effectively to generate value. *Prerequisite: ECON 001. Letter grade only.*

COGS 153: Judgment and Decision Making [4]

An introduction to the study of human judgment and decision making. Topics include decision making under uncertainty, financial choices, health decision making, group decisions, rational theories of choice behavior, and improving decision making. The material is related to cognitive science, psychology, economics, and other social sciences. *Prerequisite: COGS 001 or PSY 001.*

COGS 154: Cognitive Science Applications for Management [4]

Covers thought, behavior, and interaction in modern businesses, where knowledge workers interact with one another and with technology. Topics include business decision making, risk behavior, attitudes toward risk, planning, communication, information management, information systems, human-computer interaction, neuroeconomics, and organizational behavior. *Prerequisite: COGS 001 or PSY 001 or consent of instructor.*

COGS 155: Language Acquisition [4]

A comprehensive survey of the theories, methods and findings on first and second language acquisition. *Prerequisite: (COGS 001 or PSY 001) and COGS 005 or consent of instructor.*

COGS 159: Metaphor and Thought [4]

An interdisciplinary survey of metaphor with links to linguistics, literature, philosophy, psychology, and other areas. The focus is on the use and understanding of metaphor in everyday thought and communication, art, politics, literature, and technology. Popular theories and approaches to studying metaphor are included. *Prerequisite: COGS 001.*

COGS 171: Memory and Cognition [4]

Advanced study of recent research on human memory such as systems of memory, memory disorders, the neural basis of memory, memory and consciousness, memory and emotion, representation of knowledge, computer models of memory. *Prerequisite: COGS 121 or PSY 121 or consent of instructor. Letter grade only.*

COGS 172: Thinking and Reasoning [4]

Advanced study of recent research on thinking and reasoning such as inductive and deductive reasoning, concepts and categorization, problem solving, creative thinking, expertise, cognition in groups, relations to philosophy of science. *Prerequisite: COGS 121 or PSY 121 or consent of instructor. Letter grade only.*

COGS 173: Advanced Judgment and Decision Making [4]

Advanced study of recent research on judgment and decision making, such as behavioral economics, rationality and intelligence, health and medical decision making, decision neuroscience. *Prerequisite: COGS 153 or MGMT 153.*

COGS 175: Spatial Cognition [4]

Topics include navigation, perception of space and motion, spatial attention, spatial language, neurological deficits related to spatial cognition, spatial mental models, motion path planning in humans and computers, and visual representation in the arts and new media. *Prerequisite: COGS 001 or PSY 001.*

COGS 180: Topics in Cognitive Science [4]

A variety of topics in cognitive science are offered. *Prerequisite: COGS 001 or PSY 001 or consent of instructor. May be repeated for credit twice.*

COGS 190: Advanced Seminar in Cognitive Science [4]

Intensive treatment of a special topic or problem within cognitive science. *Prerequisite: Junior standing. Permission of instructor required. May be repeated for credit once.*

COGS 192: Internship in Cognitive Science [1-4]

Provides oversight and structure for a student's internship in a field related to cognitive science connected to the study of cognitive science. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of cognitive science. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

COGS 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

COGS 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

COGS 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

COGS 201: Cognitive Science Foundations I [4]

Solidification and expansion of students' existing knowledge of the fundamental theoretical frameworks and methodological tools of cognitive science. Connections among Philosophy of Mind, Cognitive Neuroscience, Theoretical Linguistics, Artificial Intelligence, and Cognitive Psychology, are emphasized. Required of all first-year Cognitive Science graduate students.

COGS 202: Cognitive Science Foundations II [4]

Continuation of COGS 201, with more emphasis placed on recent developments and applications in Cognitive Science, and tools needed to conduct cognitive science research in a variety of domains. Also includes practical career information, such as tutorials in grant-writing, effective presentation, writing techniques, and professional development. Required of all first-year Cognitive Science graduate students.

COGS 203: Introduction to Neural Networks in Cognitive Science [4]

Introduction to the use of neural networks in the study of cognitive phenomena. Topics include perception, attention, language, memory and biologically realistic model neurons. This graduate level version of the course includes a sizeable final project that simulates data from cognitive research.

COGS 223: Computational Cognitive Neuroscience [4]

Design and analysis of computational simulations of human behavior and brain function. Techniques for modeling active membranes, individual neurons, the dynamics produced by recurrent excitation and lateral inhibition, synaptic plasticity, and the computational role of neurotransmitters. Formal models of perception, attention, learning, memory, language, categorization, and cognitive control. *Permission of instructor required. Laboratory included.*

COGS 250: Cognitive Science Graduate Seminar [4]

The course covers broad issues in cognitive science, with an emphasis on computation, and the connections among mind, technology, and society. Each semester will feature guest speakers and topics such as artificial intelligence, design, human-computer interaction, perception, language, high-level cognition, reasoning, philosophy of cognitive science, neuroscience, and the role of technology in society. *Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

COGS 269: Topics in Cognitive Science [4]

Seminar on a specific topic in cognitive science. May be repeated for credit on a different topic. *Permission of instructor required. May be repeated for credit.*

COGS 285: Topics in Philosophy of Cognitive Science [4]

Detailed study of special topics in the philosophy of cognitive science, including (but not limited to): Animal Cognition, Cognitive Architecture, Consciousness, Mental Representation, Modularity, Nativism vs. Empiricism, and Self. *May be repeated for credit three times.*

COGS 295: Graduate Research [1-12]

Supervised research.

Permission of instructor required. May be repeated for credit.

COGS 298: Directed Group Study [1-6]

Group project under faculty supervision.

Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.

COGS 299: Directed Independent Study [1-6]

Independent project under faculty supervision.

Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.

CORE**CORE 001: The World at Home: Planning for the Future in a Complex World I [4]**

A foundation for UC Merced's general education program with a strong emphasis on writing, quantitative literacy, critical thinking, and understanding events in their historical and cultural contexts. The inaugural theme is a study of how individuals and societies can make the best choices in preparing for an uncertain future. The unifying theme in these modules is contemporary California which acts as a common reference point highlighting the regional implications of global events or the global consequences of seemingly local choices. A wide range of interdisciplinary perspectives from the arts, humanities, social sciences, life and physical sciences, and engineering are brought to bear on the course topics. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only. Discussion included.*

CORE 090X: Freshman Seminar [1]

Examination of a topic. *Prerequisite: Pass/No Pass grading only. May be repeated for credit.*

CORE 100: The World at Home: Planning for the Future in a Complex World II [4]

Second half of the Core course sequence, building on the foundation of UC Merced's general education program and has a strong emphasis on writing, quantitative literacy, critical thinking, and understanding events in their historical and cultural contexts. The inaugural theme is a study of how individuals and societies can make the best choices in preparing for an uncertain future. The unifying theme in these modules is contemporary California which acts as a common reference point highlighting the regional implications of global events or the global consequences of seemingly local choices. A wide range of interdisciplinary perspectives from the arts, humanities, social sciences, life and physical sciences, and engineering are brought to bear on the course topics. Upper-division-level quantitative literacy skills and writing ability is expected. *Prerequisite: CORE 001 and junior standing. Letter grade only. Discussion included.*

COMPUTER SCIENCE AND ENGINEERING**CSE 005: Introduction to Computer Applications [4]**

This project-based experience presents the use of computers to control information flow: data collection, management, analysis, and presentation. Basic programming skills, selection of appropriate computer-based tools and languages, and data security are covered. Emphasis is placed on computer knowledge necessary for non-CSE majors to successfully use and manage data and information. *Offered fall and spring. Letter grade only. Laboratory included.*

CSE 020: Introduction to Computing I [2]

Designed to give students comprehensive introduction to computing using quantitative examples. Fundamentals of computer programming, including basic algorithms, programming styles, program validation, debugging, and Methods Objects. Major compound data types including arrays, queues, tuples, stacks, binary. *Offered fall and spring. Letter grade only. Laboratory included.*

CSE 021: Introduction to Computing II [2]

Designed to give students comprehensive introduction to computing using quantitative examples. Fundamentals of computer programming, including basic algorithms, programming styles, program validation, debugging, and Methods Objects. Major compound data types including arrays, queues, tuples, stacks, binary. *Prerequisite: CSE 020. Offered fall and spring. Letter grade only. Laboratory included.*

CSE 030: Introduction to Computer Science and Engineering I [4]

Provides students with an overview of the diverse field of computer science and engineering. Provides an in-depth analysis of several key inventions in the field that have been instrumental in advancing CSE and driving worldwide technical growth. *Prerequisite: CSE 021. Offered fall and spring. Laboratory included.*

CSE 031: Introduction to Computer Science and Engineering II [4]

Provides students with an overview of the diverse field of computer science and engineering. Also provides an in-depth analysis of several key inventions in the field that have been instrumental in advancing CSE and driving worldwide technical growth. *Prerequisite: CSE 030. Offered fall and spring. Laboratory included.*

CSE 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

CSE 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CSE 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CSE 100: Algorithm Design and Analysis [4]

Introduction to the design and analysis of computer algorithms. Topics will include concepts of algorithm complexity, and various algorithmic design patterns like divide and conquer, dynamic programming and greedy algorithms. Course will also cover major algorithms and data structures for searching and sorting, graphs and some optimization techniques. *Prerequisite: CSE 031. Letter grade only. Laboratory and tutorial included*

CSE 106: Exploratory Computing [4]

Our ability to manipulate data depends on and is limited by our familiarity with computing technologies. We study tools for exploratory computing, emphasizing programming and scripting languages over point-and-click interfaces. We cover the Unix basics and common utilities, regular expressions, Perl and R languages. Development of a problem solving ability to learn languages independently and cull online documentation. *Letter grade only. Laboratory included.*

CSE 111: Database Systems [4]

Principles of database design and operation. Major types of databases, including flat-file, hierarchical, relational, and object-oriented. Other topics include database querying languages, database security, and special issues related to the www-based database systems. *Prerequisite: CSE 100. Offered fall only. Laboratory included.*

CSE 120: Software Engineering [4]

Modern engineering techniques for developing reliable, efficient, reusable, and maintainable computer software. Primary software design models, including functional, structured, and object-oriented programming. Other topics include software validation, revision control, project management, and documentation. *Prerequisite: CSE 111 or CSE 150 or CSE 160 or CSE 170. Offered spring only. Laboratory included.*

CSE 140: Computer Architecture [4]

Fundamental concepts of digital computer design, including instruction sets, memory systems and registers, logic and mathematics units, and off-cpu communication and control. Also surveys the diversity of contemporary computer designs. *Prerequisite: CSE 031. Offered spring only. Laboratory included.*

CSE 150: Operating Systems [4]

Concepts of computer operating systems including memory management, file systems, multitasking, performance analysis, and security. *Prerequisite: CSE 031. Offered spring only. Laboratory included.*

CSE 160: Computer Networks [4]

Design concepts and implementation features of computer networks. Concepts of network robustness, scalability, addressing, routing, and security. Several contemporary networking protocols are analyzed. *Prerequisite: CSE 031. Offered fall only. Laboratory included.*

CSE 170: Computer Graphics [4]

Basic algorithms in computer graphics enabling students to understand and experience the process of implementing modern computer graphics applications. The topics covered are: rasterization, clipping, hidden surface removal, transformations, rendering pipeline, scene graphs, graphics libraries, interpolation, curves and surfaces, constructive solid geometry, boundary representation, spatial partition methods, texture mapping, color models, illumination and shading. *Prerequisite: CSE 031. Offered spring only. Letter grade only. Laboratory included.*

CSE 171: Programming Interactive 3D Graphics and Games [4]

This course covers the main algorithms and techniques used in the implementation of interactive 3D Graphics, such as in Computer Games, Robotics Simulators and Virtual Reality. Topics covered are: keyframe animation, articulated figures, direct and inverse kinematics, physically-based simulation, path planning, behavior-based animation, scripting behaviors, and other advanced topics. *Prerequisite: CSE 170. Letter grade only. Laboratory included.*

CSE 173: Computational Cognitive Neuroscience [4]

Design and analysis of computational simulations of human behavior and brain function. Techniques for modeling active membranes, individual neurons, the dynamics produced by recurrent excitation and lateral inhibition, synaptic plasticity, and the computational role of neurotransmitters. Formal models of perception, attention, learning, memory, language, categorization, and cognitive control. *Prerequisite: (COGS 001 or PSY 001) and one additional upper division COGS course or consent of instructor. Laboratory included.*

CSE 175: Introduction to Artificial Intelligence [4]

An overview of the main concepts and algorithms underlying the understanding and construction of intelligent systems: agents, problem solving, search, representation, reasoning, planning, communication, perception, robotics, neural networks. Includes practical experimentation of algorithms in computer labs. *Prerequisite: CSE 020 and CSE 021 or consent of instructor. COGS 001 recommended. Offered fall only. Letter grade only. Laboratory included.*

CSE 176: Machine Learning [4]

Survey of techniques for the development and analysis of software that learns from experience. An introduction to computational learning theory. Bayesian approaches to learning. Instance-based methods and case-based learning. Decision tree learning. Inductive logic. Artificial neural networks. Kernel methods. Reinforcement learning. Learning from demonstrations and explicit instruction. *Prerequisite: MATH 032 and CSE 175 or consent of instructor. Offered alternate years, spring only. Laboratory included.*

CSE 180: Introduction to Robotics [4]

The course covers the basic of robotics focusing on the algorithmic side, rather than technology. Students will be introduced to basic computational techniques concerning spatial modeling, planning, and sensor processing. The course has a strong hands-on component. Implementation of different techniques in simulation will complement the theoretical lectures. *Prerequisite: CSE 100. Letter grade only. Laboratory and tutorial included*

CSE 185: Introduction to Computer Vision [4]

Overview of fundamental image processing and pattern recognition techniques including image formation, edge detection, image segmentation, optical flow, recovery of three-dimensional structure from shading or stereo information, shape representations, and issues in object recognition. *Prerequisite: CSE 031 or equivalent programming skills. Mathematical background commensurate with upper division engineering students. Offered fall only. Letter grade only. Laboratory included.*

CSE 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

CSE 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

CSE 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ECONOMICS**ECON 001: Introduction to Economics [4]**

Introduction to economics principles and methods, including microeconomics (operation of the economy at the individual and firm level) and macroeconomics (nature and functions of the national economy in a global context).

ECON 010: Statistical Inference [4]

Introduction to the application of social scientific methods to the study of economics, politics, and management. Covers research design, random sampling, descriptive and inferential statistics, hypothesis testing, and the linear regression model with an emphasis on applications. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam MATH 005 or Equivalent. Laboratory included.*

ECON 011: History of Economic Thought [4]

A survey of the theories of major economists from Adam Smith to Keynes. *Prerequisite: ECON 001.*

ECON 090X: Freshman Seminar [1]

Examination of a topic in economics. *May be repeated for credit.*

ECON 092: Internship in Economics [1-4]

Provides oversight and structure for a student's internship in a field related to Economics in community organizations, professional research projects, etc. connected to the study of Economics. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Economics. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

ECON 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ECON 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ECON 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ECON 100: Intermediate Microeconomic Theory [4]

Exploration of the foundations of microeconomic theory, focusing on the behavior of individuals and firms, and the interaction of these agents in the market. Price determination and resource distribution theory under conditions of perfect and imperfect competition. General equilibrium and welfare economics. *Prerequisite: ECON 001 and (MATH 021 or ICP 001A) or consent of instructor. Discussion included.*

ECON 101: Intermediate Macroeconomic Theory [4]

Analysis of output, employment, interest rates, and the price level. The effects of these on changes in monetary and fiscal variables. *Prerequisite: ECON 001 and (MATH 021 or ICP 001A) or consent of instructor. Discussion included.*

ECON 111: American Economic History [4]

Analysis of output, employment, interest rates, and the price level. A survey of trends in the American economy; emphasis on factors explaining economic growth and on the changing distribution of the gains and losses associated with growth. *Prerequisite: ECON 100 or MGMT 100.*

ECON 115: Economics of Industrial Organization [4]

The organization and structure of industrial production in the United States economy. *Prerequisite: ECON 100 or MGMT 100.*

ECON 116: Organizational Strategy [4]

Discussion of critical issues in the design and functioning of effective organizations. Topics covered include: the boundary of the firm, firm structure, arrangements within the firm, alliances and contracts between firms, and trust and culture in the firm. *Prerequisite: ECON 001.*

ECON 120: Economics of the Environment and Public Policy [3]

The course provides a systematic analysis of environmental policy issues using microeconomic theory. Topics covered include elements of welfare economics, theories of environmental policy instruments, the law and economics of environmental regulation, economics of recycling, and international environmental issues. *Prerequisite: ECON 001 or ESS 001. Letter grade only.*

ECON 121: The Economics of Money, Banking, and Financial Institutions [4]

This course addresses issues of money, banking, and financial institutions. Topics covered include: the structure of central banks and the Federal Reserve system, theories of money demand and money supply, the relationship between money supply and overall economic activity, and the role the Federal Reserve plays in economic stabilization. *Prerequisite: ECON 001. Letter grade only.*

ECON 130: Econometrics [4]

Introduction of problems of observation, estimation, and hypotheses testing in economics through the study of the theory and application of linear regression models, critical evaluation of selected examples of empirical research, and exercises in applied economics. *Prerequisite: (ECON 010 or POLI 010) and (MATH 021 or ICP 001A). Letter grade only. Laboratory included.*

ECON 140: Labor Economics [4]

Analysis of the economic forces that shape labor markets, institutions, and performance in the United States and other countries, with special attention to the determinants of labor supply and demand, human capital investment, and government policy. *Prerequisite: ECON 100 or MGMT 100.*

ECON 141: Human Resource Economics [4]

Examination of how firms make decisions involving human resources. Topics covered include employee hiring and recruitment, compensation and use of incentives, and employee motivation and teamwork. Builds on both economic theory and practical examples to illuminate key concepts. *Prerequisite: ECON 100 or MGMT 100. Letter grade only.*

ECON 142: The Economics of Gender and Poverty [4]

Analysis of the economic issues pertaining to gender with an emphasis on studying and evaluating U.S. policy. Topics include work-life balance, occupational choice, the gender earnings/wage gap, housework, and changing social norms. The intersection between gender and poverty is also discussed, particularly as it pertains to U.S. welfare policy. *Prerequisite: ECON 001.*

ECON 145: Health Economics [4]

An economic analysis of policies and institutions in the U.S. health care sector: supply and demand for health services, conceptual and policy issues relating to health insurance, and economic analysis of efficient regulatory policies toward the health care sector. *Prerequisite: ECON 100 or MGMT 100.*

ECON 150: Economic Development [4]

Problems of underdevelopment and poverty, policy issues, and development strategy. *Prerequisite: ECON 100 or MGMT 100.*

ECON 151: Public Economics [4]

The influence of governmental revenue and expenditure decisions on economic performance. Examines such issues as public goods and externalities, as well as specific expenditure and taxation programs. *Prerequisite: ECON 100 or MGMT 100.*

ECON 152: Law and Economics [4]

The economic analysis of legal rules and institutions, including property, contract, and tort law. We also consider issues surrounding crime and punishment. *Prerequisite: ECON 100 or MGMT 100.*

ECON 155: Political Economics [4]

Tools of political economics: preferences and institutions, electoral competition, agency, partisan politics. Redistributive politics: general interest politics, special interest politics. Comparative politics: electoral rules, separation of powers, political regimes. Dynamic politics: fiscal policy, growth. *Prerequisite: ECON 100 or MGMT 100.*

ECON 160: International Microeconomics [4]

This is a course in international microeconomics at the intermediate level. Standard microeconomics is the study of decision-making by various types of agents under various constraints and in various environments. International microeconomics examines such decision-making in a world of many different decision-makers, objectives, outputs, and countries. *Prerequisite: ECON 100 or MGMT 100.*

ECON 161: International Macroeconomics [4]

Macroeconomic theory of an open economy. Balance of payments adjustment mechanism, international monetary economics issues, international financial institutions and their policies. *Prerequisite: ECON 101 or MGMT 101.*

ECON 162: Corporate Finance [4]

Exploration of the valuation of assets including stocks, bonds, options, and futures contracts using modern financial theoretical models, including CAPM and APT. Optimal portfolio selection and risk management issues are also explored. *Prerequisite: ECON 100 or MGMT 100.*

ECON 170: Game Theory [4]

Consideration of non-cooperative games in the strategic and extensive form as well as applications of game theory to issues in social science and philosophy. Topics may include: solution concepts for non-cooperative games; epistemic foundations for solution concepts; indefinitely repeated games; theories of equilibrium selection; experimental game theory. *Prerequisite: ECON 100 or MGMT 100. Letter grade only.*

ECON 190: Topics in Economics [4]

Intensive treatment of a special topic or problem in economics. May be repeated for credit in different subject area. *Prerequisite: ECON 100 or MGMT 100 and junior standing or consent of instructor. Economics or Management majors only. May be repeated for credit three times.*

ECON 192: Internship in Economics [1-4]

Provides oversight and structure for a student's internship in a field related to Economics in community organizations, professional research projects, etc. connected to the study of Economics. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Economics. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

ECON 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ECON 196: Senior Thesis in Economics I [4]

First part in a year-long capstone seminar that culminates in the presentation of a senior thesis in economics. In this semester, students study research methods in economics, formulate a theoretical or empirical question for their thesis, and conduct a literature review. *Prerequisite: (ECON 100 or MGMT 100) and (ECON 130 or MGMT 130) and senior standing. Economics majors only. Letter grade only.*

ECON 197: Senior Thesis in Economics II [4]

Second part in a year-long capstone seminar that culminates in the presentation of a senior thesis in economics. In this semester, students develop and conduct the research proposed in the first semester, write the thesis, and present their work to faculty and peers. *Prerequisite: ECON 196 and senior standing. Economics majors only. Letter grade only.*

ECON 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ECON 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ECON 240: Advanced Labor Economics I [4]

Covers recent developments in research on labor economics and provide a basis for students to develop a research program in this area. We discuss human capital investment, the wage structure and inequality, labor demand, labor market institutions, internal and local labor markets. *Prerequisite of instructor required. Letter grade only. May be repeated for credit twice.*

ECON 290: Quantitative Labor Studies Seminar [3]

Research presentations by visiting scholars in the area of quantitative labor studies. *May be repeated for credit three times.*

ECON 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ECON 298: Directed Group Study [1-6]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

ECON 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

EDUCATION**EDUC 010: The Essentials of Educational Practice and Policy [4]**

Introduction to key elements in education: teaching and learning, school organization, education policy, politics, and philosophical goals of education. Topics include: educational reform, testing and accountability, school finance, student diversity, and bilingual education. Focus is on California's education system, with comparative perspectives from other states and countries. *Discussion included.*

EDUC 090X: Freshman Seminar [1]

Examination of a topic in education.

**ELECTRICAL ENGINEERING AND
COMPUTER SCIENCE****EECS 205: Probability and Stochastic Processes [4]**

Introduction of probability theory and stochastic processes. Topics: discrete-time Markov chains, conditional expectation and martingales, limiting behavior of sequences of random variables, Poisson process and continuous-time Markov chains, renewal processes and queuing theory, detection and estimation, wide-sense stationary processes and spectral density, Kalman filter and Wiener filter, and Brownian motion. *Prerequisite: MATH 032 and MATH 141 or consent of instructor. Offered in fall only. Discussion included.*

EECS 250: Advanced Topics Computer Systems [4]

Computer systems research, including operating systems, database systems, internet infrastructure systems and sensor networks systems. The goal of the course is to cover a broad array of research topics in computer systems, and to engage you in top-flight systems research. The first part is devoted to basic thematic issues and underlying techniques in computer systems, while the second part goes deeper into topics related to scalable, parallel and distributed systems. The class is based on a discussion of important research papers, and a research project. *Letter grade only. May be repeated for credit five times. Laboratory included.*

EECS 252: Embedded Computer Systems [4]

Concentration on methodologies and technologies for design of embedded systems. Topics include hardware and software platforms for embedded systems, techniques for modeling and specification of system behavior, software organization, real-time operating system scheduling, real-time communication and packet scheduling, low-power battery and energy-aware system design, timing synchronization, fault tolerance and debugging, and techniques for hardware and software architecture optimization. We cover theoretical foundations as well as practical design methods. *Offered fall only. Letter grade only. May be repeated for credit five times. Laboratory included.*

EECS 260: Optimization [4]

Introduction of theory and numerical methods for continuous multivariate optimization (unconstrained and constrained), including: line-search and trust-region strategies; conjugate-gradient, Newton, quasi-Newton and large-scale methods; linear programming; quadratic programming; penalty and augmented Lagrangian methods; sequential quadratic programming; and interior-point methods. *Prerequisite: MATH 023, MATH 024, MATH 141 or consent of instructor. Offered in spring only. Letter grade only. Laboratory included.*

EECS 262: Networking of Embedded Sensor Systems [4]

Wireless and sensor systems have achieved significant maturity in the past five years. Experimental systems research in this area has developed a wide range of innovative solutions to practical problems. There is also a fairly large literature on practical experience with these systems. In this class, we sample a wide range of current research on experimental networked wireless and sensor systems. Our exploration ranges from low-level systems and components (self-configuration, localization, time-synchronization), to networking (medium access, routing, transport), and higher-level systems issues (programming, deployment, and management). *Offered fall only. Permission of instructor required. Letter grade only. May be repeated for credit five times. Laboratory included.*

EECS 270: Robot Algorithms [4]

In depth study of algorithmic techniques to solve fundamental robotic problems, with a particular emphasis on probabilistic aspects. Sensor fusion, mission planning, and other selected topics are covered as well. Theory is complemented by a personal semester long project assigned to every student. Permission of instructor required.

Offered fall only. Permission of instructor required. Letter grade only. Laboratory included.

EECS 271: Theory of Computation [4]

The course introduces the main computational model defining the theory of computation and illustrates fundamental theorems defining the limits of what can be computed. Topics include: finite and pushdown automata; nondeterministic models; regular languages and context free grammars; Turing machines; and decidability problems. Senior level math knowledge and the fundamentals of computer algorithms are necessary for successful completion of this course.

Letter grade only. Laboratory included.

EECS 273: Computational Cognitive Neuroscience [4]

Design and analysis of computational simulations of human behavior and brain function. Techniques for modeling active membranes, individual neurons, the dynamics produced by recurrent excitation and lateral inhibition, synaptic plasticity, and the computational role of neurotransmitters. Formal models of perception, attention, learning, memory, language, categorization, and cognitive control.

Offered alternate years, spring only. Permission of instructor required. Laboratory included.

EECS 274: Computer Vision [4]

The course introduces algorithms and techniques for understanding contents in single and multiple images. It covers low-level, mid-level, high-level vision and recent research developments. *Prerequisite: CSE 185 or instructor consent, linear algebra, vector calculus, basic knowledge in probability and statistics, as well as programming skills. Letter grade only. May be repeated for credit three times. Laboratory included.*

EECS 275: Matrix Computation [4]

Numerous engineering problems can be formulated and solved via matrices. This course covers advanced algorithms for matrix computation and analysis. The introduced algorithms and numerical techniques are also important for solving linear/nonlinear systems and optimization problems. *Prerequisite: Linear algebra, programming skills. Letter grade only. May be repeated for credit twice. Laboratory included.*

EECS 276: Machine Learning [4]

Survey of techniques for the development and analysis of software that learns from experience. An introduction to computational learning theory. Bayesian approaches to learning. Instance-based methods and case-based learning. Decision tree learning. Inductive logic. Artificial neural networks. Kernel methods. Reinforcement learning. Learning from demonstrations and explicit instruction. *Offered alternate years, spring only. Permission of instructor required. Laboratory included.*

EECS 280: Advanced Topics in Computer Networks and Distributed Systems [4]

Overview of Internet development history and fundamental principles underlying TCP/IP protocol design. Discussion of current networking and distributed systems research topics, including latest research results in routing protocols, transport protocols, network measurements, network security protocols, and clean-slate approach to network architecture design. Fundamental issues in network protocol design and implementations applied to a variety of different applications and environments. *Offered fall only. Permission of instructor required. Letter grade only. May be repeated for credit five times. Laboratory included.*

EECS 281: Advanced Topics in Robotics [4]

Contemporary issues in mobile robotics, Topics include but are not limited to: cooperative mobile robotics, mathematical models for complex tasks (e.g. manipulation), humanoid robotics, human-robot interfaces, robot hardware and middleware. *Offered fall only. Letter grade only. May be repeated for credit three times. Laboratory included.*

EECS 282: Advanced Topics in Machine Learning [4]

The course reviews advanced topics in machine learning. Each edition of the course will focus on a different topic. It will consist of formal lectures, presentation and discussion of papers, and implementation of algorithms in Matlab or C. *Permission of instructor required. Letter grade only. May be repeated for credit. Laboratory included.*

EECS 283: Advanced Topics in Intelligent Systems [4]

Research in intelligent systems is multi-disciplinary and its foundation can be found from fields such as estimation, communication, and control. Other areas such as artificial intelligence, machine learning, networking, robotics, security, and signal processing are also highly related. This class will review the most current results in intelligent systems and help students prepare for research in intelligent systems. Topics will vary from semester to semester. *May be repeated for credit six times. Discussion included.*

EECS 285: Advanced Topics in Motion Planning [1-4]

Advanced algorithms in the motion planning research domain and reviews selected topics in applications to robotics, computer animation, cognitive science and bioinformatics. Includes development of a sizeable programming project and student-lead seminars. *Prerequisite: Consolidated programming skills, notions of computer graphics and robotics. Offered in fall only. Permission of instructor required. Letter grade only.*

EECS 286: Advanced Topics in Computer Vision [1-4]

Current and advanced topics in computer vision. Students develop verbal and written presentation skills through critical evaluation of seminal works. *Prerequisite: CSE 185 or consent of instructor. Offered in spring only. Letter grade only. May be repeated for credit six times.*

EECS 287: Computer Animation and Simulation [1-4]

This course reviews the main topics in computer animation, including: key frame animation and motion capture, direct and inverse kinematics, physics-based animation, particle systems and deformable surfaces, rigid body simulation, collision detection and motion planning. The course includes development of programming projects and student-lead paper presentations. *Pre-requisites: Consolidated programming skills, notions of computer graphics and instructor approval. Offered fall only. Permission of instructor required. Letter grade only. Laboratory included.*

EECS 290: Electrical Engineering and Computer Science Seminar [1]

The topics include the entire range of body knowledge within the electrical engineering and computer science domain areas. It is primarily intended to give electrical engineering and computer science graduate students breadth exposure to all the areas in the field, not just their specific individual areas of research. Students are required to attend eighty percent (80%) of the seminars scheduled in the semester unless they are excepted by written authorization of the student advisor. Attendance is registered by the faculty delivering the seminar, hosting the distinguished guest, or advising the Ph.D. graduate student presenting an advance topic. *Satisfactory/Unsatisfactory grading only. May be repeated for credit twice.*

EECS 295: Graduate Research [1-12]

Supervised research in computer science. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

EECS 298: Directed Group Study [1-12]

Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.

EECS 299: Directed Independent Study [1-12]

Satisfactory/Unsatisfactory grading only. May be repeated for credit.

ENGINEERING

ENGR 045: Introduction to Materials [4]

Relationship between the structure, processing, properties, and performance of materials. The application of physical and chemical principles in the context of engineering materials: atomic bonding, crystal structure, defects, thermodynamics, and kinetics. *Prerequisite: CHEM 002 and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) or consent of instructor. Offered spring only. Letter grade only. Laboratory included.*

ENGR 050: Statics [2]

Fundamental concepts of mechanics, including statics, dynamics, and kinetics of particles and rigid bodies. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008). Offered fall only. Letter grade only.*

ENGR 052: Computer Modeling and Analysis [3]

Basic tools needed for the design and analysis of engineering systems, including data collection, basic algorithm design, implementation and testing, and systems simulation. *Prerequisite: CSE 001 and MATH 010. Letter grade only. Laboratory included.*

ENGR 053: Materials and the Environment [3]

Impact of materials mining, processing, synthesis, use, and disposal on the environment, including cost-benefit analyses of environmentally "friendly" vs. "unfriendly" materials. Energy properties, cost, durability, disposal, and other considerations in materials selection. Materials challenges in fuel cell, battery, solar, and water filtration applications. Environmental costs and benefits of emerging nanotechnologies. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and CHEM 002 or consent of instructor. Letter grade only.*

ENGR 057: Dynamics [4]

Fundamentals of statics. Kinematics and equations of motion of a particle for rectilinear and curvilinear motion. Planar kinematics of rigid bodies. Kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008 or PHYS 018). Offered spring only. Letter grade only.*

ENGR 065: Circuit Theory [3]

This course is intended for the lower division engineering student to facilitate the student's development into bioengineering investigation. The course has been designed to introduce fundamental principles of circuit theory commonly used in biomedical research. *Prerequisite: MATH 024 and PHYS 009. Letter grade only.*

ENGR 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ENGR 097: Engineering Projects in Community Service [1-3]

Multi-disciplinary teams of freshman through senior students work with community organizations to design, build, and implement engineering-based solutions for real-world problems. Students gain insight into the design and development process. *Letter grade only. May be repeated for credit ten times. Fieldwork included.*

ENGR 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit ten times.

ENGR 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENGR 108: BioEntrepreneurship [3]

Introduces upper division undergraduate and graduate students to entrepreneurship. We start with a history of biotechnology and medical devices which hopefully inspires them to integrate entrepreneurship with engineering and/or life sciences. We work through case studies of start-up companies (including Genetech) brainstorm ideas about new inventions, and walk them through the requisite steps to start a new business venture (IP issues, team formation, raising capital). *Letter grade only. Discussion included.*

ENGR 120: Fluid Mechanics [4]

Introduction to and application of the mechanics of fluids and fluid flow in natural and engineered systems. *Prerequisite: MATH 024, which may be taken concurrently, and ENGR 057. Offered spring only. Letter grade only. Laboratory included.*

ENGR 130: Thermodynamics [3]

Fundamentals of equilibrium, temperature, energy, and entropy. Equations of state and thermodynamic properties, with engineering applications. *Prerequisite: CHEM 002 and MATH 023 and MATH 024 and (PHYS 009 or PHYS 019). Offered fall only. Letter grade only.*

ENGR 135: Heat Transfer [4]

Study of conduction, convection, and radiation heat transfer, with applications to engineering problems. *Prerequisite: ENGR 120. Offered fall only. Letter grade only. Laboratory included.*

ENGR 140: Introduction to Object Oriented Programming [4]

Object and database principles, including data models, access control, database systems architecture, functional data manipulation, database organizational design, indexing, and performance analysis. *Prerequisite: CSE 001. Letter grade only.*

ENGR 151: Strength of Materials [4]

Stresses and strain in solids with symmetric and asymmetric loads. Stresses in pressure vessels and rotating shafts. Strength and failure, plastic deformation, fatigue and elastic instability. *Prerequisite: ENGR 057. Offered fall only. Letter grade only. Laboratory included.*

ENGR 155: Engineering Economics Analysis [3]

Microeconomic principles and methods. Time value of money, interest and equivalences, analysis of economic alternatives, depreciation, inflation and taxes, estimates of demand, cost and risk, decision theory. *Prerequisite: Junior standing. Offered fall and spring.*

ENGR 160: Discrete Math and Computer Modeling [3]

Combinatorics, graph theory, cryptography, discrete optimization, mathematical programming, coding theory, information theory, game theory, principles of computer science, including algorithms, complexity, and performance modeling. *Prerequisite: CSE 001. Letter grade only.*

ENGR 165: Analog and Digital Electronics [3]

This course is intended for the upper division engineering student to facilitate the student's development into bioengineering investigation. The course has been designed to introduce fundamental principles of analog and digital electronics commonly used in biomedical research. *Prerequisite: ENGR 065. Letter grade only. Discussion included.*

ENGR 166: Analog and Digital Electronics [3]

This course is intended for the upper division engineering student to facilitate the student's development into bioengineering investigation. The course has been designed to introduce fundamental principles of analog and digital electronics commonly used in biomedical research. *Prerequisite: ENGR 065. Letter grade only.*

ENGR 170: Introduction to Electron Microscopy [3]

Principles and techniques of electron microscopy used in the study of materials. Emphasis upon practical applications. *Offered spring only. Letter grade only.*

ENGR 170L: Introduction to Electron Microscopy Laboratory [1]

Laboratory for principles and techniques of electron microscopy used in the study of materials. ENGR 170 must be taken concurrently. *Offered spring only. Letter grade only.*

ENGR 180: Spatial Analysis and Modeling [4]

Principles of geographic information systems [GIS]; applications of GIS to environmental, water, and resource management issues; problem solving with GIS. Other topics include spatial analysis interpolation techniques and model integration. *Prerequisite: MATH 021 or ICP 001A. Offered fall only. Letter grade only. Laboratory included.*

ENGR 191: Professional Seminar [1]

Presentation and discussion of professional engineering practices. Professional ethics and the roles and responsibilities of public institutions and private organizations pertaining to engineering. *Prerequisite: Senior standing. Permission of instructor required. Pass/No Pass grading only.*

ENGR 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ENGR 197: Engineering Projects in Community Service [1-3]

Multi-disciplinary teams of freshman through senior students work with community organizations to design, build, and implement engineering-based solutions for real-world problems. Students gain insight into the design and development process. *Letter grade only. May be repeated for credit ten times. Fieldwork included.*

ENGR 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENGR 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENGR 208: BioEntrepreneurship [3]

Introduction for upper division undergraduate and graduate students to entrepreneurship. We start with a history of biotechnology and medical devices which inspires them to integrate entrepreneurship with engineering and/or life sciences. Case studies of start-up companies (including Genetech) brainstorm ideas about new inventions, and the requisite steps to start a new business venture (IP issues, team formation, raising capital). *Letter grade only. Discussion included.*

ENGR 270: Introduction to Electron Microscopy [3]

Principles and techniques of electron microscopy used in the study of materials. Emphasis upon practical applications. Graduate requirements include additional assignments, quiz problems, and a project. *Offered spring only. Letter grade only.*

ENGR 270L: Introduction to Electron Microscopy Laboratory [1]

Laboratory for principles and techniques of electron microscopy used in the study of materials. Graduate requirements include additional laboratory reports and a research project. *Offered spring only. Letter grade only.*

ENGR 295: Graduate Research [1-6]

Supervised research in engineering. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

ENGR 298: Directed Group Study [1-6]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

ENGR 299: Directed Independent Study [1-6]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

ENVIRONMENTAL ENGINEERING

ENVE 010: Environment in Crisis [4]

Human effects on Earth's ecosystems, air, and waters. Social and technological solutions to interacting pressures from environmental pollution, biodiversity loss, water pollution, climate warming, and feeding Earth's population. Science and policy topics appropriate for students majoring in fields other than science or engineering. Not open to majors for credit. *Offered fall only. Laboratory included.*

ENVE 020: Introduction to Environmental Science and Technology [4]

Introduction to historical and current issues in the diverse field of environmental engineering. Principles of mass and energy balance. In-depth analysis of several key innovations from the field that have been instrumental in advancing the field. Design project. *Prerequisite: CSE 021 and CHEM 002 and MATH 032. Offered spring only. Letter grade only.*

ENVE 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ENVE 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENVE 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENVE 100: Environmental Chemistry [4]

Chemical principles of Earth and environmental systems focusing on environmental processes in water, soil, and air. Emphasis on acid-base chemistry, aqueous speciation, mineral and gas solubility, oxidation and reduction, and isotopes. *Prerequisite: CHEM 010 and (MATH 022 or ICP 001B or PHYS 008). Offered fall only. Laboratory included.*

ENVE 105: Environmental Data Analysis [3]

The objective of this class is to provide students with probabilistic and statistical methods to analyze environmental data. This class emphasizes both theoretical and applied aspects of data analysis methods. Weekly lab exercises are from environmental applications. Topics include: distribution, hypothesis test, linear regression, multiple regression, uncertainty analysis, outlier detection, sample design, and spatial and temporal data analysis. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008). Offered spring only. Letter grade only.*

ENVE 110: Hydrology and Climate [4]

Basics of the hydrological cycle and the global climate system. Fundamentals of surface water hydrology, hydrometeorology, evaporation, precipitation, statistical and probabilistic methods, unit hydrograph, and flood routing. *Prerequisite: ENVE 020 or ESS 020. Letter grade only.*

ENVE 112: Subsurface Hydrology [4]

Hydrologic and geologic factors controlling the occurrence and use of groundwater on regional and local scales. Physical, mathematical, geologic, and engineering concepts fundamental to subsurface hydrologic processes. Introduction to ground-water flow and transport modeling, with emphasis on model construction and simulation. *Prerequisite: ENVE 110 or ESS 110. Offered spring only. Letter grade only.*

ENVE 114: Mountain Hydrology of the Western United States [3]

Principles of snow formation, occurrence, and measurement; components of evapotranspiration; runoff generation; groundwater recharge processes; water resource assessments; and resource management. Focus on California and the southwestern US. Design project. *Prerequisite: ENVE 110 or ESS 110 Offered spring only. Letter grade only.*

ENVE 116: Applied Climatology [3]

Spatial and temporal patterns in climate and their association with land surface characteristics and processes. Methods for exploiting these for hypothesis testing, modeling, and forecasting. Applications include seasonal forecasting, ecological modeling, and analysis of processes such as flooding and wildfire. *Prerequisite: ENVE 110 or ESS 110 or consent of instructor.*

ENVE 118: Global Change [4]

Detection of, adaptation to, and mitigation of global climate change. Climate-change science, sources, sinks, and atmospheric cycling of greenhouse gases. Societal context for implementing engineered responses. Assessment of options for responding to the threat of climate change. *Prerequisite: CHEM 002. Discussion included.*

ENVE 121: Environmental Microbiology [4]

Fundamentals of environmental microbiology: physiology, biochemistry, metabolism, growth energetics and kinetics, ecology, pathogenicity, and genetics, with application to both engineered and natural environmental systems. Specific applications to water, wastewater, and the environmental fate of pollutants. *Prerequisite: BIO 001 and ENVE 020. Letter grade only. Laboratory included.*

ENVE 130: Meteorology and Air Pollution [4]

Basic physics and thermodynamics of the atmosphere; fundamentals of atmospheric sciences important to environmental problems; chemistry and physics of atmospheric pollutants; visibility; air quality modeling; emissions; and air pollution control strategies. *Prerequisite: ENVE 020 or ESS 020. Offered spring only. Letter grade only.*

ENVE 132: Air Pollution Control [3]

Topics include government regulations, design and economics of air pollution control for point and spatial sources, strategies for regional air pollution control and engineering solutions. Air pollution control for both point and mobile sources is addressed in the context of case studies. *Prerequisite: ENVE 130. Offered spring only. Letter grade only.*

ENVE 140: Water Resources Planning and Management [3]

Quantitative analytical methods in water resources planning and management; introduction to systems analysis, multi-objective planning and risk assessment. Design Project. *Prerequisite: ENVE 020 and ENGR 155. Letter grade only.*

ENVE 152: Remote Sensing of the Environment [4]

Fundamentals of electromagnetic remote sensing, concepts of information extraction and applications pertinent to environmental engineering and earth systems science. Topics include remote sensing principles, aerial photography, photogrammetry, image interpretation, image processing, and applications of remote sensing in a range of environmental applications (e.g water resource, terrestrial ecosystems, climate change and other environmental topics). *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) Offered fall only. Letter grade only. Laboratory included.*

ENVE 155: Decision Analysis in Management [4]

Presents the tools of decision science using a quantitative approach with a focus on investment, finance, management, technology and policy decisions. These tools include decision tree analysis, risk and uncertainty analysis, stochastic dominance, the value of information, probability bias, and subjective probability. *Prerequisite: (ECON 100 or MGMT 100) and (ECON 010 or POLI 010) or consent of instructor. Letter grade only.*

ENVE 160: Sustainable Energy [4]

Current systems for energy supply and use. Renewable energy resources, transport, storage, and transformation technologies. Technological opportunities for improving end-use energy efficiency. Recovery, sequestration, and disposal of greenhouse gases from fossil-fuel combustion. *Prerequisite: ENVE 020 or ESS 020. Offered fall only. Letter grade only.*

ENVE 162: Modeling and Design of Energy Systems [3]

Concepts and applications of solar thermal processes; applications of solar collectors for water heating; active and passive building heating and cooling; fundamentals and design of wind energy systems; economics of solar energy. *Prerequisite: ENGR 135 and ENGR 160 and ENVE 160. Offered spring only. Letter grade only.*

ENVE 164: Energy Policy and Planning Modeling [4]

Introduce recent development of energy policy and present fundamental optimization and simulation tools for modeling firm and market behavior for the energy sector, with a focus on electric power. *Prerequisite: (ENGR 155 or ECON 100) and MATH 024 or consent of instructor. Letter grade only.*

ENVE 170: Contaminant Fate and Transport [3]

Properties and behavior of organic and metal contaminants, in soils, groundwater, surface waters, and air. Emphasis on phase transfer and transport for organic compounds; complexation and surface processes for metals. Topics include modeling of environmentally important compounds, photochemical reactions, natural organic matter, sorption phenomena. *Prerequisite: ENVE 100 or ESS 100. Offered alternate years, fall only. Letter grade only.*

ENVE 171: Environmental Organic Chemistry [3]

Processes governing the distribution and transformation of anthropogenic organic chemicals in the environment. Topics include chemical-physical properties of organic chemicals, sorption processes, bioaccumulation, chemical transformations, photochemical transformations, modeling concepts. *Prerequisite: ENVE 100 or ESS 100 or consent of instructor. Offered fall only.*

ENVE 176: Water and Wastewater Treatment [3]

Water treatment, use, reclamation, and reuse. Introduction to modeling and designing treatment systems; both conventional and advanced technology. Use of mass balances for system evaluation and design. Design project. *Prerequisite: (ENVE 020 or ESS 020) and (ENVE 100 or ESS 100) and ENGR 120. Letter grade only.*

ENVE 181: Field Methods in Snow Hydrology [1-3]

Properties and measurement of snow. Principles of snow metamorphism and melting. Field workshops. *Prerequisite: ENVE 110 or ESS 110. Offered spring only. Pass/No Pass grading only.*

ENVE 182: Field Methods in Surface Hydrology [1-3]

Measurement and interpretation of data; stream gauging, hydrography, and limnology exercises; evaporation studies; micrometeorological instruments and methods; discharge measurement; flood plain mapping; preparation of hydrologic reports. Field workshops. *Prerequisite: ENVE 110 or ESS 110.*

ENVE 183: Field Methods in Subsurface Hydrology [1-3]

Introduction to fundamental field instruments used for vadose zone and subsurface field investigations. Analysis of groundwater wells and of a (hypothetical) contaminated site. Field workshops. *Prerequisite: ENVE 112. Offered fall only.*

ENVE 184: Field Methods in Environmental Chemistry [1-3]

Introduction to the fundamental field instruments used for environmental chemistry field investigations. Air, water, and soil sample collection and preservation procedures. Particle separation and analysis, ion selective electrodes, colorimetric assays for nutrients and metallic species, extraction of organic species. Experimental design, measurements, and interpretation of data. *Prerequisite: ENVE 100.*

ENVE 191: Professional Seminar [1]

Presentation and discussion of professional environmental and water resources engineering practices. Professional ethics and the roles and responsibilities of public institutions and private organizations pertaining to environmental engineering.

ENVE 192: Topics in Environmental Systems [1-6]

Examination of a topic in environmental engineering. *May be repeated for credit.*

ENVE 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ENVE 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENVE 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ENVIRONMENTAL SYSTEMS

ES 200: Environmental Systems [3]

Exploration of linkages in environmental systems and tools to evaluate important features of those systems. This is done by examining the characteristics of different Earth compartments (pedosphere, lithosphere, biosphere, atmosphere and hydrosphere) in terms of mass and energy balance, residence times and interactions. To provide a context, we examine how each of these compartments interacts with the global water cycle. *Offered spring only. Letter grade only.*

ES 202: Chemistry and Mineralogy of Soils [3]

Thermodynamics and kinetics of chemical process in soil systems. Topics include the formation and identification of common minerals, adsorption/desorption, precipitation/dissolution, and electrochemical reactions in soils. Graduate requirements include individual additional exercises and preparation of a research paper.

ES 203: Geochemistry of Earth Systems [3]

Quantitative analysis of Earth systems using principles of thermodynamics, kinetics, and isotope geochemistry; solution-mineral equilibrium and phase relations; equilibrium and reactive transport approaches to modeling geochemical processes at ambient and elevated temperatures. Graduate requirements include individual student projects.

ES 204: Organic Geochemistry [3]

Focus on organic chemical reactions in soils and sedimentary environments. Topics include the formation and weathering of natural organic matter and reactions of natural organic matter with pollutants. Graduate requirements include individual additional exercises and preparation of a research paper.

ES 205: Watershed Biogeochemistry [3]

Movement, storage, and transformations involving water, nutrients, and solutes in natural and human impacted watersheds; biological and chemical processes; modeling of biogeochemical processes. Interactions of watersheds with lakes and streams. Graduate requirements include more in-depth investigation of one or more topics and preparation of paper.

ES 206: Instructional Methods in Environmental Systems [3]

Instrumental analytical methods and quantitative analysis applied to the study of environmental materials, including inorganic, organic, and biological substances. Completion of an individual research project and preparation of a project report is required for graduate credit. *Laboratory included.*

ES 207: Environmental Data Analysis [3]

The objective of this class is to provide students with probabilistic and statistical methods to analyze environmental data. This class emphasizes both theoretical and applied aspects of data analysis methods. Weekly lab exercises are from environmental applications. Topics include: distribution, hypothesis test, linear regression, multiple regression, uncertainty analysis, outlier detection, sample design, and spatial and temporal data analysis. *Letter grade only.*

ES 208: Surface and Colloid Chemistry of Earth Materials [3]

Surface, colloid, and interfacial chemistry related to soil, environmental, and microbial applications; properties, energetics, and reactivity of surfaces and interfaces of Earth materials; the role of mineral surfaces in promoting and catalyzing chemical phenomena at phase boundaries. Graduate requirements include individual additional exercises and preparation of a research paper.

ES 209: Chemistry and Mineralogy of Earth Materials [3]

Chemical principles, structure, and bonding of minerals and Earth materials, including crystallography (symmetry, space groups, group theory), coordination chemistry, bonding models (valence bond, crystal field, and MO theories), and electronic and magnetic properties. *Prerequisite: ESS 100, CHEM 010 or consent of instructor. May be repeated for credit.*

ES 212: Subsurface Hydrology [4]

Hydrologic and geologic factors controlling the occurrence and use of groundwater on regional and local scales. Physical, mathematical, geologic, and engineering concepts fundamental to subsurface hydrologic processes. Introduction to ground-water flow and transport modeling, with emphasis on model construction and simulation. Graduate requirements include completion of advanced analysis in problem sets, completion of a term paper or project, and development of project management skills in the course design project.

ES 214: Mountain Hydrology of the Western United States [3]

Principles of snow formation, occurrence, and measurement; components of evapotranspiration; runoff generation; groundwater recharge processes; water resource assessments; and resource management. Focus on California and the southwestern US. Design project. Graduate requirements include more in-depth investigation of one or more topics and preparation of paper.

ES 218: Global Change [4]

Detection of, adaptation to, and mitigation of global climate change. Climate-change science, sources, sinks, and atmospheric cycling of greenhouse gases. Societal context for implementing engineered responses. Assessment of options for responding to the threat of climate change. Graduate requirements include preparation of a detailed case analysis.

ES 221: Environmental Microbiology [4]

Fundamentals of environmental microbiology: physiology, biochemistry, metabolism, growth energetics and kinetics, ecology, pathogenicity, and genetics, with application to both engineered and natural environmental systems. Specific applications to water, wastewater, and the environmental fate of pollutants. Graduate requirements include additional projects.

ES 224: Terrestrial Ecosystem Ecology [3]

Ecosystem ecology is the study of interactions between organisms and their environment. Focus on energy, water and nutrient flows through the living (plants, animals, microbes) and nonliving (soils, atmosphere) components of ecosystems. We examine both natural and human-modified terrestrial ecosystems. Graduate requirements include preparation and peer review of a research proposal.

ES 225: Microbial Ecology [4]

Advanced study of microbiological systems and techniques. Graduate requirements include additional exercises and preparation of a research paper.

ES 226: Environmental Genomics [4]

Introduction to the principles and methods of genomics as applied to the understanding of ecosystems. Topics include population genetics, adaptation to environmental change, and genomic analysis of environmental microbial communities; experimental and computational methods relevant to environmental genomics. Graduate requirements include additional exercises and preparation of a research paper. *Laboratory included.*

ES 228: Ecological Modeling [3]

An advanced study of modeling population dynamics and the flow of energy and matter in ecosystems. Graduate requirements include additional exercises and preparation of a research paper.

ES 232: Applied Climatology [3]

Spatial and temporal patterns in climate and their association with land surface characteristics and processes. Methods for exploiting these for hypothesis testing, modeling, and forecasting. Applications include seasonal forecasting, ecological modeling, and analysis of processes such as flooding and wildfire.

ES 234: Air Pollution and Resources [3]

Chemistry and physics of atmospheric pollutants, urban air pollution, visibility, mitigation, and resource economics. *Prerequisite: ESS 100 or consent of instructor. May be repeated for credit once.*

ES 235: Heat Transfer [4]

Study of conduction, convection, and radiation heat transfer, with applications to engineering problems. Graduate requirements include in-depth investigation of one or more topics and preparation of paper. *Laboratory included.*

ES 236: Advanced Mass Transfer [4]

Steady and unsteady mass diffusion; mass convection, simultaneous heat and mass transfer; Fick's law in a moving medium; similarity and integral methods in mass transfer; high mass transfer theory; research project in mass transport. *Prerequisite: ENGR 135 or ES 235 or ENGR 135. Offered spring only. Letter grade only. May be repeated for credit once.*

ES 237: Viscous Flows [4]

Study of the Navier-Stokes equations; Stokes' problems; creeping flows; internal and external flows; similarity and integral methods in boundary layer flows; stability and transition to turbulence. *Prerequisite: ENGR 135 or ES 235 or ENGR 135. Offered fall only. Letter grade only. May be repeated for credit once.*

ES 238: Air Pollution Control [3]

Physical and chemical principles for the capturing of air pollutants. Design of air pollution controls devices for particulate and gaseous pollutants emitted from stationary and mobile sources. State and Federal Regulations for point, mobile and area sources. Economics aspects of air pollution control to meet ambient air quality standards. In case studies, particular issues are addressed as they relate to the San Joaquin Valley.

ES 240: Water Resources Planning and Management [3]

Basic concepts of and issues in water resources management, water resources planning, institutional and policy processes. Quantitative analytical methods in water resources planning and management; introduction to systems analysis, multi-objective planning, and risk assessment. Design project. Graduate requirements include preparation of a detailed case analysis.

ES 248: Advanced Topics in Ecology [3]

Course utilizes directed readings and discussion of classical and current literature in ecology, including physiological, population, community, ecosystem, landscape, and global ecology studies. *Letter grade only.*

ES 252: Remote Sensing of the Environment [4]

Fundamental and advanced concepts of electromagnetic remote sensing, information extraction and applications in environmental monitoring. Advanced topics include principles of image extraction, image correction, image enhancement, classification methods, and new development of sensor techniques. Reading materials and final research projects are required for graduate students. *Letter grade only. Laboratory included.*

ES 260: Sustainable Energy [4]

Current systems for energy supply and use. Renewable energy resources, transport, storage, and transformation technologies. Technological opportunities for improving end-use energy efficiency. Recovery, sequestration, and disposal of greenhouse gases from fossil-fuel combustion. Graduate requirements include preparation of a detailed case analysis.

ES 262: Modeling and Design of Energy Systems [3]

Concepts and applications of solar thermal processes; applications of solar collectors for water heating; active and passive building heating and cooling; fundamentals and design of wind energy systems; economics of solar energy. Graduate-level requirements include preparation of a detailed case analysis.

ES 264: Energy Policy and Planning Modeling [4]

Introduce recent development of energy policy and present fundamental optimization and simulation tools for modeling firm and market behavior for the energy sector, with a focus on electric power. *Letter grade only.*

ES 270: Contaminant Fate and Transport [3]

Properties and behavior of organic and metal contaminants, in soils, groundwater, surface waters, and air. Emphasis on phase transfer and transport for organic compounds; complexation and surface processes for metals. Topics include modeling of environmentally important compounds, photochemical reactions, natural organic matter, sorption phenomena. Graduate-level requirements include preparation of a detailed case analysis.

ES 291: Environmental Systems Seminar [1-3]

Seminar on advanced engineering and science topics, environmental systems research, and relevant case studies. *Offered fall and spring. Satisfactory/Unsatisfactory grading only. May be repeated for credit once.*

ES 292: Topics in Environmental Systems [1-6]

Treatment of a special topic or theme in environmental systems. May be repeated for credit in a different subject area. *May be repeated for credit.*

ES 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

ES 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

ES 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

EARTH SYSTEMS SCIENCE**ESS 001: Introduction to Earth Systems Science [4]**

An introduction to basic principles of earth systems for non-science majors and prospective majors. A multidisciplinary approach that draws from geology, chemistry, physics, and biology to understand how the Earth functions as a complex system, and the role and impact of human beings on earth systems. *Laboratory included.*

ESS 002: Sustainability Science [4]

This course explores the scientific basis for a rigorous definition of the concept of sustainability and its implementation in society. Using ?back-of-the-envelope? style calculations it explains major magnitudes and trends of environmental impacts and sustainable activities. It will also employ assignments and discussions that encourage communication across disciplinary barriers. *Letter grade only. Discussion included.*

ESS 005: Introduction to Biological Earth Systems [4]

An introduction to basic principles of coupled biological and earth systems for non-science majors and prospective majors. An interdisciplinary approach that combines concepts from biology and earth science to understand how the Earth functions as a biological incubator, the origin and evolution of molecular life, the rise of complex biological and ecological earth systems, human impacts, and the sustainable Earth. *Laboratory included.*

ESS 010: Earth Resources [4]

We are users and changers of our planet. This course discusses the materials and resources our planet supplies to societies, and the environmental consequences that result from consumption. We will examine the origin and use of food, water, energy, and mineral resources, and consider challenges to management and sustainability. *Discussion included.*

ESS 012: Geology of California [4]

Introduction to the geology of California for non-science majors. A tour of the major geologic features of our state, its geologic hazards, and its natural earth resources in the context of basic plate tectonics and earth science principles. *Discussion included.*

ESS 020: Fundamentals of Earth Processes [4]

Introduction to Earth science with emphasis on physical and chemical processes that have shaped our planet through time; topics include plate tectonics, mountain building, mineral and rock formation, weathering, and landscape and soil formation. Weekly laboratories focus on the practical study of earth processes, materials, and history. *Prerequisite: (ESS 001 or ESS 005 or BIO 001 or CHEM 002) and (MATH 021 or ICP 001A or MATH 011). Laboratory included.*

ESS 025: Introduction to Ecosystem Science [4]

Fundamentals of ecosystem science; organization, function and development of ecological systems; energy and mass flow; biogeochemical cycling; biodiversity, population dynamics, and sustainability. *Prerequisite: (ESS 001 or ESS 005 or BIO 001) and (ICP 001A or MATH 021 or MATH 011) and (PHYS 008 or ICP 001B or PHYS 018). Laboratory included.*

ESS 040: Air Quality, Air Resources and Environmental Health [4]

A survey of principles and issues related to air quality and resources from global to regional scales, including evolution of the earth's atmosphere, urban smog formation, visibility, acid rain, stratospheric and tropospheric ozone, effects of meteorology on air pollution, air pollution transport across political boundaries, and health effects of exposure to air pollution. *Discussion included.*

ESS 050: Ecosystems of California [4]

An introduction to ecological principles and processes through the examination of California's varied ecosystems; discussion of native and invasive species, land use, human impacts, and biodiversity; two Saturday field trips to a variety of California habitats. *Discussion included.*

ESS 060: Global Environmental Change [4]

History, causes, and consequences of anthropogenic and natural changes in the atmosphere, oceans, and terrestrial ecosystems; geologic evidence for glacial cycles and climate changes, modern marine and atmosphere circulation, greenhouse gases, deforestation and species extinctions, and human population growth and impacts on climate and resources. *Discussion included.*

ESS 070: Soil Foundations of Terrestrial Ecosystems [4]

Examines the physical, chemical and biological properties of soils that influence terrestrial and freshwater ecosystems. Topics include processes that control soil formation, evolution, development, and chemical properties. Particular emphasis is placed on the quantitative descriptions of energy nutrient and contaminant fluxes into, out of and through soils. *Prerequisite: (ESS 001 or BIO 001) and CHEM 002. Fieldwork and discussion included.*

ESS 090X: Freshman Seminar [1]

Examination of a topic in earth systems science. *Pass/No Pass grading only.*

ESS 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ESS 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ESS 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ESS 100: Environmental Chemistry [4]

Chemical principles of Earth and environmental systems focusing on environmental processes in water, soil, and air. Emphasis on acid-base chemistry, aqueous speciation, mineral and gas solubility, oxidation and reduction, and isotopes. *Prerequisite: CHEM 010 and (MATH 022 or ICP 001B or PHYS 008). Laboratory included.*

ESS 102: Chemical Processes in the Soil Environment [3]

Thermodynamics and kinetics of chemical process in soil systems. Topics include the formation and identification of common minerals, adsorption/desorption, precipitation/dissolution, and electrochemical reactions in soils. *Prerequisite: ENVE 100 or ESS 100. Letter grade only.*

ESS 103: Geochemistry of Earth Systems [3]

Quantitative analysis of earth systems using principles of thermodynamics, kinetics, and isotope geochemistry; solution-mineral equilibrium and phase relations; equilibrium and reactive transport approaches to modeling geochemical processes at ambient and elevated temperatures. *Prerequisite: ENVE 100 or ESS 100 Letter grade only.*

ESS 104: Organic Geochemistry [3]

Focus on organic chemical reactions in soils and sedimentary environments. Topics include the formation and weathering of natural organic matter and reactions of natural organic matter with pollutants. *Prerequisite: ENVE 100 or ESS 100. Letter grade only.*

ESS 105: Biogeochemistry [3]

Movement, storage, and transformation of elements in the atmosphere, biosphere, hydrosphere, lithosphere, and pedosphere, with an emphasis on nutrients, human impacts, and global change. *Prerequisite: (ENVE 100 or ESS 100) and (ENVE 110 or ESS 110). Letter grade only.*

ESS 106: Instrumental Methods in Environmental Systems [3]

Instrumental analytical methods and quantitative analysis applied to the study of environmental materials, including inorganic, organic, and biological substances. *Prerequisite: ENVE 100 or ESS 100 or CHEM 010. Laboratory included.*

ESS 108: Surface and Colloid Chemistry of Earth Materials [3]

Surface, colloid, and interfacial chemistry related to soil, environmental, and microbial applications; properties, energetics, and reactivity of surfaces and interfaces of Earth materials; the role of mineral surfaces in promoting and catalyzing chemical phenomena at phase boundaries. *Prerequisite: ENVE 100 or ESS 100. Letter grade only.*

ESS 109: Inorganic Chemistry of Earth's Materials [3]

Chemical principles, structure, and bonding of minerals and Earth materials, including crystallography (symmetry, space groups, group theory), coordination chemistry, bonding models (valence bond, crystal field, and MO theories), and electronic and magnetic properties. *Prerequisite: ESS 100 or ENVE 100 or CHEM 010.*

ESS 110: Hydrology and Climate [4]

Basics of the hydrological cycle and the global climate system. Fundamentals of surface water hydrology, hydrometeorology, evaporation, precipitation, statistical and probabilistic methods, unit hydrograph, and flood routing. *Prerequisite: ENVE 020 or ESS 020. May be repeated for credit once.*

ESS 112: Subsurface Hydrology [4]

Hydrologic and geologic factors controlling the occurrence and use of groundwater on regional and local scales. Physical, mathematical, geologic and engineering concepts fundamental to subsurface hydrologic processes. Introduction to ground-water flow and transport modeling, with emphasis on model construction and simulation. *Prerequisite: ENVE 110 or ESS 110. Letter grade only.*

ESS 120: Introduction to Ecological and Environmental Microbiology [4]

Fundamentals of microbiology in ecological and environmental systems, including the distribution of microbial diversity throughout terrestrial, extreme, and marine environments; microbial control of global biogeochemical cycles; and environmental services provided by microorganisms. Both classical and contemporary biochemical, molecular, and genomic approaches to microbial physiology, metabolism, and ecology will be discussed. *Prerequisite: CHEM 010 and (ESS 001 or BIO 001 or ENVE 020) or consent of instructor. Discussion included.*

ESS 124: Terrestrial Ecosystem Ecology [3]

Ecosystem ecology is the study of interactions between organisms and their environment. Focus on energy, water and nutrient flows through the living (plants, animals, microbes) and nonliving (soils, atmosphere) components of ecosystems. Examines both natural and human-modified terrestrial ecosystems. *Prerequisite: BIO 148 or ESS 025 or consent of instructor. Letter grade only.*

ESS 125: Microbial Ecology [4]

Advanced study of microbiological systems and techniques. *Prerequisite: ESS 120. Letter grade only. Laboratory included.*

ESS 126: Environmental Genomics [4]

Introduction to the principles and methods of genomics as applied to the understanding of ecosystems. Topics include population genetics, adaptation to environmental change, and genomic analysis of environmental microbial communities; experimental and computational methods relevant to environmental genomics. *Prerequisite: BIO 141 or ESS 120. Letter grade only. Laboratory included.*

ESS 128: Theoretical Ecology [4]

Advanced study of the application of theoretical and quantitative methods for the analysis and interpretation of populations, communities and ecosystems. *Prerequisite: BIO 145 and (MATH 012 or MATH 022 or MATH 030). Letter grade only. Discussion included.*

ESS 131: Atmospheric Chemistry and Physics [4]

Chemistry and physics of the troposphere and stratosphere, including atmospheric aerosols. *Prerequisite: (ESS 020 or ENVE 020) and CHEM 008 and PHYS 009. Discussion included.*

ESS 132: Applied Climatology [3]

Spatial and temporal patterns in climate and their association with land surface characteristics and processes. Methods for exploiting these for hypothesis testing, modeling, and forecasting. Applications include seasonal forecasting, ecological modeling, and analysis of processes such as flooding and wildfire. *Prerequisite: ENVE 110 or ESS 110 or consent of instructor. Laboratory included.*

ESS 134: Air Pollution and Resources [3]

Chemistry and physics of atmospheric pollutants, urban air pollution, visibility, mitigation, and resource economics. *Prerequisite: ESS 100 or ENVE 100.*

ESS 141: Environmental Science Policy [4]

In depth-analysis of environmental case studies. Focus on science critical to policy development and implementation, the policy-making process, and policy outcomes. Special emphasis on interaction between scientific information and policy-making. Example topics include Western water resources, biodiversity conservation, and global warming. Emphasis on written and oral communication and critical analysis. *Prerequisite: WRI 010 and (BIO, ESS, ENVE, POLI or ECON). Discussion included.*

ESS 147: Astrobiology [4]

Astrobiology refers to the study of the origin and evolution of life in the cosmos. It is an integrative, multidisciplinary field that includes areas of biology, astronomy, geology, chemistry and physics. Students in the class face some of the most fundamental topics addressed by science today such as who we are, where we came from, and where we might go. We cover three main themes: How did life begin and evolve? Does life exist elsewhere in the universe? What is life's future on Earth and beyond? *Prerequisite: CORE 001 and (BIO 001 or BIO 005 or PHYS 006 or CHEM 002 or ESS 001) or consent of instructor. Letter grade only. Discussion included.*

ESS 148: Fundamentals of Ecology [4]

Introduction to the principles of ecology at population, community, ecosystem, landscape, and global scales. *Prerequisite: BIO 001 or BIO 005 or ESS 001 or ESS 005 or consent of instructor. Letter grade only. Fieldwork and discussion included.*

ESS 149: Conservation Biology [4]

Detailed examination of the evolutionary, ecological, management, and policy issues related to the conservation of ecosystems, species, and genetic diversity. Theory and practical aspects of biological conservation are presented, with special reference to case studies from California. *Prerequisite: BIO 001 and (MATH 018 or MATH 032) BIO 148 recommended. Letter grade only. Discussion included.*

ESS 150: Geomorphology and Surface Processes [4]

Observation and analysis of earth surface processes and the development of landforms and landscape. The interaction between surficial processes and tectonic, biologic, hydrologic, climatic, and atmospheric processes. Evaluation of environmental hazards and engineering solutions. *Prerequisite: ESS 020 or ENVE 020. Laboratory included.*

ESS 170: Fundamentals of Soil Science [3]

ESS 170/ES 270 examines the soil as a natural resource and soils as ecosystems. Soil science explores the major physical, chemical, and biological properties of soils, and fundamental processes that regulate interaction of the terrestrial biosphere with other components of the earth system. ESS 170L must be taken concurrently. *Prerequisite: CHEM 002 and (BIO 001 or ESS 001). Letter grade only.*

ESS 170L: Soil Science Laboratory [1]

ESS 170L aims to introduce students to common laboratory methods used in soil science. ESS 170 must be taken concurrently. *Letter grade only.*

ESS 180: Field Methods in Earth Systems [4]

Field techniques in chemistry, hydrology, geology, ecology, and microbiology, emphasizing principles of measurement, observation, and interpretation; integration of diverse data sets. *Prerequisite: CHEM 010 and (MATH 022 or ICP 001B or MATH 012) and (PHYS 008 or PHYS 018). Fieldwork and laboratory included*

ESS 190: Undergraduate Seminar [1]

Weekly seminar of current topics in earth and environmental systems. *Prerequisite: Junior standing.*

ESS 192: Topics in Environmental Systems [1-6]

Treatment of a special topic or theme in Environmental Systems. *Prerequisite: Junior standing or consent of instructor. May be repeated for credit four times*

ESS 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ESS 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit once.

ESS 199: Upper Division Individual Study [1-5]

Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

FRENCH

No credit is allowed for completing a less advanced course after successful completion (C- or better) of a more advanced course in the foreign languages. This applies only to lower division foreign language courses, not upper division courses.

FRE 001: Elementary French I [4]

Introduction to speaking, reading, writing and understanding French. Classes conducted in French. *Letter grade only.*

FRE 002: Elementary French II [4]

Introduction to speaking, reading, writing and understanding French. Classes conducted in French. *Prerequisite: FRE 001 or equivalent score on the French Placement Exam. Letter grade only.*

FRE 003: Intermediate French I [4]

A review of French grammar with emphasis on building speaking and writing skills and on reading to build cultural understanding. Classes conducted in French. *Prerequisite: FRE 002 or equivalent score on the French Placement Exam. Letter grade only.*

FRE 004: Intermediate French II [4]

A review of French grammar with emphasis on building speaking and writing skills and on reading to build cultural understanding. Classes conducted in French. *Prerequisite: FRE 003 or equivalent score on the French Placement Exam. Letter grade only.*

FRE 092: Internship in French [1-4]

Provides oversight and structure for a student's internship in a field related to French in community organizations, professional research projects, etc. connected to the study of French. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of French. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

FRE 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

FRE 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

FRE 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

FRE 103: French Composition and Conversation [4]

This course will develop students' abilities to communicate in spoken and written French at an advanced level. The course emphasizes the importance of the interaction between writer, reader, purpose and message. FRE 103 focuses on the four major modes of writing and oral practice. *Prerequisite: FRE 004 or equivalent (4-5 in AP French exam, appropriate grade in Placement exam). Letter grade only.*

FRE 192: Internship in French [1-4]

Provides oversight and structure for a student's internship in a field related to French in community organizations, professional research projects, etc. connected to the study of French. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of French. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

GLOBAL ARTS STUDIES PROGRAM**GASP 001: Introduction to Global Arts Studies [4]**

Study of global arts with an integrated approach that examines visual arts, music, and a variety of other subjects offered by the Global Arts Studies Program. *Letter grade only.*

GASP 002: Introduction to Music Studies [4]

Explores the fundamentals of music through various idioms, genres and traditions. *Letter grade only.*

GASP 003: Introduction to Visual Culture [4]

An introduction to visual material in art and mass media from cultures throughout the world. Emphasizes the development of students' own critical skills in analyzing and understanding visual culture. Topics include artworks from the antiquity to postmodernism, as well as issues in mass media, pop culture, and cyberspace. *Letter grade only.*

GASP 004: Introduction to Arts and Cultural Studies [4]

Introduction to a range of debates in cultural studies concerned with the impact race, gender, sexuality and class, for example, exert on cultural production, cultural identity and representation and/or aesthetics. *Letter grade only.*

GASP 005: Introduction to Arts and Technology [4]

Familiarizes students with academic debates regarding the relationship between technology writ large and artistic production, distribution and consumption - as well as creation, critique and pleasure. *Letter grade only.*

GASP 012: Asia Pacific Art [4]

Introduces students to the artistic traditions of cultures within Asia and/or the Pacific Ocean region. *Letter grade only.*

GASP 013: Latin American Art [4]

Introduces students to the artistic traditions of Latin American cultures. *Letter grade only.*

GASP 015: History of Western Art Music [4]

Introduction to the art music of western culture, including music from Medieval, Renaissance, Baroque, Classical, Romantic, and 20th Century eras, featuring study of selected masterworks in relation to the periods which they represent. Emphasis is placed upon developing awareness of musical style and structure through lectures and directed listening.

GASP 021: Ethnomusicology [4]

Introduces and familiarizes students with the theoretical and methodological issues and concerns in the field of ethnomusicology. *Letter grade only.*

GASP 023: Music of Asia Pacific [4]

Introduces and familiarizes students with a musical tradition from Asia and/or the Pacific Ocean. *Letter grade only.*

GASP 025: Music of the Middle East [4]

Introduces and familiarizes students with a musical tradition from the Middle East. *Letter grade only.*

GASP 026: Music in the World's Religions [4]

This course examines the role and power of music in the rituals of the world's religions; Hinduism, Buddhism, Judaism, Christianity, and Islam. It covers formalized ritual structures, as well as the musical systems of a variety of religious and social groups, including both older and contemporary forms. *Letter grade only. Discussion included.*

GASP 031: Critical Popular Music Studies [4]

Introduces students to current concerns in critical popular music studies, including issues of identity (e.g., race, gender) and representation. Students learn a variety of theories used in critical analyses of popular music. They also learn various methodological approaches used to research popular music. *Letter grade only.*

GASP 032: Introduction to Jazz Studies: History of Jazz [4]

This course will introduce and students to the history of jazz, including its key developments, innovators and styles. *Letter grade only. Discussion included.*

GASP 034: The American Musical [4]

Explores the relationship between the American musical and American-ness. Ideas about what it means to be an American have been expressed on the musical stage and have both reflected and helped form those ideas. Readings help link ideas about America and Americans as well as the historical contexts for the songs and narratives of the musicals. *Letter grade only.*

GASP 092: Internship in Global Arts [1-4]

Provides oversight and structure for a student's internship in a field of global arts in community organizations, professional research projects, etc. connected to the study of global arts. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of global arts. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

GASP 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

GASP 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

GASP 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

GASP 101: Visual Arts of the Twentieth Century [4]

The course surveys a selection of artists and ideas in the twentieth century with a global perspective. Students read pertinent critical theories and examine artwork in its historical, cultural and sociopolitical contexts. *Letter grade only.*

GASP 102: Asian American Art [4]

Examines the artistic production of American artists of Asian descent (both foreign and U.S. born). This class provides an overview of these artists' works in relation to issues of diaspora, immigration policies, social and civic engineering, racial relations, as well as formal and stylistic developments. *Prerequisite: Junior standing. Letter grade only.*

GASP 121: Asian Pacific American Music [4]

This course will introduce students to the history of Asian Pacific American music - the musicians, their creative work, and the social and historical contexts under which they composed and performed their music. *Prerequisite: Junior standing. Letter grade only.*

GASP 131: Critical Popular Music Studies [4]

This course will focus on current concerns in popular music studies, including issues of identity (e.g., race, gender) and representation. Students will learn a variety of theories used in critical analyses of popular music. They will also learn various methodological approaches used to research popular music. *Prerequisite: Junior standing. Letter grade only.*

GASP 132: Critical Jazz Studies [4]

This course will focus on current concerns in jazz studies, including issues of identity (e.g., race, gender) and representation. Students will learn a variety of theories used in critical analyses of jazz music. They will also learn various methodological approaches used to research jazz music. *Prerequisite: Junior standing. Letter grade only.*

GASP 135: African American Music [4]

Focuses on a central question: how do we locate African American music, i.e., how can we define African American music? In attempting to answer this question, we think through concepts such as authenticity, representation, recognition, cultural ownership, appropriation, origin(s). *Prerequisite: Junior standing. Letter grade only.*

GASP 141: History and Practice of Photography [4]

In this course students examine critical texts on the history and theory of photography, study the work of photographers from diverse backgrounds, and investigate cultural and sociopolitical issues in photographic practice and production. Students will also learn some basic techniques of taking photographs through various in-class exercises and assignments. *Prerequisite: Any lower division ARTS or GASP course and sophomore standing. Letter grade only.*

GASP 151: Topics in Visual Culture [4]

Special topics in the study of visual culture in a global context. *Prerequisite: Any lower division GASP course and junior standing or consent of instructor. Letter grade only.*

GASP 152: Topics in Music Studies [4]

Focuses on a combination of individual and group research projects in music studies. *Prerequisite: Junior standing. Letter grade only.*

GASP 175: Race and Nationalism in American Art [4]

Addresses issues concerning pictorial representations of racial and national identities in twentieth-century American art through readings of historical, cultural, and sociopolitical documents and theories. Special emphasis is placed on artists who are considered outside the canon and on debates relating to assimilation and nationalism. *Prerequisite: Any lower division GASP course and junior standing or consent of instructor. Letter grade only.*

GASP 192: Internship in Global Arts [1-4]

Provides oversight and structure for a student's internship in a field of global arts in community organizations, professional research projects, etc. connected to the study of global arts. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of global arts. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

GASP 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

GASP 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

GASP 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

GEOGRAPHY**GEOG 010: Introduction to Spatial Analysis [4]**

Teaches the value of geography as a basis for organizing and discovering information; the nature and meaning of maps, and the concepts and tools for spatial analysis: the description, organization, linkage, manipulation and communication of geographical information. *Discussion included.*

GEOG 141: Environmental Science and Policy [4]

In depth-analysis of environmental case studies. Focus on science critical to policy development and implementation, the policy-making process and policy outcomes. Special emphasis on interaction between scientific information and policy-making. Example topics include Western water resources, biodiversity conservation and global warming. Emphasis on written and oral communication and critical analysis. *Prerequisite: Any course in BIO, ESS, ENVE, POLI or ECON or consent of instructor. Discussion included.*

GEOG 142: Geography of Resource Management [4]

Climate and biogeography of Western US relevant to Forestry, Fire, and Water Resources management introduced via the writings of 19th Century explorers and surveyors of the West and recent scientific literature. Analyze role of climate and biogeographic information in public resource management policy debates of 1870s-1910s versus present day. Geographic perspective on long term repercussions of early 20th Century resource management policy choices. *Prerequisite: Any HIST, LIT, PUBP, BIO, ENVE, ESS or WRI 010 or consent of instructor. Discussion included.*

HUMAN BIOLOGY**HBIO 190: Research Seminar [1]**

Student-led presentations of current topics in human biology, including independent research presentations. *Prerequisite: Junior standing. Permission of instructor required.*

HBIO 195: Research Project in Human Biology [1-5]

Group or individual research projects in human biology under the direction of a BIO faculty member and a faculty member from the School of Social Sciences, Humanities and the Arts. *Prerequisite: Junior standing. Permission of instructor required. May be repeated for credit.*

HBIO 198: Directed Group Study in Human Biology [1-5]

Group directed study in human biology under the direction of a BIO faculty member and a faculty member from the School of Social Sciences, Humanities and the Arts. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.*

HBIO 199: Directed Independent Study in Human Biology [1-5]

Independent study in human biology under the direction of a BIO faculty member and a faculty member from the School of Social Sciences, Humanities, and the Arts. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.*

HISTORY**HIST 005: History of Cartography [4]**

Interpretation of historical maps from East Asia, the Islamic world, Europe, and indigenous societies, and the relationship of map making traditions to state power, science, religion, and other areas of thought and practice. The final unit of the course addresses GIS and mapping in the computer age.

HIST 010: Introduction to World History to 1500 [4]

World History from the origins of civilization to the European encounter with the Americas. Major topics include the growth of human populations, the rise of empires and states, routes of trade and migration, the spread of ideas and religions, and the impact of human settlement upon the natural world. *Letter grade only. Discussion included.*

HIST 011: Introduction to World History Since 1500 [4]

World history from the European encounter with the Americans to the present century. Major topics include colonization and decolonization, the rise of modern imperialism, capitalism and its opponents, urbanization and mass communication, technologies for war and peace, and the impact of human settlement upon the natural world. *Letter grade only. Discussion included.*

HIST 016: Forging of the United States, 1607-1877 [4]

The history of the U.S. from colonial roots through the Civil War and Reconstruction. Major topics include the coming of the Revolution, the impact of slavery on the development of the United States, westward expansion, and the creation of a distinctively American culture. *Discussion included.*

HIST 017: The Modern United States, 1877-Present [4]

The history of the United States from the Gilded Age through the early 21st century. Major topics include the impact of the Industrial Revolution on American life, the rise of the U.S. to a world power, the changing role of the federal government, and the ongoing struggle for civil rights. *Discussion included.*

HIST 020: History of the American West 1500 - 1849 [4]

An exploration of the idea of the west as it developed in the United States from Columbus to the advent of Gold Rush California. Emphasis will be upon the age of exploration and discovery, the notion of the frontier, and the impact of westward expansion upon the colonizer as well as the indigenous people of the west. *Discussion included.*

HIST 021: History of the American West, 1850-2000 [4]

The history of the idea of the west in the United States from the aftermath of the California Gold Rush to the rise of the Silicon Valley. Emphasis is upon the various roles that technology and the modern notion of the frontier played in the settlement and exploitation of the west before and after the Civil War. *Prerequisite: HIST 020. Discussion included.*

HIST 025: Introduction to Environmental History [4]

This course studies the interaction between environment and society, focusing on climate change and environmental degradation. This course will look at examples from historical cases including China, the Roman Empire, the Middle East and Medieval Europe, focusing on the effects of famine, resource depletion and migration.

Discussion included.

HIST 030A: Medieval Europe [4]

A survey of the development of Europe from the fall of Rome to the Renaissance. *Letter grade only. Discussion included.*

HIST 030B: Early Modern Europe [4]

A survey of Europe from the Renaissance to the French Revolution. Covers European expansion, the Renaissance and Reformation, political change, scientific revolution and changes in trade, work, gender and family. *Letter grade only. Discussion included.*

HIST 031: Modern European History [4]

A survey of the economic, social/cultural and political history of Europe from the early modern era to the present day. *Discussion included.*

HIST 060: The Silk Road [4]

For millennia, monks, merchants, warriors and brides traveled a network of routes throughout Eurasia, exchanging religious beliefs, disease pathogens, foodstuffs and luxury goods. This interdisciplinary and multi-media course examines the Silk Road through maps, art, travel narratives, archaeological reports, and other genres. *Prerequisite: HIST 010 or HIST 011 or consent of instructor.*

HIST 070: History of Islam I: From Muhammad to the Caliphate [4]

Fundamental principles of the Islamic religion, the emergence of Islam under the Prophet Muhammad, and the expansion of Islam under the First Four Caliphs to 661 A.D. Students examine Islam as a religion, a historical phenomenon, and a cultural impulse. *Discussion included.*

HIST 071: History of Islam II: From the Caliphate to the Present [4]

Covers the spread of Islam from the end of the Era of Rightly Guided Caliphs (661 AD) until the present, including Islamic empires, art and culture, colonialization and the contemporary Muslim world; and cultural and political contacts between Islam and the West. *Discussion included.*

HIST 080: History of China Through the Mongol Conquest [4]

This course introduces the history of China from Neolithic times through the early Ming dynasty. It explores the emergence of the Chinese empire and the dynamic between China and its neighbors. Students will analyze maps, and work with primary sources including art, philosophy, essays and political documents. *Discussion included.*

HIST 081: History of China Since the Mongol Conquest [4]

This course introduces the history of China from the Mongol conquest to the present. It covers the late imperial era, the nineteenth century crises of social dislocation and imperialism, and the revolutionary twentieth century. Students analyze maps and work with primary sources including art, philosophy, essays and political documents. *Discussion included.*

HIST 090X: Freshman Seminar [1]

Examination of a topic in history. *May be repeated for credit.*

HIST 092: Internship in History [1-4]

Provides oversight and structure for a student's internship in a field related to History in community organizations, professional research projects, etc. connected to the study of History. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of History. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

HIST 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Prerequisite: Permission of instructor required. May be repeated for credit.*

HIST 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

HIST 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

HIST 100: The Historian's Craft [4]

Focuses upon the various techniques of research and writing used by historians, from Thucydides to the so-called revisionists of today's "culture wars," and the changing audience of the historian. *Prerequisite: Junior standing or consent of instructor. History majors only.*

HIST 101: Visual Arts of the Twentieth Century [4]

The course surveys a selection of artists and ideas in the twentieth century with a global perspective. Students read pertinent critical theories and examine artwork in its historical, cultural and sociopolitical contexts. *Letter grade only.*

HIST 103: Critical Popular Music Studies [4]

This course will focus on current concerns in popular music studies, including issues of identity (e.g., race, gender) and representation. Students will learn a variety of theories used in critical analyses of popular music. They will also learn various methodological approaches used to research popular music. *Prerequisite: Junior standing. Letter grade only.*

HIST 104: Critical Jazz Studies [4]

This course will focus on current concerns in jazz studies, including issues of identity (e.g., race, gender) and representation. Students will learn a variety of theories used in critical analyses of jazz music. They will also learn various methodological approaches used to research jazz music. *Prerequisite: Junior standing. Letter grade only.*

HIST 108: Topics in World History [4]

Topics in the field of World History. May be repeated twice with different topics. *Prerequisite: HIST 010 and HIST 011 or consent of instructor. Letter grade only.*

HIST 109: Topics in the History of Science and Technology [4]

Addresses the relationship between historical change and significant scientific or technological developments. Possible areas include technologies of war, scientific revolutions, agricultural intensification, hydrology or other topics as determined by the instructor. *Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017) or HIST 100 or consent of instructor. Letter grade only. May be repeated for credit twice.*

HIST 110: Climate Change and World History [4]

Draws upon both environmental science and history to examine how the rise and fall of civilizations; the evolution of farming, pastoralism, and trade; the course of wars, and patterns of migration have been affected by fluctuations in temperature and rainfall. It also examines how humans have contributed to climate change.

Prerequisite: One lower-division HIST or ESS recommended.

HIST 111: The Legacy of Genghis Khan [4]

This course will examine Genghis Khan's life and legacy in Asia and the world, emphasizing topics such as the life of the Khan, Mongol military tactics, economic and trade policies, international relations, the interaction between nomadic and settled peoples, pre-modern state formation, and Mongol-influenced artistic and literary achievements. *Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017). Letter grade only.*

HIST 112: History of Islamic Art and Architecture [4]

This course studies the cultural history of Islamic societies as expressed by their art and architecture from the 7th century to the present. Changes in artistic styles, architectural advances and expression of the written word will be compared across time and geography in social context. *Prerequisite: Any lower division HIST course or consent of instructor.*

HIST 113: History of the Gunpowder Empires [4]

This course will focus on three great "gunpowder empires" of the early modern world: The Ottomans, Safavids, and Mughals. We will begin with imperial origins, and then examine methods of expansion, political and religious developments, and foreign relations. Special topics will include art and architecture, kingship, political legitimacy, and historiography. *Prerequisite: Any lower division HIST course or consent of instructor. Letter grade only.*

HIST 114: History and Practice of Photography [4]

In this course students examine critical texts on the history and theory of photography, study the work of photographers from diverse backgrounds, and investigate cultural and sociopolitical issues in photographic practice and production. Students will also learn some basic techniques of taking photographs through various in-class exercises and assignments. *Prerequisite: Any lower division ARTS or GASP course and sophomore standing. Letter grade only.*

HIST 116: History of Decolonization in the Twentieth Century [4]

This class will explore the ways that decolonization shaped the political, social, and economic landscape of the late twentieth century. Case studies of colonies throughout the world, and of imperial responses to decolonization, will illustrate the changing relationships among empires and subject peoples seeking self-determination. *Prerequisite: HIST 010 or HIST 011.*

HIST 117: Topics in Regional or State History [4]

In-depth study of a particular topic in the history of a region or state. Possible topics include the social, cultural, economic, or political history of that region or state. May be repeated for credit twice with different topics. *Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017) or HIST 100 or consent of instructor.*

HIST 118: Topics in Environmental History [4]

In-depth study of a particular topic in environmental history. Possible topics include the impact of industrialization upon the natural world, the changing notion of "wilderness," the role of national parks, California's "water wars," and others. *Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017) or HIST 100 or consent of instructor. May be repeated for credit twice.*

HIST 119: Topics in the History of Migration and Immigration [4]

In-depth study of a particular topic in the history of migration and/or immigration. Possible topics include the origins and history of America's culturally diverse population with a focus upon the experiences of European, Native, African, Chicano/Latino and Asian Americans. May be repeated twice with different topics.

Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017) or HIST 100 or consent of instructor. May be repeated for credit twice.

HIST 120: Essence of Decision: Case Studies in History [4]

Examines the art and science of decision-making with specific examples from historical case studies. The focus is upon the historical determinates of both successful and unsuccessful decisions, and upon decisions that had both foreign policy and domestic implications. *Prerequisite: HIST 016 and HIST 017 or consent of instructor.*

HIST 121: Asian Pacific American Music [4]

This course will introduce students to the history of Asian Pacific American music - the musicians, their creative work, and the social and historical contexts under which they composed and performed their music. *Prerequisite: Junior standing. Letter grade only.*

HIST 123: Comparative Race and Ethnicity in the United States [4]

This course will examine the construction of race and ethnicity in the United States in an historical and comparative context. The foundational concept of this course is that race is a social construction that comes into being through both historical and continuing interactions between various groups within U.S. society. *Prerequisite: HIST 016 or HIST 017.*

HIST 124: African American History from Slavery to Civil Rights [4]

Examines the history of African Americans from the era of slavery through emancipation, Jim Crow segregation, and the Civil Rights and Black Power movements. Topics include the development of a distinct African American culture as well as political movements ranging from abolitionism to black nationalism. *Prerequisite: Junior standing or consent of instructor. Lower division survey in American literature or history recommended. Letter grade only.*

HIST 126: Race and Nationalism in American Art [4]

Addresses issues concerning pictorial representations of racial and national identities in twentieth-century American art through readings of historical, cultural, and sociopolitical documents and theories. Special emphasis is placed on artists who are considered outside the canon and on debates relating to assimilation and nationalism. *Prerequisite: Any lower division GASP course and junior standing or consent of instructor. Letter grade only.*

HIST 128: The United States and the Vietnam War [4]

Examines the roots and conduct of the war from the initial American involvement after World War II through the withdrawal of American troops in 1973. Additionally, students explore the way in which the war both reflected and amplified divisions within American society during this period. *Prerequisite: HIST 016 or HIST 017 or consent of instructor.*

HIST 130: The Cold War, 1941-1991 [4]

The political, cultural, and intellectual history of America's confrontation with Communist at home and abroad, from U.S. entry into the Second World War to the collapse of the Soviet Union and its aftermath. *Prerequisite: HIST 016 and HIST 017 or consent of instructor.*

HIST 131: Topics in National History: “Manifest Destiny:” The United States and the World, 1840s-Present [4]

Beginning with the Mexican-American war and the conquest of the West, this seminar examines the way in which the U.S. has aggressively expanded its role on the world stage. Major themes include the impact of economics and religion and ongoing debates over globalization and imperialism. *Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017) and HIST 100, which may be taken concurrently or consent of instructor. May be repeated for credit three times.*

HIST 132: Intelligence and National Security, 1945-2000 [4]

Focuses upon the roles that intelligence and espionage have played in U.S. national security since 1945. A particular emphasis lies in those historical instances where technical intelligence had a part in resolving, or avoiding, major Cold War crises. *Prerequisite: HIST 016 and HIST 017 or consent of instructor.*

HIST 134: History and Literature of the Great Depression [4]

Focusing on the turbulent decade of the 1930s, we use the lens of history and literature to explore how events from 1929 ? 1941 helped shape modern America. Particular attention is paid to the impact of these years upon California and the West. *Prerequisite: LIT 020 or LIT 021 or HIST 016 or HIST 017 and junior standing. Letter grade only.*

HIST 135: History and Literature of the 1960s [4]

Examines American politics, culture, and society in the 1960s. Topics include civil rights, feminism, the Vietnam War, the Beat and other counterculture movements, and the sexual revolution. *Prerequisite: LIT 030 or LIT 031 or HIST 016 or HIST 017. Letter grade only.*

HIST 137: Topics in European History [4]

In-depth study of a particular topic in the history of Europe. Possible topics include the social, cultural, economic, or political/diplomatic history of Europe. *Prerequisite: HIST 010 and (HIST 011 or HIST 030) and HIST 031. Permission of instructor required.*

HIST 138: Topics in Visual Culture [4]

Special topics in the study of visual culture in a global context. *Prerequisite: Any lower division GASP course and junior standing or consent of instructor. Letter grade only.*

HIST 139: Topics in United States History [4]

Topics in the History of the United States. *Prerequisite: HIST 016 and HIST 017 or consent of instructor. May be repeated for credit twice.*

HIST 158: Topics in Middle Eastern History [4]

Topics in the field of Middle Eastern History. May be repeated twice with different topics. *Prerequisite: (HIST 010 and HIST 011) or (HIST 070 and HIST 071) and junior standing or consent of instructor. Letter grade only. May be repeated for credit twice.*

HIST 165A: China in the Ancient World [4]

This course introduces the history of ancient China. It begins with the emergence of lifeways associated with farming and pastoralism. It covers kingship and empire, philosophy, religion, and the interactions between China and its neighbors. It ends with the reunification of China under the Sui dynasty in the sixth century. *Prerequisite: Any lower division HIST course or consent of instructor.*

HIST 165B: From Tang to Song: China in the Medieval World [4]

From the seventh to the fourteenth century, China was the world's most powerful and technologically sophisticated society. This course examines the history of middle period China in the context of the Eurasian world. By emphasizing primary sources we will see how people envisioned their world. *Prerequisite: Any lower division HIST course or consent of instructor.*

HIST 165C: Late Imperial China [4]

This course introduces late imperial Chinese history. It begins with the Mongol conquest and its impacts. It explores Ming contraction and resurgence, the Manchu Qing and their ethnically hybrid state, the eighteenth century golden age, and the decline of empire in the context of Japanese and European imperialism. *Prerequisite: Any lower division HIST course or consent of instructor.*

HIST 165D: China in the Modern World [4]

This course covers the history of modern China. It begins with the decline of the Chinese empire in the nineteenth century, describes the twentieth century Republican and Communist revolutions, and charts the emergence of China as a twenty-first century world power. *Prerequisite: Any lower division HIST course or consent of instructor.*

HIST 170: Law and Society In England 1066-1800 [4]

An examination of the social, political and cultural factors shaping the development of English law and constitutional practice from the Norman Conquest until the 19th century. Attention to both the daily practice of law and constitutional principles. *Prerequisite: HIST 010 and HIST 011 or junior standing. Letter grade only.*

HIST 171: Modern European Intellectual History [4]

Examines the ideas and ideologies which transformed modern Europe: the French Revolution, nationalism, totalitarianism, the world wars, and the Cold War. Throughout, we place the major (and lesser) figures of the modern European intellectual scene in relation (or contrast) to the political and social scene in which they found themselves. *Prerequisite: HIST 030 or HIST 031 or consent of instructor.*

HIST 172: Europe and the Early Modern Atlantic World [4]

Survey of Europe's involvement in the Atlantic, including the process of colonizing the Americas, the development of the slave trade, and the European response to both Africa and American colonies. *Prerequisite: (HIST 010 and HIST 011) or (HIST 016 and HIST 017) or consent of instructor. Letter grade only.*

HIST 179: Topics in European History [4]

In-depth study of a particular topic in the history of Europe. Possible topics include the social, cultural, economic, or political/diplomatic history of Europe. *Prerequisite: (HIST 010 and HIST 011) or (HIST 030 and HIST 031) or consent of instructor. May be repeated for credit twice.*

HIST 191: History Capstone [4]

A capstone course for history majors, which involves the preparation of an extended research project done under the supervision of a faculty member and with extensive peer review. *Prerequisite: History majors only. Senior standing. Letter grade only.*

HIST 192: Internship in History [1-4]

Provides oversight and structure for a student's internship in a field related to History in community organizations, professional research projects, etc. connected to the study of History. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of History. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

HIST 193: Honors Thesis Research [4]

First half of the History Honors thesis sequence (HIST 193-4). Students research a topic in preparation for producing an Honors thesis. Enrollment restricted to students admitted to the History Honors program. *Prerequisite: History majors only. Senior standing. Permission of instructor required. Letter grade only.*

HIST 194: Honors Thesis [4]

Second half of the History Honors thesis sequence (HIST 193-4). Students write a 50-100 page thesis under the supervision of a faculty mentor. Enrollment restricted to students admitted to the History Honors program. *Prerequisite: History majors only. Senior standing. Permission of instructor required. Letter grade only.*

HIST 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

HIST 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

HIST 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

HIST 200: The Uses and Abuses of the Past: History's Role in Society [4]

Examines the role of history, and the historian, in modern American society. Topics to be considered include the various potential roles of the historian as writer and biographer, curator, social critic, ethicist, and the phenomenon of "history for hire."

HIST 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. May be repeated for credit.*

HIST 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

HIST 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

INTEGRATED CALCULUS AND PHYSICS

ICP 001A: Integrated Calculus and Physics: Calculus Component [4]

Introduction to differential and integral calculus of a single variable together with an introduction to kinematics and dynamics. For the most part, we cover the same subject material as Math 21 and Phys 8, but the structure of the course is designed to teach the two subjects in a cohesive fashion, emphasizing their historic and logical connections. Students receive a separate grade for the calculus component (ICP 1A) and the physics component (ICP 1B). ICP 001B must be taken concurrently. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam. Laboratory included.*

ICP 001B: Integrated Calculus and Physics: Physics Component [4]

Introduction to differential and integral calculus of a single variable together with an introduction to kinematics and dynamics. For the most part, we cover the same subject material as Math 21 and Phys 8, but the structure of the course is designed to teach the two subjects in a cohesive fashion, emphasizing their historic and logical connections. Students receive a separate grade for the calculus component (ICP 1A) and the physics component (ICP 1B). ICP 001A must be taken concurrently. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam. Laboratory included.*

JAPANESE

No credit is allowed for completing a less advanced course after successful completion (C- or better) of a more advanced course in the foreign languages. This applies only to lower division foreign language courses, not upper division courses.

JPN 001: Elementary Japanese I [4]

Introduction to speaking, reading, writing and understanding modern Japanese. *Letter grade only.*

JPN 002: Elementary Japanese II [4]

Introduction to speaking, reading, writing and understanding modern Japanese. *Prerequisite: JPN 001 or equivalent score on the Japanese Placement Exam. Letter grade only.*

JPN 003: Intermediate Japanese I [4]

Continuation of elementary Japanese. Emphasizes the further development of speaking, writing and reading skills, with an intensive review of basic grammar as well as an introduction to more advanced grammar and vocabulary. *Prerequisite: JPN 002 or equivalent score on the Japanese Placement Exam. Letter grade only.*

JPN 004: Intermediate Japanese II [4]

Continuation of elementary Japanese and Japanese 3. Emphasizes the further development of speaking, writing and reading skills, with an intensive review of basic grammar as well as an introduction to more advanced grammar and vocabulary. *Prerequisite: JPN 003 or equivalent score on the Japanese Placement Exam. Letter grade only.*

JPN 092: Internship in Japanese [1-4]

Provides oversight and structure for a student's internship in a field related to Japanese in community organizations, professional research projects, etc. connected to the study of Japanese. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Japanese. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

JPN 103: Advanced Japanese I [4]

Continuation of Intermediate Japanese II. Emphasizes the further development of reading, writing and speaking Japanese, with learning social and cultural issues of contemporary Japanese society. *Prerequisite: JPN 004 or consent of instructor. Letter grade only.*

JPN 104: Advanced Japanese II [4]

Continuation of Advanced Japanese II. Emphasizes the further development of reading, writing and speaking Japanese, with learning social and cultural issues of contemporary Japanese society. *Prerequisite: JPN 103 or consent of instructor. Letter grade only.*

JPN 192: Internship in Japanese [1-4]

Provides oversight and structure for a student's internship in a field related to Japanese in community organizations, professional research projects, etc. connected to the study of Japanese. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Japanese. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

LITERATURE**LIT 020: Introduction to World Culture and Literature I [4]**

Introduction to the connections between language, literature, and culture over time and across national traditions through a variety of literary genres. Introduces the masterworks of world literature in their cultural contexts, through comparative analysis. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 021: Introduction to World Culture and Literature II [4]

Introduction to the connections between language, literature, and culture over time and across national traditions through a variety of literary genres. Introduces the masterworks of world literature in their cultural contexts, through comparative analysis. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 030: Introduction to American Literature I [4]

Survey of the history and major works of literature of the United States from colonial times to the present, with a special emphasis on the range of American cultural traditions in a comparative context. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 031: Introduction to American Literature II [4]

Survey of the history and major works of literature of the United States from colonial times to the present, with a special emphasis on the range of American cultural traditions in a comparative context. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 032: American Women Writers [4]

This course will feature selected works of writers from pre-Columbian to the present, with an emphasis on social, cultural and historical constraints on women's arts; the rise in feminist artistic strategies; and contemporary trends in literary production. Includes some study of influences on American women writers. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only. Discussion included.*

LIT 040: Introduction to British Literature I [4]

Survey of the history and major works of the literature of the British Isles from the Middle Ages to the present. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 041: Introduction to British Literature II [4]

Survey of the history and major works of the literature of the British Isles from the Middle Ages to the present. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only. Discussion included.*

LIT 042: British Women Writers [4]

From selected works of British women writers, we include a variety of texts, from early religious treatise through the birth of the British novel and beyond. Students study economic, social and cultural constraints, and examine the relationship between historical context and artistic production of women writers. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only.*

LIT 050: Introduction to Hispanic Literature I [4]

Survey of the history and major works of Peninsular, Latin American and Latino literatures until the nineteenth century. *Prerequisite: SPAN 004 or SPAN 011 or equivalent score on the Spanish Placement Exam. Discussion included.*

LIT 051: Introduction to Hispanic Literature II [4]

Survey of the history and major works of Peninsular, Latin American and Latino literatures from the 19th. C to the 21st. C. *Prerequisite: SPAN 004 or SPAN 011 or equivalent score on the Spanish Placement Exam. Discussion included.*

LIT 055: Introduction to Portuguese and Brazilian Literature and Culture [4]

Emphasis on reading and discussion of literary texts representative of different literary movements and authors of the Luso-Brazilian world. Discussion of significant historical, social and cultural trends in the Portuguese-speaking world. We focus on Portugal, Azores, Portuguese Africa, the Portuguese in the United States and Brazil.

LIT 060: Introduction to Chicano Culture and Experiences [4]

This course provides an introduction to Chicano cultural practices and experiences, with an emphasis on the ties between culture, race, gender, social class, language, historical developments, artistic and literary expression, migration and transculturation. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only. Discussion included.*

LIT 061: Hispanic/Latino Children's Literature and Film [4]

Explores Latino/Hispanic children's literature and film from theoretical and cultural perspectives. We study texts, contexts, illustrations, traditions, as well as issues related to production, reception, publishing and marketing. Special attention is paid to linguistic issues, including bilingualism and translation, and to visual forms of representation, including comic books. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 063: Hispanic Film and Popular Culture [4]

Theoretical and historical overview of Hispanic film and popular culture, including music, performing arts, traditional storytelling, mass entertainment, among others. Particular attention is paid to connections with the arts and literature. Course, films, and readings are given in Spanish. *Prerequisite: SPAN 004 and (WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent). Letter grade only.*

LIT 067: Multicultural Children's Literature [4]

Explores the field of children's literature from a theoretical and a cultural perspective. Readings include books from many cultural traditions as well as secondary sources on multiculturalism and cultural literacy. We study texts, contexts, illustrations, traditions, as well as issues related to publishing and marketing. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only. Discussion included.*

LIT 069: US Latino Literature [4]

A representative overview of U.S. Latino literature, from its colonial and pre-colonial origins to the present. A socio-historical framework is first outlined in order to situate the different periods in the history of this literature. Main groups studied include Chicanos, Puerto Ricans, and Cuban-Americans, though others are represented as well. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Discussion included.*

LIT 090X: Freshman Seminar [1]

Examination of a topic in Literature. *Prerequisite: May be repeated for credit.*

LIT 092: Internship in Literatures and Cultures [1-4]

Provides oversight and structure for a student's internship in a field related to Literature in community organizations, professional research projects, etc. connected to the study of Literature. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Literature. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

LIT 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

LIT 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

LIT 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

LIT 100: Engaging Texts: Introduction to Critical Practice [4]

An introduction to issues and approaches in literary theory and criticism, with an emphasis on applications of methods to selected literary texts. *Prerequisite: Junior standing or consent of instructor. Literatures and Cultures majors only.*

LIT 110: Topics in World Literature [4]

Topics may include literature of one country or region of the world or comparisons of multiple literatures. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. May be repeated for credit twice.*

LIT 111: Empire, the Postcolonial, and Representation: Reading East and West [4]

Study through literature, film and mass media of emancipatory uprisings and postcolonial challenges of the last 200 years that unsettled the old Eurocentric and the U.S. colonial order. Includes Occidental readings on Asian and African cultures. Topics: racism, xenophobia, illegal migrations and terrorism. Strong interdisciplinary approach to case examination. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 112: Literature and History [4]

Emphasizes historical contextualization of literature, including theoretical approaches such as Marxism, Post colonialism, Intellectual and Social Historicism. Explores ways in which literary histories are written. Course may focus on a specific historical period in order to understand the distinct relationship among literature, history and cultural production. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 120: Topics in the Literature of Difference [4]

In-depth study of representative literary works in a single genre: novel, poetry, drama, et.a *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. May be repeated for credit three times.*

LIT 125: Literary Genres [4]

Explores how individual literary genres articulate larger cultural, aesthetic, and social issues. In addition, we analyze literary genres alongside other media in which those issues are also articulated, exploring differences and similarities in their treatment of those matters. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 130: Topics in American Literature [4]

In-depth study of a period, theme, et.a. in American literature. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. May be repeated for credit three times.*

LIT 131: American Literature of the Expanding Nation [4]

We focus on the narratives by which America constructed its "manifest destiny." Some writers or works that may be covered: Bradford, Bradstreet, Edwards, early Native American texts and colonial captivity narratives, and early exploration narratives. Also, we look at writers who justified and critiqued westward expansion. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 132: American Protest Literature [4]

Readings and discussion focus on literary genres that have voiced dissent, protest, and social displacements. While race and gender play a significant role in the course, protests against subjugation and/or oppression based on labor issues, religious preference, class, and age also be covered. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 133: New Voices in American Fiction and Poetry [4]

Provides an exploration of contemporary practices in the field of American literature. Students study themes and forms in the fields of poetry, prose and fiction as they have been developed and interrogated by America's young and new writers. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 134: Literature and History of the Great Depression [4]

Focusing on the turbulent decade of the 1930s, we use the lens of history and literature to explore how events from 1929 ? 1941 helped shape modern America. Particular attention is paid to the impact of these years upon California and the West. *Prerequisite: LIT 020 or LIT 021 or HIST 016 or HIST 017 and junior standing. Letter grade only.*

LIT 135: Literature and History of the 1960s [4]

Examines American politics, culture, and society in the 1960s. Topics include civil rights, feminism, the Vietnam War, the Beat and other counterculture movements, and the sexual revolution. *Prerequisite: LIT 030 or LIT 031 or HIST 016 or HIST 017 and junior standing. Letter grade only.*

LIT 136: Literature and Culture of African Americans [4]

American literature from the slavery period through the Harlem Renaissance and into the present. We emphasize African American writers in the context of cultural history that influenced and often repressed their literary production, with special emphasis on specific discursive practices and the rise and fall of various literary movements. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 137: U.S. American Indian Literature and Cultures [4]

Explores the writing and the recorded oral narratives of Native American authors and story tellers. Emphasizes the roles of story-telling, cultural heritage and preservation in constructing individual and tribal identity, and examines contemporary issues such as displacement stories and narratives, recovering of history, and the definition of self and community. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 140: Topics in British Literature [4]

In-depth study of a period, theme et.al. in British literature. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. May be repeated for credit twice.*

LIT 141: British Literature of the Expanding Empire [4]

A look at British colonial literature, from early travel narratives such as Behn's Oronoko to Forster, Orwell and current writers. Emphasis is on understanding the processes which literature helped to construct the idea of an empire. Attention is paid to relationships between postcolonial narratives and emerging character of colonized nations. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051*

LIT 143: New Voices in British Fiction and Poetry [4]

Exploration of contemporary practices in the field of British literature. Students study themes and forms in the fields of poetry, prose and fiction as they have been developed and interrogated by young and new writers in Britain and Ireland. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051*

LIT 145: Plays and Poetry of Shakespeare [4]

Introduction and analysis of Shakespeare's major plays and works of poetry. *Prerequisite: Junior standing.*

LIT 146: Shakespeare: Early Works [4]

Selected work from Shakespeare's early period up to the middle works, between 1599 and 1604. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051.*

LIT 147: Shakespeare: Later Works [4]

Selected work from Shakespeare's middle works, between 1599 and 1604, until the end of his career. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051*

LIT 150: Topics in Hispanic Literature [4]

In depth study of Spanish literature of a single country, one or more countries in a comparative context, a period et.al. *Prerequisite: LIT 050 or LIT 051 or consent of instructor. May be repeated for credit three times.*

LIT 151: Golden Age Spanish Literature [4]

Study through theater, novel and poetry of Renaissance and Baroque Peninsular literature (1492-1680): poetry of Garcilaso, Lope de Vega and the Spanish Baroque Theater; Cervantes and the origins of the modern novel; Conceptism and Culteranism; and relevant Portuguese figures (e.g., Gil Vicente and Camoes). Course is conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 152: The Transatlantic Baroque [4]

Course centers around Transatlantic exploration of Golden Age Spain and colonial Latin America. Special attention and analysis is paid to commerce and cultural contact, travel writing, center and periphery, literary representation, arts, music, and other relevant cultural forms of the times. Course and readings are conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 153: Spanish Literature Since the 20th Century [4]

From Generations of 1898 through 1927, the Civil War, Francoist and Post-Francoist literature, to contemporary voices. Selected readings on Spanish nationalisms: from Rizal to Teixidor. Course critically examines the constructions of Spain and "Spanishness", seeking to build a more complex understanding of its cultures. Conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 154: Spanish Literature 18-19 Centuries [4]

Representative works of Spanish/Peninsular prose fiction, theater, essay, and poetry produced during the 18th and 19th centuries. Students will become familiarized with texts that vary from Neoclassicism to Realism/Naturalism. Also, they will have an understanding of socio-historical phenomena such as the Industrial Revolution, The Enlightenment, and The 1st International Socialist. *Prerequisite: LIT 050 or LIT 051 or consent of instructor. Letter grade only.*

LIT 155: Latin American Colonial Literature [4]

Selected readings on chronicles, poetry and theater from Columbus travel narratives to Fernandez de Lizardi's El periquillo sarniento. Emphasis on understanding the various processes by which literature helped to construct the idea of identity and independence. Theoretical frame based on cultural studies: the relationship between knowledge and power, the text and its context. Conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 156: Latin American Literature Since the Independence [4]

Primary concentration is on Romantic poetry; Indigenist, Anti-slavery and Indianist novel: Marti, Ruben Dario and Modernismo; Rodo and the essayist of the early XX century; the novel of the Mexican Revolution; and the Latin American `Boom? and `Post Boom?. Some selected readings on Brazilian literature after Dom Pedro Primeiro are included. Conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 157: Caribbean Literatures and Cultures [4]

Explores the cultures and literatures of the Hispanic Caribbean, including those of Cuba, Puerto Rico, and the Dominican Republic. We also explore multiple cultural substrata (e.g. Spanish, African, Anglo-American, Native) as well as their current presence in the Caribbean islands. Course and readings are conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 158: Transatlantic Modernismo [4]

Study through poetry, novel, essay and chronicle of principal characteristics of Spanish-American and Peninsular Modernismo. We examine the issue of the influence of Latin American writers in Spain (e.g. Ruben Dario, Gomez Carrillo), and the evolution of poets or prose writers out of Modernismo into the Generation of '98 (e.g. Antonio Machado) or into a unique, independent voice (e.g. Juan Ramon Jimenez, Valle-Inclan, Unamuno). Conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 159: Diasporas and Exiles in the Hispanic World [4]

Concentration on literary works of political exiles from oppressive regimes (e.g., Spain's Franco, Portugal's Salazar) and 70's and 80's South American dictatorships. Focus on diasporas produced by economical constraints in the U.S., Latin America and Spain. Strong interdisciplinary approach in examining of cases and ideas. Conducted in Spanish. *Prerequisite: LIT 050 or LIT 051 or consent of instructor.*

LIT 160: Hispanic Women Writers [4]

Explores the development of writing by women in the Hispanic world, including the formation of a feminine aesthetics, the reception of works by women writers, canons and exclusions, and connections with writings by women from other cultures. Course and readings are conducted in Spanish. *Prerequisite: LIT 051.*

LIT 162: Bilingualism and Borders in Hispanic Literatures [4]

Explores cultural and linguistic contacts in borderland areas throughout the Hispanic world, from medieval times to the present. We focus on the artistic, social, and historical effects of coexistence around borders, with special attention to issues of bilingualism and cultural hybridism. Course and readings are conducted in Spanish. *Prerequisite: LIT 051.*

LIT 164: Hispanic Drama and Performing Arts [4]

Both textual and non-textual dramatic works from all around the Hispanic world are covered. Special attention is paid to Golden Age theatre, didactic and ritual dramas in the Americas, contemporary dance, Latin American theater, and the rise and development of Chicano theater. Course and most readings are conducted in Spanish. *Prerequisite: LIT 051. Discussion included.*

LIT 165: Great Writers [4]

In-depth examination of the works of a single writer, read in the original language of that writer. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051.*

LIT 168: Chicano Literature [4]

Representative overview of Chicano literature, from its colonial and pre-colonial origins to the present. Through the analysis of works from different genres, students are exposed to the main themes, techniques, styles, etc. of some of the most influential Chicano writers to date. *Prerequisite: LIT 021 or LIT 031 or LIT 051.*

LIT 169: US Latino Literature [4]

Representative overview of U.S. Latino literature, from its colonial and precolonial origins to the present. A socio-historical framework is first outlined in order to situate the different periods in the history of this literature. Main groups studied include Chicanos, Puerto Ricans, Cuban-Americans and Central Americans. *Prerequisite: LIT 021 or LIT 031 or LIT 051.*

LIT 170: Topic in Language and Linguistics [4]

Topics may include linguistic theories, history of the English language. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. May be repeated for credit twice.*

LIT 171: Teaching Literature and Culture [4]

An exploration of historical and contemporary issues related to the teaching of literature and culture. Discussions include teaching practices, pedagogy and assignments. Students are required to submit a semester project. Strongly recommended for teaching credential candidates. *Prerequisite: LIT 021, LIT 100 recommended.*

LIT 180: American Nature Writing and Literature of the Environment [4]

Study of the wilderness and environment in major texts. Attention paid to Biblical and British influences and "founding" nature writers such as Thoreau; Muir and Mary Austin, as well as more recent environmental thinkers, Gary Snyder, Edward Abbey, Leslie Marmon Silko. *Prerequisite: Junior standing.*

LIT 181: Literature of California [4]

Exploration of the developing identity of California, with emphasis on how that identity is reflected in and shaped by its literature. Covers early Native and California life, the Gold Rush, the major waves of immigration, and contemporary issues, all within a political, cultural and intellectual framework. Term paper required. *Prerequisite: LIT 020 or LIT 021 or LIT 030 or LIT 031 or LIT 040 or LIT 041 or LIT 050 or LIT 051. Letter grade only.*

LIT 183: Literature and the Other Arts [4]

Study of the relationship of literature to other arts, including visual and performance. May be focused on a detailed study of one period or artistic development. *Prerequisite: Junior standing.*

LIT 185: Literature and Power [4]

Subjects of discussion based on selected texts that deal with the use and abuse of power. We address all literary genres and concentrate in XIX through XXI century writings. Strong theoretical frame based on Foucault and Post-structuralism, Colonial and Postcolonial studies. *Prerequisite: LIT 021.*

LIT 186: Novel of the Latin American Dictator [4]

This course examines the representation of the Latin American dictator and the mediation of the mysteries of power as seen in several novels published during the second half of the 20th century and the beginning of the 21st. *Prerequisite: LIT 050 or LIT 051. Letter grade only.*

LIT 190: Senior Thesis [4]

Capstone course for majors. Completion of a senior thesis. Extensive writing required. *Prerequisite: Literatures and Cultures majors only. Senior standing. Letter grade only.*

LIT 192: Internship in Literatures and Cultures [1-4]

Provides oversight and structure for a student's internship in a field related to Literature in community organizations, professional research projects, etc. connected to the study of Literature. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Literature. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

LIT 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. Letter grade only. May be repeated for credit.*

LIT 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

LIT 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MATHEMATICS

MATH 005: Preparatory Calculus [4]

Preparation for calculus. Elementary functions, trigonometry, polynomials, rational functions, systems of equations and analytical geometry. *Course cannot be taken after obtaining credit for MATH 021. Letter grade only.*

MATH 011: Calculus I [4]

Introduction to differential and integral calculus of functions of one variable, including exponential, logarithmic and trigonometric functions, emphasizing conceptual understanding and applying mathematical concepts to real-world problems (approximation, optimization). Course may not be taken for credit after obtaining credit for MATH 021. Course does not lead to MATH 23, 24. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam For majors that do not require more than two semesters of calculus courses. Letter grade only. Discussion included.*

MATH 012: Calculus II [4]

Continuation of MATH 011. Introduction to integral calculus of functions of one variable and differential equations, emphasizing conceptual understanding and applying mathematical concepts to real-world problem. Course may not be taken for credit after obtaining credit for MATH 022. Course does not lead to Math 23, 24. *Prerequisite: MATH 011 or MATH 021 For majors that do not require more than two semesters of calculus courses. Letter grade only. Discussion included.*

MATH 015: Introduction to Scientific Data Analysis [2]

Fundamental analytical and computational skills to find, assemble and evaluate information, and to teach the basics of data analysis and modeling using spreadsheets, statistical tool, scripting languages, and high-level mathematical languages. Not for students from the School of Engineering. *Prerequisite: MATH 005, which may be taken concurrently, or equivalent score on the Math Placement Exam School of Engineering majors only. Laboratory included.*

MATH 018: Statistics for Scientific Data Analysis [4]

Analytical and computational methods for statistical analysis of data. Descriptive statistics, graphical representations of data, correlation, regression, causation, experiment design, introductory probability, random variables, sampling distributions, inference and significance. Course can not be taken for credit after obtaining credit for Math 32. *Prerequisite: MATH 015 and (MATH 005 or equivalent score on the Math Placement Exam). Letter grade only. Discussion included.*

MATH 021: Calculus I for Physical Sciences and Engineering [4]

An introduction to differential and integral calculus of functions of one variable. Elementary functions such as the exponential and the natural logarithm, rates of change and the derivative with applications to physical sciences and engineering. Course may not be taken for credit after obtaining credit for MATH 011. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam Applied Mathematical Sciences, Physics, Chemical Sciences, Earth Systems Science, and School of Engineering majors only. Letter grade only. Discussion included.*

MATH 022: Calculus II for Physical Sciences and Engineering [4]

Continuation of MATH 021. Analytical and numerical techniques of integration with applications, infinite sequences and series, first order ordinary differential equations. Course may not be taken for credit after obtaining credit for Math 012. *Prerequisite: MATH 021 or ICP 001A Applied Mathematical Sciences, Physics, Chemical Sciences, Earth Systems Science, and School of Engineering majors only. Letter grade only. Discussion included.*

MATH 023: Vector Calculus [4]

Calculus of several variables. Topics include parametric equations and polar coordinates, algebra and geometry of vectors and matrices, partial derivatives, multiple integrals, and introduction to the theorems of Green, Gauss, and Stokes. *Prerequisite: MATH 022. Letter grade only. Discussion included.*

MATH 024: Linear Algebra and Differential Equations [4]

Introduces ordinary differential equations, systems of linear equations, matrices, determinants, vector spaces, linear transformations and linear systems of differential equations. *Prerequisite: MATH 022. Letter grade only. Discussion included.*

MATH 032: Probability and Statistics [4]

Concepts of probability and statistics. Conditional probability, independence, random variables, distribution functions, descriptive statistics, transformations, sampling errors, confidence intervals, least squares and maximum likelihood. Exploratory data analysis and interactive computing. *Prerequisite: MATH 021 or ICP 001A. Discussion included.*

MATH 090X: Freshman Seminar [1]

Topics in mathematics. *Prerequisite: Letter grade only.*

MATH 091: General Topics in Applied Mathematics [1]

Introduction to a variety of concepts useful in applied mathematics. Topics covered included floating point arithmetic, methods of proofs, random walks, stereographic projections, transforms, etc. Students are exposed to advanced mathematical topics in preparation for their ongoing studies. *Prerequisite: MATH 023 and MATH 024, both of which may be taken concurrently. Pass/No Pass grading only.*

MATH 095: Lower Division Undergraduate Research [1-6]

Supervised research in mathematics. *Permission of instructor required. Letter grade only. May be repeated for credit.*

MATH 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MATH 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MATH 122: Complex variables and applications [4]

Introduction to complex variables, analytic functions, contour integration and theory of residues. Mappings of the complex plane. Introduction to mathematical analysis. *Prerequisite: MATH 023 and MATH 024. Letter grade only. Discussion included.*

MATH 125: Intermediate Differential Equations [4]

This course introduces advanced solution techniques for ordinary differential equations (ODE) and elementary solution techniques for partial differential equations (PDE). Specific topics include higher-order linear ODE, power series methods, boundary value problems, Fourier series, Sturm-Liouville theory, Laplace transforms, Fourier transforms, and applications to one-dimensional PDE. *Prerequisite: MATH 023 and MATH 024. Letter grade only. Discussion included.*

MATH 126: Partial Differential Equations [4]

This course introduces students to the theory of boundary value and initial value problems for partial differential equations with emphasis on linear equations. Topics covered include Laplace's equation, heat equation, wave equation, application of Sturm-Liouville's theory, Green's functions, Bessel functions, Laplace transform, method of characteristics. *Prerequisite: MATH 125. Letter grade only. Discussion included.*

MATH 131: Numerical Analysis I [4]

Introduction to numerical methods with emphasis on algorithm construction, analysis and implementation. Programming, round-off error, solutions of equations in one variable, interpolation and polynomial approximation, approximation theory, direct solvers for linear systems, numerical differentiation and integration, initial-value problems for ordinary differential equations. *Prerequisite: MATH 024. Letter grade only. Discussion included.*

MATH 132: Numerical Analysis II [4]

Initial-value problems for ordinary differential equations, interactive techniques for solving linear systems, numerical solutions of nonlinear systems of equations, boundary-value problems for ordinary differential equations, numerical solutions to partial differential equations. *Prerequisite: (MATH 121 or MATH 125) and MATH 131. Letter grade only. Discussion included.*

MATH 140: Mathematical Methods for Optimization [3]

Linear programming and a selection of topics from among the following: matrix games, integer programming, semidefinite programming, nonlinear programming, convex analysis and geometry, polyhedral geometry, the calculus of variations and control theory. *Prerequisite: MATH 023. Letter grade only.*

MATH 141: Linear Analysis I [4]

Applied linear analysis of finite dimensional vector spaces. Review of matrix algebra, vector spaces, orthogonality, least-squares approximations, eigenvalue problems, positive definite matrices, singular value decomposition with applications in science and engineering. *Prerequisite: MATH 131, which may be taken concurrently. Letter grade only. Discussion included.*

MATH 142: Linear Analysis II [4]

Applied linear analysis of infinite dimensional vector spaces. Inner product spaces, operators, adjoint operators, Fredholm alternative, spectral theory, Sturm-Liouville operators, distributions and Green's functions with applications in science and engineering. *Prerequisite: MATH 141. Letter grade only. Discussion included.*

MATH 150: Mathematical Modeling [4]

Introduction to the basics of mathematical modeling emphasizing model construction, analysis and application. Using examples from a variety of fields such as physics, biology, chemistry and economics, students will learn how to develop and use mathematical models of real-world systems. *Prerequisite: MATH 125, which may be taken concurrently, and MATH 131 and MATH 132 and MATH 141. Letter grade only. Discussion included.*

MATH 171: Mathematical Logic [4]

Introduction to the meta-theory of first-order logic. Topics include the consistency, compactness, completeness and soundness proofs for propositional and first-order logic; model theory; the axiomatization of number theory; Godel's incompleteness theorems and related results. *Prerequisite: PHIL 005 or consent of instructor. Discussion included.*

MATH 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

MATH 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MATH 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MATH 201: Teaching and Learning in the Sciences [1]

Students are introduced to 'scientific teaching' - an approach to teaching science that uses many of the same skills applied in research. Topics include how people learn, active learning, designing, organizing and facilitating teachable units, classroom management, diversity in the classroom and assessment design. *Satisfactory/Unsatisfactory grading only.*

MATH 221: Partial-Differential Equations I [4]

Partial differential equations (PDEs) of applied mathematics. Topics include modeling physical phenomena, linear and nonlinear first-order PDEs, D'Alembert's solution, second-order linear PDEs, characteristics, initial and boundary value problems, separation of variables, Sturm-Liouville problem, Fourier series, Duhamel's Principle, linear and nonlinear stability. *Prerequisite: MATH 122 or consent of instructor. Letter grade only. Discussion included.*

MATH 222: Partial-Differential Equations II [4]

Continuation of Math 221. Topics include integral transforms, asymptotic methods for integrals, integral equations, weak solutions, point sources and fundamental solutions, conservation laws, Green's functions, generalized functions, variational properties of eigenvalues and eigenvectors, Euler-Lagrange equations, Maximum principles. *Prerequisite: Math 221 or consent of instructor. Letter grade only. Discussion included.*

MATH 223: Asymptotics and Perturbation Methods [4]

Asymptotic evaluation of integrals, matched asymptotic expansions, multiple scales, WKB, and homogenization. Applications are made to ODEs, PDEs, difference equations, and integral equations to study boundary and shock layers, nonlinear wave propagation, bifurcation and stability, and resonance. *Prerequisite: MATH 222 or consent of instructor. Letter grade only. Discussion included.*

MATH 231: Numerical Solution of Differential Equations I [4]

Examines fundamental methods typically required in the numerical solution of differential equations. Topics include direct and indirect methods for linear systems, nonlinear systems, interpolation and approximation, eigenvalue problems, ordinary-differential equations (IVPs and BVPs), and finite differences for elliptic partial-differential equations. A significant amount of programming is required.

Prerequisite: MATH 132 or consent of instructor. Letter grade only. Discussion included.

MATH 232: Numerical Solution of Differential Equations II [4]

Fundamental methods presented in Math 231 are used as a base for discussing modern methods for solving partial-differential equations. Numerical methods include variational, finite element, collocation, spectral, and FFT. Error estimates and implementation issues are discussed. A significant amount of programming is required.

Prerequisite: Math 231 or consent of instructor. Letter grade only. Discussion included.

MATH 233: Scientific Computing [4]

Theoretical and practical introduction to parallel scientific computing. Survey of hardware and software environments, and selected algorithms and applications. Topics include linear systems, N-body problems, FFTs, and methods for solving PDEs. Practical implementation and performance analysis are emphasized in the context of demonstrative applications in science and engineering.

Prerequisite: Math 232 or consent of instructor. Letter grade only. Discussion included.

MATH 291: Applied Mathematics Seminar [1]

Seminar series covering various topics in applied mathematics presented by faculty, graduate students, and visiting speakers. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

MATH 292: Special Topics in Applied Mathematics [1-4]

Treatment of a special topic or theme in applied mathematics at the graduate level. May be repeated for credit in a different subject area. *Permission of instructor required. Letter grade only. May be repeated for credit.*

MATH 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

MATH 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. May be repeated for credit.*

MATH 299: Directed Independent Study [1-6]

Permission of instructor required. May be repeated for credit.

MATH 399: University Teaching [1]

Centered on a student's classroom experiences as a Teaching Assistant in an undergraduate Applied Mathematics course. Provides a faculty-directed opportunity to implement teaching practices presented in the course Teaching and Learning in the Sciences. Involves video-taping of teaching, peer review, and weekly meetings with faculty. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit once. Laboratory and discussion included.*

MECHANICAL ENGINEERING

ME 120: Component Design [3]

Three-dimensional stress analysis; deflection and stiffness; static and dynamic loading; failure theories and fatigue; fasteners; welded joints; mechanical springs; bearing; gears; shafts; clutches; brakes and couplings; belts and pulleys. *Prerequisite: ENGR 151. Offered spring only. Letter grade only.*

ME 135: Finite Element Analysis [3]

Introduces finite element methods used for solving linear problems in structural and continuum mechanics. Covers modeling, mathematical formulation, and computer implementation. Students develop a 2D plane-stress finite element program. Topics in nonlinear finite-element analysis, heat transfer, and fluid dynamics are introduced as time permits. *Prerequisite: MATH 131. Offered spring only. Letter grade only.*

ME 136: Aerodynamics [3]

Methodologies for conducting wind tunnel experiments; Navier-Stokes Equations; Scaling; Prandtl Systems and Boundary Layer Theory; Circulation; Vorticity; Drag and Lift; Airfoil Theory; Compressible Flows. *Prerequisite: ENGR 120 and MATH 032. Letter grade only. Laboratory included.*

ME 137: Computer Aided Engineering [3]

Introduction to the use of modern computational tools used for design and analysis. Primary focus is on product design with solid modeling and finite-element analysis. Software used is representative of that found in industry. Topics such as 2-D and 3-D drawing, tolerance specification, and FEA validation are also covered. *Prerequisite: ME 135. Offered fall only. Letter grade only. Laboratory included.*

ME 140: Vibration and Control [4]

Dynamics of particles and rigid bodies. Vibration of discrete systems with finite degrees of freedom and continuous structures including beams and plates. Resonance, anti-resonance, damping, and modal coupling. Modal analysis. Proportional, derivative and integral feedback controls of vibrations. Stability concept. Control design by root locus and frequency domain method. *Prerequisite: MATH 024 and ENGR 057. Offered spring only. Letter grade only. Laboratory included.*

ME 142: Mechatronics [4]

Introduction to electro-mechanical systems controlled by microcontroller technology. The course covers theory, design and construction of smart systems; closely coupled and fully integrated products and systems; the synergistic integration of sensors, interfaces, actuators, microcontrollers, control and information technology. *Prerequisite: ENGR 057 and ENGR 065. Offered fall only. Letter grade only. Laboratory included.*

ME 170: Mechanical Engineering Capstone Design [3]

Design project must be selected and approved; project feasibility study and outline of the design project is completed; design methodology, optimization, product reliability and liability, economics, use of ASME codes. A final presentation is given at the end of the semester. *Prerequisite: ME 120 and ENGR 135 and ME 137 and senior standing. Offered spring only. Letter grade only. Laboratory included.*

ME 188: Machine Shop Technology [1]

Introduction to machine shop technology. Study of basic measuring tools, vernier calipers, steel rules, and micrometers, layout tools, hand tools. Emphasis in the theory and practice in the use of vertical milling machine, lathes and drilling machines. *Pass/No Pass grading only. May be repeated for credit twice.*

ME 190: Special Topics in Mechanical Engineering [3]

Lectures on special topics are announced at the beginning of the semester in which the course is offered. Topics may include special mechanisms, non-Newtonian fluid mechanics, non-equilibrium thermodynamics, design methods for special applications, among other possibilities. *Prerequisite: Junior standing. Permission of instructor required. Letter grade only. May be repeated for credit twice.*

ME 195: Upper Division Undergraduate Research [1-4]

Supervised research. *Permission of instructor required. May be repeated for credit.*

ME 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

ME 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MECHANICAL ENGINEERING AND APPLIED MECHANICS

MEAM 201: Advanced Dynamics [4]

Rigid body dynamics, including topics such as: dynamical systems, motion representation and constraints, Newtonian, Lagrangian and Hamiltonian mechanics, stability analysis and introduction to multibody dynamics. *Prerequisite: MATH 024 and ENGR 057. Offered in fall only. Letter grade only. May be repeated for credit once.*

MEAM 202: Transport Phenomena [4]

Systematic analysis of fluid flow, heat transfer and mass transfer phenomena, with emphasis on the analogies and specific techniques used in treating such boundary value problems. *Prerequisite: ES 235 or ENGR 135. Offered spring only. Letter grade only.*

MEAM 210: Linear Control Systems [3]

Concepts related to Feedback Control, State-Space Representation of Dynamic Systems, Dynamics of Linear Systems, Frequency-Domain Analysis, Controllability and Observability, Linear Observers, Compensator Design, Linear Quadratic Optimum Control. *Prerequisite: MATH 024. Letter grade only. May be repeated for credit once.*

MEAM 211: Nonlinear Controls [4]

Phase plane and singularities. Methods for nonlinear analysis. Lyapunov stability theory. Passivity. Lyapunov control design. Topics of nonlinear controls including feedback linearization, sliding control and back stepping design. Adaption algorithms and system identification. Discussion of current research topics in nonlinear controls. *Permission of instructor required. Letter grade only.*

MEAM 220: Continuum Mechanics [4]

Cartesian tensors in mechanics, coordinate transformations, analysis of stress and strain, principal values, invariants, equilibrium and compatibility equations, constitutive relations, field equations; problems in elasticity; computational methods. *Prerequisite: ENGR 120. Offered in fall only. Letter grade only.*

MEAM 221: Rheology [4]

Basic concepts (forces, displacements, stress, tensor, strain, etc.), linear and nonlinear elastic solids, linear viscous fluids, linear viscoelastic fluids and solids, and selected topics in nonlinear viscoelastic behavior. *Letter grade only.*

MEAM 236: Advanced Mass Transfer [4]

Steady and unsteady mass diffusion; mass convection, simultaneous heat and mass transfer; Fick's law in a moving medium; similarity and integral methods in mass transfer; high mass transfer theory; research project in mass transport. *Prerequisite: ES 235 or ENGR 135. Letter grade only. May be repeated for credit once.*

MEAM 237: Radiative Heat Transfer [3]

thermal radiation fundamentals; radiative properties of opaque's surfaces; radiative exchange between opaque surfaces; radiative transfer equation; radiative properties of gases and particles; radiative exchange in participating media. *Prerequisite: Graduate standing; undergraduate physics sequence; undergraduate thermodynamics; undergraduate heat transfer desirable but not essential. Letter grade only.*

MEAM 250: Compressible Flows [4]

This course addresses the effects of compressibility in viscous and inviscid flows; steady and unsteady inviscid subsonic and supersonic flows; method of characteristics; small disturbance theories (linearized and hypersonic); shock dynamics; and hypersonic flows. Students are expected to be conversant in materials that are covered in ENGR 120 or the equivalent course. *Letter grade only.*

MEAM 251: Viscous Flows [4]

Study of the Navier-Stokes equations; Stokes' problems; creeping flows; internal and external flows; similarity and integral methods in boundary layer flows; stability and transition to turbulence. *Prerequisite: ES 235 or ENGR 135. Offered fall only. Letter grade only. May be repeated for credit once.*

MEAM 254: Computational Fluid Dynamics [4]

This course provides fundamentals of computational theory and computational methods. The first part covers material fundamentals to the understanding and application of numerical methods. The second part illustrates the use of such methods in solving different types of complex problems encountered in fluid mechanics and convective heat transfer. *Letter grade only.*

MEAM 280: Variable Order Mechanics [4]

Introduction to fractional calculus and fractional dynamic modeling oscillators; numerical methods for variable order differential equations; viscous particle motion; sedimentation; variable order rheology. Students are expected to be conversant in materials that are covered in MEAM 201 and MEAM 202. *Permission of instructor required. Letter grade only. Discussion included.*

MEAM 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

MEAM 298: Directed Group Study [1-6]

Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.

MEAM 299: Directed Independent Study [1-6]

Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.

MANAGEMENT

MGMT 002: Case Study Seminar on Business and Management [1]

Survey of the field of business management. Invited speakers from local companies and public organizations cover topics that include the business environment, human relations, technology in business, ethical behavior, global and economic forces, organization, quality, products and services, functional management, and current issues and developments. *Prerequisite: ECON 001. May be repeated for credit once.*

MGMT 025: Introduction to Finance [4]

Particular attention is paid to how managers maximize shareholder wealth. This class covers the foundations of financial management, including the time value of money, capital budgeting and evaluation, capital structure, and valuation of various capital sources. *Laboratory included.*

MGMT 026: Introduction to Accounting [4]

A broad introduction and accounting. Students are equipped to draw up and interpret accounts and are introduced to some key ideas of auditing. Covers the fundamental accounting concepts and how to apply them; record accounting entries, prepare accounts for different business entities and understand the differences between them, the basic principles of auditing. *Laboratory included.*

MGMT 090X: Freshman Seminar [1]

Examination of a topic in management. *May be repeated for credit.*

MGMT 092: Internship in Management [1-4]

Provides oversight and structure for a student's internship in a field related to Management in community organizations, professional research projects, etc. connected to the study of Management. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Management. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

MGMT 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

MGMT 097: Service Learning: Engineering Projects in Community Service [1-3]

Multi-disciplinary teams of freshman through senior students work with community organizations to design, build, and implement engineering-based solutions for real-world problems. Students gain insight into the design and development process, and Management students gain practical experience working in a team of engineers and managing a project. Students are encouraged to participate at both the lower division and upper-division (MGMT197) levels. *Permission of instructor required. May be repeated for credit twice.*

MGMT 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MGMT 099: Lower Division Individual Study [1-5]

The objective of an independent study is to provide advanced and capable students an opportunity to pursue a topic of their interest with in depth supervision of a faculty member. The study can be done in combination with an internship in a business or government organization. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.*

MGMT 100: Intermediate Microeconomic Theory [4]

We explore the foundations of microeconomic theory, focusing on the behavior of individuals and firms, and the interaction of these agents in the market. Price determination and resource distribution theory under conditions of perfect and imperfect competition. General equilibrium and welfare economics. *Prerequisite: ECON 001 and (MATH 021 or ICP 001A) or consent of instructor. Discussion included.*

MGMT 101: Intermediate Macroeconomic Theory [4]

Analysis of output, employment, interest rates, and the price level. The effects of these on changes in monetary and fiscal variables. *Prerequisite: ECON 001 and (MATH 021 or ICP 001A) or consent of instructor. Discussion included.*

MGMT 115: Economics of Industrial Organization [4]

The organization and structure of industrial production in the United States economy. *Prerequisite: ECON 100 or MGMT 100.*

MGMT 116: Organizational Strategy [4]

Discussion of critical issues in the design and functioning of effective organizations. Topics covered include: the boundary of the firm, firm structure, arrangements within the firm, alliances and contracts between firms, and trust and culture in the firm. *Prerequisite: ECON 001.*

MGMT 120: Marketing [4]

Marketing is about identifying consumer needs, developing products and services which meet the changing consumer needs or market conditions. We provide an examination of principles of customer marketing as well as business-to-business marketing. It focuses those aspects of marketing which most frequently demand strategic attention in any business. *Prerequisite: Junior standing or consent of instructor.*

MGMT 121: The Economics of Money, Banking, and Financial Institutions [4]

This course addresses issues of money, banking, and financial institutions. Topics covered include: the structure of central banks and the Federal Reserve system, theories of money demand and money supply, the relationship between money supply and overall economic activity, and the role the Federal Reserve plays in economic stabilization. *Prerequisite: ECON 001. Letter grade only.*

MGMT 130: Econometrics [4]

Introduction of problems of observation, estimation and hypotheses testing in economics through the study of the theory and application of linear regression models, critical evaluation of selected examples of empirical research and exercises in applied economics. *Prerequisite: (ECON 010 or POLI 010) and (MATH 021 or ICP 001A). Letter grade only. Laboratory included.*

MGMT 135: Business Law [4]

Conceptual and functional analysis of legal principles relevant to the conduct and understanding of commercial business transactions. Topics include personal and real; government regulations; negotiable instruments; debtor/creditor relationships; and bankruptcy and reorganization. Salient legal aspects of international business are also discussed. *Prerequisite: MGMT 025 and MGMT 026 or consent of instructor.*

MGMT 141: Industrial Relations and Human Resource Economics [4]

Examines how firms make decisions involving human resources. Topics covered include employee hiring and recruitment, compensation and use of incentives, and employee motivation and teamwork. Builds on both economic theory and practical examples to illuminate key concepts. *Prerequisite: ECON 100 or MGMT 100. Letter grade only.*

MGMT 150: Services Science and Management [4]

Services - e.g., restaurants, hotels, lawyers, information technology operations, business consulting -- account for more than 70% of the US economy. Through case studies of businesses and scientific studies of people in real service settings, we focus on how to align people and technology effectively to generate value. *Prerequisite: ECON 001. Letter grade only.*

MGMT 151: Public Economics [4]

The influence of governmental revenue and expenditure decisions on economic performance. Examines such issues as public goods and externalities, as well as specific expenditure and taxation programs. *Prerequisite: ECON 100 or MGMT 100.*

MGMT 152: Law and Economics [4]

The economic analysis of legal rules and institutions, including property, contract, and tort law. We also consider issues surrounding crime and punishment. *Prerequisite: ECON 100 or MGMT 100.*

MGMT 153: Judgment and Decision Making [4]

An introduction to the study of human judgment and decision making. Topics include decision making under uncertainty, financial choices, health decision making, group decisions, rational theories of choice behavior, and improving decision making. The material is related to cognitive science, psychology, economics, and other social sciences. *Prerequisite: COGS 001 or PSY 001.*

MGMT 154: Cognitive Science Applications for Management [4]

Covers thought, behavior, and interaction in modern businesses, where knowledge workers interact with one another and with technology. Topics include business decision making, risk behavior, attitudes toward risk, planning, communication, information management, information systems, human-computer interaction, neuroeconomics, and organizational behavior. *Prerequisite: COGS 001 or PSY 001 or consent of instructor.*

MGMT 155: Decision Analysis in Management [4]

Presents the tools of decision science using a quantitative approach, with a focus on investment, finance and management decisions. These tools include decision tree analysis, risk and uncertainty analysis, stochastic dominance, the value of information, probability bias, and subjective probability. *Prerequisite: (ECON 100 or MGMT 100) and (ECON 010 or POLI 010) or consent of instructor.*

MGMT 160: International Microeconomics [4]

This is a course in international microeconomics at the intermediate level. Standard microeconomics is the study of decision-making by various types of agents under various constraints and in various environments. International microeconomics examines such decision-making in a world of many different decision-makers, objectives, outputs, and countries. *Prerequisite: ECON 100 or MGMT 100.*

MGMT 165: Intermediate Finance [4]

Expansion upon the ideas introduced in MGMT 25, by exploring advanced capital budgeting topics, (estimating future operating cash flows and analyzing real options), financing decisions (corporate structure and restructuring, long-term financing, securities), advanced working capital management, and multinational finance. *Prerequisite: MGMT 025.*

MGMT 173: Advanced Judgment and Decision Making [4]

Advanced study of recent research on judgment and decision making, such as behavioral economics, rationality and intelligence, health and medical decision making, decision neuroscience. *Prerequisite: COGS 153 or MGMT 153.*

MGMT 180: Entrepreneurship [4]

Integrates the skills students have developed in prior MGMT courses, and provides a framework for the consideration of new business ventures. Topics covered include: market research, creation of a formal business plan, marketing strategy, financing, establishing channels of distribution and bringing products or services to market. *Prerequisite: MGMT 165 and junior standing or consent of instructor.*

MGMT 191: Topics in Management [4]

Intensive treatment of a special topic or problem in management. May be repeated for credit in different subject areas. *Prerequisite: MGMT 025 and MGMT 026 and junior standing or consent of instructor. May be repeated for credit three times.*

MGMT 192: Internship in Management [1-4]

Provides oversight and structure for a student's internship in a field related to Management in community organizations, professional research projects, etc. connected to the study of Management. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Management. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

MGMT 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

MGMT 196: Case Study Seminar in Management [4]

Seminar and capstone experience presents case studies in the field of business management. Issues explored are the ethical behavior, global and economic forces, organization, quality, products and services, functional management, and current issues and developments. Students work in teams analyzing the cases presented. *Prerequisite: MGMT 025 and MGMT 026 and ECON 010 and (ECON 130 or MGMT 130) and (ECON 100 or MGMT 100) and senior standing or consent of instructor. Management majors only. Letter grade only.*

MGMT 197: Service Learning: Engineering Projects in Community Service [1-3]

Multi-disciplinary teams of freshman through senior students work with community organizations to design, build, and implement engineering-based solutions for real-world problems. Students gain insight into the design and development process, and Management students gain practical experience working in a team of engineers and managing a project. Students are encouraged to participate at both the lower division (MGMT197) and upper-division (MGMT197) levels. *Permission of instructor required. May be repeated for credit twice.*

MGMT 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MGMT 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MGMT 290: Labor Studies Seminar [3]

Research presentations by visiting scholars in the area of quantitative labor studies. *Satisfactory/Unsatisfactory grading only.*

MATERIALS SCIENCE AND ENGINEERING

MSE 110: Solid State Materials Properties [4]

Structure of atomic and molecular solids; crystallography of inorganic and organic solids; symmetry; short range order; 1-, 2- and 3- dimensional defects; energy levels; band theory of conductors, semiconductors and insulators; mechanical, thermal, optical and magnetic properties of materials and their relevance to processing and devices. *Prerequisite: CHEM 002 and ENGR 045 and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008). Laboratory and discussion included.*

MSE 111: Materials Processing [4]

Thermodynamics of solid solutions; enthalpy, entropy and free energy of mixing; Ellingham diagrams; phase diagrams for 2- and 3- component systems; phase rule; lever rule; nucleation and growth; spinodal decomposition; control of microstructure; materials extraction/synthesis, forming and joining processes. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and CHEM 002 and ENGR 045*

MSE 112: Materials Selection and Performance [3]

Design considerations in the use of materials; safety factors; statistical methods of assessing performance; quality control; selecting materials to optimize multiple properties; materials failure; long-term materials properties, materials behavior under extreme conditions; corrosion. *Prerequisite: MSE 110 and MSE 111*

MSE 113: Materials Characterization [4]

Characterization of materials structure and properties. Interactions between electromagnetic radiation and matter, and between electron beams and matter. Principles of image formation; Fourier methods and convolution; image processing. X-ray diffraction, optical and electron imaging and diffraction; scanned probe methods. Thermal analysis. Mechanical property and failure characterization. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and PHYS 009 Offered spring only. Letter grade only. Laboratory included.*

MSE 114: Polymeric Materials [3]

Polymer synthesis, characterization and processing techniques. Relationships between configuration, conformation, molecular order, microstructure and properties of polymeric materials; concepts relevant to tailoring polymer molecules and microstructures for specific applications. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and CHEM 002 and CHEM 008 and PHYS 009 and ENGR 045 and junior standing or consent of instructor. Offered spring only. Letter grade only. Laboratory included.*

MSE 115: Ceramic Materials [3]

Crystallography of inorganic compounds; packing and connectivity of co-ordination polyhedral. Defects in ionic and covalent crystals and their effect on properties. Ceramics, glasses and cements. Engineering ceramics. Production of powders; compaction; sintering; control of nanostructure and microstructure; bulk defects. Zeolites. Hydration of cement and concrete. Biological ceramics. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and PHYS 009 and ENGR 045.*

MSE 116: Composites [3]

Hard materials and soft materials. Roles of matrix and filler phases. "Rule of mixtures" as a function of morphology and connectivity. Length scale effects: nanocomposites, microcomposites and macrocomposites. Biological composites. Porous materials. Interface characteristics and their effect on properties. Toughening mechanisms in composites. Processing and joining. Structure and property characterization. *Prerequisite: PHYS 009 and ENGR 045.*

MSE 117: New Materials [3]

Materials requirements for electronics, communication, transportation, energy, data storage, homeland security, healthcare. Non-linear optical materials. Liquid crystals. "Whole life cycle" concepts and sustainability. Green materials. Self-assembling materials. Self healing materials. Biological and bioinspired materials. Biomedical materials. *Prerequisite: (ICP 001A or MATH 021) and (ICP 001B or PHYS 008) and PHYS 009 and ENGR 045 Offered spring only.*

MSE 118: Introduction to Nanotechnology and Nanoscience [3]

An introduction for engineers in nanotechnology and nanoscience. Topics covered include nanoscale phenomena; nanofabrication (top-down and bottom-up approaches); and applications relevant to engineering, the physical sciences and biology. Interdisciplinary aspects of nanotechnology and nanoscience are discussed, including perspectives from materials science, chemistry, physics, and biology. *Prerequisite: (MATH 021 or PHYS 008 or ICP 001A or ICP 001B) and CHEM 002 Offered fall only. Letter grade only.*

MSE 119: Materials Modeling [3]

Difference between modeling and theory. Atomic and molecular scale modeling. Ab initio, Monte Carlo and molecular dynamics methods. Lattice models. Mesoscale and multiscale modeling. Finite element methods. Modeling phase separation, nanostructure and microstructure evolution and material properties. *Prerequisite: MATH 023 and MATH 024 and (ICP 001A or MATH 021) and (ICP 001B or PHYS 008)*

MSE 120: Materials Capstone Design [3]

Design project based on materials selection and performance evaluation, with reference to engineering standards and realistic constraints that include most of the following considerations: economic environmental, sustainability, processability, ethical, health and safety, social, political. *Prerequisite: MSE 112 and MSE 113.*

MSE 126: Nanodevice Fabrication: Bridging Research and Education [3]

This course will teach basic properties of nanomaterials and their applications (the lecture part). A nanoscale transducer will be chosen as a sensing element and sensors will be fabricated and tested (the lab part). The interactive and Experiential education will be blended into theoretical concept teaching. *Prerequisite: CHEM 002 and (PHYS 009 or PHYS 019) and (ENGR 065 or BIOE 102 or BIOE 103) and junior standing. Letter grade only. Laboratory included.*

MSE 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

MSE 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

MSE 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

NATURAL SCIENCES EDUCATION

NSED 023: Introduction to Teaching Science in Elementary School [1]

Introduction to teaching science in elementary school. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. Activities include seminars, discussions, and experimentation using inquiry-based learning modules.

NSED 024: Fieldwork: Introduction to Teaching Science in Elementary School [1]

Fieldwork component for the NSED 23 course. Classroom observations and teaching practicum at an elementary school under the guidance of a mentor teacher. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. NSED 023 must be taken concurrently.

NSED 033: Introduction to Teaching Mathematics in Elementary School [1]

Introduction to teaching mathematics in elementary school. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. Activities include seminars, discussions, and experimentation using inquiry-based learning modules.

NSED 034: Fieldwork - Introduction to Teaching Mathematics in Elementary School [1]

Fieldwork component for the NSED 33 course. Classroom observations and teaching practicum at an elementary school under the guidance of a mentor teacher. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. NSED 033 must be taken concurrently.

NSED 043: Introduction to Teaching Science in Middle School [1]

Introduction to teaching science in middle school. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. Activities include seminars, discussions, and experimentation using inquiry-based learning modules.

NSED 044: Fieldwork - Introduction to Teaching Science in Middle School [1]

Fieldwork component for the NSED 43 course. Classroom observations and teaching practicum at a middle school under the guidance of a mentor teacher. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. NSED 043 must be taken concurrently.

NSED 053: Introduction to Teaching Mathematics in Middle School [1]

Introduction to teaching mathematics in middle school. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. Activities include seminars, discussions, and experimentation using inquiry-based learning modules.

NSED 054: Fieldwork - Introduction to Teaching Mathematics in Middle School [1]

Fieldwork component for the NSED 53 course. Classroom observations and teaching practicum at a middle school under the guidance of a mentor teacher. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. NSED 053 must be taken concurrently.

NSED 063: Introduction to Teaching Science in High School [1]

Introduction to teaching science in high school. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. Activities include seminars, discussions, and experimentation using inquiry-based learning modules.

NSED 064: Fieldwork - Introduction to Teaching Science in High School [1]

Fieldwork component for the NSED 63 course. Classroom observations and teaching practicum at a high school under the guidance of a mentor teacher. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. NSED 063 must be taken concurrently.

NSED 073: Introduction to Teaching Mathematics in High School [1]

Introduction to teaching mathematics in High school. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. Activities include seminars, discussions, and experimentation using inquiry-based learning modules.

NSED 074: Fieldwork - Introduction to Teaching Mathematics in High School [1]

Fieldwork component for the NSED 73 course. Classroom observations and teaching practicum at a high school under the guidance of a mentor teacher. Emphasis on inquiry-based learning practices and effective research-based teaching strategies. NSED 073 must be taken concurrently.

NSED 090X: Introduction to Teaching Science/Math [1]

Freshman seminar. *Pass/No Pass grading only.*

NSED 095: Lower Division Undergraduate Research [1-6]

Supervised research. *Permission of instructor required. May be repeated for credit.*

NSED 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit. Discussion included.

NSED 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

NSED 100: Introduction to Instruction, Assessment, and Management for Beginning Teachers [4]

The course prepares students for careers in K-12 education. Students gain knowledge of classroom management strategies and learn how to organize a classroom, to plan units and to develop lesson plans. A special focus will be the techniques necessary to effectively teach in multicultural and multilingual schools. *Letter grade only.*

NSED 120: Diversity in Education [4]

Focusing on American education, we examine historical and current issues of diversity, noting controversial initiatives such as mainstreaming, bilingual education, multiculturalism, and gender-neutral or gender-segregated instruction. Students also consider cultural and linguistic challenges of teaching English language learners, including those who are generation 1.5 students. *Letter grade only. Discussion included.*

PHILOSOPHY**PHIL 001: Introduction to Philosophy [4]**

An introduction to the main areas of philosophy using classic and contemporary sources. Consideration of central and enduring problems in philosophy, such as skepticism about the external world, the mind-body problem and the nature of morality. *Discussion included.*

PHIL 005: Logic and Critical Reasoning [4]

Introduction to formal and informal logic. Topics include argumentation analysis, fallacies, soundness vs. validity, inductive vs. deductive reasoning, truth tables, proof techniques in statement and predicate logic, and the probability calculus. *Discussion included.*

PHIL 009: Phenomenology and Existentialism [4]

Consideration of central themes in phenomenology and existentialism and their philosophical origins in nineteenth century philosophy. Readings from such figures as Nietzsche, Husserl, Sartre, Freud, Merleau-Ponty, and Heidegger.

PHIL 090X: Freshman Seminar [1]

Examination of a topic in philosophy. *May be repeated for credit.*

PHIL 092: Internship in Philosophy [1-4]

Provides oversight and structure for a student's internship in a field related to philosophy in community organizations, professional research projects, etc. connected to the study of philosophy. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of philosophy. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

PHIL 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PHIL 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHIL 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHIL 101: Metaphysics [4]

Inquiry into the fundamental nature of reality: the categories of being; the differences between abstract entities, concrete entities, substances, properties, and processes; what constitutes identity of objects through time; necessity and possibility; free will and determinism; space, time, and causation. *Prerequisite: PHIL 001 and PHIL 005 or consent of instructor.*

PHIL 103: Philosophy of the Mind [4]

Selected topics in the philosophy of mind, including the relation between mind and body, the self, personal identity, consciousness, the unconscious, materialism, functionalism, behaviorism, determinism and free will, and nature of psychological knowledge.

PHIL 104: Ethical Theory [4]

An examination of core issues in moral philosophy. Topics may include: the nature of moral judgments, methods of ethical decision making, the relationship between morality and self-interest, and proposed resolutions to situations involving conflicting moral principles. *Prerequisite: PHIL 001 or consent of instructor. Letter grade only.*

PHIL 105: Philosophy of Language [4]

What is language? How do symbols, sounds, and gestures carry information? In this course we will study work by both philosophers and linguists on the nature of language, meaning, reference, and truth. *Prerequisite: PHIL 005 and junior standing or consent of instructor. Letter grade only.*

PHIL 107: Philosophy of Religion [4]

An examination of core issues in the philosophy of religion, using classical and contemporary sources. Topics may include: arguments for and against the existence of God, differing concepts of the divine, the rationality of religious belief, mysticism, divine foreknowledge and free will, death and immortality. *Prerequisite: PHIL 001 and junior standing or consent of instructor.*

PHIL 108: Political Philosophy [4]

An examination of core issues in political philosophy. Topics may include: descriptive and normative analyses of institutions, alternative justifications of political authority, classical and modern accounts of the social contract, theories of justice. *Prerequisite: PHIL 001. Letter grade only.*

PHIL 110: Philosophy of Cognitive Science [4]

Consideration of philosophical and foundational issues in cognitive science, including the Turing Test, the Chinese Room argument, the nature of cognitive architecture, animal cognition, connectionism vs. symbolic artificial intelligence, and the possibility of thinking machines. *Prerequisite: PHIL 001 and (COGS 001 or PSY 001).*

PHIL 111: Philosophy of Neuroscience [4]

Questions at the intersection of philosophy and neuroscience. Relevance of recent research in neuroscience to epistemology and metaphysics. Specific topics include the mind-body problem, free will, consciousness, religion, and the nature of the self.

PHIL 134: Modern Philosophy [4]

An examination of the works of several of the most important philosophers of the 17th and early 18th centuries. Special attention will be devoted to the new theories of knowledge and the new moral theories proposed during this time. *Prerequisite: PHIL 001 or consent of instructor. Letter grade only.*

PHIL 150: Topics in Phenomenology [4]

Study of the foundations of phenomenology in Husserl and its background in Bolzano, Frege, Brentano, Meinong, Kant, and Descartes. Topics include phenomenological method, theory of intentionality, meaning, perception, evidence, ego, other minds, intersubjectivity, and the life-world, as well as application of phenomenological methods to themes in natural science, social science, art, and literature. *May be repeated for credit once.*

PHIL 160: Mathematical Logic [4]

Introduction to the meta-theory of first-order logic. Topics include the consistency, compactness, completeness and soundness proofs for propositional and first-order logic; model theory; the axiomatization of number theory; Godel's incompleteness theorems and related results. *Prerequisite: PHIL 005 or consent of instructor. Discussion included.*

PHIL 170: Philosophy, Politics and Economics [4]

We will explore issues in the intersection of philosophy, political theory and economic theory. We will consider how discoveries in political science and economics can advance some debates in traditional political and moral philosophy. Conversely, we will consider how the insights and methods of philosophy influence economics and political science.

Prerequisite: PHIL 001 or consent of instructor. Letter grade only.

PHIL 190: Advanced Seminar in Philosophy [4]

Intensive treatment of a special topic or problem within philosophy. May be repeated for credit in different subject area.

Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit once.

PHIL 192: Internship in Philosophy [1-4]

Provides oversight and structure for a student's internship in a field related to philosophy in community organizations, professional research projects, etc. connected to the study of philosophy. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of philosophy. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

PHIL 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PHIL 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHIL 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHYSICS

PHYS 005: Energy and the Environment [3]

Introduction to energy and the environment. Examines different types of renewable and nonrenewable energy sources and the environmental effects of using these energy resources. We cover environmental, economic and sustainability considerations associated with fossil fuels and alternative energy sources. *Letter grade only.*

PHYS 006: The Cosmos, Science and You [4]

Introduction to physics and astronomy for non science and engineering majors. Topics include: Scientific method as illustrated by astronomical discoveries about the Cosmos; and the concepts of matter and energy; and the formation of the Universe, galaxies, stars and the Solar System. Throughout the course our physical connection and dependence the Cosmos are illustrated using new discoveries in astrophysics, astrochemistry and astrobiology. *Discussion included.*

PHYS 008: Introductory Physics I [4]

Introduction to classical and contemporary physics. Intended for students with preparation in calculus and algebra. Topics include introduction to forces, kinetics, equilibria, fluids, waves, and heat. Experiments and computer exercises are integrated into the course content. *Prerequisite: MATH 021 or ICP 001A, either of which may be taken concurrently. Laboratory and discussion included.*

PHYS 009: Introductory Physics II [4]

Continuation of introduction to classical and contemporary physics. Topics include introduction to electricity, magnetism, electromagnetic waves, optics, and modern physics. Experiments and computer exercises are integrated into the course content.

Prerequisite: (PHYS 008 or ICP 001B) and (MATH 021 or ICP 001A) and (MATH 022 or MATH 030, either of which may be taken concurrently). Laboratory and discussion included.

PHYS 010: Introductory Physics III [4]

An introduction to developments in modern physics over the last 100 years that have radically altered our view of nature. Particular emphasis is placed on the quantum theory, with applications to atoms, molecules, solids, and light. *Prerequisite: (PHYS 008 or PHYS 018 or ICP 001B) and MATH 024, which may be taken concurrently, and (PHYS 009 or PHYS 019, either of which may be taken concurrently). Laboratory included.*

PHYS 012: Light, Color, and Vision [4]

Introduction to the physics, chemistry, and biology of light and vision for nonscientists. Covers basic optics, optical instruments, photography, light and color in nature, human and animal vision, visual perception and optical illusions, and aspects of modern technology including fiber optics and lasers. Includes classroom demonstrations and out-of-class observational exercises.

Discussion included.

PHYS 018: Introductory Physics I for Biological Sciences [4]

First introductory physics course for biological science majors. Topics include vectors, kinematics, Newton's Laws, Work, Energy and Conservation, Torque and rotation, Fluids and Elasticity, Oscillations and Waves all with an emphasis on biological applications. *Prerequisite: MATH 021 or ICP 001A or MATH 011, all of which may be taken concurrently. Letter grade only. Laboratory and discussion included.*

PHYS 019: Introductory Physics II for Biological Sciences [4]

The physical principles of electromagnetism and thermodynamics are introduced, examined, and discussed in the context of biological applications. *Prerequisite: (MATH 011 or MATH 021 or ICP 001A) and (PHYS 008 or PHYS 018). Laboratory and discussion included.*

PHYS 090X: Freshman Seminar [1]

Examination of a topic in physics. *May be repeated for credit.*

PHYS 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PHYS 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHYS 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHYS 104: Biophysics [4]

This course aims to give students an understanding of relevant physical principles for biological systems, introduce them to experimental and theoretical techniques of biophysics and to communicate the excitement of cutting-edge biophysics research. Topics include diffusion, fluids, entropic forces, motor proteins, enzymes, nerve impulses, networks and evolution. *Prerequisite: (PHYS 018 or PHYS 008) and (PHYS 019 or PHYS 009). Letter grade only. Discussion included.*

PHYS 105: Analytic Mechanics Core [4]

Rigorous, mathematical foundation in classical mechanics. Topics include Newtonian mechanics; motion of particles in one, two and three dimensions; central force motion; moving coordinate systems; mechanics of continuous media; oscillations; normal modes; Lagrange's equations; and Hamiltonian methods. *Prerequisite: MATH 023 and MATH 024, both of which may be taken concurrently, and MATH 022 and (PHYS 008 or ICP 001B or PHYS 018). Letter grade only. Discussion included.*

PHYS 108: Thermal Physics Core [4]

This course aims to give students a deep understanding of the fundamental principles of thermal physics. Topics include probability, ensembles, equilibrium, entropy, laws of thermodynamics, heat engines, magnetism, chemical equilibria and quantum statistics. *Prerequisite: PHYS 009 or PHYS 019. Letter grade only. Discussion included.*

PHYS 110: Electrodynamics Core [4]

Intermediate Electrodynamics. Topics covered include vector calculus including divergence, curl and vector field theorems; Electrostatics including field, potential, work and energy; Laplace's equation including solutions in different geometries, separating variables, method of images and multipole expansions; Electrostatics in media including polarization and dielectrics (linear/nonlinear); Magnetostatics including the Biot-Savart Law, Ampere's Law and vector potentials; Magnetic fields in matter including magnetization, linear and non-linear media; and Electrodynamics including EMF, induction and Maxwell's equations as well as conservation of charge, energy, and momentum in EM fields. *Prerequisite: PHYS 009 and MATH 023. Discussion included.*

PHYS 111: Electromagnetic Radiation Minicourse [2]

This half-semester minicourse covers plane electromagnetic waves including polarization, reflection, refraction and dispersion. Electromagnetic waves in wave guides and cavities also are covered. Additional topics include radiation, both dipole and multipole as well as scattering and diffraction. *Prerequisite: PHYS 110 and PHYS 122. Discussion included.*

PHYS 112: Statistical Mechanics [4]

Covers the fundamental concepts of statistical mechanics, which form the microscopic basis for thermodynamics. Topics include applications to macroscopic systems, condensed states, phase transformations, quantum distributions, elementary kinetic theory of transport processes, and fluctuation phenomena. *Prerequisite: PHYS 108. Letter grade only. Discussion included.*

PHYS 120: Physics of Materials [4]

Electrical, optical, and magnetic properties of solids. Free electron model, introduction to band theory. Crystal structures and lattice vibrations. Mechanisms and characterization of electrical conductivity, optical absorption, magnetic behavior, dielectric properties, and p-n junctions. *Prerequisite: PHYS 009 and CHEM 112. Laboratory included.*

PHYS 122: Waves Minicourse [2]

This half-semester minicourse covers wave phenomena and associated mathematical methods in Physics. Topics include: coupled oscillations and normal modes, polarization, Fourier analysis, superposition, interference, and diffraction. *Prerequisite: PHYS 009 and MATH 024. Discussion included.*

PHYS 124: Atomic Structure Minicourse [2]

This half-semester minicourse develops the quantum theory of atomic structure, focusing on the hydrogen atom. It builds on PHYS 137 and gives students a chance to see quantum mechanics "in action". Material covered includes: angular momentum and spin, spherical harmonics, hydrogen eigenstates, spin-orbit coupling, radiative transitions, and the Stark effect. *Prerequisite: PHYS 137. Discussion included.*

PHYS 126: Special Relativity Minicourse [2]

This half-semester minicourse introduces the exciting and thought-provoking physics of special relativity. Topics include hallmark experiments; Lorentz transformations; time dilation and length contraction; relativistic optics; tensor techniques; mass, energy, and momentum; relativistic mechanics; and relativistic electricity and magnetism. *Prerequisite: PHYS 009 PHYS 110 recommended. Discussion included.*

PHYS 137: Quantum Mechanics Core [4]

This course covers the fundamentals of quantum mechanics, which forms the foundation of our modern understanding of matter at the atomic and molecular level. Topics include the Schrodinger equation, Hilbert spaces, the operator formalism, the Heisenberg Uncertainty Principle, tunneling, perturbation and WKB theory, fermions, and bosons. *Prerequisite: PHYS 10 and MATH 023 and MATH 024. Discussion included.*

PHYS 141: Condensed Matter Physics [4]

This course is an introduction to the physics of materials designed for upper level undergraduate students in physics or chemistry. The course will cover traditional solid state physics and include topics in soft matter. This class will examine the relationship between microscopic structure and bulk properties in different materials. *Prerequisite: (PHYS 137 or CHEM 112) and (PHYS 112 or CHEM 113). Letter grade only. Discussion included.*

PHYS 144: Modern Atomic Physics [4]

The description and calculation of the properties of atomic energy levels based on the central field approximation. Modern experimental methods in atomic physics and some of the important physics obtained from them. Examples include magnetic resonance, lasers and masers, ion and neutral atom traps, optical pumping and beam foil spectroscopy. *Prerequisite: PHYS 124. Discussion included.*

PHYS 148: Modern Optics [4]

Geometrical optics, radioactive transfer, partial coherence, lasers, quantum optics. *Prerequisite: PHYS 111. Discussion included.*

PHYS 150: Energy Sources [3]

Fossil energy resources, nuclear energy, solar energy, and other renewable energy sources (wind, hydro, geothermal.) *Prerequisite: (ICP 001B or PHYS 008 or MATH 022) and PHYS 009.*

PHYS 151: Solar Energy [3]

The solar energy resource, modeling and simulation, thermal collectors, photovoltaic collectors, solar energy systems, special applications (solar lasers, material processing). *Prerequisite: MATH 022 and PHYS 009.*

PHYS 159: Particle Physics [4]

Tools of particle and nuclear physics. Properties, classification, and interactions of particles including the quark-gluon constituents of hadrons. High-energy phenomena analyzed by quantum mechanical methods. Quantum number determination of resonances, hadron structure functions, introductory electroweak theory with Dirac matrices, Standard Model (overview), grand unified theories. *Prerequisite: PHYS 137. Discussion included.*

PHYS 160: Modern Physics Lab [4]

Provides a rigorous foundation in physics laboratory techniques, with an emphasis on hands-on laboratory training. The nature of the experiments available to students cover a range of modern topics, from nonlinear dynamics and chaos through nonlinear optics and spectroscopy. Emphasis is placed on error estimation, data analysis, and interpretation. *Prerequisite: PHYS 010 or consent of instructor. Laboratory included.*

PHYS 161: Astrophysics and Cosmology [3]

Elements of general relativity. Physics of pulsars, cosmic rays, black holes. The cosmological distance scale, elementary cosmological models, properties of galaxies and quasars. The mass density and age of the universe. Evidence for dark matter and concepts of the early universe and of galaxy formation. Reflections on astrophysics as a probe of the extrema of physics. *Prerequisite: MATH 022 and PHYS 009.*

PHYS 192: Special Topics in Physics [1-4]

Treatment of a special topic or theme in Physics. May be repeated for credit in a different subject area. This is a variable unit course: 1 to 4 units. *Prerequisite: PHYS 009 or PHYS 019 or consent of instructor. May be repeated for credit six times.*

PHYS 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PHYS 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHYS 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PHYS 204: Biophysics [4]

This course aims to give students an understanding of relevant physical principles for biological systems, introduce them to experimental and theoretical techniques of biophysics and to communicate the excitement of cutting-edge biophysics research. Topics include diffusion, fluids, entropic force, motor proteins, enzymes, nerve impulses, networks and evolution. *Letter grade only. Discussion included.*

PHYS 205: Classical Mechanics [4]

Topics in classical mechanics, including Lagrangian and Hamiltonian formulations, Conservation Laws and Symmetry and the relationship, Calculus of variations and variational principle, Euler angles and rigid body dynamics, Oscillations and normal modes. *Letter grade only. Discussion included.*

PHYS 210: Electrodynamics and Optics I [4]

Introduction to electrodynamics. Electrostatics including Poisson and Laplace Equations, Green's Theorem and different Boundary Value Problems, Polarizability, Susceptibility and dielectric media. Magnetostatics, Maxwell's equations, Plane Electromagnetic Waves, Polarization of light, Electromagnetic radiation in different media. *Letter grade only. Discussion included.*

PHYS 211: Electrodynamics and Optics II [4]

Continuation of electrodynamics. Wave guides and resonant cavities, Multipole radiation, Relativistic charged particles in electromagnetic fields, Collisions between charged particles and radiation from moving charges with relativistic corrections, introductory magnetohydrodynamics. *Letter grade only. Discussion included.*

PHYS 212: Statistical Mechanics [4]

Topics include: General principles of statistical mechanics including microcanonical, macrocanonical and grand canonical ensembles, fluctuations and equilibrium. Thermodynamics including Legendre transforms and Maxwell relations, fluctuations and stability and Landau theory. Quantum statistical mechanics including Bose-Einstein and Fermi-Dirac statistics. *Letter grade only. Discussion included.*

PHYS 237: Quantum Mechanics I [4]

Introductory Quantum Mechanics starting with simple Quantum two-state systems and one-dimensional problems, Uncertainty relations, Solution of Schrodinger's equation for important two and three dimensional physical situations, Angular momentum, identical particles and spin statistics. Hydrogen and multi-electron atoms. *Letter grade only. Discussion included.*

PHYS 238: Quantum Mechanics II [4]

Perturbation methods, both stationary and time-dependent, Scattering, interaction with electromagnetic fields, Stark effect, Measurement theory and decoherence, Quantum Hall effect. *Letter grade only. Discussion included.*

PHYS 241: Condensed Matter Physics [4]

This course is an introduction to the physics of materials designed for graduate students in physics or chemistry. The course will cover traditional solid state physics and include topics in soft matter. This class will examine the relationship between microscope structure and bulk properties in different properties. *Prerequisite: Students should have taken classes in electrodynamics, thermal physics and introductory quantum mechanics. Letter grade only. Discussion included.*

PHYS 249: Introduction to Quantum Field Theory [1-4]

This course introduces quantum field theory with a special emphasis on quantum electrodynamics (QED). Topics include canonical quantization of scalar fields, electromagnetic fields, perturbation theory and renormalization methods among others. *Prerequisites: Phys 238. Letter grade only. Discussion included.*

PHYS 290: Current Topics in Physics and Chemistry [3]

Exploration of current research directions, problems, and techniques in molecular and materials chemistry, physics and engineering. Course format emphasizes student-led presentation, analysis, and discussion of reading assignments from the current and recent scientific literature. Topics determined by the instructor and changes each semester. *May be repeated for credit.*

PHYS 291: Physics and Chemistry Seminar [1]

Graduate seminar on current research in molecular and materials chemistry, physics, and engineering. *Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

PHYS 292: Special Topics in Physics [1-4]

Treatment of a special topic or theme in Physics at the graduate level. May be repeated for credit in a different subject area. *Prerequisite: Graduate standing or consent of instructor. May be repeated for credit. Laboratory included.*

PHYS 293: Physics Colloquium [1]

This is a colloquium series with talks on a wide range of research topics in Physics. Speakers for the colloquia are primarily invited researchers from other Institutions. Some of the seminars additionally showcase the research performed by UC Merced Physics faculty, post doctoral researchers and graduate students. This is a forum to introduce the undergraduate and graduate students to cutting edge research in Physics conducted on-site and elsewhere, and to give them an opportunity to meet researchers and faculty from other Universities/Research Institutions. *Satisfactory/Unsatisfactory grading only. May be repeated for credit six times.*

PHYS 295: Graduate Research [1-15]

Supervised research. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

PHYS 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

PHYS 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

POLITICAL SCIENCE**POLI 001: Introduction to American Politics [4]**

A general introduction to political institutions and political behavior in the United States. Specific topics include the U.S. Constitution, Congress, the presidency, the federal judiciary, political parties, interest groups, mass public opinion, elections, and voting behavior. *Discussion included.*

POLI 002: Controversies in American Politics [4]

Examination of select problems in contemporary American politics. Possible subjects include campaign finance, culture wars and party polarization, barriers to third party success, and media coverage of politics. *Discussion included.*

POLI 003: Introduction to Comparative Politics [4]

Introduction to the cross-national study of political institutions and behavior. Formal and informal aspects of politics in selected countries are covered, as are comparative research methods. *Discussion included.*

POLI 005: Introduction to International Relations [4]

Introduction to the study of the politics of conflict and war, diplomacy, international cooperation, and international institutions. *Discussion included.*

POLI 006: Global Issues [4]

Examination of select problems in international relations and foreign policy. Possible topics include terrorism, proliferation of nuclear weapons, and conflict in the Middle East. *Discussion included.*

POLI 009: Community Mobilization and Politics [4]

Examination of political and social mobilization at the local level, including strategies for organization and advocacy. *Discussion included.*

POLI 010: Analysis of Political Data [4]

Overview of the application of social scientific methods to the study of politics. Covers research design, measurement, descriptive and inferential statistics, and the linear regression model as applied to political phenomena. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam. Laboratory included.*

POLI 090X: Freshman Seminar [1]

Examination of a topic in political science. *May be repeated for credit once.*

POLI 092: Internship in Political Science [1-4]

Provides oversight and structure for a student's internship in a field of political science in community organizations, professional research projects, etc. connected to the study of political science. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of political science. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

POLI 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

POLI 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

POLI 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

POLI 100: Congressional Politics [4]

Elections and representation, legislative organization and process, legislative parties and leadership, lobbying, legislative outcomes, and the determinants of these outcomes in the U.S. Congress. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 101: The Presidency [4]

Powers, constraints, and behavior of the U.S. president and executive branch. Includes specific topics such as legislative-executive interactions, presidential control of the bureaucracy, nomination campaigns and general elections, and public opinion and the presidency. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 102: Judicial Politics [4]

Structure, function, and politics of the U.S. court system, with a particular focus on the selection of judges, judicial decision making, external political influences on the judiciary, and the impact of court decisions. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 105: Interest Groups and Political Parties [4]

Formation, strategies, and effectiveness of interest groups and political parties in the U.S. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 106: Urban Politics [4]

This course examines urban political development and policy processes in the United States. It will trace the historical development of local government, analyze urban coalitions and the distributions of power, and tackle the relationship between politics and policy making in the areas of growth, education, cultural issues, and welfare. *Prerequisite: POLI 001. Letter grade only.*

POLI 107: State Politics [4]

The structure and performance of state governments, including California state politics. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 108: Direct Democracy [4]

The politics of the initiative, referendum, and recall in the American states. Specific topics may include the history and origins of direct democracy, voter support for ballot measures, the role of interest groups, the effect of initiatives and referenda on candidate elections and civic engagement, and policy implications. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 110: Governmental Power and the Constitution [4]

Introduces students to the manner in which Supreme Court decisions shape our political system by delineating the sources and limits of governmental power. The powers of the three branches of the federal government are covered, as is the relationship between the federal government and the states. *Prerequisite: POLI 001 and junior standing or consent of instructor.*

POLI 111: Liberty, Equality and the Constitution [4]

Examines the constitutional politics of landmark U.S. Supreme Court cases involving civil liberties and civil rights. Specific topics may include First Amendment freedoms, privacy, the rights of criminal suspects, and discrimination based on race, gender, and sexual orientation. *Prerequisite: POLI 001 and junior standing or consent of instructor.*

POLI 120: Voting Behavior, Campaigns, and Elections [4]

Voting behavior, voter turnout, campaign strategies, and election outcomes. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 125: Public Opinion [4]

An examination of the nature and origins of public opinion in the United States and the role of public opinion in the policy process. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 127: Race, Gender, and Politics [4]

Contemporary and historical identity politics in the U.S., with a focus on the importance of race and gender in political representation, attitude formation, and civil rights. *Prerequisite: POLI 001 and (POLI 010 or ECON 010).*

POLI 130: Comparative Political Institutions [4]

Cross-national comparison of the design, evolution, and impact of political institutions, such as electoral systems, legislatures, executives, courts, and parties. *Prerequisite: POLI 003 and (POLI 010 or ECON 010).*

POLI 135: Comparative Political Behavior [4]

Analysis of multiple forms of political behavior across a variety of countries. Includes public opinion, political culture, voting, and less conventional forms of participation. *Prerequisite: POLI 003 and (POLI 010 or ECON 010).*

POLI 140: Transitions to Democracy [4]

Formation of democratic institutions and norms. Particular attention is paid to nations labeled as developing democracies. *Letter grade only.*

POLI 142: Contemporary Chinese Politics [4]

The purpose of the course is to introduce students to major issues in contemporary Chinese politics. The course will focus on the major challenges confronting China today, including economic reform and development, social unrest, democratization and the Tiananmen movement, village elections, ethnic conflicts, news media, Taiwan, and China's foreign relations. *Letter grade only.*

POLI 150: Causes of International Conflict [4]

Investigation of the causes of international conflict and war, the conduct of war, its ultimate termination, and the possibility of its prevention. *Prerequisite: POLI 005 and (POLI 010 or ECON 010).*

POLI 155: International Political Economy [4]

The connections between politics, policy, and international economics. *Prerequisite: POLI 005 and (POLI 010 or ECON 010).*

POLI 160: US Foreign Policy [4]

The formation of U.S. foreign policy, with an emphasis on the modern era and an introduction to analytical tools for understanding current foreign policy issues and debates. *Prerequisite: POLI 005 and (POLI 010 or ECON 010).*

POLI 165: International Organizations & Regimes [4]

Investigates the emergence and rise of international organizations and the network of regulation and international governance that they facilitate. The course explores the institutional structures, political processes, and impact of international organizations within three issue areas: international peace and security, human rights and humanitarian affairs, and global trade and development. *Prerequisite: POLI 005. Letter grade only.*

POLI 170: Theoretical Models of Politics [4]

The development, utility, and limitations of theoretical models of the political world. May include rational choice theory, game theory, and psychological theories of politics. *Prerequisite: POLI 010 or ECON 010.*

POLI 171: Politics and Film [4]

The course will consider whether politics as portrayed on film differs from political reality as understood through political science, and further uses films as vehicles for better understanding an array of topics from political science, including legislative behavior, elections, presidential politics, local politics, war, and international relations. *Prerequisite: POLI 001. Letter grade only.*

POLI 190: Topics in Political Science [4]

Intensive treatment of a special topic or problem in political science. *Prerequisite: POLI 001 and junior standing or consent of instructor. Political Science majors only. May be repeated for credit three times.*

POLI 192: Internship in Political Science [1-4]

Provides oversight and structure for a student's internship in a field of political science in community organizations, professional research projects, etc. connected to the study of political science. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of political science. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

POLI 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

POLI 196: UC Sac Public Policy [1-5]

Letter grade only. May be repeated for credit.

POLI 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

POLI 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PSYCHOLOGY

PSY 001: Introduction to Psychology [4]

Introduction to psychology as a science of behavior, including history, research methods, biological bases of behavior, cognition, personality, social behavior, psychological disorders, techniques of therapy and applied science.

PSY 010: Analysis of Psychological Data [4]

Design and analysis of psychological research including experimental design, correlational research, and descriptive and inferential statistics. Students in the Psychology major or minor must take this course before taking any upper division Psychology courses.

Prerequisite: COGS 001 or PSY 001.

PSY 015: Research Methods in Psychology [4]

Survey of common methodological approaches in psychological research. *Prerequisite: PSY 010.*

PSY 090X: Freshman Seminar [1]

Examination of a topic in psychology. *May be repeated for credit once.*

PSY 092: Internship in Psychology [1-4]

Provides oversight and structure for a student's internship in a field related to psychology in community organizations, professional research projects, etc. connected to the study of psychology. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of psychology. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

PSY 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PSY 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PSY 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PSY 105: Advanced Research Methods in Psychology [4]

Survey of advanced methodological approaches in psychological research. *Prerequisite: PSY 015. Letter grade only.*

PSY 110: History of Psychology [4]

Major schools of psychology, as well as the philosophical and physiological influences that lead to the birth of psychology as an independent discipline. Focus is on integration over these areas with the goal of better understanding the current state of the science of psychology. *Prerequisite: PSY 001 and junior standing or consent of instructor.*

PSY 123: Alcohol, Drugs, and Behavior [4]

Survey of major drugs of abuse, their mode of action, and their behavioral effects, both acute and chronic; etiology and maintenance of drug abuse and review of prominent strategies for prevention, intervention and treatment. *Prerequisite: PSY 001.*

PSY 124: Health Disparities [4]

In this course, we will focus on the differential effect of environmental factors and behavior on human health. In our examination of the determinants of health, we will discuss issues related to ethnic, cultural, and gender psychology, risk behavior, behavioral medicine, psychosocial epidemiology, and policy. *Letter grade only.*

PSY 130: Developmental Psychology [4]

Covers the stages that children go through as they develop; covers cognitive development, biological development, social development, personality development, emotional development, among others. Focus is on integrating across these different content areas.

Prerequisite: PSY 001 and junior standing or consent of instructor.

PSY 131: Social Psychology [4]

Behavior of the individual in social situations, surveying problems of social cognition, social interaction, group tensions, norm development, attitudes, values, public opinion, status. *Prerequisite: PSY 001. Letter grade only.*

PSY 135: Language Acquisition [4]

Covers the stages that children go through as they learn their first language. We also explore the causal mechanisms behind language acquisition as outlined by the major theoretical approaches in the field. Bilingual language acquisition are also covered. *Prerequisite: PSY 130 and junior standing or consent of instructor.*

PSY 136: Cognitive Development [4]

Covers the major theories and stages of children's cognitive development. Among others, we cover Piaget, Vygotsky, information processing theories, and connectionist approaches to learning. *Prerequisite: PSY 130 and junior standing or consent of instructor.*

PSY 137: Conceptual Development [4]

Exploration of how children learn about specific conceptual domains, such as naive biology and theory of mind. The major theoretical approaches in the area are covered. Questions of process, such as radical reorganization vs. enrichment of content areas set the context for the course. *Prerequisite: PSY 130 and junior standing.*

PSY 138: The Development of Social Mind [4]

Considers the emergence of social reasoning and behavior from infancy to adulthood. Special focus on the cognitive processes underlying reasoning about others as intentional agents, as members of social groups such as race and gender. *Prerequisite: PSY 001.*

PSY 139: Cognitive Development and Education [4]

How can developmental psychology inform educational practice? We review current developmental theories as well as attempts to apply them to education, with the aim of building an understanding of both the promise and pitfalls of a developmentally based approach to education. *Prerequisite: PSY 130.*

PSY 140: Clinical Psychology [4]

Major theoretical approaches to clinical psychology, including psychoanalysis, existentialism, humanism, systems theory, and behavioral approaches. A review of what clinical psychologists do, including assessment methods, professional roles, and approaches to treatment. *Prerequisite: PSY 001.*

PSY 142: Abnormal Psychology [4]

Descriptive and functional account of behavioral disorders, with primary consideration given to neurotic and psychotic behavior. *Prerequisite: PSY 001.*

PSY 143: Abnormal Child Psychology [4]

Approaches to and current scientific knowledge about psychological disorders during childhood are reviewed. Examples are anxiety, attention deficit, autistic, and substance use disorders. Interventions implemented to prevent or treat these disorders are also examined. *Prerequisite: PSY 001.*

PSY 145: Human Sexuality [4]

Survey of existing knowledge of human sexual behavior; physiological, anatomical, psychological, and cultural components; normative sexual functioning. Such topics as sexual deviation, sexual dysfunctions, and types of treatment are also considered. *Prerequisite: PSY 001.*

PSY 147: Health Psychology [4]

Survey of topics in health psychology, behavioral medicine, and pediatric health psychology. *Prerequisite: PSY 001.*

PSY 150: Psychological Perspective on Cultural, Racial Ethnic Diversity [4]

Issues that bear upon race, ethnicity, and culture, such as the cultural specificity of psychological theories, cultural influences on child development, ethnic identity, psychological issues in immigration, ethnic and racial prejudice, and assessment and interventions with culturally diverse and ethnic minority populations. *Prerequisite: PSY 001.*

PSY 151: The Psychology of Stereotyping and Prejudice [4]

Cognitive processes underlying stereotyping and prejudice are reviewed. Focuses on the relationship between stereotyping and categorization in general, the development of stereotyping and prejudice, and empirical proposals to reduce bias through contact or other forms of intervention. *Prerequisite: PSY 001 or COGS 001.*

PSY 157: Personal Relationships [4]

This course will survey the psychological science of close relationships, including interpersonal attraction, communication, interdependence, friendship, love, sex, conflict, violence, breakups and relationship loss. *Prerequisite: PSY 001. Letter grade only.*

PSY 158: Positive Psychology [4]

Survey of research on the strengths and virtues that enable individuals and communities to thrive. Positive Psychology emphasizes positive emotions, positive individual traits, and positive institutions. Note: This course fundamentally addresses the UC Merced guiding principles of scientific literacy, communication, self and society, and development of personal potential. *Prerequisite: PSY 001.*

PSY 159: Personality Psychology [4]

The theories of Freud, Erikson, and other major twentieth-century contemporary approaches to personality. *Prerequisite: PSY 001.*

PSY 160: Cognitive Psychology [4]

Introduction to human information processing, mental representation and transformation, imagery, attention, memory, language processing, concept formation, problem solving, and computer simulation. *Prerequisite: PSY 001 or COGS 001. Laboratory included.*

PSY 161: Perception [4]

An introduction to key theoretical constructs and experimental procedures in visual and auditory perception. Topics include psychophysics; perception of color, space, shape and motion; pattern recognition; perceptual attention; and brain areas engaged in perception. *Prerequisite: PSY 001 or COGS 001.*

PSY 162: Visual Perception [4]

A survey of central topics in the psychological study of vision: neurophysiological structure and function of the visual system; psychophysical methods for studying visual perception; color, motion, and form perception; three dimensional space perception; visual attention and oculomotor behavior; evolutionary advantages of vision; psychological and philosophical theories of visual consciousness. *Prerequisite: PSY 001 or COGS 001.*

PSY 170: Industrial and Organizational Psychology [4]

How psychology is applied to industrial and organizational problems, including workplace testing, personnel issues, advertising, etc. *Prerequisite: PSY 001.*

PSY 171: Psychological Tests and Measurement [4]

Principles of measuring behavior and developing and selecting psychological tests are explained. Common tests are also surveyed, such as intelligence, achievement, personality, and employment related tests. *Prerequisite: PSY 001.*

PSY 172: Forensic Psychology [4]

Survey of the application of psychology to the criminal justice system, including public policy, sanity, competency, eyewitness testimony and treatment of mentally ill offenders. *Prerequisite: PSY 001.*

PSY 180: Physiological Psychology [4]

Relationship of brain structure and function to behavior, motivation, emotion, language, and learning in humans and other animals. Review of research methods used in physiological psychology and neuroscience. *Prerequisite: PSY 001.*

PSY 181: Clinical Neuropsychology [4]

The organization of the brain at the gross, cellular and molecular level and how the brain accomplishes vision, hearing, sleep, motor skills, emotions and memory. Brain disease such as agnosias, depression, addictions, stroke, Alzheimer's and Parkinson's are investigated. *Prerequisite: PSY 001. Letter grade only.*

PSY 190: Topics in Psychology [4]

Intensive treatment of a special topic or problem of psychological interest. May be repeated for credit in different subject area. *Prerequisite: PSY 001 and junior standing or consent of instructor. Psychology majors only. May be repeated for credit three times.*

PSY 192: Internship in Psychology [1-4]

Provides oversight and structure for a student's internship in a field related to psychology in community organizations, professional research projects, etc. connected to the study of psychology. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of psychology. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

PSY 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PSY 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PSY 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PSY 200A: Professional Seminar for First-Year PhD Graduate Students I [4]

A two semester sequence required of and limited to first-year Ph.D. students in Psychology. Survey of major issues in contemporary psychology with their historical backgrounds. *Letter grade only.*

PSY 200B: Professional Seminar for First-Year Graduate Students II [4]

A two semester sequence required of and limited to first-year Ph.D. students in Psychology. Survey of major issues in contemporary psychology with their historical backgrounds. *Letter grade only.*

PSY 202A: Advanced Psychological Statistics I [4]

The nature of causal inference; experimental and quasi-experimental designs including randomized experiments, nonrandomized control group studies, time series, regression discontinuity; generalizing from experiments; ethical issues and ethical principles of research conduct; practical problems in experiments. *Letter grade only.*

PSY 202B: Advanced Psychological Statistics II [4]

Classical test theory; factor analysis; generalizability theory; item-response theory; inter-rater reliability; fundamental measurement theory. *Letter grade only.*

PSY 202C: Multivariate Analysis [4]

Introduction to analysis of data having multiple dependent variables. Topics include continuous multivariate distributions, multiple regression, multivariate analysis of variance, discriminant analysis, classification, canonical correlation, principal component analysis. Applications from clinical, cognitive, physiological, and social psychology. Computer methods. *Letter grade only.*

PSY 204: Research Design and Methodology [4]

The nature of causal inference; experimental and quasi-experimental designs including randomized experiments, nonrandomized control groups studies, time series, regression discontinuity; generalizing from experiments; ethical issues and ethical principles of research conduct; practical problems in experiments. *Letter grade only.*

PSY 205: Measurement Theory and Psychometrics [4]

Classical test theory, factor analysis, generalizability theory, item response theory, interrater reliability, fundamental measurement theory. *Letter grade only.*

PSY 206: Quantitative Methods for Reviewing Research [4]

Quantitative procedures (meta-analysis) for reviewing research findings; techniques for locating and coding research studies, calculating effect sizes, and analyzing study findings. *Letter grade only.*

PSY 207: Linear Structural Modeling [4]

Path models, path analysis, cross-lagged panel studies, confirmatory factor analysis, and complete latent variable causal models, applications to experimental and nonexperimental data. *Letter grade only.*

PSY 208A: Methods for Program Evaluation [4]

Introduction to program evaluation. Survey of the many methods used in program evaluation, including needs assessment, surveys, experiments, and qualitative methods. Discussion of policy and strategy issues, and of utilization of findings. *Letter grade only.*

PSY 208B: Theory of Program Evaluation [4]

History and nature of program evaluation, review of different approaches taken to evaluation by variety of major theorists in the field; practice in evaluation. *Letter grade only.*

PSY 211: Computer Programming for Social Sciences [4]

An introduction to specialty computer programs that are useful in the social sciences, such as Matlab, GAUSS, specialty programs in meta-analysis, and basic languages. *Letter grade only.*

PSY 212: Special Problems in Psychological Statistics [4]

Special problems in psychological statistics and data analysis. *Letter grade only.*

PSY 214: History of Psychology [4]

Covers the major schools of psychology, including Wundtian psychology, structuralism, functionalism, behaviorism, gestalt psychology, cognitive psychology, etc., as well as the philosophical and physiological influences that lead to the birth of psychology as an independent discipline. Focus is on integration over these areas with the goal of better understanding the current state of the science of psychology. Major recurring themes within these schools include the mind/body problem, the nature/nurture debate, and the criteria for practicing a science. *Letter grade only.*

PSY 220: Health Psychology [4]

A review of theory and research on how behavior affects health and disease as well as how disease affects behavior (e.g., cognitions, emotions, relationships) in humans. Research into behavioral interventions to improve, ameliorate, or prevent disease are also reviewed. Focus is placed on the role of behavior for the major diseases and threats to health in children, adolescents, and adults. *Letter grade only.*

PSY 230: Developmental Psychology [4]

The stages that children go through as they develop. Covers cognitive development, biological development, social development, personality development, emotional development, among others. Focus is on integrating across these different content areas. *Letter grade only.*

PSY 234: The Nativism Empiricism Debate [4]

A major debate in developmental psychology concerns the relative contribution of innate versus learned knowledge and skills. We focus on theoretical and empirical contributions to this debate, and try to place them within a broader framework of contemporary cognitive development. *Letter grade only.*

PSY 235: Language Acquisition [4]

The stages that children go through as they learn their first language. Course also explores the causal mechanisms behind language acquisition as outlined by the major theoretical approaches in the field. Bilingual language acquisition are also covered. *Letter grade only.*

PSY 236: Cognitive Development [4]

The major theories and stages of children's cognitive development. Among others, we cover Piaget, Vygotsky, information processing theories, and connectionist approaches to learning. *Letter grade only.*

PSY 237: Conceptual Development [4]

Explores how children learn about specific conceptual domains, such as naive biology and theory of mind. The major theoretical approaches in the area are covered. Questions of process, such as radical reorganization vs. enrichment of content areas set the context for the course. *Letter grade only.*

PSY 238: The Development of Social Mind [4]

Considers the emergence of social reasoning and behavior from infancy to adulthood. Special focus on the cognitive processes underlying reasoning about others as intentional agents, as members of social groups such as race and gender. *Letter grade only.*

PSY 239: Cognitive Development and Education [4]

How can developmental psychology inform educational practice? We review current developmental theories as well as attempts to apply them to education, with the aim of building an understanding of both the promise and pitfalls of a developmentally based approach to education. *Letter grade only.*

PSY 250: Social Psychology [4]

Designed for graduate psychology students. Intensive consideration of concepts, theories, and major problems in social psychology. *Letter grade only.*

PSY 251: The Psychology of Prejudice and Stereotyping [4]

Cognitive processes underlying prejudice and stereotyping are reviewed. We focus on the relationship between stereotyping and categorization in general, the development of stereotyping and prejudice, and empirical proposals to reduce bias through contact or other forms of intervention. *Letter grade only.*

PSY 263: Language and Communication in Everyday Life [4]

Conversational language, metaphor, idioms, ambiguity, spatial language, gesture, sign language, propaganda, dialects, cross-cultural variation, semantic change. *Letter grade only.*

PSY 264: Language, Mind and Brain [4]

Language and linguistic representation from various angles and disciplines, including psychology, linguistics, philosophy, and neuroscience. Possible topics: sentence processing, word meaning, neurolinguistic deficits, language learning, artificial intelligence (natural language processing), and the interaction of language with other cognitive processes. *Letter grade only.*

PSY 286: Presentation of Psychological Materials [4]

Supervised practicum in undergraduate teaching. Students serve as discussion section leaders in selected undergraduate courses, and give guest lectures in courses where appropriate. *Satisfactory/Unsatisfactory grading only.*

PSY 288: Psychological Research Practicum [1-4]

Faculty and graduate students who share interests discuss current literature, new ideas, methodological issues, and preliminary findings. Meetings include research presentations and opportunities for feedback on current and proposed research activity to encourage, support, and facilitate student research expertise. Assigned reading including. *Satisfactory/Unsatisfactory grading only.*

PSY 289: Psychology Colloquium [1]

One and one-half hours of colloquium per week. Reports and discussions of original research in psychology. Not all participants must report in any given semester, but all are expected to attend and to enter into the discussion. *Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

PSY 290: Special Topics Study Course [4]

Under faculty supervision, group of students meets each week for a semester in a student-led study group to pursue a specific topic of their choice that is not covered in other department courses. *Letter grade only. May be repeated for credit.*

PSY 294: Individual Studies [1-12]

Designed primarily as preparation for qualifying examinations. May be required by some area committees as a requisite for taking examinations. *Satisfactory/Unsatisfactory grading only. May be repeated for credit eight times.*

PSY 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PSY 296: Research Topics in Psychology [1]

Research group meeting, one hour. Limited to graduate students. Discussion of current literature, new ideas, methodological issues, and preliminary findings. Research presentations and opportunities for feedback on current and proposed research activity to encourage, support, and facilitate student research expertise. Assigned readings included. *Satisfactory/Unsatisfactory grading only. May be repeated for credit eight times.*

PSY 297: Research for Ph.D. Dissertation [1-12]

At least one 297 course is required during each year following completion of qualifying examinations. *Satisfactory/Unsatisfactory grading only. May be repeated for credit eight times.*

PSY 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

PSY 299: Directed Individual Research and Study in Psychology [1-12]

One 299 course is required during second semester of the first year of graduate study, and both semesters of the second year of graduate study. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

PUBLIC POLICY

PUBP 001: Introduction to Public Policy [4]

Interdisciplinary introduction to public policy and policy issues facing the American voter. Emphasis is on how difficult it is to arrive at an informed decision--not on determining what that decision ought to be. Examines a diverse set of policy topics, including environment, health, education, and social policy, among others. *Letter grade only.*

PUBP 090X: Freshman Seminar [1]

Examination of a topic in public policy. *Pass/No Pass grading only. May be repeated for credit.*

PUBP 092: Internship in Public Policy [1-4]

Provides oversight and structure for a student's internship in a field of public policy in community organizations, professional research projects, etc. connected to the study of public policy. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of public policy. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

PUBP 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

PUBP 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PUBP 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

PUBP 100: Political Process and Institutions [4]

Political and governmental context of policy, form agenda setting to evaluation. Course examines the context for setting constitutional, federal and local policy, as well as processes by which governmental institutions make decisions. We also examine interactions between institutions and approaches that further policy decision making. *Prerequisite: PUBP 001 or POLI 001. Letter grade only.*

PUBP 110: Poverty and Social Policy [4]

Overview of poverty and social policy in the United States in a historical context from the nineteenth century until the present. Discusses current policy issues and policy debates surrounding poverty and inequality. *Prerequisite: (PUBP 001 and PUBP 100 and ECON 100 and PSY 105) or ECON 130. Letter grade only.*

PUBP 120: Health Care Policy [4]

Examines current health policy issues and policy approaches, as a way of exploring problems in the design and implementation of policy. It concentrates on issues of access to care, quality of care, health care costs, health insurance, health behavior, and the cultural and linguistic issues facing immigrants' access to care. *Prerequisite: (PUBP 001 and PUBP 100 and ECON 100 and PSY 105) or ECON 130. Letter grade only.*

PUBP 130: Environmental Policy [4]

Examines current environmental policy as a way of exploring problems in the design and implementation of policy. Provides an overview of basic concepts and methods of environmental policy analysis and implementation looking at a range of local and global environmental policy issues, such as environmental justice, air quality, and urbanization. *Prerequisite: (PUBP 001 and PUBP 100 and ECON 100 and PSY 105) or ECON 130. Letter grade only.*

PUBP 140: Immigration and Public Policy [4]

Examines the origins, consequences, and characteristics of immigrants to the United States, from the nineteenth century to the present. We look at social and economic forces behind immigration; the impact of immigrants; and their process of integration. We also examine various debates on immigrant and immigration policy. *Prerequisite: (PUBP 001 and PUBP 100 and ECON 100 and PSY 105) or ECON 130. Letter grade only.*

PUBP 150: Race, Ethnicity and Public Policy [4]

Examines the ways in which policies are shaped by and respond to issues of race, ethnicity and culture. Among others, we explore issues of inequality in the labor market, segregation, discrimination, environmental justice, health care access, and social and political inequality. *Prerequisite: (PUBP 001 and PUBP 100 and ECON 100 and PSY 105) or ECON 130. Letter grade only.*

PUBP 192: Internship in Public Policy [1-4]

Provides oversight and structure for a student's internship in a field of public policy in community organizations, professional research projects, etc. connected to the study of public policy. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of public policy. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

PUBP 195: Upper Division Undergraduate Research [1-4]

Supervised research. *Permission of instructor required. May be repeated for credit twice.*

PUBP 198: Upper Division Directed Group Study [1-5]

Group directed study. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.*

PUBP 199: Upper Division Individual Study [1-4]

Course involves an independent research project under the supervision of a Public Policy faculty member. Public Policy majors are required to take the course for 4 units and are required to write a major research paper. To be taken in the senior year. *Prerequisite: PUBP 100 and ECON 100 and (PSY 105 or ECON 130). Permission of instructor required. May be repeated for credit twice.*

QUANTATIVE AND SYSTEMS BIOLOGY**QSB 200: Molecular Cell Biology [3]**

A graduate-level course focusing on molecular aspects of cellular processes, including signal transduction, cell division, differentiation, protein synthesis and degradation, and regulation of gene expression. Each topic is accompanied by critical evaluation of classic papers and recent publications. Upper division undergraduate courses in cell and molecular biology should have been completed as course requisites for this course. *Letter grade only.*

QSB 201: Teaching and Learning in the Sciences [1]

Students are introduced to 'scientific teaching' - an approach to teaching science that uses many of the same skills applied in research. Topics include how people learn, active learning, designing, organizing and facilitating teachable units, classroom management, diversity in the classroom and assessment design. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. Discussion and seminar included.*

QSB 207: Physical Biochemistry [3]

Physical Biochemistry is the study of properties such as macromolecular folding, multimerization, structure, and ligand binding. This course will instruct students on these, and on the experimental techniques that can quantitatively probe these properties, including hands-on work with multidimensional NMR data. Also included is in-depth discussion of recent biophysical literature. *Letter grade only.*

QSB 212: Advanced Signal Transduction and Growth Control [4]

Signal transduction in mammalian cells with emphasis on molecular and genetic regulation of these processes and their role in cell function. Graduate requirement includes an advanced discussion section involving research methodology and data interpretation led by the instructor. *Prerequisite: An undergraduate biochemistry course or consent of instructor.*

QSB 214: Tissue Engineering Design [3]

Fundamental topics include: issues related to the cell source (including stem cells, plasticity, transdifferentiation, therapeutic cloning vs. reproductive cloning, bone marrow transplants, and cell differentiation and purification), cell culture and tissue organization, gene therapy delivery methods, cell adhesion and migration, issues in construct design, tissue preservation, and immunoisolation and/or modulation. Current case studies and issues for FDA approval of tissue engineered products are also covered. *Prerequisite: ICP 001A, ICP 001B and BIO 100 or equivalent.*

QSB 215: Principles of Biological Technologies [3]

The principles underlying commonly used and cutting-edge technical procedures in biological research. Lectures and primary literature critiques on biochemical, molecular, cellular, bioengineering and computational techniques. *Prerequisite: QSB 290 or consent of instructor.*

QSB 217: Lab on a Chip: Developing 3rd World Diagnostics for Global Health [3]

This is the first-ever four campus course between UC San Francisco, UC Berkeley, UC Santa Cruz, and UC Merced which aims to 1) raise awareness and knowledge about global health issues 2) teach students critical engineering skills such as nano/micro-fabrication 3) enable students to design, build, and test their own diagnostics and 4) develop entrepreneurial skills. Students learn about tuberculosis from leading experts at UCSF and then address the dearth of sensitive diagnostics by designing and testing their own nano/micro-systems. Taught at UC Merced with tele-conferencing to the other campuses and two field trips. Funded in part by QB3. *Letter grade only. Laboratory included.*

QSB 220: Cellular Microbiology [3]

Emphasizes the molecular basis of interaction between microbial pathogens (bacteria, viruses and protozoan parasites) and host cells. We also include discussion of the immune response to infection. Student-led presentations and discussion of reading assignments from the current scientific literature. *Letter grade only.*

QSB 227: Virology [3]

Overview of viruses, focusing on structure, infecting cycle, interactions with host, transmission and methods of detection and control. *Prerequisite: QSB 290 or consent of instructor. Discussion included.*

QSB 241: Advanced Genomic Biology [4]

Comprehensive introduction to the language of genes and genomes, including genotype to phenotype relationships, gene regulation of development and disease, sources of phenotypic variation, and organization of genomes across the domains of life. Graduate requirements include advanced discussion section led by instructor and genome informatics project.

QSB 242: Genome Biology [5]

Introduction to the concepts behind genome biology and a detailed overview of the many tools used in comparative genomics. Specific topics include genome assembly, gene modeling and comparative genomics, transcriptomics, and proteomics of prokaryotic and eukaryotic organisms. Students carry out real scientific projects in collaboration with course faculty and produce new genomic data of publishable quality. Mandatory weekly three hour lab is part of this course. *Prerequisite: BIO 141. Letter grade only. Laboratory and discussion included.*

QSB 244: Phylogenetics: Speciation and Macroevolution [3]

Theory underlying reconstruction of evolutionary relationships and introduces the comparative methods and tools of phylogenetics. Topics include morphological, molecular, and fossil data in distance, parsimony, likelihood, and Bayesian frameworks for investigating geographic patterns and rates of speciation, phenotypic evolution, diversification, extinction, and biogeography. *Letter grade only. Discussion included.*

QSB 244L: Phylogenetics Laboratory: Speciation and Macroevolution [1]

Practice in reconstruction of evolutionary relationships and introduces the comparative methods and tools of phylogenetics. Topics include morphological, molecular, and fossil data in distance, parsimony, likelihood, and Bayesian frameworks for investigating geographic patterns and rates of speciation, phenotypic evolution, diversification, extinction, and biogeography. QSB 244 must be taken concurrently. *Letter grade only.*

QSB 248: Advanced Topics in Ecology [3]

Course utilizes directed readings and discussion of classical and current literature in ecology, including physiological, population, community, ecosystem, landscape, and global ecology studies. *Letter grade only. Discussion and seminar included.*

QSB 250: Embryos, Genes and Development [3]

Principles of developmental biology as revealed through analysis of invertebrate and vertebrate system. Animal models are used to examine the molecular and cellular mechanisms that influence cell fate. Cell signaling is studied in the context of embryonic pattern formation and the development of body plans and organ systems. Graduate level students read discuss and critique current research papers relevant for the field. *Prerequisite: QSB 290 and BIO 110 or equivalent, or consent of instructor. Letter grade only. Discussion included.*

QSB 252: Cancer Genetics and Tumor Biology [3]

Topics include viral and hormonal carcinogenesis, molecular aberrations in cancer, tumor development, epigenetic and cancer, tumor immunology, oncogenes. *Letter grade only.*

QSB 253: Evolution and Development [1-3]

This course compares and contrasts the developmental cues of a variety of animals and emphasizes how conserved developmental pathways have been manipulated through evolutionary processes to produce different physical features. The effects of regulatory region mutations, gene duplication, and genetic co-opting will be investigated. *Permission of instructor required. Letter grade only. Discussion included.*

QSB 261: Human Physiology [3]

Understanding the mechanisms underlying function of major human organs. Emphasis includes neural transmission and action potential, cardiovascular, renal and gastrointestinal physiology, metabolism, and endocrinology. Laboratory experiments demonstrating and reinforcing topics covered in lecture with an emphasis on scientific method. Discussion section critically reads and evaluates papers in physiology and provide an opportunity for the students to practice presenting scientific data to an audience. *Permission of instructor required. Letter grade only. Laboratory and discussion included.*

QSB 280: Advanced Mathematical Biology [3]

Graduate level mathematical modeling and data analysis skills for life science researchers taught through hands-on computational laboratories. Topics include population models, predator-prey and competition systems, epidemic models with applications to sexually transmitted diseases, dynamic diseases, enzyme kinetics, biological oscillators, and switches. *Letter grade only. Discussion included.*

QSB 281: Advanced Computational Biology [4]

Introduction to the principles and application of computational simulations and modeling in biology, ranging from bioinformatics to computational cell biology. Topics to be covered include genome sequence analysis and annotation, phylogenetic analysis, protein structure prediction, molecular modeling, and docking and simulations of metabolic and regulatory networks. Graduate requirements include advanced discussion section led by instructor and computational biology project. *Laboratory and discussion included.*

QSB 282: Bioinformatics [5]

Graduate level introduction to tools, algorithms, statistics, and databases used in bioinformatics, emphasizing an open-source, command-line toolbox approach. Topics covered as in BIO 182, plus critical assessment of bioinformatics literature, introduction to Perl, and an independent research project. Mandatory computer laboratory, for which prior programming experience helpful but not assumed. *Laboratory and discussion included.*

QSB 283: Population Genetics [3]

The various factors that affect gene flow and frequency within a population. Theories of selection, neutrality, drift, hitchhiking, recombination, mutation, isolation, in-breeding, and selfish genetic elements are taught along with statistical tests and experimental methods for detecting these forces. *Letter grade only. Discussion included.*

QSB 290: Current Topics in Quantitative and Systems Biology [3]

Discussion, reading, and study that exposes students to current research directions in the field; student-led presentation, analysis, and discussion of reading assignments from the scientific literature. *Letter grade only.*

QSB 291: Quantitative and Systems Biology Seminar [1]

Seminar series covering various topics in quantitative and systems biology presented by QSB Graduate Group faculty and visiting speakers. *Letter grade only. May be repeated for credit.*

QSB 292: Quantitative and Systems Biology Group Meeting [1]

Meetings to describe current progress and research plans lead by individual QSBGG faculty. *Letter grade only. May be repeated for credit.*

QSB 293: Quantitative and Systems Biology Journal Club [1]

Student-led presentation, analysis, and discussion of reading assignments from the scientific literature. *Letter grade only. May be repeated for credit.*

QSB 294: Responsible Conduct of Research [1]

Seminar covering responsibilities and expectations for researchers as well as advice for success in graduate school and science careers, required for NIH-funded graduate students. *Satisfactory/Unsatisfactory grading only.*

QSB 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. May be repeated for credit.*

QSB 296: Professional Skills Development [1]

This course is limited to graduate students only. The course will expose graduate students to some of the more critical skill sets to enhance their professional development. Topics to be covered will consist of (but not limited to): 1) Writing abstracts, 2) Writing a manuscript, 3) writing grants, 4) research presentations (oral and poster), 5) lecture presentation, 6) critical scientific evaluation, 7) manuscript review, and 8) developing a CV. *Satisfactory/Unsatisfactory grading only.*

QSB 297: Systems Biology: From Molecules to Metabolic Networks [3]

The goal of this course is to provide a rigorous introduction to the theories, tools, and applications of systems biology. The course is organized around the biological flow of information (i.e. the Central Dogma) from DNA to RNA to proteins, then extending into metabolic and cellular networks. Each component includes an introduction to the experimental and high throughput approaches for generating large datasets, then continues with the theory, algorithms, and computational approaches for their analysis. Data for analysis will come from ongoing systems biology projects taking place in the Instructors lab (genomics, metagenomics, metabolomics) as well as those of collaborators at UC Merced and other nearby institutions (transcriptomics, proteomics). The course will take advantage of presentations by guest lecturers with expertise in one of the many aspects of systems biology, or one of the sciences upon which it crucially depends. QSB 297L must be taken concurrently.

Prerequisite: QSB 297L Systems Biology lab is a co-requisite for enrolling in QSB 297, though may be opted out of by instructors permission if students have taken coursework covering the material of QSB 297L. Letter grade only.

QSB 297L: Systems Biology Lab [1]

The goal of this course is to provide the mathematical and computational foundations necessary to understand, apply and advance the tools of modern systems biology. QSB 297 must be taken concurrently. *Prerequisite: QSB 297 is co-requisite. Students with previous coursework that covers the topics of QSB 297L can opt out of 297L by instructor's permission only. Letter grade only.*

QSB 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

QSB 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Grading option is instructor preference. May be repeated for credit.*

QSB 399: University Teaching [1]

Centered on a student's classroom experiences as a Teaching Assistant in an undergraduate Biological Sciences course. Provides a faculty-directed opportunity to implement teaching practices presented in the course Teaching and Learning in the Sciences. Involves video-taping of teaching, peer review, and weekly meetings with faculty. *Prerequisite: Must hold at least a 25%-time appointment as a Teaching Assistant for an undergraduate course in Biological Sciences. QSB 201 or MATH 201 or (Teaching and Learning in the Sciences) are co-requisites. Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit once. Laboratory and discussion included.*

SOCIAL AND COGNITIVE SCIENCES**SCS 090X: Freshman Seminar [1]**

Examination of a topic in the social, behavioral and cognitive sciences. *May be repeated for credit once.*

SCS 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SCS 098: Lower Division Directed Group Study [1-5]

Instructor directed study for groups of lower division status. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit once.*

SCS 099: Lower Division Individual Study [1-5]

Instructor directed study for groups of lower division status. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit once.*

SCS 140: Psychology and Economics [4]

A review of psychological and economic research on departures from perfect rationality, self-interest, and other classical assumptions of economics. The implications of these new findings for classical economics are explored. *Prerequisite: PSY 001 and ECON 001. Discussion included.*

SCS 145: Second Language Learning and Bilingualism [4]

Issues in second language acquisition, including processing of linguistic information by bilinguals (perception, recall, translation), structure of bilingual discourse, child bilingualism, language maintenance or shift, with particular focus on the North American Context. *Prerequisite: PSY 001. Discussion included.*

SCS 192: Integrative Topics [4]

Special topics that integrate theory or research from more than one discipline in the social and behavioral sciences. *Prerequisite: PSY 001 or ECON 001 or SOC 001 or POLI 001 or consent of instructor. May be repeated for credit once.*

SCS 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SCS 198: Upper Division Directed Group Study [1-5]

Group study for upper division students. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit three times.*

SCS 199: Upper Division Individual Study [1-5]

Individual directed study for upper division students. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit three times.*

SCS 210: Philosophy of Cognitive Science [4]

Consideration of philosophical and foundational issues in cognitive science, such as: behaviorism, functionalism, the Turing Test, the Chinese Room argument, the nature of cognitive architecture, animal cognition, connectionism vs. symbolic artificial intelligence, consciousness, the self, free will, embodiment, and ethics. *Letter grade only. Discussion included.*

SCS 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SCS 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

SCS 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

SOCIOLOGY**SOC 001: Introduction to Sociology [4]**

The study of groups, culture, collective behavior, classes and caste, community and ecology, role, status, and personality. *Discussion included.*

SOC 009: Community Mobilization and Politics [4]

Examination of political and social mobilization at the local level, including strategies for organization and advocacy. *Discussion included.*

SOC 010: Statistics for Sociology [4]

This course will introduce students to the logic and use of statistical techniques in sociological research. By the end of the course, students will have the tools to appreciate and evaluate social research, and a foundation for conducting statistical social research themselves. *Prerequisite: MATH 005 or equivalent score on the Math Placement Exam. Letter grade only. Laboratory included.*

SOC 015: Sociological Research Methods [4]

This course provides students with a basic understanding of how to conduct social science research. Topics will include the logic of research design, issues of conceptualization and measurement, the range of data collection methods available to social scientists, and what social scientists do with data once they have collected it. *Prerequisite: Sophomore standing. Letter grade only. Discussion included.*

SOC 020: Social Problems [4]

Social problems examines the perceptions, theories, arguments, and proposed solutions to the most vexing social issues. Explanations of these problems can be grouped into micro, meso, and macro levels of analysis. In addition, for the last 100 years researchers have examined the overlap between different social problems. *Discussion included.*

SOC 030: Social Inequality [4]

The course will examine the main classical and modern explanations of the causes of social, economic and political inequality. Issues include: power; processes that create/maintain inequality, the central axes of inequality in society (race/class/gender); consequences of inequality for individuals and groups; how policy can mitigate or exacerbate inequality. *Discussion included.*

SOC 035: Introduction to Political Sociology [4]

The most pressing issues of our time are addressed via the political system. This course considers the many processes that influence the political system and political outcomes. By drawing on the insights of sociology, we will better understand these processes and how the political system works. *Discussion included.*

SOC 036: Globalization [4]

This course surveys major global social trends over the last few centuries. Specifically, we examine the rise of bureaucracy, industrial capitalism, and national social movements/revolutions to assist us in comprehending current social trends such as the network society, neo-liberal economic restructuring, international social movements, and global conflict. *Letter grade only. Discussion included.*

SOC 055: Sociology of the Family [4]

This course will introduce basic sociological theories, concepts and issues regarding marriage and the family in a larger societal context. The course will investigate the diversity that marriages and families have in society, and examine how theoretical paradigms influence the way sociology perceives and studies marriages and families. *Discussion included.*

SOC 070: Introduction to Crime and Deviance [4]

Examines the process of criminal justice in the US and address major theories of crime and deviance. In addition: how individuals and social groups are processed through the criminal court system; historical changes in correctional philosophy and organizational structure; inmate socialization, and social environment changes in U.S. prisons. *Discussion included.*

SOC 090X: Freshman Seminar [1]

Examination of a topic in sociology. *May be repeated for credit once.*

SOC 092: Internship in Sociology [1-4]

Provides oversight and structure for a student's internship in a field related to sociology in community organizations, professional research projects, etc. connected to the study of sociology. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of sociology. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

SOC 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SOC 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SOC 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SOC 100: Sociological Theory [4]

Sociological theory explores many big questions that people have pondered for centuries, including inequality and why it is tolerated, social change and how it occurs, and social order and how it is maintained. This course provides an introduction to sociological theory, examining both classic and contemporary schools of sociological thought. *Prerequisite: SOC 001 and any lower division SOC course and junior standing. Letter grade only.*

SOC 110: Social Movements, Protest and Collective Action [4]

Introduction to the social scientific study of social protest (meaning all forms of non-routine, or contentious politics) and collective action. Examines organized collective efforts to promote or resist change in society that rely, in some part, on non-institutionalized forms of political action. *Prerequisite: POLI 001 or SOC 001 or PUBP 001 or consent of instructor.*

SOC 115: Political Sociology [4]

Sociological analysis of types of political organization and action and their relations to elements of social life. Topics include: Social movements, voting, interest group politics, protest behavior, revolutions, human rights, global political diffusion, and other elements of the interaction between the political structure and everyday life. *Prerequisite: SOC 001 or POLI 001 or PUBP 001. Letter grade only.*

SOC 118: Hate Crime [4]

The course will examine the causes and consequences of hate crimes, as well as the social contexts within which they occur. *Prerequisite: SOC 001 or SOC 070. Letter grade only.*

SOC 120: Sociology of Culture [4]

The sociology of culture is both an approach to, and a subject within sociology. This course will explore central themes and issues in the sociology of culture, such as: What is the relation of the cultural forms studied by humanists to the social structures studied by sociologists and political scientists? *Prerequisite: SOC 001 or ANTH 001 or POLI 001 or ECON 001. Letter grade only.*

SOC 130: Social Stratification [4]

classical and modern explanations of the causes of social, economic and political inequality. Issues include: the central axes of inequality in society (race/class/gender); power; processes that create/maintain inequality; and, the consequences of inequality for individuals and groups. *Prerequisite: SOC 001 or SOC 030 or consent of instructor. Letter grade only.*

SOC 131: Urban Inequality [4]

The goal of this course is to examine a small selection of the work on urban poverty in the United States in a seminar setting. We examine in depth theories behind the evolution of the urban poor, as well as the impact of poverty upon individuals. *Prerequisite: SOC 001 or SOC 003 or SOC 008 or POLI 001 or PUBP 001 or consent of instructor. Letter grade only.*

SOC 132: Sociology of Education [4]

This course focuses on how social forces (such as politics, economics, demographics and institutional context) create variation in school practices, and how variation in school practices affects individual student achievement and behavior. Students will also become familiar with presenting, interpreting, and discussing public education data. *Prerequisite: SOC 001 or SOC 030 or consent of instructor. Letter grade only.*

SOC 134: Sports and Society [4]

Sports are often dismissed as unimportant to society's working. However, some of society's most important moments, racial integration (Jackie Robinson), gender equality (Title IX), and recognition of new nations (Olympics) have been through sports. We examine the dynamics sports play in society, focusing on issues of race, gender and nationality. *Prerequisite: SOC 001 or ANTH 001 or POLI 001 or consent of instructor.*

SOC 140: Organizational Behavior [4]

This course examines the evolution of the modern organization, focusing on approaches to corporate strategy and to managing employees. We read social scientific analyses and case studies to trace the history of management, and study social science perspectives that question the efficiency and the equity of current organizational practices. *Prerequisite: SOC 001 or ECON 001 or POLI 001. Letter grade only. Discussion included.*

SOC 150: Self and Society [4]

This course presents an overview of one fundamental topic in the sociological approach to social-psychology, the shaping of consciousness by interaction. Beginning with classical texts, we will then examine a set of contemporary works, arranged in order of the degree to which psychology is made fundamentally social. *Prerequisite: SOC 001 or PSY 001. Letter grade only.*

SOC 160: Gender and Society [4]

The role gender plays in structuring social lives. We begin by discussing sociological theories of gender, gender socialization/parenting, gender identity and intersections of gender and sexuality. We then examine gender on an institutional and systemic level-focusing on how organizations, such as work, education, the law, and politics are gendered. *Prerequisite: SOC 001 or consent of instructor. Letter grade only. May be repeated for credit three times.*

SOC 161: Sociology of Sexuality [4]

The course will focus on the social construction of sexuality and on sexual behavior and demographic trends. We will also study the intersection of sexuality and social institutions, as well as the politics of sexuality. *Prerequisite: SOC 001 or SOC 030 or consent of instructor. Letter grade only.*

SOC 170: Qualitative Research Methods [4]

This course introduces techniques of, and approaches to, qualitative research. We will explore research design issues including developing research questions, selecting methods, and the ethics of research. We will then examine the collection, analysis, and presentation of qualitative data. *Prerequisite: SOC 001 or ANTH 001 or POLI 001. Letter grade only.*

SOC 180: Advanced Issues in Race and Ethnicity [4]

Examines in depth the main classical and modern explanations of the issues surrounding Race and Ethnicity. Issues include: Power; processes that create/maintain inequality, biological vs social constructions of race, race and ethnicity in the age of conquest, race and ethnicity in modern society. *Prerequisite: SOC 001 or PUBP 001 or POLI 001 or ANTH 001. Letter grade only.*

SOC 185: Topics in Sociology [4]

Intensive treatment of a special topic or problem in sociology. May be repeated for credit in different subject area. *Prerequisite: SOC 001. May be repeated for credit three times.*

SOC 192: Internship in Sociology [1-4]

Provides oversight and structure for a student's internship in a field related to sociology in community organizations, professional research projects, etc. connected to the study of sociology. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of sociology. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

SOC 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SOC 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SOC 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SPANISH

No credit is allowed for completing a less advanced course after successful completion (C- or better) of a more advanced course in the foreign languages. This applies only to lower division foreign language courses, not upper division courses.

SPAN 001: Elementary Spanish I [4]

Introduction to speaking, reading, writing, and understanding Spanish. Classes will be conducted in Spanish. *Prerequisite: Letter grade only.*

SPAN 002: Elementary Spanish II [4]

Introduction to speaking, reading, writing, and understanding Spanish. Classes will be conducted in Spanish. *Prerequisite: SPAN 001 or equivalent score on the Spanish Placement Exam. Letter grade only.*

SPAN 003: Intermediate Spanish I [4]

Review of Spanish grammar with emphasis on building speaking and writing skills and on readings to build cultural understanding. Classes conducted in Spanish. *Prerequisite: SPAN 002 or equivalent score on the Spanish Placement Exam. Letter grade only.*

SPAN 004: Intermediate Spanish II [4]

Review of Spanish grammar with emphasis on building speaking and writing skills and on readings to build cultural understanding. Classes conducted in Spanish. *Prerequisite: SPAN 003 or equivalent score on the Spanish Placement Exam. Letter grade only.*

SPAN 010: Spanish for Heritage Speakers I [4]

For native speakers with limited experience in grammar and composition. Emphasis on formal language study and writing. Classes and discussion conducted in Spanish. *Prerequisite: Passing score on the Spanish Placement Exam.*

SPAN 011: Spanish for Heritage Speakers II [4]

For native speakers with limited experience in grammar and composition. Emphasis on formal language study and writing. Classes conducted in Spanish. *Prerequisite: SPAN 010.*

SPAN 090X: Freshman Seminar [1]

Examination of a topic in Spanish. *May be repeated for credit.*

SPAN 092: Internship in Spanish [1-4]

Provides oversight and structure for a student's internship in a field related to Spanish in community organizations, professional research projects, etc. connected to the study of Spanish. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Spanish. *Prerequisite: Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

SPAN 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SPAN 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SPAN 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SPAN 103: Spanish Composition and Conversation [4]

To develop a student's abilities to communicate in spoken and written Spanish, we emphasize the importance of the interaction between writer, reader, purpose and message. We focus on the four major modes of writing: description, narration, exposition and argumentation. Oral practice is also a major component in this course. *Prerequisite: SPAN 004 or SPAN 011. Letter grade only.*

SPAN 105: Hispanic Cultures I [4]

The cultures of the Hispanic world from an interdisciplinary perspective. Covers the period ending in the nineteenth century, emphasizing conversation and composition. *Prerequisite: SPAN 103 or consent of instructor.*

SPAN 106: Hispanic Cultures II [4]

Hispanic cultural manifestations from an interdisciplinary perspective. Covers from the nineteenth century to the present, emphasizing conversation and composition. *Prerequisite: SPAN 103 or consent of instructor.*

SPAN 110: Spanish Linguistics [4]

Introduction to the study of key areas of Spanish Linguistics such as the sound system, word form, syntactic patterns, the development of language, and regional and social variations. *Prerequisite: SPAN 103 or consent of instructor. Letter grade only.*

SPAN 141: Spanish for Health Professionals [4]

Specialized Spanish vocabulary and expressions that health-care professionals need to communicate with Hispanic patients and to carry out research in that language. Includes the reading of medical essays and composition. *Prerequisite: SPAN 004 or SPAN 011 or equivalent score on the Spanish Placement Exam.*

SPAN 142: Spanish for Business and Management [4]

Specialized Spanish vocabulary and expressions used to carry out business with Hispanic individuals or companies. Addresses cultural awareness and includes the reading of essays that deal with the course's topics. In addition, students learn how to write professional letters and other documents in Spanish. *Prerequisite: SPAN 004 or SPAN 011 or equivalent score on the Spanish Placement Exam.*

SPAN 180: Topics in Hispanic Languages and Cultures [4]

In-depth study of Spanish Languages and/or Hispanic Culture. Possible topics include Latin American and Spanish Film, the Mexican Corrido, Gender and Latin American Popular Music. With permission of the instructor, can be repeated for credit as topics change. *Prerequisite: SPAN 103 or equivalent score on the Spanish Placement Exam. Permission of instructor required. Letter grade only. May be repeated for credit twice.*

SPAN 192: Internship in Spanish [1-4]

Provides oversight and structure for a student's internship in a field related to Spanish in community organizations, professional research projects, etc. connected to the study of Spanish. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of Spanish. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

SPAN 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

SPAN 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

SPAN 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

UNDERGRADUATE STUDIES**USTU 010: Introduction to Undergraduate Studies [1]**

Combining weekly, large-group, interactive lectures and small-group discussion sessions, we focus on topics related to navigating campus life and strategies for effective learning at UC Merced. Reflective writings and engagement in activities on campus that promote self-empowerment and academic success play key roles in this course. *Prerequisite: Freshman only. Pass/No Pass grading only. May be repeated for credit twice.*

USTU 092: Internship in Undergraduate Studies [1-4]

Provides oversight and structure for a student's internship in a field of undergraduate studies in community organizations, professional research projects, etc. connected to the study of undergraduate studies. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of undergraduate studies. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

USTU 110: Undergraduate Studies: Tutor Training [4]

Students will analyze and apply current and traditional pedagogy and best practices of tutoring undergraduates in different disciplines. Principles of active learning and strategies for managing peer groups will be examined in the context of tutoring diverse student populations. Applications of learning theory will occur in peer-critiqued practicums. *Prerequisite: WRI 110 or upper-division standing (at least 60 units). Letter grade only.*

USTU 192: Internship in Undergraduate Studies [1-4]

Provides oversight and structure for a student's internship in a field of undergraduate studies in community organizations, professional research projects, etc. connected to the study of undergraduate studies. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of undergraduate studies. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

WORLD CULTURES AND HISTORY**WCH 100: Topics in Area Studies [4]**

In-depth study of the history and cultural, political, and economic systems of a region. *May be repeated for credit three times.*

WCH 190: World Cultures and History Proseminar: Research [4]

Capstone course for majors. Students conduct research under faculty supervision to culminate in a senior thesis. Required of all World Cultures and History majors. *Prerequisite: Senior standing. Pass/No Pass grading only.*

WCH 191: World Cultures and History Proseminar: Senior Thesis [4]

Capstone course for majors. Completion of a senior thesis; extensive writing required. Required of all World Cultures and History majors. *Prerequisite: WCH 190 and senior standing. Letter grade only.*

WCH 192: Public Research Project in World Cultures and History [1-4]

Directed individual or group project designed around need of an external agency for research and public communication on an issue of vital public interest. End product may be in the form of a written report, interpretive text for the public, web site, etc. Extensive writing is required. *Letter grade only.*

WCH 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

WCH 198: Upper Division Directed Group Study [1-5]

Directed group study and research, under the direction of WCH faculty. *Permission of instructor required. Letter grade only. May be repeated for credit three times.*

WCH 199: Upper Division Individual Study [1-5]

Directed individual study and research, under the direction of WCH faculty, in area not normally covered in the WCH curriculum. *Permission of instructor required. Letter grade only. May be repeated for credit.*

WCH 200: The University as an Institution [4]

Provides students with the capacity to critically analyze the university as an institution embedded in American society. Students address issues such as the corporate funding of university research, the relationship between academia and foreign policy, and what happens when professors write controversial books. *Letter grade only.*

WCH 201: Research Proseminar [4]

Introduces graduate students to the different methods of research employed in the disciplines represented in World Cultures and History. Students work on specific topics pertaining to their research, and they approach them using a variety of those methods covered in class. *Letter grade only.*

WCH 202: Theories and Methods in the Study of Cultures [4]

Seminar introduces graduate students to the wide variety of theories and methods employed in the disciplines represented in World Cultures and History. It also serves to prepare students for their Comprehensive Examination. Students work with members of the Examination Committee to compose reading lists tailored to their research interests. *Letter grade only. May be repeated for credit once.*

WCH 203: The Historian's Craft [4]

Various techniques of research and writing used by historians, from Thucydides to the so-called revisionists of today's "culture wars," and the changing audience of the historian. *Letter grade only.*

WCH 210: Topics in California Studies: Constructing California [4]

Major texts that have helped to construct our understanding of and attitude toward California's environment, with an interdisciplinary emphasis that includes publications in environmental policy and law, conservation, quality assessment, landmark legal and historical cases, as well as fiction, poetry and non-fiction. *Letter grade only.*

WCH 211: Mindscapes: Ecology of Cultural Landscapes [4]

The course will be focused on the methodologies of research aimed to interpret, reconstruct and communicate cultural landscapes according to an eco-anthropological approach: the ecosystem is constructed through relations between organisms and environment. Examples and case studies of heritage and archaeological landscapes from Asia, Africa and Europe will be analyzed and interpreted. *Letter grade only.*

WCH 220: Chicano/a Literature [4]

Multidisciplinary analysis of Chicano/a literature. Main aspects covered include: Chicano/a literary history (including issues of canonicity and reception), bilingualism and literature (including both stylistic and sociolinguistic approaches), ethnicity and race, gender parameters, the aesthetics of the borderlands, class and regional variations, migration and diaspora, film and folklore, and the journalistic tradition. *Letter grade only. May be repeated for credit twice.*

WCH 221: U.S. Latino/A Literature [4]

In-depth study of U.S. Latino/a literature and its history. Through the analysis of works from different genres, the student is exposed to the main themes, techniques, styles, etc. used by Latino/a authors. Students will present orally on selected topics and secondary bibliography, and they will write an original research paper. *Letter grade only.*

WCH 225: Philosophy and Theory [4]

Seminar explores the interdisciplinary common ground between philosophy and literary theory. Authors studied may include Husserl, Heidegger, Gadamer, Iser, Jauss, Fish, Deleuze, Sartre, Wittgenstein, Kant, and Aristotle, among others. Course is complemented by a practical application of these theories to selected literary texts. *Letter grade only.*

WCH 229: Critical Theory and Film [4]

Interdisciplinary study of contemporary literary theories and modern critical thought, and its potential for text and film analysis. *Letter grade only.*

WCH 230: Topics in Humanities and New Media [4]

How emerging technologies are used to record, analyze and communicate information about history and culture; read critical theory in order to understand the characteristics of text, image, and interactive media; and survey the future challenges and prospects for new media in the humanities. *Letter grade only. May be repeated for credit.*

WCH 231: The Great Depression in History and Literature [4]

Focusing on the turbulent decade of the 1930s, we use the lens of history and literature to explore how events from 1929-1941 helped shape modern America. Particular attention is paid to the impact of these years upon California and the West. *Letter grade only.*

WCH 240: Topics in United States Social and Cultural History [4]

Selected topics in U.S. social and cultural history through a reading of both classic and newer studies in areas such as race, ethnicity, class, and gender. Students are exposed to both theoretical approaches to these issues as well as monograph case studies. *Letter grade only.*

WCH 245: China and World History [4]

Topics concerning the middle period of imperial China, the world's most durable and successful agrarian empire. Second, course locates China in world history, raising historiographical questions about the study of a regional history in both a national and a global tradition.

WCH 248: Race, Empire, and US Foreign Policy [4]

U.S. foreign policy from the 1890s through the present using the lenses of empire and race. Students are introduced to theories and methods within the study of U.S. foreign policy in the course of studying events ranging from the Spanish American War of 1898 to the Iraq war. *Letter grade only.*

WCH 250: The Cold War, 1941 - 1991 [4]

The political, cultural, and intellectual history of America's confrontation with Communist at home and abroad, from U.S. entry into the second World War to the collapse of the Soviet Union and its aftermath. *Letter grade only.*

WCH 258: Hispanic and Anglo-American Modernisms [4]

Study through novel of principal characteristics of Hispanic Modernismo and Anglo-American Modernism. We examine the representation of the city in literature through the works of Pio Baroja, Valle Inclan, James Joyce and John Dos Passos, among others. Texts are analyzed through key urban literature historians/critics such as Lewis Mumford, Walter Benjamin, Raymond Williams, Burton Pike and Richard Lehan. Seminar is taught in English. *Letter grade only.*

WCH 260: Social Memory [4]

Theoretical exploration of the practices, sites, and functions of social memory. Topics include the social construction of the past; how societies remember; the relationship between history and memory; collective identity; oral history; tradition and modernity; public memory; nostalgia; amnesia; and the politics of memory. *Letter grade only.*

WCH 262: Material Culture [4]

Multidisciplinary examination of material objects and the role artifacts play in human social relations, identity, and representation in both the past and present. Explores the range of production and use of material objects, including theories of material culture, technology, identity, class, gender, value, style, meaning, memory, agency, commodification, collecting, and museums. *Letter grade only.*

WCH 270: Transatlantic Utopias in Literature and Culture [4]

Comparative and trans spatial approach to examining Utopian constructions in literature. Using both primary sources such as novels, and secondary readings in theory and criticism, course seeks to examine the role such constructions play in historical and contemporary understandings of society. *Letter grade only. May be repeated for credit once.*

WCH 280: American Nature Writing and Literature of the Environment [4]

Seeks to understand American attitudes toward natural and constructed landscapes by examining various modes of literary responses to the American environment, including poetry, non fiction, and fiction. Attention is given to historical and political movements and texts. *Letter grade only.*

WCH 290: Teaching Pedagogy and Practice [4]

Designed for graduate student teaching assistants. Discussion focuses on pedagogical issues such as grading, syllabus design and assignments, as well as on classroom practices. Students meet at frequent intervals, and they have the chance to meet with professors in their areas of expertise and to meet as a group.

WCH 291: Themes in Cultural Studies [4]

Exploration of various themes in cultural studies. Course reading list is drawn from foundational texts as well as contemporary writings drawn from feminist theory, gender studies, and critical theory. *Letter grade only.*

WCH 295: Graduate Research [1-12]

Supervised research. *Permission of instructor required. May be repeated for credit.*

WCH 296: Research MA Thesis [1-6]

Research and writing of M.A. thesis. *Permission of instructor required. Satisfactory/Unsatisfactory grading only.*

WCH 297: Research for PhD Dissertation [1-12]

Research and writing of Ph.D. dissertation. At least one 297 course is required during each year following completion of qualifying examinations. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

WCH 298: Directed Group Study [1-12]

Group project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

WCH 299: Directed Independent Study [1-12]

Independent project under faculty supervision. *Permission of instructor required. Satisfactory/Unsatisfactory grading only. May be repeated for credit.*

WORLD HERITAGE**WH 001: Introduction to World Heritage [4]**

Introduction to the concept of cultural and natural World Heritage. Topics include international policy in heritage management, the role of governments and organizations in identifying and protecting heritage, methods for documenting and interpreting heritage sites, and cultural and intellectual property ethics. *Discussion included.*

WH 002: Cyber Heritage [4]

An examination of the new forms of communication and interpretation provided by internet 2.0, viewed in the context of the creation of virtual heritage on the web. Second Life will be used to explore the social and technological dimensions and to experiment with a cyber-anthropological approach. *Letter grade only. Laboratory included.*

WH 003: International Heritage [4]

Cultural heritage is studied in relation to legal and management issues, cultural heritage protection, and its principal organizations and institutions. Students will analyze the key principles and policies through the examination of international heritage institutions, conventions and charters. *Letter grade only. Discussion included.*

WH 092: Internship in World Heritage [1-4]

Provides oversight and structure for a student's internship in a field of world heritage in community organizations, professional research projects, etc. connected to the study of world heritage. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of world heritage. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

WH 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

WH 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WH 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WH 100: Virtual Heritage and World Heritage [4]

Introduction to virtual heritage and world heritage, definitions and methods. Students learn how to describe, analyze, contextualize, preserve, and communicate information derived from heritage resources. *Prerequisite: WH 001 or consent of instructor.*

WH 110: Reconstructing Ancient Worlds [4]

Methodological issues concerning the reconstruction and depiction of the ancient world; study of validation processes for virtual reconstruction; epistemological and anthropological issues. Techniques of documentation, reconstruction, 3D modeling, computer graphics, virtual reality. *Prerequisite: WH 001 or consent of instructor. Laboratory included.*

WH 120: 3D-Digging [1-12]

Main goal of the course is to interpret an archaeological excavation in 3D using advanced technologies for recording and visualizing structures, objects and stratigraphies. 3D interpretation of an archaeological site creates new perspectives of research and training, with the experimental possibility to simulate archaeological data in a virtual environment. *Prerequisite: WH 001 or WH 002 or WH 003 or WH 110 or ANTH 003 or ANTH 001 or ANTH 130 or ANTH 149 or ANTH 134 or ANTH 140 or ANTH 142 or ANTH 146. Letter grade only.*

WH 140: Cultural Heritage Policy and Practice [4]

Critical examination of the legal, practical, and ethical aspects of cultural heritage management in the United States and abroad. Topics include cultural resource management in public and private contexts, participation of stakeholders, the application of anthropological knowledge, and public outreach. *Prerequisite: ANTH 003 or WH 001 or junior standing or consent of instructor.*

WH 192: Internship in World Heritage [1-4]

Provides oversight and structure for a student's internship in a field of world heritage in community organizations, professional research projects, etc. connected to the study of world heritage. Requires students to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of world heritage. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

WH 195: Upper Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

WH 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WH 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WRITING**WRI 001: Academic Writing [4]**

Development of critical reading, thinking, and academic writing ability. Intensive practice in analysis of college-level texts and in expository writing and revision. Section placement based on the student's UC Entry Level Writing Requirement Exam score. Completion with a grade of C or better meets University of California Entry Level Writing Requirement. *Letter grade only.*

WRI 001A: Intensive Academic Writing [2]

For students who are repeating WRI 1, or students entering with AWPE scores of 4 or lower, we provide an intensive focus on academic language, including grammar, vocabulary, and editing practices. *Not available for academic credit. Letter grade only.*

WRI 010: College Reading and Composition [4]

Development of college-level skills in effective use of language, analysis and argumentation, organization and strategies for creation, revision and editing. *Prerequisite: WRI 001 or passing score on the entry level analytical Writing Placement Exam or equivalent. Letter grade only.*

WRI 011: Supplemental Instruction [1]

Supervised by a supplemental instructor, students will complete 1 unit of additional work on reading and writing aligned with the curriculum of another lower division Writing Program course (e.g., WRI 10) or writing-intensive course (e.g., Core 1). Course may be repeated once in subsequent semester. *Permission of instructor required. Letter grade only. May be repeated for credit once.*

WRI 025: Introduction to Creative Writing [4]

Introduction to the craft of writing poetry, fiction, and creative non-fiction. Students study literary devices and style by considering a variety of texts by published authors. In addition, we provide an opportunity to explore their own imaginative participation in the world around them. They also compose poems, short stories, and literary essays. *Prerequisite: WRI 010. Letter grade only.*

WRI 030: Introduction to Professional Writing [4]

Students develop proficiency in forms of written communication typical in academic and professional settings. In addition, students perform critical analyses of texts within a variety of rhetorical modes. Assignments emphasize responsible and ethical practices in writing to communicate in the professional world. *Prerequisite: WRI 010. Letter grade only.*

WRI 092: Internship in Writing [1-4]

Provides oversight and structure for a student's internship in a field related to writing in community organizations, professional research projects, etc. connected to the study of writing. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of writing. *Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

WRI 095: Lower Division Undergraduate Research [1-5]

Supervised research. *Permission of instructor required. May be repeated for credit.*

WRI 098: Lower Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WRI 099: Lower Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WRI 100: Advanced Writing [4]

Follows WRI 10 and continues to have an interdisciplinary emphasis. However, the emphasis is on the development of style, voice and syntax within writing projects. This could be considered a pre-professional writing course, and it includes readings and writing in creative non-fiction as well as writing for popular and academic periodicals. *Prerequisite: WRI 025 or WRI 030. Letter grade only.*

WRI 101: Writing in the Disciplines: Psychology [4]

Intended for psychology majors and majors in closely related disciplines, this course refines a student's ability to analyze, synthesize, and explain complex information by producing professional written texts and oral reports for appropriate audiences. Using APA style, each student will also collaborate on a research project. *Prerequisite: WRI 010 or consent of instructor. Letter grade only.*

WRI 105: Grammar and Style [4]

Basic principles of language study, including the key distinction between classifying and explaining linguistic forms and functions. Building on these principles of language study, students analyze texts of various genres and formats, ranging from literary to conversational to disciplinary discourse. No prior knowledge of grammar or linguistics is required. *Prerequisite: WRI 010 and junior standing. Letter grade only.*

WRI 110: Tutor Training [4]

Students develop, understand and practice professional ethics as they gain experience in the tutoring process. The theoretical and practical parameters of how students learn to write, and pedagogies for working with second language students, and a diverse student population, including students with learning disabilities are addressed through readings, reflective journals, research, writing projects and a practicum. *Prerequisite: WRI 100. Letter grade only.*

WRI 115: Topics in Science Writing [4]

To better understand the difficult process of explaining technical information in clear, accessible, non-technical language, students read widely in the scientific literature, including works by established science journalists and by prominent scientists who have written for the general public. Oral presentations and group projects complement various writing tasks. *Prerequisite: WRI 100. Letter grade only. May be repeated for credit twice.*

WRI 116: Science Writing in Natural Sciences [4]

To improve their command of scientific discourse, students in the School of Natural Sciences read widely in scientific literature, including research published in established scientific journals and articles or books by prominent scientists who have written for the general public. Oral presentations and group projects complement various writing tasks. *Prerequisite: WRI 010 Permission of instructor required for non-science majors. Letter grade only.*

WRI 117: Writing for the Social Sciences and Humanities [4]

Analysis and practice of various research methods and forms of writing in the social sciences and humanities including qualitative/ethnographic, quantitative, interpretive and theoretical. Writing projects such as literature reviews, proposals, case studies, scientific reports, interviews. Attention to disciplinary resources, formal conventions, graphics and style. *Prerequisite: (WRI 025 or WRI 030) and WRI 100. Letter grade only.*

WRI 118: Management Communication Theory and Practice [4]

Students analyze and demonstrate effective managerial communication skills, with an emphasis on public speaking, presentations, and writing. Topics include business ethics, media relations, intercultural communication, interviewing, persuasion, and the visual representation of data. Extensive work in impromptu oral and written communication in various managerial, organizational, interpersonal situations. *Prerequisite: WRI 010 and ECON 001. Letter grade only.*

WRI 119: Writing for Engineering [4]

Intensive practice in the presentation of technical subject matter. Students survey the range of audiences to which engineering communities respond, and explore variations in the style and logic of written discourse within the profession. Assignments may include technical reports, design projects, project proposals, press releases, oral presentations, and collaborative projects. *Prerequisite: WRI 010. Letter grade only.*

WRI 120: Rhetorical Theory [4]

Intensive study in classical and contemporary theories of written rhetoric. The course will enable students to analyze, criticize and deploy rhetorical strategies via readings in rhetorical theory, application of theory to the criticism of texts, and the imitation and production of arguments. *Prerequisite: WRI 100 or consent of instructor. Letter grade only.*

WRI 125: Topics in Creative Writing [4]

Provides an opportunity to pursue advanced work in creative writing. Each section focuses on one genre: poetry, fiction, drama, or creative nonfiction. Workshop format with a focus on student writing. With permission of the instructor, this course can be repeated for credit as topics change. *Prerequisite: WRI 100. Letter grade only. May be repeated for credit twice.*

WRI 130: Topics in Professional Writing [4]

Specialized instruction in one aspect of Professional writing. Topics include, but are not limited to, Journalism, Technical Writing, Copy-Editing, Writing for the Internet, and Research for Writers. Class provides practical instruction in "real-world" writing scenarios, considering important factors such as clarity, tone, audience, ethics, and context. With permission of the instructor, can be repeated for credit as topics change. *Prerequisite: WRI 100. Letter grade only. May be repeated for credit twice.*

WRI 131: Journal Production [1-2]

Intended for students working on the Undergraduate Research Journal, we examine issues of journal production in print and electronic forms, including editorial analysis of texts and principles of revision. Course work is adjusted to match each student's experience in publication. *Prerequisite: WRI 100 recommended. May be repeated for credit four times*

WRI 150: Seminar in Creative Writing [4]

In this advanced workshop students will produce creative and critical work in one of the following genres: fiction, playwriting, poetry, or creative nonfiction. *Prerequisite: WRI 100 and (WRI 125 or WRI 130) and junior standing. Letter grade only. May be repeated for credit once.*

WRI 155: Seminar in Professional Writing [4]

This seminar is based on case studies representing different contexts of professional writing. Specific attention will be devoted to technical writing for the representation of complex information in a form that is accessible to general readers. Elements of translation theory will also be reviewed. *Prerequisite: WRI 100 and WRI 130. Letter grade only.*

WRI 160: Seminar in Editing [4]

This workshop course on editing examines grammar and style, documentation, manuscript solicitation, selection and review, as well as generating manuscripts. Concerns fundamental to editing, such as consistency of voice, integrity of the author's concepts, and use of multiple languages, will be included as part of the editorial process. *Prerequisite: WRI 100 and WRI 130 or consent of instructor. Letter grade only.*

WRI 192: Internship in Writing [1-4]

Provides oversight and structure for a student's internship in a field related to writing in community organizations, professional research projects, etc. connected to the study of writing. Students are required to write an original research paper or relevant product that demonstrates how the internship advanced their knowledge of writing. *Prerequisite: Junior standing. Permission of instructor required. Pass/No Pass grading only. May be repeated for credit twice.*

WRI 195: Upper Division Undergraduate Research [1-4]

Supervised research. *Permission of instructor required. May be repeated for credit.*

WRI 198: Upper Division Directed Group Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.

WRI 199: Upper Division Individual Study [1-5]

Permission of instructor required. Pass/No Pass grading only. May be repeated for credit.